HANDBOOK

OF

CHEMISTRY AND PHYSICS

A READY-REFERENCE BOOK OF CHEMICAL AND PHYSICAL DATA

THIRTIETH EDITION

EDITOR IN CHIEF

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IN COLLABORATION WITH A LARGE NUMBER OF PROFESSIONAL CHEMISTS AND PHYSICISTS WHOSE ASSISTANCE IS ACKNOWLEDGED IN THE LIST OF GENERAL COLLABORATORS AND IN CONNECTION WITH THE PARTICULAR TABLES OR SECTIONS INVOLVED.

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PREFACE

The Handbook of Chemistry and Physics, continuing the policy of the past, is being revised at frequent intervals.

The general features and scheme of arrangement, which have received extensive endorsement in former editions have been retained. The aim throughout has been to present in condensed form as large an amount of accurate, reliable and up-to-date information in the fields of chemistry and physics as was consistent with convenience in form and the possibility of wide utility and distribution. A very large proportion of the tables have been compiled especially for the Handbook from various authoritative collections of data and from the current journals.

Since the beginning special consideration has been given to the requests and suggestions of those who have used former editions. In this way it has been hoped to develop the book along lines most acceptable to those interested in a volume of this type. Suggestions and contributions are received each year from many eminent chemists and physicists including members of the teaching profession and those engaged in industrial work. We believe this coöperation to have been of very great value in the growth and development of the work.

An attempt has been made to include material on all branches of chemistry and physics and the closely allied sciences, which would be likely to find any extended use. On the other hand, in order to retain the convenience of moderate dimensions and at the same time allow for natural growth due to the extension of knowledge in these sciences, and logical additions along lines already developed, it has seemed necessary to exclude types of material of use only in certain highly specialized lines of work.

Chemistry and physics, always closely related sciences, have been brought into much more intimate relations by the more recent developments of research. To an increasing extent the student of either science should have a knowledge of the other. It would seem that there should be a large field for a single volume containing the constants and formulæ of the two sciences together with mathematical and conversion tables adequate for

accurate computation. The generous response which the previous editions have met indicates that the volumes have been found useful and it is with the hope of even more completely meeting the needs of the chemists and physicists of the English-speaking world that succeeding editions are offered.

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PREFACE TO THE THIRTIETH EDITION

Tables originally occupying over one hundred pages have been more or less completely revised for the Thirtieth Edition of the Handbook of Chemistry and Physics. This, with the new material which has been added, represents a total of about one hundred and forty pages of new composition.

To those interested in atomic and nuclear physics one of the most useful changes will probably prove to be the replacement of several separate tables giving information concerning isotopes and radioactivity by a recent single compilation listing the properties of all artificial and natural radioactive isotopes and stable isotopes. More complete and more recent data are made readily available in a single table. A long list of references provides a very complete bibliography of the subject of nuclear physics.

The mathematical section has been modified by the substitution of a more convenient and more complete table of natural logarithms, and by some minor rearrangement of tabular material.

The growing importance of synthetic rubber is reflected by the addition of a new table giving a large range of physical properties of natural and synthetic rubber stocks.

In food chemistry the completely new presentation of the material on vitamins, will be of value. Much added information is now presented and in a more readily available form. A comprehensive table of dietary allowances has been added.

The section on viscosity has been largely revised, many items added and more recent values given.

An improved list of persistent lines of the elements replaces the former table.

Several other tables have undergone more or less complete revision and minor changes, and additions have been made throughout the volume.

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In addition to the above, assistance in special fields is acknowledged in connection with the various contributions, particularly the Physical Constants of Inorganic Compounds and the Physical Constants of Organic Compounds.

The Publishers and Editor will be grateful to readers of this Handbook who will call their attention to errors which may be discovered. Suggestions for improvement are also welcome.
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ANTIDOTES OF POISONS

Acetic Acid.—Emetics, magnesia, chalk, soap, oil.

Acetylene.—Same as for carbon monoxide.

Arsenic, Rat Poison, Paris Green.—Milk, raw egg, sweet oil, lime water, flour and water.

Carbolic Acid.—Any soluble non-toxic sulphate, after provoking vomiting with zinc sulphate; uncooked white of egg in abundance, milk of lime, saccharate of calcium, olive or castor oil with magnesia in suspension, ice, washing the stomach with equal parts water and vinegar; give alcohol or whiskey or about four fluid ounces camphorated oil at one dose.

Carbon Monoxide.—Remove to fresh air immediately and call for pulmotor; apply artificial respiration for at least one hour or until the pulmotor arrives. Administration of oxygen containing 5% of carbon dioxide is beneficial; inhalation of ammonia or amyl nitrite is often of value.

Chloroform, Chloral, Ether.—Dash cold water on head and chest, artificial respiration.

Ethylene.—Same as for carbon monoxide.

Gas (illuminating).—Same as for carbon monoxide.

Hydrochloric Acid.—Magnesia, alkali carbonates, albumen, ice.

Hydrocyanic or Prussic Acid.—Hydrogen peroxide internally, and artificial respiration, breathing ammonia or chlorine from chlorinated lime, ferrous sulphate followed by potassium carbonate, emetics, warmth.

Iodine.—Emetics, stomach siphon, starchy foods in abundance, sodium thiosulphate.

Lead Acetate.—Emetics, stomach siphon, sodium, potassium or magnesium sulphates, milk, albumen.

Mercuric Chloride or Corrosive Sublimate.—Zinc sulphate, emetics, stomach siphon, white of egg, milk, chalk, castor oil, table salt, reduced iron.

Nitrate of Silver.—Salt and water.

Nitric Acid.—Same as for hydrochloric acid.

Opium, Morphine, Laudanum, Paregoric, etc.—Strong coffee, hot bath. Keep awake and moving at any cost.

Phosphoric Acid.—Same as for hydrochloric.

Sodium Hydroxide or Potassium Hydroxide.—Vinegar, lemon juice, orange juice, oil, milk.

Sulfuric Acid—Same as for hydrochloric acid with the addition of soap or oil.

Sulfurous Acid or Sulfur Dioxide.—Mustard plaster on chest; narcotics, expectorants.

Wood Alcohol (Methyl Alcohol or Methanol).–Emetic or wash out stomach (stomach tube) with a solution of 10 grains sodium citrate per ounce of water. Give milk, white of egg or flour in water; purgative of magnesium sulfate (15 grams); stimulate and combat collapse. In case of cardiac or pulmonary failure use artificial respiration. Physicians may administer atropine, digitalin or strychnine as stimulants; to cause perspiration and elimination of the poison use 0.1 grain of pilocarpine hydrochloride.

BURNS AND SCALDS

Exclude air by thin paste of starch, flour, or baking soda. Ordinary oils such as Vaseline petroleum jelly, olive or castor oil, lard or cream may also be used except for phosphorus burns. Lime water mixed with an equal part of raw linseed oil makes an excellent dressing. An especially valuable material for all burns is picric acid gauze which may be applied in the form of a compress.

After treatment with any of the above materials, cover with a cloth or with cotton and hold in place with a light bandage.

Apply a freshly prepared 5% tannic acid solution. Place several layers of sterile gauze over the burned area, saturate with the tannic acid solution and bandage loosely.

ACID AND ALKALI BURNS

With either, wash off as quickly as possible with a large quantity of water. Water from a tap may be allowed to flow over burns.

Acids

While the injury is being washed, have procured lime water or lime water and raw linseed oil mixed together in equal proportions or a mixture of baking soda and water or soap suds and apply freely. For acid in the eye wash as quickly as possible with water and then with lime water.

Alkalis

Wash with a large quantity of water as for acid burns. Neutralize with weak vinegar, hard cider or lemon juice. For lime or other strong alkali burns in the eye wash with weak solution of vinegar or with olive oil or a saturated solution of boric acid.

FIRE PRECAUTIONS AND CHEMICAL HAZARDS

Acetone.—Dilute with a spray of water to avoid spread of burning liquid. Use suitable gas mask.

Alcohol.—See under acetone.

Ammonia.—Use water and dilute acid. Use suitable gas mask.

Benzol or Benzene.—Use water to cool containers which are endangered; extinguish flame with sand, earth, fire-foam or carbon tetrachloride fire extinguishers. Use suitable gas mask.

Calcium Carbide.—Do not use water as this generates acetylene, an inflammable and explosive gas; cut off electric current to avoid ignition of gas. Remove containers to a dry place. Use gas mask.

Carbon Disulfide.—Use water to cool containers which are endangered; extinguish blaze with sand, earth, fire-foam or carbon tetrachloride fire extinguishers. Use suitable gas mask.

Carbon Tetrachloride.—Do not use a fire extinguisher filled with carbon tetrachloride (pyrene or carbona) on flames caused by an electrical short circuit in a confined space; the carbon tetrachloride may be decomposed into toxic gases.

Celluloid.—Use large volumes of water and sand. The smoke contains oxides of nitrogen which are injurious. Use suitable gas mask.

Chlorine.—Spray with water. The pungent nature of the gas makes the use of a gas mask imperative.

Collodion.—See under carbon disulfide.

Ether.—See under carbon disulfide.

Gasoline.—See under carbon disulfide.

Hydrochloric Acid.—Use large volumes of water also chalk or soda. Use gas mask.

Hydrocyanic or Prussic Acid.—Suitable gas mask is essential because of the extremely poisonous nature of the vapors. Provide ventilation.

Lacquer Solvents.—See under carbon disulfide.

Magnesium.—Do not use water. Use sand or earth to extinguish flames. Remove containers to a dry place.

Nitric Acid and Oxides of Nitrogen.—Use large volumes of water. Do not use sand or earth. Use gas mask.

FIRE PRECAUTIONS (Continued)

Potassium.—Do not use water. Remove containers to a dry place. Extinguish flames with sand or earth. For storage, potassium is kept immersed in petroleum.

Potassium Hydroxide.—Use large volumes of water or dilute acids.

Phosphorus.—Use water and wet sand. Use gas mask. For storage, white phosphorus must be kept immersed in water. Red phosphorus is less dangerous.

Sodium.—See under potassium.

Sodium Hydroxide.—See under potassium hydroxide.

Sulfur.—Extinguish with water or sand. Use gas mask.

Sulfuric Acid.—See under hydrochloric acid.

Turpentine.—See under acetone.

MATHEMATICAL TABLES

USE OF MATHEMATICAL TABLES

For a complete discussion of the principles and use of mathematical tables, textbooks on the subject should be consulted. The following brief statements are intended to give only sufficient information to make possible the intelligent use of the tables, omitting for the most part any attempt at treating the theory and principles.

Exponential Method of Expressing Numbers—For convenience in writing and manipulation, numbers are often expressed as factors of appropriate powers of 10. The following examples will illustrate:

2,380,000,000.	may be written	2.38×10^9
238.	may be written	2.38×10^2
.238	may be written	2.38×10^{-1}
.000000238	may be written	2.38×10^{-7}

Logarithms—The logarithm of a number is the exponent of that power to which another number, the base, must be raised to give the number first named. Any positive number greater than 1 might serve as a base. Two have been selected, yielding two systems of logarithms. One base, 2.718 . . . . usually indicated by the letter e, gives rise to a system of logarithms convenient in higher mathematics. These are called natural, Napierian, or hyperbolic logarithms. Reference will be made to their use in a subsequent paragraph.

The other base used is 10, giving logarithms particularly adapted to use in computation, called common or Briggian logarithms. Tables of logarithms given without designation are invariably of this latter type.

Since most numbers are incommensurable powers of ten, a common logarithm, in general, consists of an integer which is called the characteristic and an endless decimal, the mantissa.

It is to be observed that the common logarithms of all numbers expressed by the same figures in the same order with the decimal point in different positions have different characteristics but the same mantissa. To illustrate:—if the decimal point stand after the first figure of a number, counting from the left, the characteristic is 0; if after two figures, it is 1; if after three figures, it is 2, and so forth. If the decimal point stand before the first significant figure the characteristic is -1, usually written $\bar{1}$; if there is one zero between the decimal point and the first significant figure it is $\bar{2}$ and so on. For example: $\log 256 = 2.40824$, $\log 2.56 = 0.40824$, $\log 0.256 = \bar{1}.40824$, $\log 0.00256 = \bar{3}.40824$. The two latter are often written $\log 0.256 = 9.40824 - 10$, $\log 0.00256 = 7.40824 - 10$.

USE OF MATHEMATICAL TABLES (Continued)

A method of determining characteristics of logarithms is to write the number with one figure to the left of the decimal point multiplied by the appropriate power of 10. The characteristic is then the exponent used. For example:

$$256{,}000{,}000 = 2.56 \times 10^{8} \qquad \log = 8.40824$$
$$0.000000256 = 2.56 \times 10^{-7} \qquad \log = \bar{7}.40824 \text{ or } 3.40824-10$$

Inasmuch as the characteristic may be determined by inspection the mantissas only are given in tables of common logarithms.

To find the logarithm of a number:

For a number of four figures, take out the tabular mantissa on a line with the first three figures of the number and under its fourth figure. The characteristic is determined as previously explained.

For a number of less than four figures, supply zeros to make a four figure number and take the value of the mantissa from the tables as before. For example: $\log 2 = \log 2.000 = 0.30103$.

For a number of more than four figures, take the tabular value of the mantissa for the first four figures; find the difference between this mantissa and the next greater tabular mantissa and multiply the difference so found by the remaining figures of the number as a decimal and add the product to the mantissa of the first four figures. For example: to find log 46.762.

$$\log 46.76 = 1.66987$$

Tabular difference between this mantissa and that for 4677 is .00010.

$$\begin{aligned} \therefore \log 46.762 &= 1.66987 + .2 \times .00010 \\ &= 1.66987 + .00002 \\ &= 1.66989 \end{aligned}$$

To find the number corresponding to a given logarithm:

If the mantissa is found exactly in the table, join the figure at the top which is directly above the given mantissa to the three figures on the line at the left and place the decimal point according to the characteristic of the logarithm. For example, $\log^{-1}$ (antilogarithm) $3.39967 = 2510.$

If the mantissa is not found exactly in the table it is necessary to interpolate. For example, $\log^{-1} 3.40028 = 2513. + {}^{9}/_{18} = 2513.5.$

The column of proportional parts at the right of each page of the table shows, under the heading of the various tabular differences, the parts of these differences which correspond to the digits from 1 to 9 in the fifth place. This makes it possible to take out a logarithm for a five figure number or to find an antilogarithm of the same number of significant figures with increased facility, usually by inspection.

USE OF MATHEMATICAL TABLES (Continued)

The following formulae express the relations on which the use of logarithms is based:

$$\log ab = \log a + \log b$$

$$\log \frac{a}{b} = \log a - \log b$$

$$\log a^n = n \times \log a$$

$$\log \sqrt[n]{a} = \frac{\log a}{n}.$$

The following examples will serve as illustrations:

1. $52600 \times 0.00381 \times 2.74 = 549.1$

$$\begin{aligned} \log 52600 &= 4.72099 \\ \log 0.00381 &= \bar{3}.58092 \\ \log 2.74 &= 0.43775 \\ \hline \text{Sum:} &= 2.73966 \\ \text{Antilogarithm} &= 549.1 \end{aligned}$$

The sum is the logarithm of the product, the mantissa of which is 73966. On looking up this mantissa in the logarithm tables we see that it corresponds to the digits 5491. The characteristic is 2, hence there are three figures before the decimal point. The number corresponding to the logarithm, called the antilogarithm, is 549.1.

2. $0.00123 \div 52.7 = 0.00002334$

			An Alternative method:	
log 0.00123	= $\bar{3}.08991$		log 0.00123	= 7.08991 −10
log 52.7	= 1.72181		log 52.7	= 1.72181
Subtracting	$\bar{5}.36810$			5.36810 −10
Antilog	0.00002334			

The characteristic $\bar{5}$ (5. −10) shows four zeros after the decimal point before the first significant figure.

3. $\dfrac{273 \times 780}{292 \times 760} \times 15 \times 0.09 = 1.295$

log 273	= 2.43616	log 292	= 2.46538
log 780	= 2.89209	log 760	= 2.88081
log 15	= 1.17609		
log 0.09	= $\bar{2}.95424$	log denominator	= 5.34619
log sum	= 5.45858		

$$\begin{aligned} \text{log numerator} &= 5.45858 \\ \text{log denominator} &= 5.34619 \\ \hline \text{subtracting} &= 0.11239 \\ \text{antilogarithm} &= 1.295 \end{aligned}$$

USE OF MATHEMATICAL TABLES (Continued)

As division may be accomplished by multiplying by the reciprocal of a number, the above may be considerably simplified. The logarithm of the reciprocal of a number, called the cologarithm, is readily obtained from the table by subtracting the logarithm of the number from zero. This may readily be read off from the table of mantissas. Change the sign of the characteristic algebraically adding to it -1, then mentally subtract each figure of the mantissa from 9 proceeding from left to right, the last figure being subtracted from 10. The example then is:

$$
\begin{array}{lrl}
\log & 273 & = 2.43616 \\
\log & 780 & = 2.89209 \\
\log & 15 & = 1.17609 \\
\log & 0.09 & = \bar{2}.95424 \\
\text{colog} & 292 & = \bar{3}.53462 \\
\text{colog} & 760 & = \bar{3}.11919 \\
\hline
 & & 0.11239
\end{array}
$$

4. $(0.00098)^4 = 9.224 \times 10^{-13}$

$$
\begin{array}{lrl}
\log 0.00098 & = \bar{4}.99123 & \\
 & 4 & \\
\hline
 & 3.96492 & \text{(a)} \\
\bar{4} \times 4 & \overline{16}. & \text{(b)} \\
\hline
\log (0.00098)^4 & = \overline{13}.96492 & \\
\text{antilog} = 9.224 \times 10^{-13} & & \text{(c)}
\end{array}
$$

An alternative method:

$$
\begin{array}{lr}
\log 0.00098 = & 6.99123-10 \\
 & 4 \\
\hline
 & 27.96492-40 \\
\text{or} & 7.96492-20 \\
\text{or} & \overline{13}.96492 \\
\text{antilog} = & 9.224 \times 10^{-13}
\end{array}
$$

In the above it will be noted that the mantissa is always positive hence the multiplication of the mantissa shown at (a) while (b) shows the multiplication of the characteristic. (c) is the algebraic sum.

5. $\sqrt[5]{492} = 3.455$

$\log 492 = 2.69197$

Dividing the logarithm by 5 gives as the logarithm of the root 0.53839 the antilogarithm of which is 3.455 both characteristic and mantissa being positive. When the characteristic is negative and not evenly divisible by the root to be taken a modification of the logarithm is necessary.

6. $\sqrt[3]{0.000372} =$

$$
\begin{array}{rll}
\log 3.72 \times 10^{-4} & = \bar{4}\ 57054 & \text{(a)} \\
 & = 26.57054 - 30 & \text{(b)}
\end{array}
$$

dividing (b) by 3 gives $8.85685-10$ which may be written

$\bar{2}.85685$ and is the logarithm of the root sought, the antilogarithm of which is 0.07192.

$$
\begin{array}{lll}
7. & 0.000372^{1.2} & = 0.000076674 \\
 & \log 0.000372 & = \bar{4}.57054 \\
 & & \text{or } 6.57054-10 \\
 & & \qquad\qquad 1.2 \\
\hline
 & & 7.88465-12 \\
 & \text{antilogarithm} & 0.000076674
\end{array}
$$

Four-Place Logarithms—This short table on two facing pages makes possible logarithmic computation precise to four significant figures, (three without interpolation). The mantissa is given complete and the proportional parts indicated for each line.

Four-Place Antilogarithms—Some computers prefer to use separate tables for determining antilogarithms; the table being entered from the margins with the logarithm and the number being found in the body of the table. Such a table is given to accompany the four-place logarithms.

Five-Place Logarithms—For computation involving five significant figures, (four without interpolation) the five-place table will be adequate. Since the first two figures will be the same for several lines of the table they are given in the first line only. The point at which these first two figures change is indicated by an asterisk. While space does not permit the proportional parts for each line, tables will be found for each tabular difference.

The supplementary table following the five-place logarithms, giving seven-place logarithms for numbers of five significant figures from 10,000 to 12,000 will be found convenient to increase precision and avoid the inconvenience of interpolation where the differences are large.

Logarithms of the Trigonometric Functions—Logarithms of the functions are given for each minute from 0-360°.

The quantity -10 is to be appended to all logarithms of the sine and cosine, to logarithms of the tangent from 0-45° and of the cotangent from 45-90°.

With degrees indicated at either side of the top of the page use the column headings at the top. With degrees stated at the bottom of the page use the column designations at the bottom.

With degrees at the left (top or bottom) use the minute column at the left, and with degrees on the right side of the page use the minute column at the right.

USE OF MATHEMATICAL TABLES (Continued)

To illustrate the proper employment of headings for angles in the four quadrants—

log sin 6° 24′ = 9.04715 − 10	log sin 186° 24′ = 9.04715 − 10
log sin 83° 15′ = 9.99698 − 10	log sin 263° 15′ = 9.99698 − 10
log cos 96° 41′ = 9.06589 − 10	log cos 276° 41′ = 9.06589 − 10
log cos 173° 49′ = 9.99747 − 10	log cos 353° 49′ = 9.99747 − 10

For the accurate determination of values where the tabular differences are large, the values of CS and CT are given. The following equations indicate their use.

To find the logarithm of the functions of an angle:

For angles 0–3°	For angles 87–90°
$\log \sin \theta = \log \theta'' - CS$	$\log \cos \theta = \log (90° - \theta)'' - CS$
$\log \tan \theta = \log \theta'' - CT$	$\log \cot \theta = \log (90° - \theta)'' - CT$
$\log \cot \theta = \operatorname{colog} \tan \theta$	$\log \tan \theta = \operatorname{colog} \cot \theta$

To find the angle:

For angles 0–3°	For angles 87–90°
$\log \theta'' = \log \sin \theta + CS$	$\log (90° - \theta)'' = \log \cos \theta + CS$
$\log \theta'' = \log \tan \theta + CT$	$\log (90° - \theta)'' = \log \cot \theta + CT$

In the above expressions, θ'' and $(90° - \theta)''$ are used to indicate the value of the angles expressed in seconds. The values in the body of the table are the cologarithms and should be used as indicated above.

The values of the logarithms S and T are also given in a separate table. For these the following relations hold:

To find the functions of an angle.

$\log \sin \theta = \log \theta'' + S$	$\log \cos \theta = \log (90° - \theta)'' + S$
$\log \tan \theta = \log \theta'' + T$	$\log \cot \theta = \log (90° - \theta)'' + T$

To find the angle.

$\log \theta'' = \log \sin \theta - S$	$\log (90° - \theta)'' = \log \cos \theta - S$
$\log \theta'' = \log \tan \theta - T$	$\log (90° - \theta)'' = \log \cot \theta - T$

Where the values of CS and CT are given, the angles expressed in seconds are given in the supplementary column at the left.

The tabular differences are given under the headings "d" and "c.d.", the latter referring to the common difference for the tangent and cotangent. Tables of proportional parts ("P.P.") facilitate interpolation. At the bottom of each column will be found special proportional parts between the tabular differences for the tangent or cotangent and those for the sine or cosine. These are useful when one function is to be obtained directly from the other without determining the angle.

For example, suppose log tan θ is given as 9.67644 and log cos θ is required. The difference between the given logarithm and that given in the table, 9.67622 (opposite 25° 23′), is 22.

The tabular differences of the two logarithmic functions at this place are 32 and 6. In the proportional table for $\frac{6}{32}$, 22 corresponds to 4; this, subtracted from the tabular logarithmic cosine 9.95591, gives the required log cos θ = 9.95587.

The symbols $\bar{5}$ and $\dot{5}$ are used to indicate how the terminal 5 has been derived. For example, the logarithm 8.83075 is more fully given as 8.8307495 while the value $9.4082\dot{5}$ is derived from 9.4082539.

Natural Trigonometric Functions—Values of the natural trigonometric functions of angles are given for each minute from 0–360°.

For degrees indicated at the top of the page use the column headings at the top. For degrees indicated at the bottom use the column indications at the bottom.

With degrees at the left of each block (top or bottom), use the minute column at the left and with degrees at the right of each block use the minute column at the right.

Natural Functions and their Logarithms are given for angles in degrees and tenths from 0 to 90 degrees.

Natural Functions and their Logarithms are given for angles in radians and hundredths, from 0 to 2 radians.

Haversines—Values of $(1 - \cos \theta)/2$ for angles between 0 and 180° are given to four significant figures. The four-place mantissas of the logarithms of the haversines are also given. The correct characteristic must be provided in each case.

The listed values of the haversines were derived from values which were computed to seven significant figures. The logarithms were independently derived from the more exact values of the haversines and are, therefore, in many cases not the exact value of the logarithm of the haversine as listed. This is notably true at the beginning of the table where the logarithm can be given with more exactness than the function.

Natural Logarithms—The natural logarithms of numbers from 0.000 to 999. are given in a group of four tables. The method of finding logarithms of numbers not included in the tables is indicated at the beginning of the third page. A convenient table of constants occurs at the top of the fourth page.

The first page gives the natural logarithms of numbers from 0.000 to 0.499. Since the characteristics change rapidly for the smaller numbers, they are indicated *above* the mantissa in the first line. In the second and following lines the characteristics are given at the left only. For example, $\log_e 0.004 = -5.52146$; $\log_e 0.014 = -4.26870$.

The succeeding pages give the natural logarithms of numbers up to 999.

USE OF MATHEMATICAL TABLES (Continued)

Exponential Functions—Values of e^x, log e^x and e^{-x} where e is the base of the natural system of logarithms 2.71828 . . . and x has values from 0 to 10. Facilitating the solution of exponential equations, these tables also serve as a table of natural or Naperian antilogarithms. For instance if the logarithm or exponent $x = 3.26$ the corresponding number or value of e^x is 26.050. Its reciprocal e^{-x} is .038388.

Hyperbolic Functions—The table gives the values and logarithms of the hyperbolic sine x, cosine x, tangent x and cotangent x for values of x from 0 to 5.

Degrees-Radians—This table gives the value in radians to five significant figures; for each 10 minutes from 0° 0′ to 90° 0′; for each degree from 90 to 180; for each 10 degrees from 180 to 480. Values are also given for each minute from 0–60′ and for each second from 0–60″.

Tables are also provided to facilitate changing from degrees and decimal fractions to radians, from decimal fractions of a degree to minutes and seconds and the reverse operations.

Numerical Tables—The first section gives the reciprocals of numbers from 0 to 1000 and circumferences and areas of circles with diameters having these values. Reciprocals and circumferences for values not listed can be obtained by an appropriate shift of the decimal point.

The second section is devoted to squares, cubes and roots. The squares and cubes from 1 to 1000 are given exactly. The roots are given to seven significant figures. Since the square roots of $10n$ are given, values of the square roots from 1 to 10,000 may be found directly. For the square roots of numbers below and above this range, use may be made of the following relations: $\sqrt{100n} = 10\sqrt{n}$; $\sqrt{1000n} = 10\sqrt{10n}$; $\sqrt{\tfrac{1}{10}n} = \tfrac{1}{10}\sqrt{10n}$; $\sqrt{\tfrac{1}{100}n} = \tfrac{1}{10}\sqrt{n}$; $\sqrt{\tfrac{1}{1000}n} = \tfrac{1}{100}\sqrt{10n}$. For example, the square root of 0.268 may be found by using the form, $\sqrt{0.268} = \tfrac{1}{100}\sqrt{10 \times 268}$. The tabular value for the square root of $10n$ for 268 is 51.76872. Hence, the desired root is 0.5176872.

Values of cube roots for all numbers from 1 to 100,000 will be found directly in the table. Cube roots for numbers above or below this range will be found from the following relations: $\sqrt[3]{1000n} = 10\sqrt[3]{n}$; $\sqrt[3]{10{,}000n} = 10\sqrt[3]{10n}$; $\sqrt[3]{100{,}000n} = 10\sqrt[3]{100n}$; $\sqrt[3]{\tfrac{1}{10}n} = \tfrac{1}{10}\sqrt[3]{100n}$; $\sqrt[3]{\tfrac{1}{100}n} = \tfrac{1}{10}\sqrt[3]{10n}$; $\sqrt[3]{\tfrac{1}{1000}n} = \tfrac{1}{10}\sqrt[3]{n}$. For example, the cube root of 731,000 may be found

by using the form, $\sqrt[3]{731{,}000} = 10\sqrt[3]{731}$. The tabular value of the root for 731 is 9.008223. The desired root is, therefore, 90.08223.

Powers of Numbers—This table is given to supplement the values of squares and cubes of numbers found in the preceding numerical table. The larger numbers are expressed exponentially to at least seven significant figures. The approximate value written as a whole number may be obtained by shifting the decimal point to the right by the number of places indicated in the exponent of 10 shown at the head of each group of values. For example: the approximate value of 33^8 is found in the table as 14.064086×10^{11}. Written as a whole number it is 1,406,408,600,000.

Factorials and their Logarithms—The product $n \times (n-1) \times (n-2) \times \cdots \times 1$ is called factorial n, expressed as $n!$ or $\underline{|n}$. For example: factorial $5 = 5 \times 4 \times 3 \times 2 \times 1 = 120$. Factorials are very often met with in series. For purposes of computation in such cases the table giving the values of the factorials and of their logarithms for numbers from 1 to 100 is provided. The values of the factorials are expressed exponentially to 5 significant figures.

A brief table of exact values and reciprocals of factorials is to be found on page 161.

Factors for Computing Probable Errors—The probable error of a series of n measures $a_1, a_2, a_3 \ldots a_n$, the mean of which is m, is given by the expression,

$$e = \frac{0.6745}{\sqrt{n-1}}\sqrt{(m-a_1)^2 + (m-a_2)^2 + \cdots (m-a_n)^2}$$

The probable error of the mean is,

$$E = \frac{0.6745}{\sqrt{n(n-1)}}\sqrt{(m-a_1)^2 + (m-a_2)^2 + \cdots (m-a_n)^2}$$

The following approximate equations are convenient forms for computation,

$$e = 0.8453\frac{\Sigma d}{\sqrt{n(n-1)}}$$

$$E = 0.8453\frac{\Sigma d}{n\sqrt{n-1}}$$

The symbol Σd represents the arithmetical sum of the deviations.

For convenience in computing the probable error the value of several of the factors involved is given for values of n from 2 to 100.

Probability of Occurrence of Deviations—The significance of deviations is indicated by this table. The probability of occurrence of deviations as great as or greater than any specific value is given for various ratios of deviation to probable error and also with respect to the standard deviation σ. The probability of occurrence is stated in per cent or chances in 100. The odds against occurrence are also stated. The probable error is $0.6745 \times (\sigma)$.

Areas, Ordinates and Derivatives of the Normal Curve of Error—If, for a large number of observations, the frequency y, of the occurrence of an error of magnitude t be plotted, a curve results whose equation may be written,

$$y = \frac{1}{\sqrt{2\pi}} e^{-t^2/2}$$

The area, ordinates and derivatives for this curve given in the table are useful in the treatment of observational data. A text on statistical methods should be consulted for a complete explanation.

Factors and Primes—The table presents the prime factors of *all* factorable numbers and the logarithms of all prime numbers from 1 to 2000.

Conversion Table

Inches		Centimeters	Centimeters		Inches
1	=	2.54001	1	=	0.39370
2	=	5.08001	2	=	0.78740
3	=	7.62002	3	=	1.1811
4	=	10.16002	4	=	1.5748
5	=	12.70003	5	=	1.9685
6	=	15.24003	6	=	2.3622
7	=	17.78004	7	=	2.7559
8	=	20.32004	8	=	3.1496
9	=	22.86005	9	=	3.5433
Feet		**Meters**	**Meters**		**Feet**
1	=	0.304801	1	=	3.28083
2	=	0.609601	2	=	6.56167
3	=	0.914402	3	=	9.84250
4	=	1.219202	4	=	13.12333
5	=	1.524003	5	=	16.40417
6	=	1.828804	6	=	19.68500
7	=	2.133604	7	=	22.96583
8	=	2.438405	8	=	26.24666
9	=	2.743205	9	=	29.52750
Yards		**Meters**	**Meters**		**Yards**
1	=	0.914402	1	=	1.093611
2	=	1.828804	2	=	2.187222
3	=	2.743205	3	=	3.280833
4	=	3.657607	4	=	4.374444
5	=	4.572009	5	=	5.468056
6	=	5.486411	6	=	6.561667
7	=	6.400813	7	=	7.655278
8	=	7.315215	8	=	8.748889
9	=	8.229616	9	=	9.842500

Conversion Tables (Continued)

Miles	Kilometers	Kilometers	Miles
1	1.60935	1	0.62137
2	3.21869	2	1.24274
3	4.82804	3	1.86411
4	6.43739	4	2.48548
5	8.04674	5	3.10685
6	9.65608	6	3.72822
7	11.26543	7	4.34959
8	12 87478	8	4 97096
9	14.48412	9	5 59233
Pounds Av.	**Kilograms**	**Kilograms**	**Pounds Av.**
1	0.45359	1	2.20462
2	0 90718	2	4.40924
3	1 36078	3	6.61387
4	1.81437	4	8 81849
5	2.26796	5	11 02311
6	2 72155	6	13.22773
7	3 17514	7	15.43236
8	3.62874	8	17.63698
9	4 08233	9	19 84160

Conversion Factors

U. S. AND METRIC UNITS

Each unit in bold face type is followed by its equivalent in one or other units of the same quantity.

Acre—0.0015625 square mile, 4.3560 $\times 10^4$ square feet; 0.4046873 hectare

Bushel—1.2444 cubic feet; 2150.42 cubic inches; 0.035239 cubic meter; 35.238 liters

Centimeter—0.032808 foot; 0.39370 inch.

Circular Mil.—7.854 $\times 10^{-7}$ square inch; 5.0671 $\times 10^{-6}$ square centimeter

Cubic Centimeter—0.061023 cubic inch; 0.27051 dram; 16.231 minims; 0.99997 milliliter

Cubic Foot—0.80357 bushel; 7.481 gallon; 0.02831701 cubic meter; 28.316 liters

Cubic Inch—16.387162 cubic centimeters

Cubic Meter—35.314445 cubic feet; 264.173 gallons

Foot—0.3048006 meter

Gallon—0.13368 cubic foot; 0.83268 gallons (British); 231.00 cubic inches; 0.0037854 cubic meter; 3.7853 liters

Grain—0.064798918 gram

Gram—0.00220462 pound (avoirdupois); .0352740 ounce (avoirdupois); 15.4324 grains

Hectare—2.471044 acres; 1.0764 $\times 10^5$ square feet

Inch—2.540005 centimeter

Kilogram—2.2046223 pounds (avoirdupois)

Kilometer—0.62137 mile

Liter—0.26417762 gallon; 0.035316 cubic foot; 1.056710 quarts

Meter—1.093611 yards; 3.280833 feet; 39.3700 inches

Mile—1.60935 kilometers

Ounce (fluid)—1.80469 cubic inches; 29.5737 cubic centimeters

Ounce (avoirdupois)—28.349527 grams

Ounce (apothecary or troy)—31.103481 grams

Pint (liquid)—0.473167 liter; 473.179 cubic centimeters

Pound (avoirdupois)—0.453592 kilogram; 453.5924 grams

Pound (apothecary or troy)—0.3732418 kilogram; 373.2418 grams

Quart—1.10120 liters

Quart (liquid)—.946333 liter

Radian—57.29578 degrees

Rod—5.029210 meters

Square Centimeter—0.15500 square inches

Square Foot—0.09290341 square meter

Square Inch—645.16258 square millimeters

Square Meter—10.76387 square feet

Square Yard—0.83613 square meter

Ton (short)—907.185 kilograms

Yard—0.91440183 meter

NUMERICAL CONSTANTS

Numbers Containing π

$\pi = 3.14159\ 26536$ $\quad \log_{10}\pi = 0.49714\ 98727$ $\quad \log_e \pi = 1.14472\ 98858$

	Number	Logarithm		Number	Logarithm
π	3.1415 927	0.4971 499	π^2	9.8696 044	0.9942 997
2π	6.2831 853	0.7981 799	$2\pi^2$	19.7392 088	1.2953 297
3π	9.4247 780	0.9742 711	$4\pi^2$	39.4784 176	1.5963 597
4π	12.5663 706	1.0992 099	$1/\pi^2$	0.1013 212	9.0057 003−10
8π	25.1327 412	1.4002 399	$1/(2\pi^2)$	0.0506 606	8.7046 703−10
$\pi/2$	1.5707 963	0.1961 199	$1/(4\pi^2)$	0.0253 303	8.4036 403−10
$\pi/3$	1.0471 976	0.0200 286	$\sqrt{\pi}$	1.7724 539	0.2485 749
$\pi/4$	0.7853 982	9.8950 899−10	$\sqrt{\pi/4}$ or	0.8862 269	9.9475 449−10
$\pi/6$	0.5235 988	9.7189 986−10	$\sqrt{\pi}/2$		
$\pi/8$	0.3926 991	9.5940 599−10	$\sqrt{\pi}/4$	0.4431 135	9.6465 149−10
$2\pi/3$	2.0943 951	0.3210 586	$\sqrt{\pi/2}$	1.2533 141	0.0980 599
$4\pi/3$	4.1887 902	0.6220 886	$\sqrt{2/\pi}$	0.7978 846	9.9019 401−10
$1/\pi$	0.3183 099	9.5028 501−10	π^3	31.0062 767	1.4914 496
$2/\pi$	0.6366 198	9.8038 801−10	$\sqrt[3]{\pi}$	1.4645 919	0.1657 166
$4/\pi$	1.2732 395	0.1049 101	$1/\sqrt[3]{\pi}$	0.6827 841	9.8342 834−10
$1/(2\pi)$	0.1591 549	9.2018 201−10	$\sqrt[3]{\pi^2}$	2.1450 294	0.3314 332
$1/(4\pi)$	0.0795 775	8.9007 901−10	$1/\sqrt{\pi}$	0.5641 896	9.7514 251−10
$1/(6\pi)$	0.0530 516	8.7246 989−10	$2/\sqrt{\pi}$ or	1.1283 792	0.0524 551
$1/(8\pi)$	0.0397 887	8.5997 601−10	$\sqrt{4/\pi}$		

Logarithmic Constants

$e = 2.71828\ 18285$ $\qquad M = \log_{10} e = 0.43429\ 44819$

$1/M = \log_e 10 = 2.30258\ 50930$ $\qquad \log_{10} M = \log_{10}\log_{10} e = 9.63778\ 43113$

$1/e = 0.36787\ 94412$

$\log_e 2 = 0.69314\ 71806$ $\qquad \log_{10} 2 = 0.30102\ 99957$

Change of Base

$$\log_a x = \log_b x/\log_b a$$

$$\log_{10} x = \log_e x/\log_e 10 \qquad \log_e x = \log_{10} x/\log_{10} e$$

$$\log_e x = 1/M \log_{10} x = 2.30258\ 50930 \log_{10} x$$

$$\log_{10} x = M \log_e x = 0.43429\ 44819 \log_e x$$

DECIMAL EQUIVALENTS OF COMMON FRACTIONS

	1/32	2/64 =	0.03125			17/32	34/64 =	0.53125
1/16	2/32	4/64 =	.0625		9/16	18/32	36/64 =	.5625
	3/32	6/64 =	.09375			19/32	38/64 =	.59375
1/8	4/32	8/64 =	.125		5/8	20/32	40/64 =	.625
	5/32	10/64 =	.15625			21/32	42/64 =	.65625
3/16	6/32	12/64 =	.1875		11/16	22/32	44/64 =	.6875
	7/32	14/64 =	.21875			23/32	46/64 =	.71875
1/4	8/32	16/64 =	.25		3/4	24/32	48/64 =	.75
	9/32	18/64 =	.28125			25/32	50/64 =	.78125
5/16	10/32	20/64 =	.3125		13/16	26/32	52/64 =	.8125
	11/32	22/64 =	.34375			27/32	54/64 =	.84375
3/8	12/32	24/64 =	.375		7/8	28/32	56/64 =	.875
	13/32	26/64 =	.40625			29/32	58/64 =	.90625
7/16	14/32	28/64 =	.4375		15/16	30/32	60/64 =	.9375
	15/32	30/64 =	.46875			31/32	62/64 =	.96875
1/2	16/32	32/64 =	.50					

MISCELLANEOUS CONSTANTS

Mean radius of the earth, 3959 miles = 6371 kilometers.

1 degree of latitude at 40° = 69 miles.

1 nautical mile = 1′ of arc on the earth's surface at the equator.

Mean density of the earth, 5.522 grams per cm^3.

Constant of gravitation, $K = 6.670 \times 10^{-8}$ = the attraction in dynes between two gram masses one centimeter apart.

Acceleration due to gravity at sea level, lat. 45° = 980.616 cm. per sec. per sec. = 32.172 feet per sec. per sec.

Length of seconds pendulum at sea level, lat. 45° = 99.356 cm. = 39.116 in.

Density of mercury at 0°C. = 13.59509 g. per cm^3.

Density of water, maximum at 3.98° C. = 0.999973 g. per cm^3

Density of dry air at 0° C. and 760 mm. = .001293 g. per cm^3.

Velocity of sound in dry air at 0° C., 33,136 cm. per sec. = 1089 feet per sec.

Velocity of light in a vacuum = 2.99776×10^{10} cm. per sec. = 9.83514×10^{8} feet per sec. = 186,272 mi./sec.

Heat equivalent of fusion of water 79.71 cal. (15° C.) per gram.

Heat equivalent of vaporization of water, 539.55 cal. (15° C.) per gram.

Coefficient of expansion of gases, .003665.

Specific heat of air, at constant pressure, 0.238.

Electrochemical equivalent of silver, 0.001118 g. per sec. per int. ampere.

Mean wave length of sodium light, .00005893 cm. or 5893. ångström units.

Absolute wave length of red cadmium line in air, 760 mm. pressure, 15° C.; 6438.4696 ångström units.

GREEK ALPHABET

Greek letter	Greek name	English equivalent	Greek letter	Greek name	English equivalent
Α α	Alpha	a	Ν ν	Nu	n
Β β	Beta	b	Ξ ξ	Xi	x
Γ γ	Gamma	g	Ο ο	Omicron	ŏ
Δ δ	Delta	d	Π π	Pi	p
Ε ε	Epsilon	ĕ	Ρ ρ	Rho	r
Ζ ζ	Zeta	z	Σ σ	Sigma	s
Η η	Eta	ē	Τ τ	Tau	t
Θ θ	Theta	th	Υ υ	Upsilon	u
Ι ι	Iota	i	Φ φ	Phi	ph
Κ κ	Kappa	k	Χ χ	Chi	ch
Λ λ	Lambda	l	Ψ ψ	Psi	ps
Μ μ	Mu	m	Ω ω	Omega	ō

N	0	1	2	3	4	5	6	7	8	9	PP 1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	*4	8	12	17	21	25	29	33	37
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16	19	23	26	29
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	*3	6	8	11	14	17	20	22	25
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	20	22
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12	14	16	19	21
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11	13	16	18	20
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

(PP = Proportional Parts)

* **Interpolation in this section of the table is inaccurate.**

N	0	1	2	3	4	5	6	7	8	9	Proportional Parts 1	2	3	4	5	6	7	8	9
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

	0	1	2	3	4	5	6	7	8	9	Proportional Parts 1	2	3	4	5	6	7	8	9
.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1	1	2	2	2
.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1	1	2	2	2
.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2
.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2
.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1	2	2	2	2
.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1	2	2	2	2
06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	1	1	2	2	2	2
.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1	2	2	2	2
.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	1	2	2	2	3
.09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	1	1	2	2	2	3
.10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	1	1	2	2	2	3
.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2	2	2	2	3
.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	2	2	2	2	3
.13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	1	1	2	2	2	3	3
.14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	1	1	2	2	2	3	3
.15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	1	1	2	2	2	3	3
.16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	1	1	2	2	2	3	3
.17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	1	1	2	2	2	3	3
.18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	1	1	2	2	2	3	3
.19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	1	1	2	2	3	3	3
.20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	2	2	3	3	3
21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	2	2	2	3	3	3
.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	2	2	2	3	3	3
.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	2	2	2	3	3	4
.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	2	2	2	3	3	4
.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	1	2	2	2	3	3	4
.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	2	2	3	3	3	4
27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	2	2	3	3	3	4
.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	2	2	3	3	4	4
.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	2	2	3	3	4	4
.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	2	2	3	3	4	4
.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2	3	3	4	4
.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	2	2	3	3	4	4
.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	3	3	4	4	5
.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	3	3	4	4	5
.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	3	3	4	4	5
.37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	1	2	2	3	3	4	4	5
.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	3	3	4	4	5
.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	3	3	4	5	5
.40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	1	2	2	3	4	4	5	5
.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	3	4	4	5	5
.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3	4	4	5	6
.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	3	3	4	4	5	6
.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	3	3	4	4	5	6
.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	3	3	4	5	5	6
.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3	4	5	5	6
.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	3	3	4	5	5	6
.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	3	4	4	5	6	6
.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	3	4	4	5	6	6
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

ANTILOGARITHMS

	0	1	2	3	4	5	6	7	8	9	Proportional Parts								
											1	2	3	4	5	6	7	8	9
.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4	4	5	6	7
.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	2	3	4	5	5	6	7
.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	2	3	4	5	5	6	7
.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4	5	6	6	7
.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4	5	6	6	7
.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7
.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8
.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8
.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8
.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8
.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8
.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9
.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9
.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9
.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9
.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9
.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10
.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10
.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10
.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10
.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11
.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11
.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6	7	9	10	11
.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11
.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12
.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12
.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12
.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7	8	10	11	12
.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13
.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7	9	10	11	13
.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13
.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14
.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	5	6	8	9	11	12	14
.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14
.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15
.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15
.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	15
.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	3	5	7	9	10	12	14	16
.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9	11	12	14	16
.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	13	14	16
.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17
.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17
.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17
.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18
.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10	12	14	16	18
.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10	12	15	17	19
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11	13	16	18	20
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	14	16	18	20
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts			
100	00 000	043	087	130	173	217	260	303	346	389		**44**	**43**	**42**
101	432	475	518	561	604	647	689	732	775	817	1	4,4	4,3	4,2
102	860	903	945	988	*030	*072	*115	*157	*199	*242	2	8,8	8,6	8,4
103	01 284	326	368	410	452	494	536	578	620	662	3	13,2	12,9	12,6
104	703	745	787	828	870	912	953	995	*036	*078	4	17,6	17,2	16,8
105	02 119	160	202	243	284	325	366	407	449	490	5	22,0	21,5	21,0
106	531	572	612	653	694	735	776	816	857	898	6	26,4	25,8	25,2
107	938	979	*019	*060	*100	*141	*181	*222	*262	*302	7	30,8	30,1	29,4
108	03 342	383	423	463	503	543	583	623	663	703	8	35,2	34,4	33,6
109	743	782	822	862	902	941	981	*021	*060	*100	9	39,6	38,7	37,8
110	04 139	179	218	258	297	336	376	415	454	493		**41**	**40**	**39**
111	532	571	610	650	689	727	766	805	844	883	1	4,1	4,0	3,9
112	922	961	999	*038	*077	*115	*154	*192	*231	*269	2	8,2	8,0	7,8
113	05 308	346	385	423	461	500	538	576	614	652	3	12,3	12,0	11,7
114	690	729	767	805	843	881	918	956	994	*032	4	16,4	16,0	15,6
115	06 070	108	145	183	221	258	296	333	371	408	5	20,5	20,0	19,5
116	446	483	521	558	595	633	670	707	744	781	6	24,6	24,0	23,4
117	819	856	893	930	967	*004	*041	*078	*115	*151	7	28,7	28,0	27,3
118	07 188	225	262	298	335	372	408	445	482	518	8	32,8	32,0	31,2
119	555	591	628	664	700	737	773	809	846	882	9	36,9	36,0	35,1
120	918	954	990	*027	*063	*099	*135	*171	*207	*243		**38**	**37**	**36**
121	08 279	314	350	386	422	458	493	529	565	600	1	3,8	3,7	3,6
122	636	672	707	743	778	814	849	884	920	955	2	7,6	7,4	7,2
123	991	*026	*061	*096	*132	*167	*202	*237	*272	*307	3	11,4	11,1	10,8
124	09 342	377	412	447	482	517	552	587	621	656	4	15,2	14,8	14,4
125	691	726	760	795	830	864	899	934	968	*003	5	19,0	18,5	18,0
126	10 037	072	106	140	175	209	243	278	312	346	6	22,8	22,2	21,6
127	380	415	449	483	517	551	585	619	653	687	7	26,6	25,9	25,2
128	721	755	789	823	857	890	924	958	992	*025	8	30,4	29,6	28,8
129	11 059	093	126	160	193	227	261	294	327	361	9	34,2	33,3	32,4
130	394	428	461	494	528	561	594	628	661	694		**35**	**34**	**33**
131	727	760	793	826	860	893	926	959	992	*024	1	3,5	3,4	3,3
132	12 057	090	123	156	189	222	254	287	320	352	2	7,0	6,8	6,6
133	385	418	450	483	516	548	581	613	646	678	3	10,5	10,2	9,9
134	710	743	775	808	840	872	905	937	969	*001	4	14,0	13,6	13,2
135	13 033	066	098	130	162	194	226	258	290	322	5	17,5	17,0	16,5
136	354	386	418	450	481	513	545	577	609	640	6	21,0	20,4	19,8
137	672	704	735	767	799	830	862	893	925	956	7	24,5	23,8	23,1
138	988	*019	*051	*082	*114	*145	*176	*208	*239	*270	8	28,0	27,2	26,4
139	14 301	333	364	395	426	457	489	520	551	582	9	31,5	30,6	29,7
140	613	644	675	706	737	768	799	829	860	891		**32**	**31**	**30**
141	922	953	983	*014	*045	*076	*106	*137	*168	*198	1	3,2	3,1	3,0
142	15 229	259	290	320	351	381	412	442	473	503	2	6,4	6,2	6,0
143	534	564	594	625	655	685	715	746	776	806	3	9,6	9,3	9,0
144	836	866	897	927	957	987	*017	*047	*077	*107	4	12,8	12,4	12,0
145	16 137	167	197	227	256	286	316	346	376	406	5	16,0	15,5	15,0
146	435	465	495	524	554	584	613	643	673	702	6	19,2	18,6	18,0
147	732	761	791	820	850	879	909	938	967	997	7	22,4	21,7	21,0
148	17 026	056	085	114	143	173	202	231	260	289	8	25,6	24,8	24,0
149	319	348	377	406	435	464	493	522	551	580	9	28,8	27,9	27,0
150	609	638	667	696	725	754	782	811	840	869				
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts			

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		
150	17 609	638	667	696	725	754	782	811	840	869		**29**	**28**
151	898	926	955	984	*013	*041	*070	*099	*127	*156	1	2,9	2,8
152	18 184	213	241	270	298	327	355	384	412	441	2	5,8	5,6
153	469	498	526	554	583	611	639	667	696	724	3	8,7	8,4
154	752	780	808	837	865	893	921	949	977	*005	4	11,6	11,2
155	19 033	061	089	117	145	173	201	229	257	285	5	14,5	14,0
156	312	340	368	396	424	451	479	507	535	562	6	17,4	16,8
157	590	618	645	673	700	728	756	783	811	838	7	20,3	19,6
158	866	893	921	948	976	*003	*030	*058	*085	*112	8	23,2	22,4
159	20 140	167	194	222	249	276	303	330	358	385	9	26,1	25,2
160	412	439	466	493	520	548	575	602	629	656		**27**	**26**
161	683	710	737	763	790	817	844	871	898	925	1	2,7	2,6
162	952	978	*005	*032	*059	*085	*112	*139	*165	*192	2	5,4	5,2
163	21 219	245	272	299	325	352	378	405	431	458	3	8,1	7,8
164	484	511	537	564	590	617	643	669	696	722	4	10,8	10,4
165	748	775	801	827	854	880	906	932	958	985	5	13,5	13,0
166	22 011	037	063	089	115	141	167	194	220	246	6	16,2	15,6
167	272	298	324	350	376	401	427	453	479	505	7	18,9	18,2
168	531	557	583	608	634	660	686	712	737	763	8	21,6	20,8
169	789	814	840	866	891	917	943	968	994	*019	9	24,3	23,4
170	23 045	070	096	121	147	172	198	223	249	274		**25**	
171	300	325	350	376	401	426	452	477	502	528	1	2,5	
172	553	578	603	629	654	679	704	729	754	779	2	5,0	
173	805	830	855	880	905	930	955	980	*005	*030	3	7,5	
174	24 055	080	105	130	155	180	204	229	254	279	4	10,0	
175	304	329	353	378	403	428	452	477	502	527	5	12,5	
176	551	576	601	625	650	674	699	724	748	773	6	15,0	
177	797	822	846	871	895	920	944	969	993	*018	7	17,5	
178	25 042	066	091	115	139	164	188	212	237	261	8	20,0	
179	285	310	334	358	382	406	431	455	479	503	9	22,5	
180	527	551	575	600	624	648	672	696	720	744		**24**	**23**
181	768	792	816	840	864	888	912	935	959	983	1	2,4	2,3
182	26 007	031	055	079	102	126	150	174	198	221	2	4,8	4,6
183	245	269	293	316	340	364	387	411	435	458	3	7,2	6,9
184	482	505	529	553	576	600	623	647	670	694	4	9,6	9,2
185	717	741	764	788	811	834	858	881	905	928	5	12,0	11,5
186	951	975	998	*021	*045	*068	*091	*114	*138	*161	6	14,4	13,8
187	27 184	207	231	254	277	300	323	346	370	393	7	16,8	16,1
188	416	439	462	485	508	531	554	577	600	623	8	19,2	18,4
189	646	669	692	715	738	761	784	807	830	852	9	21,6	20,7
190	875	898	921	944	967	989	*012	*035	*058	*081		**22**	**21**
191	28 103	126	149	171	194	217	240	262	285	307	1	2,2	2,1
192	330	353	375	398	421	443	466	488	511	533	2	4,4	4,2
193	556	578	601	623	646	668	691	713	735	758	3	6,6	6,3
194	780	803	825	847	870	892	914	937	959	981	4	8,8	8,4
195	29 003	026	048	070	092	115	137	159	181	203	5	11,0	10,5
196	226	248	270	292	314	336	358	380	403	425	6	13,2	12,6
197	447	469	491	513	535	557	579	601	623	645	7	15,4	14,7
198	667	688	710	732	754	776	798	820	842	863	8	17,6	16,8
199	885	907	929	951	973	994	*016	*038	*060	*081	9	19,8	18,9
200	30 103	125	146	168	190	211	233	255	276	298			
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		
200	30 103	125	146	168	190	211	233	255	276	298		**22**	**21**
201	320	341	363	384	406	428	449	471	492	514	1	2,2	2,1
202	535	557	578	600	621	643	664	685	707	728	2	4,4	4,2
203	750	771	792	814	835	856	878	899	920	942	3	6,6	6,3
204	963	984	*006	*027	*048	*069	*091	*112	*133	*154	4	8,8	8,4
205	31 175	197	218	239	260	281	302	323	345	366	5	11,0	10,5
206	387	408	429	450	471	492	513	534	555	576	6	13,2	12,6
207	597	618	639	660	681	702	723	744	765	785	7	15,4	14,7
208	806	827	848	869	890	911	931	952	973	994	8	17,6	16,8
209	32 015	035	056	077	098	118	139	160	181	201	9	19,8	18,9
210	222	243	263	284	305	325	346	366	387	408		**20**	
211	428	449	469	490	510	531	552	572	593	613	1	2,0	
212	634	654	675	695	715	736	756	777	797	818	2	4,0	
213	838	858	879	899	919	940	960	980	*001	*021	3	6,0	
214	33 041	062	082	102	122	143	163	183	203	224	4	8,0	
215	244	264	284	304	325	345	365	385	405	425	5	10,0	
216	445	465	486	506	526	546	566	586	606	626	6	12,0	
217	646	666	686	706	726	746	766	786	806	826	7	14,0	
218	846	866	885	905	925	945	965	985	*005	*025	8	16,0	
219	34 044	064	084	104	124	143	163	183	203	223	9	18,0	
220	242	262	282	301	321	341	361	380	400	420		**19**	
221	439	459	479	498	518	537	557	577	596	616	1	1,9	
222	635	655	674	694	713	733	753	772	792	811	2	3,8	
223	830	850	869	889	908	928	947	967	986	*005	3	5,7	
224	35 025	044	064	083	102	122	141	160	180	199	4	7,6	
225	218	238	257	276	295	315	334	353	372	392	5	9,5	
226	411	430	449	468	488	507	526	545	564	583	6	11,4	
227	603	622	641	660	679	698	717	736	755	774	7	13,3	
228	793	813	832	851	870	889	908	927	946	965	8	15,2	
229	984	*003	*021	*040	*059	*078	*097	*116	*135	*154	9	17,1	
230	36 173	192	211	229	248	267	286	305	324	342		**18**	
231	361	380	399	418	436	455	474	493	511	530	1	1,8	
232	549	568	586	605	624	642	661	680	698	717	2	3,6	
233	736	754	773	791	810	829	847	866	884	903	3	5,4	
234	922	940	959	977	996	*014	*033	*051	*070	*088	4	7,2	
235	37 107	125	144	162	181	199	218	236	254	273	5	9,0	
236	291	310	328	346	365	383	401	420	438	457	6	10,8	
237	475	493	511	530	548	566	585	603	621	639	7	12,6	
238	658	676	694	712	731	749	767	785	803	822	8	14,4	
239	840	858	876	894	912	931	949	967	985	*003	9	16,2	
240	38 021	039	057	075	093	112	130	148	166	184		**17**	
241	202	220	238	256	274	292	310	328	346	364	1	1,7	
242	382	399	417	435	453	471	489	507	525	543	2	3,4	
243	561	578	596	614	632	650	668	686	703	721	3	5,1	
244	739	757	775	792	810	828	846	863	881	899	4	6,8	
245	917	934	952	970	987	*005	*023	*041	*058	*076	5	8,5	
246	39 094	111	129	146	164	182	199	217	235	252	6	10,2	
247	270	287	305	322	340	358	375	393	410	428	7	11,9	
248	445	463	480	498	515	533	550	568	585	602	8	13,6	
249	620	637	655	672	690	707	724	742	759	777	9	15,3	
250	794	811	829	846	863	881	898	915	933	950			
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		

FIVE-PLACE LOGARITHMS (Continued)

N.		0	1	2	3	4	5	6	7	8	9	Proportional parts	
250	39	794	811	829	846	863	881	898	915	933	950		**18**
251		967	985	*002	*019	*037	*054	*071	*088	*106	*123	1	1,8
252	40	140	157	175	192	209	226	243	261	278	295	2	3,6
253		312	329	346	364	381	398	415	432	449	466	3	5,4
254		483	500	518	535	552	569	586	603	620	637	4	7,2
255		654	671	688	705	722	739	756	773	790	807	5	9,0
256		824	841	858	875	892	909	926	943	960	976	6	10,8
257		993	*010	*027	*044	*061	*078	*095	*111	*128	*145	7	12,6
258	41	162	179	196	212	229	246	263	280	296	313	8	14,4
259		330	347	363	380	397	414	430	447	464	481	9	16,2
260		497	514	531	547	564	581	597	614	631	647		**17**
261		664	681	697	714	731	747	764	780	797	814	1	1,7
262		830	847	863	880	896	913	929	946	963	979	2	3,4
263		996	*012	*029	*045	*062	*078	*095	*111	*127	*144	3	5,1
264	42	160	177	193	210	226	243	259	275	292	308	4	6,8
265		325	341	357	374	390	406	423	439	455	472	5	8,5
266		488	504	521	537	553	570	586	602	619	635	6	10,2
267		651	667	684	700	716	732	749	765	781	797	7	11,9
268		813	830	846	862	878	894	911	927	943	959	8	13,6
269		975	991	*008	*024	*040	*056	*072	*088	*104	*120	9	15,3
270	43	136	152	169	185	201	217	233	249	265	281		**16**
271		297	313	329	345	361	377	393	409	425	441	1	1,6
272		457	473	489	505	521	537	553	569	584	600	2	3,2
273		616	632	648	664	680	696	712	727	743	759	3	4,8
274		775	791	807	823	838	854	870	886	902	917	4	6,4
275		933	949	965	981	996	*012	*028	*044	*059	*075	5	8,0
276	44	091	107	122	138	154	170	185	201	217	232	6	9,6
277		248	264	279	295	311	326	342	358	373	389	7	11,2
278		404	420	436	451	467	483	498	514	529	545	8	12,8
279		560	576	592	607	623	638	654	669	685	700	9	14,4
280		716	731	747	762	778	793	809	824	840	855		**15**
281		871	886	902	917	932	948	963	979	994	*010	1	1,5
282	45	025	040	056	071	086	102	117	133	148	163	2	3,0
283		179	194	209	225	240	255	271	286	301	317	3	4,5
284		332	347	362	378	393	408	423	439	454	469	4	6,0
285		484	500	515	530	545	561	576	591	606	621	5	7,5
286		637	652	667	682	697	712	728	743	758	773	6	9,0
287		788	803	818	834	849	864	879	894	909	924	7	10,5
288		939	954	969	984	*000	*015	*030	*045	*060	*075	8	12,0
289	46	090	105	120	135	150	165	180	195	210	225	9	13,5
290		240	255	270	285	300	315	330	345	359	374		**14**
291		389	404	419	434	449	464	479	494	509	523	1	1,4
292		538	553	568	583	598	613	627	642	657	672	2	2,8
293		687	702	716	731	746	761	776	790	805	820	3	4,2
294		835	850	864	879	894	909	923	938	953	967	4	5,6
295		982	997	*012	*026	*041	*056	*070	*085	*100	*114	5	7,0
296	47	129	144	159	173	188	202	217	232	246	261	6	8,4
297		276	290	305	319	334	349	363	378	392	407	7	9,8
298		422	436	451	465	480	494	509	524	538	553	8	11,2
299		567	582	596	611	625	640	654	669	683	698	9	12,6
300		712	727	741	756	770	784	799	813	828	842		
N.		0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.		0	1	2	3	4	5	6	7	8	9
300	47	712	727	741	756	770	784	799	813	828	842
301		857	871	885	900	914	929	943	958	972	986
302	48	001	015	029	044	058	073	087	101	116	130
303		144	159	173	187	202	216	230	244	259	273
304		287	302	316	330	344	359	373	387	401	416
305		430	444	458	473	487	501	515	530	544	558
306		572	586	601	615	629	643	657	671	686	700
307		714	728	742	756	770	785	799	813	827	841
308		855	869	883	897	911	926	940	954	968	982
309		996	*010	*024	*038	*052	*066	*080	*094	*108	*122
310	49	136	150	164	178	192	206	220	234	248	262
311		276	290	304	318	332	346	360	374	388	402
312		415	429	443	457	471	485	499	513	527	541
313		554	568	582	596	610	624	638	651	665	679
314		693	707	721	734	748	762	776	790	803	817
315		831	845	859	872	886	900	914	927	941	955
316		969	982	996	*010	*024	*037	*051	*065	*079	*092
317	50	106	120	133	147	161	174	188	202	215	229
318		243	256	270	284	297	311	325	338	352	365
319		379	393	406	420	433	447	461	474	488	501
320		515	529	542	556	569	583	596	610	623	637
321		651	664	678	691	705	718	732	745	759	772
322		786	799	813	826	840	853	866	880	893	907
323		920	934	947	961	974	987	*001	*014	*028	*041
324	51	055	068	081	095	108	121	135	148	162	175
325		188	202	215	228	242	255	268	282	295	308
326		322	335	348	362	375	388	402	415	428	441
327		455	468	481	495	508	521	534	548	561	574
328		587	601	614	627	640	654	667	680	693	706
329		720	733	746	759	772	786	799	812	825	838
330		851	865	878	891	904	917	930	943	957	970
331		983	996	*009	*022	*035	*048	*061	*075	*088	*101
332	52	114	127	140	153	166	179	192	205	218	231
333		244	257	270	284	297	310	323	336	349	362
334		375	388	401	414	427	440	453	466	479	492
335		504	517	530	543	556	569	582	595	608	621
336		634	647	660	673	686	699	711	724	737	750
337		763	776	789	802	815	827	840	853	866	879
338		892	905	917	930	943	956	969	982	994	*007
339	53	020	033	046	058	071	084	097	110	122	135
340		148	161	173	186	199	212	224	237	250	263
341		275	288	301	314	326	339	352	364	377	390
342		403	415	428	441	453	466	479	491	504	517
343		529	542	555	567	580	593	605	618	631	643
344		656	668	681	694	706	719	732	744	757	769
345		782	794	807	820	832	845	857	870	882	895
346		908	920	933	945	958	970	983	995	*008	*020
347	54	033	045	058	070	083	095	108	120	133	145
348		158	170	183	195	208	220	233	245	258	270
349		283	295	307	320	332	345	357	370	382	394
350		407	419	432	444	456	469	481	494	506	518
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	15	**14**	**13**	**12**
1	1,5	1,4	1,3	1,2
2	3,0	2,8	2,6	2,4
3	4,5	4,2	3,9	3,6
4	6,0	5,6	5,2	4,8
5	7,5	7,0	6,5	6,0
6	9,0	8,4	7,8	7,2
7	10,5	9,8	9,1	8,4
8	12,0	11,2	10,4	9,6
9	13,5	12,6	11,7	10,8

Proportional parts

N.		0	1	2	3	4	5	6	7	8	9
350	54	407	419	432	444	456	469	481	494	506	518
351		531	543	555	568	580	593	605	617	630	642
352		654	667	679	691	704	716	728	741	753	765
353		777	790	802	814	827	839	851	864	876	888
354		900	913	925	937	949	962	974	986	998	*011
355	55	023	035	047	060	072	084	096	108	121	133
356		145	157	169	182	194	206	218	230	242	255
357		267	279	291	303	315	328	340	352	364	376
358		388	400	413	425	437	449	461	473	485	497
359		509	522	534	546	558	570	582	594	606	618
360		630	642	654	666	678	691	703	715	727	739
361		751	763	775	787	799	811	823	835	847	859
362		871	883	895	907	919	931	943	955	967	979
363		991	*003	*015	*027	*038	*050	*062	*074	*086	*098
364	56	110	122	134	146	158	170	182	194	205	217
365		229	241	253	265	277	289	301	312	324	336
366		348	360	372	384	396	407	419	431	443	455
367		467	478	490	502	514	526	538	549	561	573
368		585	597	608	620	632	644	656	667	679	691
369		703	714	726	738	750	761	773	785	797	808
370		820	832	844	855	867	879	891	902	914	926
371		937	949	961	972	984	996	*008	*019	*031	*043
372	57	054	066	078	089	101	113	124	136	148	159
373		171	183	194	206	217	229	241	252	264	276
374		287	299	310	322	334	345	357	368	380	392
375		403	415	426	438	449	461	473	484	496	507
376		519	530	542	553	565	576	588	600	611	623
377		634	646	657	669	680	692	703	715	726	738
378		749	761	772	784	795	807	818	830	841	852
379		864	875	887	898	910	921	933	944	955	967
380		978	990	*001	*013	*024	*035	*047	*058	*070	*081
381	58	092	104	115	127	138	149	161	172	184	195
382		206	218	229	240	252	263	274	286	297	309
383		320	331	343	354	365	377	388	399	410	422
384		433	444	456	467	478	490	501	512	524	535
385		546	557	569	580	591	602	614	625	636	647
386		659	670	681	692	704	715	726	737	749	760
387		771	782	794	805	816	827	838	850	861	872
388		883	894	906	917	928	939	950	961	973	984
389		995	*006	*017	*028	*040	*051	*062	*073	*084	*095
390	59	106	118	129	140	151	162	173	184	195	207
391		218	229	240	251	262	273	284	295	306	318
392		329	340	351	362	373	384	395	406	417	428
393		439	450	461	472	483	494	506	517	528	539
394		550	561	572	583	594	605	616	627	638	649
395		660	671	682	693	704	715	726	737	748	759
396		770	780	791	802	813	824	835	846	857	868
397		879	890	901	912	923	934	945	956	966	977
398		988	999	*010	*021	*032	*043	*054	*065	*076	*086
399	60	097	108	119	130	141	152	163	173	184	195
400		206	217	228	239	249	260	271	282	293	304
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	13	**12**	**11**	**10**
1	1,3	1,2	1,1	1,0
2	2,6	2,4	2,2	2,0
3	3,9	3,6	3,3	3,0
4	5,2	4,8	4,4	4,0
5	6,5	6,0	5,5	5,0
6	7,8	7,2	6,6	6,0
7	9,1	8,4	7,7	7,0
8	10,4	9,6	8,8	8,0
9	11,7	10,8	9,9	9,0

N.	0	1	2	3	4	5	6	7	8	9
400	60 206	217	228	239	249	260	271	282	293	304
401	314	325	336	347	358	369	379	390	401	412
402	423	433	444	455	466	477	487	498	509	520
403	531	541	552	563	574	584	595	606	617	627
404	638	649	660	670	681	692	703	713	724	735
405	746	756	767	778	788	799	810	821	831	842
406	853	863	874	885	895	906	917	927	938	949
407	959	970	981	991	*002	*013	*023	*034	*045	*055
408	61 066	077	087	098	109	119	130	140	151	162
409	172	183	194	204	215	225	236	247	257	268
410	278	289	300	310	321	331	342	352	363	374
411	384	395	405	416	426	437	448	458	469	479
412	490	500	511	521	532	542	553	563	574	584
413	595	606	616	627	637	648	658	669	679	690
414	700	711	721	731	742	752	763	773	784	794
415	805	815	826	836	847	857	868	878	888	899
416	909	920	930	941	951	962	972	982	993	*003
417	62 014	024	034	045	055	066	076	086	097	107
418	118	128	138	149	159	170	180	190	201	211
419	221	232	242	252	263	273	284	294	304	315
420	325	335	346	356	366	377	387	397	408	418
421	428	439	449	459	469	480	490	500	511	521
422	531	542	552	562	572	583	593	603	613	624
423	634	644	655	665	675	685	696	706	716	726
424	737	747	757	767	778	788	798	808	818	829
425	839	849	859	870	880	890	900	910	921	931
426	941	951	961	972	982	992	*002	*012	*022	*033
427	63 043	053	063	073	083	094	104	114	124	134
428	144	155	165	175	185	195	205	215	225	236
429	246	256	266	276	286	296	306	317	327	337
430	347	357	367	377	387	397	407	417	428	438
431	448	458	468	478	488	498	508	518	528	538
432	548	558	568	579	589	599	609	619	629	639
433	649	659	669	679	689	699	709	719	729	739
434	749	759	769	779	789	799	809	819	829	839
435	849	859	869	879	889	899	909	919	929	939
436	949	959	969	979	988	998	*008	*018	*028	*038
437	64 048	058	068	078	088	098	108	118	128	137
438	147	157	167	177	187	197	207	217	227	237
439	246	256	266	276	286	296	306	316	326	335
440	345	355	365	375	385	395	404	414	424	434
441	444	454	464	473	483	493	503	513	523	532
442	542	552	562	572	582	591	601	611	621	631
443	640	650	660	670	680	689	699	709	719	729
444	738	748	758	768	777	787	797	807	816	826
445	836	846	856	865	875	885	895	904	914	924
446	933	943	953	963	972	982	992	*002	*011	*021
447	65 031	040	050	060	070	079	089	099	108	118
448	128	137	147	157	167	176	186	196	205	215
449	225	234	244	254	263	273	283	292	302	312
450	321	331	341	350	360	369	379	389	398	408
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	11
1	1,1
2	2,2
3	3,3
4	4,4
5	5,5
6	6,6
7	7,7
8	8,8
9	9,9

	10
1	1,0
2	2,0
3	3,0
4	4,0
5	5,0
6	6,0
7	7,0
8	8,0
9	9,0

	9
1	0,9
2	1,8
3	2,7
4	3,6
5	4,5
6	5,4
7	6,3
8	7,2
9	8,1

Proportional parts

N.		0	1	2	3	4	5	6	7	8	9
450	65	321	331	341	350	360	369	379	389	398	408
451		418	427	437	447	456	466	475	485	495	504
452		514	523	533	543	552	562	571	581	591	600
453		610	619	629	639	648	658	667	677	686	696
454		706	715	725	734	744	753	763	772	782	792
455		801	811	820	830	839	849	858	868	877	887
456		896	906	916	925	935	944	954	963	973	982
457		992	*001	*011	*020	*030	*039	*049	*058	*068	*077
458	66	087	096	106	115	124	134	143	153	162	172
459		181	191	200	210	219	229	238	247	257	266
460		276	285	295	304	314	323	332	342	351	361
461		370	380	389	398	408	417	427	436	445	455
462		464	474	483	492	502	511	521	530	539	549
463		558	567	577	586	596	605	614	624	633	642
464		652	661	671	680	689	699	708	717	727	736
465		745	755	764	773	783	792	801	811	820	829
466		839	848	857	867	876	885	894	904	913	922
467		932	941	950	960	969	978	987	997	*006	*015
468	67	025	034	043	052	062	071	080	089	099	108
469		117	127	136	145	154	164	173	182	191	201
470		210	219	228	237	247	256	265	274	284	293
471		302	311	321	330	339	348	357	367	376	385
472		394	403	413	422	431	440	449	459	468	477
473		486	495	504	514	523	532	541	550	560	569
474		578	587	596	605	614	624	633	642	651	660
475		669	679	688	697	706	715	724	733	742	752
476		761	770	779	788	797	806	815	825	834	843
477		852	861	870	879	888	897	906	916	925	934
478		943	952	961	970	979	988	997	*006	*015	*024
479	68	034	043	052	061	070	079	088	097	106	115
480		124	133	142	151	160	169	178	187	196	205
481		215	224	233	242	251	260	269	278	287	296
482		305	314	323	332	341	350	359	368	377	386
483		395	404	413	422	431	440	449	458	467	476
484		485	494	502	511	520	529	538	547	556	565
485		574	583	592	601	610	619	628	637	646	655
486		664	673	681	690	699	708	717	726	735	744
487		753	762	771	780	789	797	806	815	824	833
488		842	851	860	869	878	886	895	904	913	922
489		931	940	949	958	966	975	984	993	*002	*011
490	69	020	028	037	046	055	064	073	082	090	099
491		108	117	126	135	144	152	161	170	179	188
492		197	205	214	223	232	241	249	258	267	276
493		285	294	302	311	320	329	338	346	355	364
494		373	381	390	399	408	417	425	434	443	452
495		461	469	478	487	496	504	513	522	531	539
496		548	557	566	574	583	592	601	609	618	627
497		636	644	653	662	671	679	688	697	705	714
498		723	732	740	749	758	767	775	784	793	801
499		810	819	827	836	845	854	862	871	880	888
500		897	906	914	923	932	940	949	958	966	975
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	10
1	1.0
2	2.0
3	3.0
4	4.0
5	5.0
6	6.0
7	7.0
8	8.0
9	9.0

	9
1	0.9
2	1.8
3	2.7
4	3.6
5	4.5
6	5.4
7	6.3
8	7.2
9	8.1

	8
1	0.8
2	1.6
3	2.4
4	3.2
5	4.0
6	4.8
7	5.6
8	6.4
9	7.2

N.	0	1	2	3	4	5	6	7	8	9
500	69 897	906	914	923	932	940	949	958	966	975
501	984	992	*001	*010	*018	*027	*036	*044	*053	*062
502	70 070	079	088	096	105	114	122	131	140	148
503	157	165	174	183	191	200	209	217	226	234
504	243	252	260	269	278	286	295	303	312	321
505	329	338	346	355	364	372	381	389	398	406
506	415	424	432	441	449	458	467	475	484	492
507	501	509	518	526	535	544	552	561	569	578
508	586	595	603	612	621	629	638	646	655	663
509	672	680	689	697	706	714	723	731	740	749
510	757	766	774	783	791	800	808	817	825	834
511	842	851	859	868	876	885	893	902	910	919
512	927	935	944	952	961	969	978	986	995	*003
513	71 012	020	029	037	046	054	063	071	079	088
514	096	105	113	122	130	139	147	155	164	172
515	181	189	198	206	214	223	231	240	248	257
516	265	273	282	290	299	307	315	324	332	341
517	349	357	366	374	383	391	399	408	416	425
518	433	441	450	458	466	475	483	492	500	508
519	517	525	533	542	550	559	567	575	584	592
520	600	609	617	625	634	642	650	659	667	675
521	684	692	700	709	717	725	734	742	750	759
522	767	775	784	792	800	809	817	825	834	842
523	850	858	867	875	883	892	900	908	917	925
524	933	941	950	958	966	975	983	991	999	*008
525	72 016	024	032	041	049	057	066	074	082	090
526	099	107	115	123	132	140	148	156	165	173
527	181	189	198	206	214	222	230	239	247	255
528	263	272	280	288	296	304	313	321	329	337
529	346	354	362	370	378	387	395	403	411	419
530	428	436	444	452	460	469	477	485	493	501
531	509	518	526	534	542	550	558	567	575	583
532	591	599	607	616	624	632	640	648	656	665
533	673	681	689	697	705	713	722	730	738	746
534	754	762	770	779	787	795	803	811	819	827
535	835	843	852	860	868	876	884	892	900	908
536	916	925	933	941	949	957	965	973	981	989
537	997	*006	*014	*022	*030	*038	*046	*054	*062	*070
538	73 078	086	094	102	111	119	127	135	143	151
539	159	167	175	183	191	199	207	215	223	231
540	239	247	255	263	272	280	288	296	304	312
541	320	328	336	344	352	360	368	376	384	392
542	400	408	416	424	432	440	448	456	464	472
543	480	488	496	504	512	520	528	536	544	552
544	560	568	576	584	592	600	608	616	624	632
545	640	648	656	664	672	679	687	695	703	711
546	719	727	735	743	751	759	767	775	783	791
547	799	807	815	823	830	838	846	854	862	870
548	878	886	894	902	910	918	926	933	941	949
549	957	965	973	981	989	997	*005	*013	*020	*028
550	74 036	044	052	060	068	076	084	092	099	107

| N. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

Proportional parts

	9
1	0.9
2	1.8
3	2.7
4	3.6
5	4.5
6	5.4
7	6.3
8	7.2
9	8.1

	8
1	0.8
2	1.6
3	2.4
4	3.2
5	4.0
6	4.8
7	5.6
8	6.4
9	7.2

	7
1	0.7
2	1.4
3	2.1
4	2.8
5	3.5
6	4.2
7	4.9
8	5.6
9	6.3

Proportional parts

N.		0	1	2	3	4	5	6	7	8	9	Proportional parts
550	74	036	044	052	060	068	076	084	092	099	107	
551		115	123	131	139	147	155	162	170	178	186	
552		194	202	210	218	225	233	241	249	257	265	
553		273	280	288	296	304	312	320	327	335	343	
554		351	359	367	374	382	390	398	406	414	421	
555		429	437	445	453	461	468	476	484	492	500	
556		507	515	523	531	539	547	554	562	570	578	
557		586	593	601	609	617	624	632	640	648	656	
558		663	671	679	687	695	702	710	718	726	733	
559		741	749	757	764	772	780	788	796	803	811	
560		819	827	834	842	850	858	865	873	881	889	**8**
561		896	904	912	920	927	935	943	950	958	966	1 0·8
562		974	981	989	997	*005	*012	*020	*028	*035	*043	2 1·6
563	75	051	059	066	074	082	089	097	105	113	120	3 2·4
564		128	136	143	151	159	166	174	182	189	197	4 3·2
565		205	213	220	228	236	243	251	259	266	274	5 4·0
566		282	289	297	305	312	320	328	335	343	351	6 4·8
567		358	366	374	381	389	397	404	412	420	427	7 5·6
568		435	442	450	458	465	473	481	488	496	504	8 6·4
569		511	519	526	534	542	549	557	565	572	580	9 7·2
570		587	595	603	610	618	626	633	641	648	656	
571		664	671	679	686	694	702	709	717	724	732	
572		740	747	755	762	770	778	785	793	800	808	
573		815	823	831	838	846	853	861	868	876	884	
574		891	899	906	914	921	929	937	944	952	959	
575		967	974	982	989	997	*005	*012	*020	*027	*035	
576	**76**	042	050	057	065	072	080	087	095	103	110	
577		118	125	133	140	148	155	163	170	178	185	
578		193	200	208	215	223	230	238	245	253	260	
579		268	275	283	290	298	305	313	320	328	335	
580		343	350	358	365	373	380	388	395	403	410	**7**
581		418	425	433	440	448	455	462	470	477	485	1 0·7
582		492	500	507	515	522	530	537	545	552	559	2 1·4
583		567	574	582	589	597	604	612	619	626	634	3 2·1
584		641	649	656	664	671	678	686	693	701	708	4 2·8
585		716	723	730	738	745	753	760	768	775	782	5 3·5
586		790	797	805	812	819	827	834	842	849	856	6 4·2
587		864	871	879	886	893	901	908	916	923	930	7 4·9
588		938	945	953	960	967	975	982	989	997	*004	8 5·6
589	**77**	012	019	026	034	041	048	056	063	070	078	9 6·3
590		085	093	100	107	115	122	129	137	144	151	
591		159	166	173	181	188	195	203	210	217	225	
592		232	240	247	254	262	269	276	283	291	298	
593		305	313	320	327	335	342	349	357	364	371	
594		379	386	393	401	408	415	422	430	437	444	
595		452	459	466	474	481	488	495	503	510	517	
596		525	532	539	546	554	561	568	576	583	590	
597		597	605	612	619	627	634	641	648	656	663	
598		670	677	685	692	699	706	714	721	728	735	
599		743	750	757	764	772	779	786	793	801	808	
600		815	822	830	837	844	851	859	866	873	880	
N.		0	1	2	3	4	5	6	7	8	9	Proportional parts

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
600	77 815	822	830	837	844	851	859	866	873	880	
601	887	895	902	909	916	924	931	938	945	952	
602	960	967	974	981	988	996	*003	*010	*017	*025	
603	78 032	039	046	053	061	068	075	082	089	097	
604	104	111	118	125	132	140	147	154	161	168	
605	176	183	190	197	204	211	219	226	233	240	
606	247	254	262	269	276	283	290	297	305	312	
607	319	326	333	340	347	355	362	369	376	383	**8**
608	390	398	405	412	419	426	433	440	447	455	1 | 0.8
609	462	469	476	483	490	497	504	512	519	526	2 | 1.6
											3 | 2.4
610	533	540	547	554	561	569	576	583	590	597	4 | 3.2
611	604	611	618	625	633	640	647	654	661	668	5 | 4.0
612	675	682	689	696	704	711	718	725	732	739	6 | 4.8
613	746	753	760	767	774	781	789	796	803	810	7 | 5.6
614	817	824	831	838	845	852	859	866	873	880	8 | 6.4
615	888	895	902	909	916	923	930	937	944	951	9 | 7.2
616	958	965	972	979	986	993	*000	*007	*014	*021	
617	79 029	036	043	050	057	064	071	078	085	092	
618	099	106	113	120	127	134	141	148	155	162	
619	169	176	183	190	197	204	211	218	225	232	
620	239	246	253	260	267	274	281	288	295	302	**7**
621	309	316	323	330	337	344	351	358	365	372	1 | 0.7
622	379	386	393	400	407	414	421	428	435	442	2 | 1.4
623	449	456	463	470	477	484	491	498	505	511	3 | 2.1
624	518	525	532	539	546	553	560	567	574	581	4 | 2.8
625	588	595	602	609	616	623	630	637	644	650	5 | 3.5
626	657	664	671	678	685	692	699	706	713	720	6 | 4.2
627	727	734	741	748	754	761	768	775	782	789	7 | 4.9
628	796	803	810	817	824	831	837	844	851	858	8 | 5.6
629	865	872	879	886	893	900	906	913	920	927	9 | 6.3
630	934	941	948	955	962	969	975	982	989	996	
631	80 003	010	017	024	030	037	044	051	058	065	
632	072	079	085	092	099	106	113	120	127	134	
633	140	147	154	161	168	175	182	188	195	202	
634	209	216	223	229	236	243	250	257	264	271	
635	277	284	291	298	305	312	318	325	332	339	**6**
636	346	353	359	366	373	380	387	393	400	407	1 | 0.6
637	414	421	428	434	441	448	455	462	468	475	2 | 1.2
638	482	489	496	502	509	516	523	530	536	543	3 | 1.8
639	550	557	564	570	577	584	591	598	604	611	4 | 2.4
											5 | 3.0
640	618	625	632	638	645	652	659	665	672	679	6 | 3.6
641	686	693	699	706	713	720	726	733	740	747	7 | 4.2
642	754	760	767	774	781	787	794	801	808	814	8 | 4.8
643	821	828	835	841	848	855	862	868	875	882	9 | 5.4
644	889	895	902	909	916	922	929	936	943	949	
645	956	963	969	976	983	990	996	*003	*010	*017	
646	81 023	030	037	043	050	057	064	070	077	084	
647	090	097	104	111	117	124	131	137	144	151	
648	158	164	171	178	184	191	198	204	211	218	
649	224	231	238	245	251	258	265	271	278	285	
650	291	298	305	311	318	325	331	338	345	351	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

N.		0	1	2	3	4	5	6	7	8	9	Proportional parts	
650	81	291	298	305	311	318	325	331	338	345	351		
651		358	365	371	378	385	391	398	405	411	418		
652		425	431	438	445	451	458	465	471	478	485		
653		491	498	505	511	518	525	531	538	544	551		
654		558	564	571	578	584	591	598	604	611	617		
655		624	631	637	644	651	657	664	671	677	684		
656		690	697	704	710	717	723	730	737	743	750		
657		757	763	770	776	783	790	796	803	809	816		
658		823	829	836	842	849	856	862	869	875	882		
659		889	895	902	908	915	921	928	935	941	948		
660		954	961	968	974	981	987	994	*000	*007	*014		**7**
661	82	020	027	033	040	046	053	060	066	073	079	1	0.7
662		086	092	099	105	112	119	125	132	138	145	2	1.4
663		151	158	164	171	178	184	191	197	204	210	3	2.1
664		217	223	230	236	243	249	256	263	269	276	4	2.8
665		282	289	295	302	308	315	321	328	334	341	5	3.5
666		347	354	360	367	373	380	387	393	400	406	6	4.2
667		413	419	426	432	439	445	452	458	465	471	7	4.9
668		478	484	491	497	504	510	517	523	530	536	8	5.6
669		543	549	556	562	569	575	582	588	595	601	9	6.3
670		607	614	620	627	633	640	646	653	659	666		
671		672	679	685	692	698	705	711	718	724	730		
672		737	743	750	756	763	769	776	782	789	795		
673		802	808	814	821	827	834	840	847	853	860		
674		866	872	879	885	892	898	905	911	918	924		
675		930	937	943	950	956	963	969	975	982	988		
676		995	*001	*008	*014	*020	*027	*033	*040	*046	*052		
677	83	059	065	072	078	085	091	097	104	110	117		
678		123	129	136	142	149	155	161	168	174	181		
679		187	193	200	206	213	219	225	232	238	245		
680		251	257	264	270	276	283	289	296	302	308		**6**
681		315	321	327	334	340	347	353	359	366	372	1	0.6
682		378	385	391	398	404	410	417	423	429	436	2	1.2
683		442	448	455	461	467	474	480	487	493	499	3	1.8
684		506	512	518	525	531	537	544	550	556	563	4	2.4
685		569	575	582	588	594	601	607	613	620	626	5	3.0
686		632	639	645	651	658	664	670	677	683	689	6	3.6
687		696	702	708	715	721	727	734	740	746	753	7	4.2
688		759	765	771	778	784	790	797	803	809	816	8	4 8
689		822	828	835	841	847	853	860	866	872	879	9	5.4
690		885	891	897	904	910	916	923	929	935	942		
691		948	954	960	967	973	979	985	992	998	*004		
692	84	011	017	023	029	036	042	048	055	061	067		
693		073	080	086	092	098	105	111	117	123	130		
694		136	142	148	155	161	167	173	180	186	192		
695		198	205	211	217	223	230	236	242	248	255		
696		261	267	273	280	286	292	298	305	311	317		
697		323	330	336	342	348	354	361	367	373	379		
698		386	392	398	404	410	417	423	429	435	442		
699		448	454	460	466	473	479	485	491	497	504		
700		510	516	522	528	535	541	547	553	559	566		
N.		0	1	2	3	4	5	6	7	8	9	Proportional parts	

N.	0	1	2	3	4	5	6	7	8	9
700	84 510	516	522	528	535	541	547	553	559	566
701	572	578	584	590	597	603	609	615	621	628
702	634	640	646	652	658	665	671	677	683	689
703	696	702	708	714	720	726	733	739	745	751
704	757	763	770	776	782	788	794	800	807	813
705	819	825	831	837	844	850	856	862	868	874
706	880	887	893	899	905	911	917	924	930	936
707	942	948	954	960	967	973	979	985	991	997
708	85 003	009	016	022	028	034	040	046	052	058
709	065	071	077	083	089	095	101	107	114	120
710	126	132	138	144	150	156	163	169	175	181
711	187	193	199	205	211	217	224	230	236	242
712	248	254	260	266	272	278	285	291	297	303
713	309	315	321	327	333	339	345	352	358	364
714	370	376	382	388	394	400	406	412	418	425
715	431	437	443	449	455	461	467	473	479	485
716	491	497	503	509	516	522	528	534	540	546
717	552	558	564	570	576	582	588	594	600	606
718	612	618	625	631	637	643	649	655	661	667
719	673	679	685	691	697	703	709	715	721	727
720	733	739	745	751	757	763	769	775	781	788
721	794	800	806	812	818	824	830	836	842	848
722	854	860	866	872	878	884	890	896	902	908
723	914	920	926	932	938	944	950	956	962	968
724	974	980	986	992	998	*004	*010	*016	*022	*028
725	86 034	040	046	052	058	064	070	076	082	088
726	094	100	106	112	118	124	130	136	141	147
727	153	159	165	171	177	183	189	195	201	207
728	213	219	225	231	237	243	249	255	261	267
729	273	279	285	291	297	303	308	314	320	326
730	332	338	344	350	356	362	368	374	380	386
731	392	398	404	410	415	421	427	433	439	445
732	451	457	463	469	475	481	487	493	499	504
733	510	516	522	528	534	540	546	552	558	564
734	570	576	581	587	593	599	605	611	617	623
735	629	635	641	646	652	658	664	670	676	682
736	688	694	700	705	711	717	723	729	735	741
737	747	753	759	764	770	776	782	788	794	800
738	806	812	817	823	829	835	841	847	853	859
739	864	870	876	882	888	894	900	906	911	917
740	923	929	935	941	947	953	958	964	970	976
741	982	988	994	999	*005	*011	*017	*023	*029	*035
742	87 040	046	052	058	064	070	075	081	087	093
743	099	105	111	116	122	128	134	140	146	151
744	157	163	169	175	181	186	192	198	204	210
745	216	221	227	233	239	245	251	256	262	268
746	274	280	286	291	297	303	309	315	320	326
747	332	338	344	349	355	361	367	373	379	384
748	390	396	402	408	413	419	425	431	437	442
749	448	454	460	466	471	477	483	489	495	500
750	506	512	518	523	529	535	541	547	552	558
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	7
1	0.7
2	1.4
3	2.1
4	2.8
5	3.5
6	4.2
7	4.9
8	5.6
9	6.3

	6
1	0.6
2	1.2
3	1.8
4	2.4
5	3.0
6	3.6
7	4.2
8	4.8
9	5.4

	5
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5
8	4.0
9	4.5

Proportional parts

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
750	87 506	512	518	523	529	535	541	547	552	558	
751	564	570	576	581	587	593	599	604	610	616	
752	622	628	633	639	645	651	656	662	668	674	
753	679	685	691	697	703	708	714	720	726	731	
754	737	743	749	754	760	766	772	777	783	789	
755	795	800	806	812	818	823	829	835	841	846	
756	852	858	864	869	875	881	887	892	898	904	
757	910	915	921	927	933	938	944	950	955	961	
758	967	973	978	984	990	996	*001	*007	*013	*018	
759	88 024	030	036	041	047	053	058	064	070	076	
760	081	087	093	098	104	110	116	121	127	133	6
761	138	144	150	156	161	167	173	178	184	190	1 | 0.6
762	195	201	207	213	218	224	230	235	241	247	2 | 1.2
763	252	258	264	270	275	281	287	292	298	304	3 | 1.8
764	309	315	321	326	332	338	343	349	355	360	4 | 2.4
765	366	372	377	383	389	395	400	406	412	417	5 | 3.0
766	423	429	434	440	446	451	457	463	468	474	6 | 3.6
767	480	485	491	497	502	508	513	519	525	530	7 | 4.2
768	536	542	547	553	559	564	570	576	581	587	8 | 4.8
769	593	598	604	610	615	621	627	632	638	643	9 | 5.4
770	649	655	660	666	672	677	683	689	694	700	
771	705	711	717	722	728	734	739	745	750	756	
772	762	767	773	779	784	790	795	801	807	812	
773	818	824	829	835	840	846	852	857	863	868	
774	874	880	885	891	897	902	908	913	919	925	
775	930	936	941	947	953	958	964	969	975	981	
776	986	992	997	*003	*009	*014	*020	*025	*031	*037	
777	89 042	048	053	059	064	070	076	081	087	092	
778	098	104	109	115	120	126	131	137	143	148	
779	154	159	165	170	176	182	187	193	198	204	
780	209	215	221	226	232	237	243	248	254	260	5
781	265	271	276	282	287	293	298	304	310	315	1 | 0.5
782	321	326	332	337	343	348	354	360	365	371	2 | 1.0
783	376	382	387	393	398	404	409	415	421	426	3 | 1.5
784	432	437	443	448	454	459	465	470	476	481	4 | 2.0
785	487	492	498	504	509	515	520	526	531	537	5 | 2.5
786	542	548	553	559	564	570	575	581	586	592	6 | 3.0
787	597	603	609	614	620	625	631	636	642	647	7 | 3.5
788	653	658	664	669	675	680	686	691	697	702	8 | 4.0
789	708	713	719	724	730	735	741	746	752	757	9 | 4.5
790	763	768	774	779	785	790	796	801	807	812	
791	818	823	829	834	840	845	851	856	862	867	
792	873	878	883	889	894	900	905	911	916	922	
793	927	933	938	944	949	955	960	966	971	977	
794	982	988	993	998	*004	*009	*015	*020	*026	*031	
795	90 037	042	048	053	059	064	069	075	080	086	
796	091	097	102	108	113	119	124	129	135	140	
797	146	151	157	162	168	173	179	184	189	195	
798	200	206	211	217	222	227	233	238	244	249	
799	255	260	266	271	276	282	287	293	298	304	
800	309	314	320	325	331	336	342	347	352	358	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
800	90 309	314	320	325	331	336	342	347	352	358	
801	363	369	374	380	385	390	396	401	407	412	
802	417	423	428	434	439	445	450	455	461	466	
803	472	477	482	488	493	499	504	509	515	520	
804	526	531	536	542	547	553	558	563	569	574	
805	580	585	590	596	601	607	612	617	623	628	
806	634	639	644	650	655	660	666	671	677	682	
807	687	693	698	703	709	714	720	725	730	736	
808	741	747	752	757	763	768	773	779	784	789	
809	795	800	806	811	816	822	827	832	838	843	
810	849	854	859	865	870	875	881	886	891	897	**6**
811	902	907	913	918	924	929	934	940	945	950	1 | 0.6
812	956	961	966	972	977	982	988	993	998	*004	2 | 1.2
813	91 009	014	020	025	030	036	041	046	052	057	3 | 1.8
814	062	068	073	078	084	089	094	100	105	110	4 | 2.4
815	116	121	126	132	137	142	148	153	158	164	5 | 3.0
816	169	174	180	185	190	196	201	206	212	217	6 | 3.6
817	222	228	233	238	243	249	254	259	265	270	7 | 4.2
818	275	281	286	291	297	302	307	312	318	323	8 | 4.8
819	328	334	339	344	350	355	360	365	371	376	9 | 5.4
820	381	387	392	397	403	408	413	418	424	429	
821	434	440	445	450	455	461	466	471	477	482	
822	487	492	498	503	508	514	519	524	529	535	
823	540	545	551	556	561	566	572	577	582	587	
824	593	598	603	609	614	619	624	630	635	640	
825	645	651	656	661	666	672	677	682	687	693	
826	698	703	709	714	719	724	730	735	740	745	
827	751	756	761	766	772	777	782	787	793	798	
828	803	808	814	819	824	829	834	840	845	850	
829	855	861	866	871	876	882	887	892	897	903	
830	908	913	918	924	929	934	939	944	950	955	**5**
831	960	965	971	976	981	986	991	997	*002	*007	1 | 0.5
832	92 012	018	023	028	033	038	044	049	054	059	2 | 1.0
833	065	070	075	080	085	091	096	101	106	111	3 | 1.5
834	117	122	127	132	137	143	148	153	158	163	4 | 2.0
835	169	174	179	184	189	195	200	205	210	215	5 | 2.5
836	221	226	231	236	241	247	252	257	262	267	6 | 3.0
837	273	278	283	288	293	298	304	309	314	319	7 | 3.5
838	324	330	335	340	345	350	355	361	366	371	8 | 4.0
839	376	381	387	392	397	402	407	412	418	423	9 | 4.5
840	428	433	438	443	449	454	459	464	469	474	
841	480	485	490	495	500	505	511	516	521	526	
842	531	536	542	547	552	557	562	567	572	578	
843	583	588	593	598	603	609	614	619	624	629	
844	634	639	645	650	655	660	665	670	675	681	
845	686	691	696	701	706	711	716	722	727	732	
846	737	742	747	752	758	763	768	773	778	783	
847	788	793	799	804	809	814	819	824	829	834	
848	840	845	850	855	860	865	870	875	881	886	
849	891	896	901	906	911	916	921	927	932	937	
850	942	947	952	957	962	967	973	978	983	988	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
850	92 942	947	952	957	962	967	973	978	983	988
851	993	998	*003	*008	*013	*018	*024	*029	*034	*039
852	93 044	049	054	059	064	069	075	080	085	090
853	095	100	105	110	115	120	125	131	136	141
854	146	151	156	161	166	171	176	181	186	192
855	197	202	207	212	217	222	227	232	237	242
856	247	252	258	263	268	273	278	283	288	293
857	298	303	308	313	318	323	328	334	339	344
858	349	354	359	364	369	374	379	384	389	394
859	399	404	409	414	420	425	430	435	440	445
860	450	455	460	465	470	475	480	485	490	495
861	500	505	510	515	520	526	531	536	541	546
862	551	556	561	566	571	576	581	586	591	596
863	601	606	611	616	621	626	631	636	641	646
864	651	656	661	666	671	676	682	687	692	697
865	702	707	712	717	722	727	732	737	742	747
866	752	757	762	767	772	777	782	787	792	797
867	802	807	812	817	822	827	832	837	842	847
868	852	857	862	867	872	877	882	887	892	897
869	902	907	912	917	922	927	932	937	942	947
870	952	957	962	967	972	977	982	987	992	997
871	94 002	007	012	017	022	027	032	037	042	047
872	052	057	062	067	072	077	082	086	091	096
873	101	106	111	116	121	126	131	136	141	146
874	151	156	161	166	171	176	181	186	191	196
875	201	206	211	216	221	226	231	236	240	245
876	250	255	260	265	270	275	280	285	290	295
877	300	305	310	315	320	325	330	335	340	345
878	349	354	359	364	369	374	379	384	389	394
879	399	404	409	414	419	424	429	433	438	443
880	448	453	458	463	468	473	478	483	488	493
881	498	503	507	512	517	522	527	532	537	542
882	547	552	557	562	567	571	576	581	586	591
883	596	601	606	611	616	621	626	630	635	640
884	645	650	655	660	665	670	675	680	685	689
885	694	699	704	709	714	719	724	729	734	738
886	743	748	753	758	763	768	773	778	783	787
887	792	797	802	807	812	817	822	827	832	836
888	841	846	851	856	861	866	871	876	880	885
889	890	895	900	905	910	915	919	924	929	934
890	939	944	949	954	959	963	968	973	978	983
891	988	993	998	*002	*007	*012	*017	*022	*027	*032
892	95 036	041	046	051	056	061	066	071	075	080
893	085	090	095	100	105	109	114	119	124	129
894	134	139	143	148	153	158	163	168	173	177
895	182	187	192	197	202	207	211	216	221	226
896	231	236	240	245	250	255	260	265	270	274
897	279	284	289	294	299	303	308	313	318	323
898	328	332	337	342	347	352	357	361	366	371
899	376	381	386	390	395	400	405	410	415	419
900	424	429	434	439	444	448	453	458	463	468
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	6
1	0.6
2	1.2
3	1.8
4	2.4
5	3.0
6	3.6
7	4.2
8	4.8
9	5.4

	5
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5
8	4.0
9	4.5

	4
1	0.4
2	0.8
3	1.2
4	1.6
5	2.0
6	2.4
7	2.8
8	3.2
9	3.6

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
900	95 424	429	434	439	444	448	453	458	463	468	
901	472	477	482	487	492	497	501	506	511	516	
902	521	525	530	535	540	545	550	554	559	564	
903	569	574	578	583	588	593	598	602	607	612	
904	617	622	626	631	636	641	646	650	655	660	
905	665	670	674	679	684	689	694	698	703	708	
906	713	718	722	727	732	737	742	746	751	756	
907	761	766	770	775	780	785	789	794	799	804	
908	809	813	818	823	828	832	837	842	847	852	
909	856	861	866	871	875	880	885	890	895	899	
910	904	909	914	918	923	928	933	938	942	947	**5**
911	952	957	961	966	971	976	980	985	990	995	1 | 0.5
912	999	*004	*009	*014	*019	*023	*028	*033	*038	*042	2 | 1.0
913	96 047	052	057	061	066	071	076	080	085	090	3 | 1.5
914	095	099	104	109	114	118	123	128	133	137	4 | 2.0
915	142	147	152	156	161	166	171	175	180	185	5 | 2.5
916	190	194	199	204	209	213	218	223	227	232	6 | 3.0
917	237	242	246	251	256	261	265	270	275	280	7 | 3.5
918	284	289	294	298	303	308	313	317	322	327	8 | 4.0
919	332	336	341	346	350	355	360	365	369	374	9 | 4.5
920	379	384	388	393	398	402	407	412	417	421	
921	426	431	435	440	445	450	454	459	464	468	
922	473	478	483	487	492	497	501	506	511	515	
923	520	525	530	534	539	544	548	553	558	562	
924	567	572	577	581	586	591	595	600	605	609	
925	614	619	624	628	633	638	642	647	652	656	
926	661	666	670	675	680	685	689	694	699	703	
927	708	713	717	722	727	731	736	741	745	750	
928	755	759	764	769	774	778	783	788	792	797	
929	802	806	811	816	820	825	830	834	839	844	
930	848	853	858	862	867	872	876	881	886	890	**4**
931	895	900	904	909	914	918	923	928	932	937	1 | 0.4
932	942	946	951	956	960	965	970	974	979	984	2 | 0.8
933	988	993	997	*002	*007	*011	*016	*021	*025	*030	3 | 1.2
934	97 035	039	044	049	053	058	063	067	072	077	4 | 1.6
935	081	086	090	095	100	104	109	114	118	123	5 | 2.0
936	128	132	137	142	146	151	155	160	165	169	6 | 2.4
937	174	179	183	188	192	197	202	206	211	216	7 | 2.8
938	220	225	230	234	239	243	248	253	257	262	8 | 3.2
939	267	271	276	280	285	290	294	299	304	308	9 | 3.6
940	313	317	322	327	331	336	340	345	350	354	
941	359	364	368	373	377	382	387	391	396	400	
942	405	410	414	419	424	428	433	437	442	447	
943	451	456	460	465	470	474	479	483	488	493	
944	497	502	506	511	516	520	525	529	534	539	
945	543	548	552	557	562	566	571	575	580	585	
946	589	594	598	603	607	612	617	621	626	630	
947	635	640	644	649	653	658	663	667	672	676	
948	681	685	690	695	699	704	708	713	717	722	
949	727	731	736	740	745	749	754	759	763	768	
950	772	777	782	786	791	795	800	804	809	813	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
950	97 772	777	782	786	791	795	800	804	809	813	
951	818	823	827	832	836	841	845	850	855	859	
952	864	868	873	877	882	886	891	896	900	905	
953	909	914	918	923	928	932	937	941	946	950	
954	955	959	964	968	973	978	982	987	991	996	
955	98 000	005	009	014	019	023	028	032	037	041	
956	046	050	055	059	064	068	073	078	082	087	
957	091	096	100	105	109	114	118	123	127	132	
958	137	141	146	150	155	159	164	168	173	177	
959	182	186	191	195	200	204	209	214	218	223	
960	227	232	236	241	245	250	254	259	263	268	**5**
961	272	277	281	286	290	295	299	304	308	313	1 | 0.5
962	318	322	327	331	336	340	345	349	354	358	2 | 1.0
963	363	367	372	376	381	385	390	394	399	403	3 | 1.5
964	408	412	417	421	426	430	435	439	444	448	4 | 2.0
965	453	457	462	466	471	475	480	484	489	493	5 | 2.5
966	498	502	507	511	516	520	525	529	534	538	6 | 3.0
967	543	547	552	556	561	565	570	574	579	583	7 | 3.5
968	588	592	597	601	605	610	614	619	623	628	8 | 4.0
969	632	637	641	646	650	655	659	664	668	673	9 | 4.5
970	677	682	686	691	695	700	704	709	713	717	
971	722	726	731	735	740	744	749	753	758	762	
972	767	771	776	780	784	789	793	798	802	807	
973	811	816	820	825	829	834	838	843	847	851	
974	856	860	865	869	874	878	883	887	892	896	
975	900	905	909	914	918	923	927	932	936	941	
976	945	949	954	958	963	967	972	976	981	985	
977	989	994	998	*003	*007	*012	*016	*021	*025	*029	
978	99 034	038	043	047	052	056	061	065	069	074	
979	078	083	087	092	096	100	105	109	114	118	
980	123	127	131	136	140	145	149	154	158	162	**4**
981	167	171	176	180	185	189	193	198	202	207	1 | 0.4
982	211	216	220	224	229	233	238	242	247	251	2 | 0.8
983	255	260	264	269	273	277	282	286	291	295	3 | 1.2
984	300	304	308	313	317	322	326	330	335	339	4 | 1.6
985	344	348	352	357	361	366	370	374	379	383	5 | 2.0
986	388	392	396	401	405	410	414	419	423	427	6 | 2.4
987	432	436	441	445	449	454	458	463	467	471	7 | 2.8
988	476	480	484	489	493	498	502	506	511	515	8 | 3.2
989	520	524	528	533	537	542	546	550	555	559	9 | 3.6
990	564	568	572	577	581	585	590	594	599	603	
991	607	612	616	621	625	629	634	638	642	647	
992	651	656	660	664	669	673	677	682	686	691	
993	695	699	704	708	712	717	721	726	730	734	
994	739	743	747	752	756	760	765	769	774	778	
995	782	787	791	795	800	804	808	813	817	822	
996	826	830	835	839	843	848	852	856	861	865	
997	870	874	878	883	887	891	896	900	904	909	
998	913	917	922	926	930	935	939	944	948	952	
999	957	961	965	970	974	978	983	987	991	996	
1000	00 000	004	009	013	017	022	026	030	035	039	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	d
1000	000 0000	0434	0869	1303	1737	2171	2605	3039	3473	3907	434
1001	4341	4775	5208	5642	6076	6510	6943	7377	7810	8244	434
1002	8677	9111	9544	9977	*0411	*0844	*1277	*1710	*2143	*2576	433
1003	001 3009	3442	3875	4308	4741	5174	5607	6039	6472	6905	433
1004	7337	7770	8202	8635	9067	9499	9932	*0364	*0796	*1228	432
1005	002 1661	2093	2525	2957	3389	3821	4253	4685	5116	5548	432
1006	5980	6411	6843	7275	7706	8138	8569	9001	9432	9863	431
1007	003 0295	0726	1157	1588	2019	2451	2882	3313	3744	4174	431
1008	4605	5036	5467	5898	6328	6759	7190	7620	8051	8481	431
1009	8912	9342	9772	*0203	*0633	*1063	*1493	*1924	*2354	*2784	430
1010	004 3214	3644	4074	4504	4933	5363	5793	6223	6652	7082	430
1011	7512	7941	8371	8800	9229	9659	*0088	*0517	*0947	*1376	429
1012	005 1805	2234	2663	3092	3521	3950	4379	4808	5237	5666	429
1013	6094	6523	6952	7380	7809	8238	8666	9094	9523	9951	429
1014	006 0380	0808	1236	1664	2092	2521	2949	3377	3805	4233	428
1015	4660	5088	5516	5944	6372	6799	7227	7655	8082	8510	428
1016	8937	9365	9792	*0219	*0647	*1074	*1501	*1928	*2355	*2782	427
1017	007 3210	3637	4064	4490	4917	5344	5771	6198	6624	7051	427
1018	7478	7904	8331	8757	9184	9610	*0037	*0463	*0889	*1316	426
1019	008 1742	2168	2594	3020	3446	3872	4298	4724	5150	5576	426
1020	6002	6427	6853	7279	7704	8130	8556	8981	9407	9832	426
1021	009 0257	0683	1108	1533	1959	2384	2809	3234	3659	4084	425
1022	4509	4934	5359	5784	6208	6633	7058	7483	7907	8332	425
1023	8756	9181	9605	*0030	*0454	*0878	*1303	*1727	*2151	*2575	424
1024	010 3000	3424	3848	4272	4696	5120	5544	5967	6391	6815	424
1025	7239	7662	8086	8510	8933	9357	9780	*0204	*0627	*1050	424
1026	011 1474	1897	2320	2743	3166	3590	4013	4436	4859	5282	423
1027	5704	6127	6550	6973	7396	7818	8241	8664	9086	9509	423
1028	9931	*0354	*0776	*1198	*1621	*2043	*2465	*2887	*3310	*3732	422
1029	012 4154	4576	4998	5420	5842	6264	6685	7107	7529	7951	422
1030	8372	8794	9215	9637	*0059	*0480	*0901	*1323	*1744	*2165	422
1031	013 2587	3008	3429	3850	4271	4692	5113	5534	5955	6376	421
1032	6797	7218	7639	8059	8480	8901	9321	9742	*0162	*0583	421
1033	014 1003	1424	1844	2264	2685	3105	3525	3945	4365	4785	420
1034	5205	5625	6045	6465	6885	7305	7725	8144	8564	8984	420
1035	9403	9823	*0243	*0662	*1082	*1501	*1920	*2340	*2759	*3178	420
1036	015 3598	4017	4436	4855	5274	5693	6112	6531	6950	7369	419
1037	7788	8206	8625	9044	9462	9881	*0300	*0718	*1137	*1555	419
1038	016 1974	2392	2810	3229	3647	4065	4483	4901	5319	5737	418
1039	6155	6573	6991	7409	7827	8245	8663	9080	9498	9916	418
1040	017 0333	0751	1168	1586	2003	2421	2838	3256	3673	4090	417
1041	4507	4924	5342	5759	6176	6593	7010	7427	7844	8260	417
1042	8677	9094	9511	9927	*0344	*0761	*1177	*1594	*2010	*2427	417
1043	018 2843	3259	3676	4092	4508	4925	5341	5757	6173	6589	416
1044	7005	7421	7837	8253	8669	9084	9500	9916	*0332	*0747	416
1045	019 1163	1578	1994	2410	2825	3240	3656	4071	4486	4902	415
1046	5317	5732	6147	6562	6977	7392	7807	8222	8637	9052	415
1047	9467	9882	*0296	*0711	*1126	*1540	*1955	*2369	*2784	*3198	415
1048	020 3613	4027	4442	4856	5270	5684	6099	6513	6927	7341	414
1049	7755	8169	8583	8997	9411	9824	*0238	*0652	*1066	*1479	414
1050	021 1893	2307	2720	3134	3547	3961	4374	4787	5201	5614	413
N.	0	1	2	3	4	5	6	7	8	9	d.

LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	d.
1050	021 1893	2307	2720	3134	3547	3961	4374	4787	5201	5614	413
1051	6027	6440	6854	7267	7680	8093	8506	8919	9332	9745	413
1052	022 0157	0570	0983	1396	1808	2221	2634	3046	3459	3871	413
1053	4284	4696	5109	5521	5933	6345	6758	7170	7582	7994	412
1054	8406	8818	9230	9642	*0054	*0466	*0878	*1289	*1701	*2113	412
1055	023 2525	2936	3348	3759	4171	4582	4994	5405	5817	6228	411
1056	6639	7050	7462	7873	8284	8695	9106	9517	9928	*0339	411
1057	024 0750	1161	1572	1982	2393	2804	3214	3625	4036	4446	411
1058	4857	5267	5678	6088	6498	6909	7319	7729	8139	8549	410
1059	8960	9370	9780	*0190	*0600	*1010	*1419	*1829	*2239	*2649	410
1060	025 3059	3468	3878	4288	4697	5107	5516	5926	6335	6744	410
1061	7154	7563	7972	8382	8791	9200	9609	*0018	*0427	*0836	409
1062	026 1245	1654	2063	2472	2881	3289	3698	4107	4515	4924	409
1063	5333	5741	6150	6558	6967	7375	7783	8192	8600	9008	408
1064	9416	9824	*0233	*0641	*1049	*1457	*1865	*2273	*2680	*3088	408
1065	027 3496	3904	4312	4719	5127	5535	5942	6350	6757	7165	408
1066	7572	7979	8387	8794	9201	9609	*0016	*0423	*0830	*1237	407
1067	028 1644	2051	2458	2865	3272	3679	4086	4492	4899	5306	407
1068	5713	6119	6526	6932	7339	7745	8152	8558	8964	9371	406
1069	9777	*0183	*0590	*0996	*1402	*1808	*2214	*2620	*3026	*3432	406
1070	029 3838	4244	4649	5055	5461	5867	6272	6678	7084	7489	406
1071	7895	8300	8706	9111	9516	9922	*0327	*0732	*1138	*1543	405
1072	030 1948	2353	2758	3163	3568	3973	4378	4783	5188	5592	405
1073	5997	6402	6807	7211	7616	8020	8425	8830	9234	9638	405
1074	031 0043	0447	0851	1256	1660	2064	2468	2872	3277	3681	404
1075	4085	4489	4893	5296	5700	6104	6508	6912	7315	7719	404
1076	8123	8526	8930	9333	9737	*0140	*0544	*0947	*1350	*1754	403
1077	032 2157	2560	2963	3367	3770	4173	4576	4979	5382	5785	403
1078	6188	6590	6993	7396	7799	8201	8604	9007	9409	9812	403
1079	033 0214	0617	1019	1422	1824	2226	2629	3031	3433	3835	402
1080	4238	4640	5042	5444	5846	6248	6650	7052	7453	7855	402
1081	8257	8659	9060	9462	9864	*0265	*0667	*1068	*1470	*1871	402
1082	034 2273	2674	3075	3477	3878	4279	4680	5081	5482	5884	401
1083	6285	6686	7087	7487	7888	8289	8690	9091	9491	9892	401
1084	035 0293	0693	1094	1495	1895	2296	2696	3096	3497	3897	400
1085	4297	4698	5098	5498	5898	6298	6698	7098	7498	7898	400
1086	8298	8698	9098	9498	9898	*0297	*0697	*1097	*1496	*1896	400
1087	036 2295	2695	3094	3494	3893	4293	4692	5091	5491	5890	399
1088	6289	6688	7087	7486	7885	8284	8683	9082	9481	9880	399
1089	037 0279	0678	1076	1475	1874	2272	2671	3070	3468	3867	399
1090	4265	4663	5062	5460	5858	6257	6655	7053	7451	7849	398
1091	8248	8646	9044	9442	9839	*0237	*0635	*1033	*1431	*1829	398
1092	038 2226	2624	3022	3419	3817	4214	4612	5009	5407	5804	398
1093	6202	6599	6996	7393	7791	8188	8585	8982	9379	9776	397
1094	039 0173	0570	0967	1364	1761	2158	2554	2951	3348	3745	397
1095	4141	4538	4934	5331	5727	6124	6520	6917	7313	7709	397
1096	8106	8502	8898	9294	9690	*0086	*0482	*0878	*1274	*1670	396
1097	040 2066	2462	2858	3254	3650	4045	4441	4837	5232	5628	396
1098	6023	6419	6814	7210	7605	8001	8396	8791	9187	9582	395
1099	9977	*0372	*0767	*1162	*1557	*1952	*2347	*2742	*3137	*3532	395
1100	041 3927	4322	4716	5111	5506	5900	6295	6690	7084	7479	395
N.	0	1	2	3	4	5	6	7	8	9	d.

LOGARITHMS—(Continued)

N	0	1	2	3	4	5	6	7	8	9	d.
1100	041 3927	4322	4716	5111	5506	5900	6295	6690	7084	7479	395
1101	7873	8268	8662	9056	9451	9845	*0239	*0633	*1028	*1422	394
1102	042 1816	2210	2604	2998	3392	3786	4180	4574	4968	5361	394
1103	5755	6149	6543	6936	7330	7723	8117	8510	8904	9297	394
1104	9691	*0084	*0477	*0871	*1264	*1657	*2050	*2444	*2837	*3230	393
1105	043 3623	4016	4409	4802	5195	5587	5980	6373	6766	7159	393
1106	7551	7944	8337	8729	9122	9514	9907	*0299	*0692	*1084	393
1107	044 1476	1869	2261	2653	3045	3437	3829	4222	4614	5006	392
1108	5398	5790	6181	6573	6965	7357	7749	8140	8532	8924	392
1109	9315	9707	*0099	*0490	*0882	*1273	*1664	*2056	*2447	*2839	392
1110	045 3230	3621	4012	4403	4795	5186	5577	5968	6359	6750	391
1111	7141	7531	7922	8313	8704	9095	9485	9876	*0267	*0657	391
1112	046 1048	1438	1829	2219	2610	3000	3391	3781	4171	4561	390
1113	4952	5342	5732	6122	6512	6902	7292	7682	8072	8462	390
1114	8852	9242	9632	*0021	*0411	*0801	*1190	*1580	*1970	*2359	390
1115	047 2749	3138	3528	3917	4306	4696	5085	5474	5864	6253	389
1116	6642	7031	7420	7809	8198	8587	8976	9365	9754	*0143	389
1117	048 0532	0921	1309	1698	2087	2475	2864	3253	3641	4030	389
1118	4418	4806	5195	5583	5972	6360	6748	7136	7525	7913	388
1119	8301	8689	9077	9465	9853	*0241	*0629	*1017	*1405	*1792	388
1120	049 2180	2568	2956	3343	3731	4119	4506	4894	5281	5669	388
1121	6056	6444	6831	7218	7606	7993	8380	8767	9154	9541	387
1122	9929	*0316	*0703	*1090	*1477	*1863	*2250	*2637	*3024	*3411	387
1123	050 3798	4184	4571	4958	5344	5731	6117	6504	6890	7277	387
1124	7663	8049	8436	8822	9208	9595	9981	*0367	*0753	*1139	386
1125	051 1525	1911	2297	2683	3069	3455	3841	4227	4612	4998	386
1126	5384	5770	6155	6541	6926	7312	7697	8083	8468	8854	386
1127	9239	9624	*0010	*0395	*0780	*1166	*1551	*1936	*2321	*2706	385
1128	052 3091	3476	3861	4246	4631	5016	5400	5785	6170	6555	385
1129	6939	7324	7709	8093	8478	8862	9247	9631	*0016	*0400	385
1130	053 0784	1169	1553	1937	2321	2706	3090	3474	3858	4242	384
1131	4626	5010	5394	5778	6162	6546	6929	7313	7697	8081	384
1132	8464	8848	9232	9615	9999	*0382	*0766	*1149	*1532	*1916	384
1133	054 2299	2682	3066	3449	3832	4215	4598	4981	5365	5748	383
1134	6131	6514	6896	7279	7662	8045	8428	8811	9193	9576	383
1135	9959	*0341	*0724	*1106	*1489	*1871	*2254	*2636	*3019	*3401	382
1136	055 3783	4166	4548	4930	5312	5694	6077	6459	6841	7223	382
1137	7605	7987	8369	8750	9132	9514	9896	*0278	*0659	*1041	382
1138	056 1423	1804	2186	2567	2949	3330	3712	4093	4475	4856	381
1139	5237	5619	6000	6381	6762	7143	7524	7905	8287	8668	381
1140	9049	9429	9810	*0191	*0572	*0953	*1334	*1714	*2095	*2476	381
1141	057 2856	3237	3618	3998	4379	4759	5140	5520	5900	6281	381
1142	6661	7041	7422	7802	8182	8562	8942	9322	9702	*0082	380
1143	058 0462	0842	1222	1602	1982	2362	2741	3121	3501	3881	380
1144	4260	4640	5019	5399	5778	6158	6537	6917	7296	7676	380
1145	8055	8434	8813	9193	9572	9951	*0330	*0709	*1088	*1467	379
1146	059 1846	2225	2604	2983	3362	3741	4119	4498	4877	5256	379
1147	5634	6013	6391	6770	7148	7527	7905	8284	8662	9041	379
1148	9419	9797	*0175	*0554	*0932	*1310	*1688	*2066	*2444	*2822	378
1149	060 3200	3578	3956	4334	4712	5090	5468	5845	6223	6601	378
1150	6978	7356	7734	8111	8489	8866	9244	9621	9999	*0376	378
N	0	1	2	3	4	5	6	7	8	9	d.

LOGARITHMS—(Continued)

N	0	1	2	3	4	5	6	7	8	9	d.
1150	060 6978	7356	7734	8111	8489	8866	9244	9621	9999	*0376	378
1151	061 0753	1131	1508	1885	2262	2639	3017	3394	3771	4148	377
1152	4525	4902	5279	5656	6032	6409	6786	7163	7540	7916	377
1153	8293	8670	9046	9423	9799	*0176	*0552	*0929	*1305	*1682	377
1154	062 2058	2434	2811	3187	3563	3939	4316	4692	5068	5444	376
1155	5820	6196	6572	6948	7324	7699	8075	8451	8827	9203	376
1156	9578	9954	*0330	*0705	*1081	*1456	*1832	*2207	*2583	*2958	376
1157	063 3334	3709	4084	4460	4835	5210	5585	5960	6335	6711	375
1158	7086	7461	7836	8211	8585	8960	9335	9710	*0085	*0460	375
1159	064 0834	1209	1584	1958	2333	2708	3082	3457	3831	4205	375
1160	4580	4954	5329	5703	6077	6451	6826	7200	7574	7948	374
1161	8322	8696	9070	9444	9818	*0192	*0566	*0940	*1314	*1688	374
1162	065 2061	2435	2809	3182	3556	3930	4303	4677	5050	5424	374
1163	5797	6171	6544	6917	7291	7664	8037	8410	8784	9157	373
1164	9530	9903	*0276	*0649	*1022	*1395	*1768	*2141	*2514	*2886	373
1165	066 3259	3632	4005	4377	4750	5123	5495	5868	6241	6613	373
1166	6986	7358	7730	8103	8475	8847	9220	9592	9964	*0336	372
1167	067 0709	1081	1453	1825	2197	2569	2941	3313	3685	4057	372
1168	4428	4800	5172	5544	5915	6287	6659	7030	7402	7774	372
1169	8145	8517	8888	9259	9631	*0002	*0374	*0745	*1116	*1487	371
1170	068 1859	2230	2601	2972	3343	3714	4085	4456	4827	5198	371
1171	5569	5940	6311	6681	7052	7423	7794	8164	8535	8906	371
1172	9276	9647	*0017	*0388	*0758	*1129	*1499	*1869	*2240	*2610	370
1173	069 2980	3350	3721	4091	4461	4831	5201	5571	5941	6311	370
1174	6681	7051	7421	7791	8160	8530	8900	9270	9639	*0009	370
1175	070 0379	0748	1118	1487	1857	2226	2596	2965	3335	3704	369
1176	4073	4442	4812	5181	5550	5919	6288	6658	7027	7396	369
1177	7765	8134	8503	8871	9240	9609	9978	*0347	*0715	*1084	369
1178	071 1453	1822	2190	2559	2927	3296	3664	4033	4401	4770	369
1179	5138	5506	5875	6243	6611	6979	7348	7716	8084	8452	368
1180	8820	9188	9556	9924	*0292	*0660	*1028	*1396	*1763	*2131	368
1181	072 2499	2867	3234	3602	3970	4337	4705	5072	5440	5807	368
1182	6175	6542	6910	7277	7644	8011	8379	8746	9113	9480	367
1183	9847	*0215	*0582	*0949	*1316	*1683	*2050	*2416	*2783	*3150	367
1184	073 3517	3884	4251	4617	4984	5351	5717	6084	6450	6817	367
1185	7184	7550	7916	8283	8649	9016	9382	9748	*0114	*0481	366
1186	074 0847	1213	1579	1945	2311	2677	3043	3409	3775	4141	366
1187	4507	4873	5239	5605	5970	6336	6702	7068	7433	7799	366
1188	8164	8530	8895	9261	9626	9992	*0357	*0723	*1088	*1453	365
1189	075 1819	2184	2549	2914	3279	3644	4010	4375	4740	5105	365
1190	5470	5835	6199	6564	6929	7294	7659	8024	8388	8753	365
1191	9118	9482	9847	*0211	*0576	*0940	*1305	*1669	*2034	*2398	364
1192	076 2763	3127	3491	3855	4220	4584	4948	5312	5676	6040	364
1193	6404	6768	7132	7496	7860	8224	8588	8952	9316	9680	364
1194	077 0043	0407	0771	1134	1498	1862	2225	2589	2952	3316	364
1195	3679	4042	4406	4769	5133	5496	5859	6222	6585	6949	363
1196	7312	7675	8038	8401	8764	9127	9490	9853	*0216	*0579	363
1197	078 0942	1304	1667	2030	2393	2755	3118	3480	3843	4206	363
1198	4568	4931	5293	5656	6018	6380	6743	7105	7467	7830	362
1199	8192	8554	8916	9278	9640	*0003	*0365	*0727	*1089	*1451	362
1200	079 1812	2174	2536	2898	3260	3622	3983	4345	4707	5068	362

| N | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | d. |

LOGARITHMS OF THE TRIGONOMETRIC FUNCTIONS

Logarithms of the functions are given for each minute from 0-360°.

The quantity -10 is to be appended to all logarithms of the sine and cosine, to logarithms of the tangent from 0-45° and of the cotangent from 45-90°.

With degrees indicated at either side of the top of the page use the column headings at the top. With degrees stated at the bottom of the page use the column designations at the bottom.

With degrees at the left (top or bottom) use the minute column at the left, and with degrees on the right side of the page use the minute column at the right.

The method of determining the functions of small angles by the auxiliary quantities S and T is given in the section explaining the use of the mathematical tables at the front of the volume.

Min.	Values of S, −10 to be appended					Values of T, −10 to be appended					Sec.
	0°	1°	2°	3°	4°	0°	1°	2°	3°	4°	
0′	4 68 557	555	549	538	522	4 68 557	562	575	597	628	0″
1	557	555	549	537	522	557	562	575	598	629	60
2	557	555	548	537	522	557	562	576	598	629	120
3	557	555	548	537	521	557	562	576	599	630	180
4	557	555	548	537	521	558	563	576	599	631	240
5	557	555	548	537	521	558	563	577	599	631	300
6	557	555	548	536	520	558	563	577	600	632	360
7	557	555	548	536	520	558	563	577	600	632	420
8	557	555	548	536	520	558	563	578	601	633	480
9	557	555	547	536	520	558	563	578	601	634	540
10	4.68 557	555	547	535	519	4 68 558	564	578	602	634	600
11	557	554	547	535	519	558	564	579	602	635	660
12	557	554	547	535	519	558	564	579	603	635	720
13	557	554	547	535	518	558	564	579	603	636	780
14	557	554	547	534	518	558	564	580	604	637	840
15	557	554	546	534	518	558	564	580	604	637	900
16	557	554	546	534	517	558	565	580	605	638	960
17	557	554	546	534	517	558	565	581	605	639	1020
18	557	554	546	534	517	558	565	581	606	639	1080
19	557	554	546	533	516	558	565	581	606	640	1140
20	4.68 557	554	546	533	516	4.68 558	565	582	607	640	1200
21	557	554	545	533	516	558	566	582	607	641	1260
22	557	553	545	533	515	558	566	582	608	642	1320
23	557	553	545	532	515	558	566	583	608	642	1380
24	557	553	545	532	515	558	566	583	609	643	1440
25	557	553	545	532	515	558	566	583	609	644	1500
26	557	553	544	532	514	558	567	584	610	644	1560
27	557	553	544	531	514	558	567	584	610	645	1620
28	557	553	544	531	514	558	567	584	611	646	1680
29	557	553	544	531	513	559	567	585	611	646	1740
30	4.68 557	553	544	531	513	4.68 559	567	585	612	647	1800
31	557	552	544	530	513	559	568	585	612	648	1860
32	557	552	543	530	512	559	568	586	613	648	1920
33	557	552	543	530	512	559	568	586	613	649	1980
34	557	552	543	529	512	559	568	587	614	650	2040
35	557	552	543	529	511	559	569	587	614	650	2100
36	557	552	543	529	511	559	569	587	615	651	2160
37	557	552	542	529	511	559	569	588	615	652	2220
38	557	552	542	528	510	559	569	588	616	652	2280
39	557	552	542	528	510	559	570	589	616	653	2340
40	4.68 557	551	542	528	510	4.68 559	570	589	617	654	2400
41	556	551	542	528	509	560	570	589	617	654	2460
42	556	551	541	527	509	560	570	590	618	655	2520
43	556	551	541	527	508	560	571	590	619	656	2580
44	556	551	541	527	508	560	571	591	619	656	2640
45	556	551	541	527	508	560	571	591	620	657	2700
46	556	551	541	526	507	560	571	591	620	658	2760
47	556	551	540	526	507	560	572	592	621	659	2820
48	556	550	540	526	507	560	572	592	621	659	2880
49	556	550	540	525	506	560	572	593	622	660	2940
50	4.68 556	550	540	525	506	4.68 561	572	593	622	661	3000
51	556	550	540	525	506	561	573	593	623	661	3060
52	556	550	539	525	505	561	573	594	624	662	3120
53	556	550	539	524	505	561	573	594	624	663	3180
54	556	550	539	524	505	561	573	595	625	664	3240
55	556	549	539	524	504	561	574	595	625	664	3300
56	556	549	539	523	504	561	574	596	626	665	3360
57	556	549	538	523	503	562	574	596	626	666	3420
58	555	549	538	523	503	562	575	596	627	667	3480
59	555	549	538	523	503	562	575	597	628	667	3540
60	4.68 555	549	538	522	502	4.68 562	575	597	628	668	3600

LOGARITHMS OF THE FUNCTIONS (Continued)

0° (180°) (359°) 179°

"	'	L. Sin.	d	C. S	C. T.	L. Tan.	c d	L. Cot	L. Cos	'
0	**0**	—		—	—	—		—	0 00 000	**60**
60	1	6 46 373	30103	5.31 443	5 31 443	6 46 373	30103	3 53 627	0 00 000	59
120	2	6.76 476	17609	5.31 443	5 31 443	6 76 476	17609	3 23 524	0 00 000	58
180	3	6 94 085	12494	5 31 443	5 31 443	6 94 085	12494	3 05 915	0 00 000	57
240	4	7 06 579	9691	5 31 443	5 31 442	7 06 579	9691	2 93 421	0 00 000	56
300	5	7 16 270	7918	5.31 443	5 31 442	7 16 270	7918	2 83 730	0 00 000	55
360	6	7 24 188	6694	5.31 443	5 31 442	7 24 188	6694	2.75 812	0 00 000	54
420	7	7 30 882	5800	5 31 443	5 31 442	7 30 882	5800	2 69 118	0 00 000	53
480	8	7 36 682	5115	5 31 443	5 31 442	7 36 682	5115	2 63 318	0 00 000	52
540	9	7 41 797	4576	5 31 443	5 31 442	7 41 797	4576	2 58 203	0 00 000	51
600	**10**	7 46 373	4139	5 31 443	5 31 442	7 46 373	4139	2 53 627	0 00 000	**50**
660	11	7 50 512	3779	5 31 443	5 31 442	7 50 512	3779	2 49 488	0 00 000	49
720	12	7 54 291	3476	5 31 443	5 31 442	7 54 291	3476	2 45 709	0 00 000	48
780	13	7 57 767	3218	5 31 443	5 31 442	7.57 767	3219	2 42 233	0 00 000	47
840	14	7 60 985	2997	5 31 443	5 31 442	7 60 986	2996	2 39 014	0 00 000	46
900	15	7 63 982	2802	5 31 443	5 31 442	7 63 982	2803	2 36 018	0 00 000	45
960	16	7 66 784	2633	5 31 443	5 31 442	7 66 785	2633	2 33 215	0 00 000	44
1020	17	7.69 417	2483	5 31 443	5 31 442	7 69 418	2482	2 30 582	9 99 999	43
1080	18	7 71 900	2348	5.31 443	5 31 442	7 71 900	2348	2 28 100	9 99 999	42
1140	19	7 74 248	2227	5 31 443	5 31 442	7 74 248	2228	2 25 752	9 99 999	41
1200	**20**	7 76 475	2119	5 31 443	5 31 442	7 76 476	2119	2 23 524	9 99 999	**40**
1260	21	7.78 594	2021	5 31 443	5 31 442	7 78 595	2020	2 21 405	9 99 999	39
1320	22	7 80 615	1930	5.31 443	5 31 442	7 80 615	1931	2 19 385	9 99 999	38
1380	23	7 82 545	1848	5 31 443	5 31 442	7 82 546	1848	2 17 454	9 99 999	37
1440	24	7 84 393	1773	5 31 443	5 31 442	7 84 394	1773	2 15 606	9 99 999	36
1500	25	7 86 166	1704	5 31 443	5 31 442	7 86 167	1704	2 13 833	9 99 999	35
1560	26	7 87 870	1639	5 31 443	5 31 442	7 87 871	1639	2 12 129	9 99 999	34
1620	27	7 89 509	1579	5 31 443	5 31 442	7 89 510	1579	2 10 490	9 99 999	33
1680	28	7 91 088	1524	5 31 443	5 31 442	7 91 089	1524	2 08 911	9 99 999	32
1740	29	7 92 612	1472	5 31 443	5 31 441	7 92 613	1473	2 07 387	9 99 998	31
1800	**30**	7 94 084	1424	5 31 443	5 31 441	7 94 086	1424	2 05 914	9 99 998	**30**
1860	31	7 95 508	1379	5 31 443	5 31 441	7 95 510	1379	2 04 490	9 99 998	29
1920	32	7 96 887	1336	5 31 443	5 31 441	7 96 889	1336	2.03 111	9 99 998	28
1980	33	7.98 223	1297	5 31 443	5 31 441	7 98 225	1297	2 01 775	9 99 998	27
2040	34	7 99 520	1259	5 31 443	5 31 441	7 99 522	1259	2 00 478	9 99 998	26
2100	35	8 00 779	1223	5 31 443	5 31 441	8 00 781	1223	1 99 219	9 99 998	25
2160	36	8 02 002	1190	5 31 443	5 31 441	8 02 004	1190	1 97 996	9 99 998	24
2220	37	8 03 192	1158	5 31 443	5 31 441	8 03 194	1159	1 96 806	9 99 997	23
2280	38	8 04 350	1128	5 31 443	5 31 441	8 04 353	1128	1 95 647	9 99 997	22
2340	39	8 05 478	1100	5 31 443	5 31 441	8 05 481	1100	1 94 519	9 99 997	21
2400	**40**	8 06 578	1072	5 31 443	5 31 441	8 06 581	1072	1 93 419	9 99 997	**20**
2460	41	8 07 650	1046	5 31 444	5 31 440	8 07 653	1047	1 92 347	9 99 997	19
2520	42	8 08 696	1022	5 31 444	5 31 440	8 08 700	1022	1 91 300	9 99 997	18
2580	43	8 09 718	999	5.31 444	5.31 440	8 09 722	998	1.90 278	9 99 997	17
2640	44	8 10 717	976	5 31 444	5 31 440	8 10 720	976	1.89 280	9 99 996	16
2700	45	8 11 693	954	5 31 444	5 31 440	8 11 696	955	1 88 304	9 99 996	15
2760	46	8 12 647	934	5 31 444	5 31 440	8 12 651	934	1 87 349	9 99 996	14
2820	47	8.13 581	914	5 31 444	5 31 440	8 13 585	915	1.86 415	9 99 996	13
2880	48	8 14 495	896	5 31 444	5 31 440	8 14 500	895	1 85 500	9 99 996	12
2940	49	8 15 391	877	5 31 444	5 31 440	8 15 395	878	1 84 605	9 99 996	11
3000	**50**	8 16 268	860	5 31 444	5 31 439	8 16 273	860	1 83 727	9 99 995	**10**
3060	51	8 17 128	843	5.31 444	5 31 439	8 17 133	843	1 82 867	9 99 995	9
3120	52	8.17 971	827	5.31 444	5 31 439	8 17 976	828	1 82 024	9 99 995	8
3180	53	8 18 798	812	5 31 444	5 31 439	8 18 804	812	1 81 196	9 99 995	7
3240	54	8 19 610	797	5 31 444	5 31 439	8 19 616	797	1 80 384	9 99 995	6
3300	55	8 20 407	782	5 31 444	5 31 439	8 20 413	782	1 79 587	9 99 994	5
3360	56	8 21 189	769	5 31 444	5 31 439	8 21 195	769	1 78 805	9 99 994	4
3420	57	8 21 958	755	5 31 445	5 31 439	8 21 964	756	1 78 036	9 99 994	3
3480	58	8 22 713	743	5 31 445	5 31 438	8 22 720	742	1.77 280	9 99 994	2
3540	59	8 23 456	730	5 31 445	5 31 438	8 23 462	730	1 76 538	9 99 994	1
3600	**60**	8 24 186		5 31 445	5 31 438	8 24 192		1 75 808	9 99 993	**0**
	'	L. Cos.	d.			L. Cot.	c d.	L. Tan.	L. Sin.	'

90° (270°) (269°) 89°

1° (181°) | **(358°) 178°**

"	′	L Sin	d	C. S.	C. T.	L. Tan.	c.d	L. Cot	L Cos	′
3600	**0**	8.24 186	717	5.31 445	5.31 438	8.24 192	718	1.75 808	9.99 993	**60**
3660	1	8.24 903	706	5.31 445	5.31 438	8.24 910	706	1.75 090	9.99 993	59
3720	2	8.25 609	695	5.31 445	5.31 438	8.25 616	696	1.74 384	9.99 993	58
3780	3	8.26 304	684	5.31 445	5.31 438	8.26 312	684	1.73 688	9.99 993	57
3840	4	8.26 988	673	5.31 445	5.31 437	8.26 996	673	1.73 004	9.99 992	56
3900	5	8.27 661	663	5.31 445	5.31 437	8.27 669	663	1.72 331	9.99 992	55
3960	6	8.28 324	653	5.31 445	5.31 437	8.28 332	654	1.71 668	9.99 992	54
4020	7	8.28 977	644	5.31 445	5.31 437	8.28 986	643	1.71 014	9.99 992	53
4080	8	8.29 621	634	5.31 445	5.31 437	8.29 629	634	1.70 371	9.99 992	52
4140	9	8.30 255	624	5.31 445	5.31 437	8.30 263	625	1.69 737	9.99 991	51
4200	**10**	8.30 879	616	5.31 446	5.31 437	8.30 888	617	1.69 112	9.99 991	**50**
4260	11	8.31 495	608	5.31 446	5.31 436	8.31 505	607	1.68 495	9.99 991	49
4320	12	8.32 103	599	5.31 446	5.31 436	8.32 112	599	1.67 888	9.99 990	48
4380	13	8.32 702	590	5.31 446	5.31 436	8.32 711	591	1.67 289	9.99 990	47
4440	14	8.33 292	583	5.31 446	5.31 436	8.33 302	584	1.66 698	9.99 990	46
4500	15	8.33 875	575	5.31 446	5.31 436	8.33 886	575	1.66 114	9.99 990	45
4560	16	8.34 450	568	5.31 446	5.31 435	8.34 461	568	1.65 539	9.99 989	44
4620	17	8.35 018	560	5.31 446	5.31 435	8.35 029	561	1.64 971	9.99 989	43
4680	18	8.35 578	553	5.31 446	5.31 435	8.35 590	553	1.64 410	9.99 989	42
4740	19	8.36 131	547	5.31 446	5.31 435	8.36 143	546	1.63 857	9.99 989	41
4800	**20**	8.36 678	539	5.31 446	5.31 435	8.36 689	540	1.63 311	9.99 988	**40**
4860	21	8.37 217	533	5.31 447	5.31 434	8.37 229	533	1.62 771	9.99 988	39
4920	22	8.37 750	526	5.31 447	5.31 434	8.37 762	527	1.62 238	9.99 988	38
4980	23	8.38 276	520	5.31 447	5.31 434	8.38 289	520	1.61 711	9.99 987	37
5040	24	8.38 796	514	5.31 447	5.31 434	8.38 809	514	1.61 191	9.99 987	36
5100	25	8.39 310	508	5.31 447	5.31 434	8.39 323	509	1.60 677	9.99 987	35
5160	26	8.39 818	502	5.31 447	5.31 433	8.39 832	502	1.60 168	9.99 986	34
5220	27	8.40 320	496	5.31 447	5.31 433	8.40 334	496	1.59 666	9.99 986	33
5280	28	8.40 816	491	5.31 447	5.31 433	8.40 830	491	1.59 170	9.99 986	32
5340	29	8.41 307	485	5.31 447	5.31 433	8.41 321	486	1.58 679	9.99 985	31
5400	**30**	8.41 792	480	5.31 447	5.31 433	8.41 807	480	1.58 193	9.99 985	**30**
5460	31	8.42 272	474	5.31 448	5.31 432	8.42 287	475	1.57 713	9.99 985	29
5520	32	8.42 746	470	5.31 448	5.31 432	8.42 762	470	1.57 238	9.99 984	28
5580	33	8.43 216	464	5.31 448	5.31 432	8.43 232	464	1.56 768	9.99 984	27
5640	34	8.43 680	459	5.31 448	5.31 432	8.43 696	460	1.56 304	9.99 984	26
5700	35	8.44 139	455	5.31 448	5.31 431	8.44 156	455	1.55 844	9.99 983	25
5760	36	8.44 594	450	5.31 448	5.31 431	8.44 611	450	1.55 389	9.99 983	24
5820	37	8.45 044	445	5.31 448	5.31 431	8.45 061	446	1.54 939	9.99 983	23
5880	38	8.45 489	441	5.31 448	5.31 431	8.45 507	441	1.54 493	9.99 982	22
5940	39	8.45 930	436	5.31 449	5.31 431	8.45 948	437	1.54 052	9.99 982	21
6000	**40**	8.46 366	433	5.31 449	5.31 430	8.46 385	432	1.53 615	9.99 982	**20**
6060	41	8.46 799	427	5.31 449	5.31 430	8.46 817	428	1.53 183	9.99 981	19
6120	42	8.47 226	424	5.31 449	5.31 430	8.47 245	424	1.52 755	9.99 981	18
6180	43	8.47 650	419	5.31 449	5.31 430	8.47 669	420	1.52 331	9.99 981	17
6240	44	8.48 069	416	5.31 449	5.31 429	8.48 089	416	1.51 911	9.99 980	16
6300	45	8.48 485	411	5.31 449	5.31 429	8.48 505	412	1.51 495	9.99 980	15
6360	46	8.48 896	408	5.31 449	5.31 429	8.48 917	408	1.51 083	9.99 979	14
6420	47	8.49 304	404	5.31 450	5.31 428	8.49 325	404	1.50 675	9.99 979	13
6480	48	8.49 708	400	5.31 450	5.31 428	8.49 729	401	1.50 271	9.99 979	12
6540	49	8.50 108	396	5.31 450	5.31 428	8.50 130	397	1.49 870	9.99 978	11
6600	**50**	8.50 504	393	5.31 450	5.31 428	8.50 527	393	1.49 473	9.99 978	**10**
6660	51	8.50 897	390	5.31 450	5.31 427	8.50 920	390	1.49 080	9.99 977	9
6720	52	8.51 287	386	5.31 450	5.31 427	8.51 310	386	1.48 690	9.99 977	8
6780	53	8.51 673	382	5.31 450	5.31 427	8.51 696	383	1.48 304	9.99 977	7
6840	54	8.52 055	379	5.31 450	5.31 427	8.52 079	380	1.47 921	9.99 976	6
6900	55	8.52 434	376	5.31 451	5.31 426	8.52 459	376	1.47 541	9.99 976	5
6960	56	8.52 810	373	5.31 451	5.31 426	8.52 835	373	1.47 165	9.99 975	4
7020	57	8.53 183	369	5.31 451	5.31 426	8.53 208	370	1.46 792	9.99 975	3
7080	58	8.53 552	367	5.31 451	5.31 425	8.53 578	367	1.46 422	9.99 974	2
7140	59	8.53 919	363	5.31 451	5.31 425	8.53 945	363	1.46 055	9.99 974	1
7200	**60**	8.54 282		5.31 451	5.31 425	8.54 308		1.45 692	9.99 974	**0**
	′	L Cos.	d.			L. Cot.	c.d.	L. Tan.	L Sin.	′

91° (271°) | **(268°) 88°**

LOGARITHMS OF THE FUNCTIONS (Continued)

2° (182°) (357°) **177°**

″	′	L. Sin.	d	C. S.	C. T.	L. Tan	c d.	L. Cot	L. Cos	′
7200	**0**	8 54 282	360	5 31 451	5 31 425	8 54 308	361	1 45 692	9 99 974	**60**
7260	1	8 54 642	357	5 31 451	5 31 425	8 54 669	358	1 45 331	9 99 973	59
7320	2	8 54 999	355	5 31 452	5 31 424	8 55 027	355	1.44 973	9 99 973	58
7380	3	8.55 354	351	5 31 452	5 31 424	8 55 382	352	1.44 618	9 99 972	57
7440	4	8 55 705	349	5 31 452	5 31 424	8.55 734	349	1.44 266	9 99 972	56
7500	5	8 56 054	346	5 31 452	5 31 423	8 56 083	346	1 43 917	9 99 971	55
7560	6	8 56 400	343	5 31 452	5 31 423	8 56 429	344	1.43 571	9 99 971	54
7620	7	8 56 743	341	5 31 452	5 31 423	8 56 773	341	1 43 227	9 99 970	53
7680	8	8 57 084	337	5 31 453	5 31 422	8 57 114	338	1.42 886	9.99 970	52
7740	9	8 57 421	336	5 31 453	5 31 422	8 57 452	336	1 42 548	9 99 969	51
7800	**10**	8 57 757	332	5 31 453	5 31 422	8 57 788	333	1 42 212	9 99 969	**50**
7860	11	8 58 089	330	5 31 453	5 31 421	8 58 121	330	1 41 879	9 99 968	49
7920	12	8 58 419	328	5 31 453	5 31 421	8 58 451	328	1.41 549	9 99 968	48
7980	13	8 58 747	325	5 31 453	5.31 421	8 58 779	326	1 41 221	9 99 967	47
8040	14	8 59 072	323	5 31 454	5 31 421	8 59 105	323	1 40 895	9 99 967	46
8100	15	8 59 395	320	5 31 454	5.31 420	8 59 428	321	1 40 572	9 99 967	45
8160	16	8 59 715	318	5 31 454	5 31 420	8.59 749	319	1.40 251	9 99 966	44
8220	17	8 60 033	316	5 31 454	5 31 420	8.60 068	316	1.39 932	9 99 966	43
8280	18	8.60 349	313	5 31 454	5 31 419	8 60 384	314	1.39 616	9 99 965	42
8340	19	8 60 662	311	5 31 454	5 31 419	8 60 698	311	1.39 302	9 99 964	41
8400	**20**	8.60 973	309	5 31 455	5 31 418	8 61 009	310	1.38 991	9 99 964	**40**
8460	21	8 61 282	307	5 31 455	5 31 418	8 61 319	307	1.38 681	9 99 963	39
8520	22	8 61 589	305	5 31 455	5 31 418	8 61 626	305	1.38 374	9 99 963	38
8580	23	8.61 894	302	5 31 455	5 31 417	8 61 931	303	1.38 069	9 99 962	37
8640	24	8 62 196	301	5 31 455	5 31 417	8 62 234	301	1 37 766	9 99 962	36
8700	25	8 62 497	298	5 31 455	5 31 417	8 62 535	299	1 37 465	9 99 961	35
8760	26	8 62 795	296	5 31 456	5 31 416	8 62 834	297	1.37 166	9 99 961	34
8820	27	8 63 091	294	5 31 456	5 31 416	8 63 131	295	1 36 869	9 99 960	33
8880	28	8 63 385	293	5 31 456	5 31 416	8 63 426	292	1.36 574	9 99 960	32
8940	29	8 63 678	290	5 31 456	5 31 415	8 63 718	291	1 36 282	9 99 959	31
9000	**30**	8 63 968	288	5 31 456	5 31 415	8 64 009	289	1 35 991	9 99 959	**30**
9060	31	8 64 256	287	5 31 456	5 31 415	8 64 298	287	1.35 702	9 99 958	29
9120	32	8 64 543	284	5 31 457	5 31 414	8 64 585	285	1.35 415	9 99 958	28
9180	33	8 64 827	283	5 31 457	5 31 414	8 64 870	284	1 35 130	9 99 957	27
9240	34	8 65 110	281	5 31 457	5 31 413	8 65 154	281	1 34 846	9 99 956	26
9300	35	8 65 391	279	5 31 457	5 31 413	8 65 435	280	1.34 565	9 99 956	25
9360	36	8 65 670	277	5 31 457	5 31 413	8 65 715	278	1.34 285	9 99 955	24
9420	37	8 65 947	276	5 31 458	5 31 412	8.65 993	276	1 34 007	9 99 955	23
9480	38	8 66 223	274	5 31 458	5 31 412	8 66 269	274	1 33 731	9 99 954	22
9540	39	8.66 497	272	5 31 458	5 31 412	8 66 543	273	1.33 457	9 99 954	21
9600	**40**	8 66 769	270	5 31 458	5 31 411	8 66 816	271	1.33 184	9 99 953	**20**
9660	41	8 67 039	269	5 31 458	5 31 411	8.67 087	269	1 32 913	9 99 952	19
9720	42	8 67 308	267	5 31 459	5 31 410	8 67 356	268	1 32 644	9 99 952	18
9780	43	8 67 575	266	5 31 459	5 31 410	8 67 624	266	1 32 376	9 99 951	17
9840	44	8 67 841	263	5 31 459	5 31 410	8 67 890	264	1 32 110	9 99 951	16
9900	45	8 68 104	263	5 31 459	5.31 409	8 68 154	263	1 31 846	9 99 950	15
9960	46	8 68 367	260	5 31 459	5 31 409	8 68 417	261	1.31 583	9 99 949	14
10020	47	8.68 627	259	5 31 460	5 31 408	8 68 678	260	1 31 322	9 99 949	13
10080	48	8 68 886	258	5 31 460	5 31 408	8.68 938	258	1.31 062	9 99 948	12
10140	49	8 69 144	256	5 31 460	5 31 408	8.69 196	257	1 30 804	9 99 948	11
10200	**50**	8 69 400	254	5 31 460	5 31 407	8 69 453	255	1.30 547	9.99 947	**10**
10260	51	8 69 654	253	5 31 460	5.31 407	8 69 708	254	1 30 292	9 99 946	9
10320	52	8 69 907	252	5 31 461	5 31 406	8 69 962	252	1.30 038	9 99 946	8
10380	53	8 70 159	250	5 31 461	5 31 406	8 70 214	251	1 29 786	9 99 945	7
10440	54	8 70 409	249	5 31 461	5 31 405	8 70 465	249	1.29 535	9.99 944	6
10500	55	8 70 658	247	5 31 461	5 31 405	8 70 714	248	1 29 286	9 99 944	5
10560	56	8 70 905	246	5 31 461	5 31 405	8 70 962	246	1 29 038	9 99 943	4
10620	57	8 71 151	244	5 31 462	5 31 404	8 71 208	245	1 28 792	9 99 942	3
10680	58	8 71 395	243	5 31 462	5 31 404	8 71 453	244	1 28 547	9 99 942	2
10740	59	8 71 638	242	5 31 462	5 31 403	8 71 697	243	1 28 303	9.99 941	1
10800	**60**	8.71 880		5 31 462	5 31 403	8 71 940		1 28 060	9.99 940	**0**
	′	L. Cos	d.			L. Cot.	c d	L. Tan.	L. Sin.	′

92° (272°) (267°) **87°**

LOGARITHMS OF THE FUNCTIONS (Continued)

8° (183°) (356°) 176°

′	L. Sin.	d.	L. Tan.	c d.	L. Cot.	L. Cos.	′	″	P. P.				
0	8.71 880	240	8.71 940	241	1.28 060	9.99 940	60	″	241	239	237	235	234
1	8.72 120	239	8.72 181	239	1.27 819	9.99 940	59	1	4.0	4.0	4.0	3.9	3.9
2	8.72 359	238	8.72 420	239	1.27 580	9.99 939	58	2	8.0	8.0	7.9	7.8	7.8
3	8.72 597	237	8.72 659	237	1.27 341	9.99 938	57	3	12.0	12.0	11.8	11.8	11.7
4	8.72 834	235	8.72 896	236	1.27 104	9.99 938	56	4	16.1	15.9	15.8	15.7	15.6
5	8.73 069	234	8.73 132	234	1.26 868	9.99 937	55	5	20.1	19.9	19.8	19.6	19.5
6	8.73 303	232	8.73 366	234	1.26 634	9.99 936	54	6	24.1	23.9	23.7	23.5	23.4
7	8.73 535	232	8.73 600	232	1.26 400	9.99 936	53	7	28.1	27.9	27.6	27.4	27.3
8	8.73 767	230	8.73 832	231	1.26 168	9.99 935	52	8	32.1	31.9	31.6	31.3	31.2
9	8.73 997	229	8.74 063	229	1.25 937	9.99 934	51	9	36.2	35.8	35.6	35.2	35.1
10	8.74 226	228	8.74 292	229	1.25 708	9.99 934	50	″	232	229	227	225	223
11	8.74 454	226	8.74 521	227	1.25 479	9.99 933	49	1	3.9	3.8	3.8	3.8	3.7
12	8.74 680	226	8.74 748	226	1.25 252	9.99 932	48	2	7.7	7.6	7.6	7.5	7.4
13	8.74 906	224	8.74 974	225	1.25 026	9.99 932	47	3	11.6	11.4	11.4	11.2	11.2
14	8.75 130	223	8.75 199	224	1.24 801	9.99 931	46	4	15.5	15.3	15.1	15.0	14.9
15	8.75 353	222	8.75 423	222	1.24 577	9.99 930	45	5	19.3	19.1	18.9	18.8	18.6
16	8.75 575	220	8.75 645	222	1.24 355	9.99 929	44	6	23.2	22.9	22.7	22.5	22.3
17	8.75 795	220	8.75 867	220	1.24 133	9.99 929	43	7	27.1	26.7	26.5	26.2	26.0
18	8.76 015	219	8.76 087	219	1.23 913	9.99 928	42	8	30.9	30.5	30.3	30.0	29.7
19	8.76 234	217	8.76 306	219	1.23 694	9.99 927	41	9	34.8	34.4	34.0	33.8	33.4
20	8.76 451	216	8.76 525	217	1.23 475	9.99 926	40	″	222	220	217	215	213
21	8.76 667	216	8.76 742	216	1.23 258	9.99 926	39	1	3.7	3.7	3.6	3.6	3.6
22	8.76 883	214	8.76 958	215	1.23 042	9.99 925	38	2	7.4	7.3	7.2	7.2	7.1
23	8.77 097	213	8.77 173	214	1.22 827	9.99 924	37	3	11.1	11.0	10.8	10.8	10.6
24	8.77 310	212	8.77 387	213	1.22 613	9.99 923	36	4	14.8	14.7	14.5	14.3	14.2
25	8.77 522	211	8.77 600	211	1.22 400	9.99 923	35	5	18.5	18.3	18.1	17.9	17.8
26	8.77 733	210	8.77 811	211	1.22 189	9.99 922	34	6	22.2	22.0	21.7	21.5	21.3
27	8.77 943	209	8.78 022	210	1.21 978	9.99 921	33	7	25.9	25.7	25.3	25.1	24.8
28	8.78 152	208	8.78 232	209	1.21 768	9.99 920	32	8	29.6	29.3	28.9	28.7	28.4
29	8.78 360	208	8.78 441	208	1.21 559	9.99 920	31	9	33.3	33.0	32.6	32.2	32.0
30	8.78 568	206	8.78 649	206	1.21 351	9.99 919	30	″	211	208	206	203	201
31	8.78 774	205	8.78 855	206	1.21 145	9.99 918	29	1	3.5	3.5	3.4	3.4	3.4
32	8.78 979	204	8.79 061	205	1.20 939	9.99 917	28	2	7.0	6.9	6.9	6.8	6.7
33	8.79 183	203	8.79 266	204	1.20 734	9.99 917	27	3	10.6	10.4	10.3	10.2	10.0
34	8.79 386	202	8.79 470	203	1.20 530	9.99 916	26	4	14.1	13.9	13.7	13.5	13.4
35	8.79 588	201	8.79 673	202	1.20 327	9.99 915	25	5	17.6	17.3	17.2	16.9	16.8
36	8.79 789	201	8.79 875	201	1.20 125	9.99 914	24	6	21.1	20.8	20.6	20.3	20.1
37	8.79 990	199	8.80 076	201	1.19 924	9.99 913	23	7	24.6	24.3	24.0	23.7	23.4
38	8.80 189	199	8.80 277	199	1.19 723	9.99 913	22	8	28.1	27.7	27.5	27.1	26.8
39	8.80 388	197	8.80 476	198	1.19 524	9.99 912	21	9	31.6	31.2	30.9	30.4	30.2
40	8.80 585	197	8.80 674	198	1.19 326	9.99 911	20	″	199	197	195	193	192
41	8.80 782	196	8.80 872	196	1.19 128	9.99 910	19	1	3.3	3.3	3.2	3.2	3.2
42	8.80 978	195	8.81 068	196	1.18 932	9.99 909	18	2	6.6	6.6	6.5	6.4	6.4
43	8.81 173	194	8.81 264	195	1.18 736	9.99 909	17	3	10.0	9.8	9.8	9.6	9.6
44	8.81 367	193	8.81 459	194	1.18 541	9.99 908	16	4	13.3	13.1	13.0	12.9	12.8
45	8.81 560	192	8.81 653	193	1.18 347	9.99 907	15	5	16.6	16.4	16.2	16.1	16.0
46	8.81 752	192	8.81 846	192	1.18 154	9.99 906	14	6	19.9	19.7	19.5	19.3	19.2
47	8.81 944	190	8.82 038	192	1.17 962	9.99 905	13	7	23.2	23.0	22.8	22.5	22.4
48	8.82 134	190	8.82 230	190	1.17 770	9.99 904	12	8	26.5	26.3	26.0	25.7	25.6
49	8.82 324	189	8.82 420	190	1.17 580	9.99 904	11	9	29.8	29.6	29.2	29.0	28.8
50	8.82 513	188	8.82 610	189	1.17 390	9.99 903	10	″	189	187	185	183	181
51	8.82 701	187	8.82 799	188	1.17 201	9.99 902	9	1	3.2	3.1	3.1	3.0	3.0
52	8.82 888	187	8.82 987	188	1.17 013	9.99 901	8	2	6.3	6.2	6.2	6.1	6.0
53	8.83 075	186	8.83 175	186	1.16 825	9.99 900	7	3	9.4	9.4	9.2	9.2	9.0
54	8.83 261	185	8.83 361	186	1.16 639	9.99 899	6	4	12.6	12.5	12.3	12.2	12.1
55	8.83 446	184	8.83 547	185	1.16 453	9.99 898	5	5	15.8	15.6	15.4	15.2	15.1
56	8.83 630	183	8.83 732	184	1.16 268	9.99 898	4	6	18.9	18.7	18.5	18.3	18.1
57	8.83 813	183	8.83 916	184	1.16 084	9.99 897	3	7	22.0	21.8	21.6	21.4	21.1
58	8.83 996	181	8.84 100	182	1.15 900	9.99 896	2	8	25.2	24.9	24.7	24.4	24.1
59	8.84 177	181	8.84 282	182	1.15 718	9.99 895	1	9	28.4	28.0	27.8	27.4	27.2
60	8.84 358		8.84 464		1.15 536	9.99 894	0	10	31.5	31.2	30.8	30.5	30.2
′	L. Cos.	d.	L. Cot.	c.d	L. Tan.	L. Sin	′		P. P.				

93° (273°) (266°) 86°

4° (184°) (355°) **175°**

′	L. Sin.	d	L. Tan	c.d.	L. Cot.	L. Cos	′
0	8.84 358	181	8.84 464	182	1.15 536	9.99 894	**60**
1	8.84 539	179	8.84 646	180	1.15 354	9.99 893	59
2	8.84 718	179	8.84 826	180	1.15 174	9.99 892	58
3	8.84 897	178	8.85 006	179	1.14 994	9.99 891	57
4	8.85 075̄	177	8.85 185	178	1.14 815	9.99 891	56
5	8.85 252	177	8.85 363	177	1.14 637	9.99 890	55
6	8.85 429	176	8.85 540	177	1.14 460	9.99 889	54
7	8.85 605̄	175	8.85 717	176	1.14 283	9.99 888	53
8	8.85 780	175	8.85 893	176	1.14 107	9.99 887	52
9	8.85 955̄	173	8.86 069	174	1.13 931	9.99 886	51
10	8.86 128	173	8.86 243	174	1.13 757	9.99 885̄	**50**
11	8.86 301	173	8.86 417	174	1.13 583	9.99 884	49
12	8.86 474	171	8.86 591	172	1.13 409	9.99 883	48
13	8.86 645̄	171	8.86 763	172	1.13 237	9.99 882	47
14	8.86 816	171	8.86 935̄	171	1.13 065̄	9.99 881	46
15	8.86 987	169	8.87 106	171	1.12 894	9.99 880	45
16	8.87 156	169	8.87 277	170	1.12 723	9.99 879	44
17	8.87 325̄	169	8.87 447	169	1.12 553	9.99 879	43
18	8.87 494	167	8.87 616	169	1.12 384	9.99 878	42
19	8.87 661	168	8.87 785̄	168	1.12 215̄	9.99 877	41
20	8.87 829	166	8.87 953	167	1.12 047	9.99 876	**40**
21	8.87 995̄	166	8.88 120	167	1.11 880	9.99 875̄	39
22	8.88 161	165	8.88 287	166	1.11 713	9.99 874	38
23	8.88 326	164	8.88 453	165	1.11 547	9.99 873	37
24	8.88 490	164	8.88 618	165	1.11 382	9.99 872	36
25	8.88 654	163	8.88 783	165	1.11 217	9.99 871	35
26	8.88 817	163	8.88 948	163	1.11 052	9.99 870	34
27	8.88 980	162	8.89 111	163	1.10 889	9.99 869	33
28	8.89 142	162	8.89 274	163	1.10 726	9.99 868	32
29	8.89 304	160	8.89 437	161	1.10 563	9.99 867	31
30	8.89 464	161	8.89 598	162	1.10 402	9.99 866	**30**
31	8.89 625̄	159	8.89 760	160	1.10 240	9.99 865̄	29
32	8.89 784	159	8.89 920	160	1.10 080	9.99 864	28
33	8.89 943	159	8.90 080	160	1.09 920	9.99 863	27
34	8.90 102	158	8.90 240	159	1.09 760	9.99 862	26
35	8.90 260	157	8.90 399	158	1.09 601	9.99 861	25
36	8.90 417	157	8.90 557	158	1.09 443	9.99 860	24
37	8.90 574	156	8.90 715̄	157	1.09 285̄	9.99 859	23
38	8.90 730	155	8.90 872	157	1.09 128	9.99 858	22
39	8.90 885	155	8.91 029	156	1.08 971	9.99 857	21
40	8.91 040	155	8.91 185̄	155	1.08 815̄	9.99 856	**20**
41	8.91 195̄	154	8.91 340	155	1.08 660	9.99 855̄	19
42	8.91 349	153	8.91 495̄	155	1.08 505̄	9.99 854	18
43	8.91 502	153	8.91 650	153	1.08 350	9.99 853	17
44	8.91 655̄	152	8.91 803	154	1.08 197	9.99 852	16
45	8.91 807	152	8.91 957	153	1.08 043	9.99 851	15
46	8.91 959	151	8.92 110	152	1.07 890	9.99 850̄	14
47	8.92 110	151	8.92 262	152	1.07 738	9.99 848	13
48	8.92 261	150	8.92 414	151	1.07 586	9.99 847	12
49	8.92 411	150	8.92 565̄	151	1.07 435̄	9.99 846	11
50	8.92 561	149	8.92 716	150	1.07 284	9.99 845̄	**10**
51	8.92 710	149	8.92 866	150	1.07 134	9.99 844	9
52	8.92 859	148	8.93 016	149	1.06 984	9.99 843	8
53	8.93 007	147	8.93 165̄	148	1.06 835̄	9.99 842	7
54	8.93 154	147	8.93 313	149	1.06 687	9.99 841	6
55	8.93 301	147	8.93 462	147	1.06 538	9.99 840	5
56	8.93 448	146	8.93 609	147	1.06 391	9.99 839	4
57	8.93 594	146	8.93 756	147	1.06 244	9.99 838	3
58	8.93 740	145	8.93 903	146	1.06 097	9.99 837	2
59	8.93 885̄	145	8.94 049	146	1.05 951	9.99 836	1
60	8.94 030		8.94 195̄		1.05 805̄	9.99 834	**0**
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	′

94° (274°) (265°) **85°**

P. P.

″					
″	**182**	**181**	**179**	**178**	**177**
1	3.0	3.0	3.0	3.0	3.0
2	6.1	6.0	6.0	5.9	5.9
3	9.1	9.0	9.0	8.9	8.8
4	12.1	12.1	11.9	11.9	11.8
5	15.2	15.1	14.9	14.8	14.8
6	18.2	18.1	17.9	17.8	17.7
7	21.2	21.1	20.9	20.8	20.6
8	24.3	24.1	23.9	23.7	23.6
9	27.3	27.2	26.8	26.7	26.6
″	**176**	**175**	**174**	**173**	**172**
1	2.9	2.9	2.9	2.9	2.9
2	5.9	5.8	5.8	5.8	5.7
3	8.8	8.8	8.7	8.6	8.6
4	11.7	11.7	11.6	11.5̇	11.5̄
5	14.7	14.6	14.5	14.4	14.3
6	17.6	17.5	17.4	17.3	17.2
7	20.5̇	20.4	20.3	20.2	20.1
8	23.5̄	23.3	23.2	23.1	22.9
9	26.4	26.2	26.1	26.0	25.8
″	**171**	**170**	**169**	**168**	**167**
1	2.8	2.8	2.8	2.8	2.8
2	5.7	5.7	5.6	5.6	5.6
3	8.6	8.5	8.4	8.4	8.4
4	11.4	11.3	11.3	11.2	11.1
5	14.2	14.2	14.1	14.0	13.9
6	17.1	17.0	16.9	16.8	16.7
7	20.0	19.8	19.7	19.6	19.5̄
8	22.8	22.7	22.5̇	22.4	22.3
9	25.6	25.5	25.4	25.2	25̇.0
″	**166**	**165**	**164**	**163**	**162**
1	2.8	2.8	2.7	2.7	2.7
2	5.5̇	5.5	5.5̄	5.4	5.4
3	8.3	8.2	8.2	8.2	8.1
4	11.1	11.0	10.9	10.9	10.8
5	13.8	13.8	13.7	13.6	13.5
6	16.6	16.5	16.4	16.3	16.2
7	19.4	19.2	19.1	19.0	18.9
8	22.1	22.0	21.9	21.7	21.6
9	24.9	24.8	24.6	24.4	24.3
″	**161**	**160**	**159**	**158**	**157**
1	2.7	2.7	2.6	2.6	2.6
2	5.4	5.3	5.3	5.3	5.2
3	8.0	8.0	8.0	7.9	7.8
4	10.7	10.7	10.6	10.5	10.5̄
5	13.4	13.3	13.2	13.2	13.1
6	16.1	16.0	15.9	15.8	15.7
7	18.8	18.7	18.6	18.4	18.3
8	21.5̄	21.3	21.2	21.1	20.9
9	24.2	24.0	23.8	23.7	23.6
″	**156**	**155**	**154**	**153**	**152**
1	2.6	2.6	2.6	2.6	2.5
2	5.2	5.2	5.1	5.1	5.1
3	7.8	7.8	7.7	7.6	7.6
4	10.4	10.3	10.3	10.2	10.1
5	13.0	12.9	12.8	12.8	12.7
6	15.6	15.5	15.4	15.3	15.2
7	18.2	18.1	18.0	17.8	17.7
8	20.8	20.7	20.5̇	20.4	20.3
9	23.4	23.2	23.1	23.0	22.8
10	26.0	25.8	25.7	25.5	25.3

P. P.

′	L. Sin.	d.	L Tan.	c.d.	L. Cot.	L. Cos.	′
0	8.94 030	144	8.94 195	145	1.05 805	9.99 834	60
1	8.94 174	143	8.94 340	145	1.05 660	9.99 833	59
2	8.94 317	144	8.94 485	145	1.05 515	9.99 832	58
3	8.94 461	142	8.94 630	143	1.05 370	9.99 831	57
4	8.94 603	143	8.94 773	144	1.05 227	9.99 830	56
5	8.94 746	141	8.94 917	143	1.05 083	9.99 829	55
6	8.94 887	142	8.95 060	142	1.04 940	9.99 828	54
7	8.95 029	141	8.95 202	142	1.04 798	9.99 827	53
8	8.95 170	140	8.95 344	142	1.04 656	9.99 826	52
9	8.95 310	140	8.95 486	141	1.04 514	9.99 824	51
10	8.95 450	139	8.95 627	140	1.04 373	9.99 823	50
11	8.95 589	139	8.95 767	141	1.04 233	9.99 822	49
12	8.95 728	139	8.95 908	139	1.04 092	9.99 821	48
13	8.95 867	138	8.96 047	140	1.03 953	9.99 820	47
14	8.96 005	138	8.96 187	138	1.03 813	9.99 819	46
15	8.96 143	137	8.96 325	139	1.03 675	9.99 817	45
16	8.96 280	137	8.96 464	138	1.03 536	9.99 816	44
17	8.96 417	136	8.96 602	137	1.03 398	9.99 815	43
18	8.96 553	136	8.96 739	138	1.03 261	9.99 814	42
19	8.96 689	136	8.96 877	136	1.03 123	9.99 813	41
20	8.96 825	135	8.97 013	137	1.02 987	9.99 812	40
21	8.96 960	135	8.97 150	135	1.02 850	9.99 810	39
22	8.97 095	134	8.97 285	136	1.02 715	9.99 809	38
23	8.97 229	134	8.97 421	135	1.02 579	9.99 808	37
24	8.97 363	133	8.97 556	135	1.02 444	9.99 807	36
25	8.97 496	133	8.97 691	134	1.02 309	9.99 806	35
26	8.97 629	133	8.97 825	134	1.02 175	9.99 804	34
27	8.97 762	132	8.97 959	133	1.02 041	9.99 803	33
28	8.97 894	132	8.98 092	133	1.01 908	9.99 802	32
29	8.98 026	131	8.98 225	133	1.01 775	9.99 801	31
30	8.98 157	131	8.98 358	132	1.01 642	9.99 800	30
31	8.98 288	131	8.98 490	132	1.01 510	9.99 798	29
32	8.98 419	130	8.98 622	131	1.01 378	9.99 797	28
33	8.98 549	130	8.98 753	131	1.01 247	9.99 796	27
34	8.98 679	129	8.98 884	131	1.01 116	9.99 795	26
35	8.98 808	129	8.99 015	130	1.00 985	9.99 793	25
36	8.98 937	129	8.99 145	130	1.00 855	9.99 792	24
37	8.99 066	128	8.99 275	130	1.00 725	9.99 791	23
38	8.99 194	128	8.99 405	129	1.00 595	9.99 790	22
39	8.99 322	128	8.99 534	128	1.00 466	9.99 788	21
40	8.99 450	127	8.99 662	129	1.00 338	9.99 787	20
41	8.99 577	127	8.99 791	128	1.00 209	9.99 786	19
42	8.99 704	126	8.99 919	127	1.00 081	9.99 785	18
43	8.99 830	126	9.00 046	128	0.99 954	9.99 783	17
44	8.99 956	126	9.00 174	127	0.99 826	9.99 782	16
45	9.00 082	125	9.00 301	126	0.99 699	9.99 781	15
46	9.00 207	125	9.00 427	126	0.99 573	9.99 780	14
47	9.00 332	124	9.00 553	126	0.99 447	9.99 778	13
48	9.00 456	125	9.00 679	126	0.99 321	9.99 777	12
49	9.00 581	123	9.00 805	125	0.99 195	9.99 776	11
50	9.00 704	124	9.00 930	125	0.99 070	9.99 775	10
51	9.00 828	123	9.01 055	124	0.98 945	9.99 773	9
52	9.00 951	123	9.01 179	124	0.98 821	9.99 772	8
53	9.01 074	122	9.01 303	124	0.98 697	9.99 771	7
54	9.01 196	122	9.01 427	123	0.98 573	9.99 769	6
55	9.01 318	122	9.01 550	123	0.98 450	9.99 768	5
56	9.01 440	121	9.01 673	123	0.98 327	9.99 767	4
57	9.01 561	121	9.01 796	122	0.98 204	9.99 765	3
58	9.01 682	121	9.01 918	122	0.98 082	9.99 764	2
59	9.01 803	120	9.02 040	122	0.97 960	9.99 763	1
60	9.01 923		9.02 162		0.97 838	9.99 761	0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	′

P.P.

″					
″	**151**	**149**	**148**	**147**	**146**
1	2.5	2.5	2.5	2.4	2.4
2	5.0	5.0	4.9	4.9	4.9
3	7.6	7.4	7.4	7.4	7.3
4	10.1	9.9	9.9	9.8	9.7
5	12.6	12.4	12.3	12.2	12.2
6	15.1	14.9	14.8	14.7	14.6
7	17.6	17.4	17.3	17.2	17.0
8	20.1	19.9	19.7	19.6	19.5
9	22.6	22.4	22.2	22.0	21.9
″	**145**	**144**	**143**	**142**	**141**
1	2.4	2.4	2.4	2.4	2.4
2	4.8	4.8	4.8	4.7	4.7
3	7.2	7.2	7.2	7.1	7.0
4	9.7	9.6	9.5	9.5	9.4
5	12.1	12.0	11.9	11.8	11.8
6	14.5	14.4	14.3	14.2	14.1
7	16.9	16.8	16.7	16.6	16.4
8	19.3	19.2	19.1	18.9	18.8
9	21.8	21.6	21.4	21.3	21.2
″	**140**	**139**	**138**	**137**	**136**
1	2.3	2.3	2.3	2.3	2.3
2	4.7	4.6	4.6	4.6	4.5
3	7.0	7.0	6.9	6.8	6.8
4	9.3	9.3	9.2	9.1	9.1
5	11.7	11.6	11.5	11.4	11.3
6	14.0	13.9	13.8	13.7	13.6
7	16.3	16.2	16.1	16.0	15.9
8	18.7	18.5	18.4	18.3	18.1
9	21.0	20.8	20.7	20.6	20.4
″	**135**	**134**	**133**	**132**	**131**
1	2.2	2.2	2.2	2.2	2.2
2	4.5	4.5	4.4	4.4	4.4
3	6.8	6.7	6.6	6.6	6.6
4	9.0	8.9	8.9	8.8	8.7
5	11.2	11.2	11.1	11.0	10.9
6	13.5	13.4	13.3	13.2	13.1
7	15.8	15.6	15.5	15.4	15.3
8	18.0	17.9	17.7	17.6	17.5
9	20.2	20.1	20.0	19.8	19.6
″	**130**	**129**	**128**	**127**	**126**
1	2.2	2.2	2.1	2.1	2.1
2	4.3	4.3	4.3	4.2	4.2
3	6.5	6.4	6.4	6.4	6.3
4	8.7	8.6	8.5	8.5	8.4
5	10.8	10.8	10.7	10.6	10.5
6	13.0	12.9	12.8	12.7	12.6
7	15.2	15.0	14.9	14.8	14.7
8	17.3	17.2	17.1	16.9	16.8
9	19.5	19.4	19.2	19.0	18.9
″	**125**	**124**	**123**	**122**	**121**
1	2.1	2.1	2.0	2.0	2.0
2	4.2	4.1	4.1	4.1	4.0
3	6.2	6.2	6.2	6.1	6.0
4	8.3	8.3	8.2	8.1	8.1
5	10.4	10.3	10.2	10.2	10.1
6	12.5	12.4	12.3	12.2	12.1
7	14.6	14.5	14.4	14.2	14.1
8	16.7	16.5	16.4	16.3	16.1
9	18.8	18.6	18.4	18.3	18.2
10	20.8	20.7	20.5	20.3	20.2

P.P.

LOGARITHMS OF THE FUNCTIONS (Continued)

6° (186°) (353°) 173°

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	′	″	P. P.			
0	9.01 923	120	9.02 162	121	0.97 838	9.99 761	60	″	121	120	119	118
1	9.02 043	120	9.02 283	121	0.97 717	9.99 760	59	1	2.0	2.0	2.0	2.0
2	9.02 163	120	9.02 404	121	0.97 596	9.99 759	58	2	4.0	4.0	4.0	3.9
3	9.02 283	119	9.02 525	120	0.97 475	9.99 757	57	3	6.0	6.0	6.0	5.9
4	9.02 402	118	9.02 645	121	0.97 355	9.99 756	56	4	8.1	8.0	7.9	7.9
5	9.02 520	119	9.02 766	119	0.97 234	9.99 755	55	5	10.1	10.0	9.9	9.8
6	9.02 639	118	9.02 885	120	0.97 115	9.99 753	54	6	12.1	12.0	11.9	11.8
7	9.02 757	117	9.03 005	119	0.96 995	9.99 752	53	7	14.1	14.0	13.9	13.8
8	9.02 874	118	9.03 124	118	0.96 876	9.99 751	52	8	16.1	16.0	15.9	15.7
9	9.02 992	117	9.03 242	119	0.96 758	9.99 749	51	9	18.2	18.0	17.8	17.7
10	9.03 109	117	9.03 361	118	0.96 639	9.99 748	50	10	20.2	20.0	19.8	19.7
11	9.03 226	116	9.03 479	118	0.96 521	9.99 747	49	20	40.3	40.0	39.7	39.3
12	9.03 342	116	9.03 597	117	0.96 403	9.99 746	48	30	60.5	60.0	59.5	59.0
13	9.03 458	116	9.03 714	118	0.96 286	9.99 744	47	40	80.7	80.0	79.3	78.7
14	9.03 574	116	9.03 832	116	0.96 168	9.99 742	46	50	100.8	100.0	99.2	98.3
15	9.03 690	115	9.03 948	117	0.96 052	9.99 741	45	″	117	116	115	114
16	9.03 805	115	9.04 065	116	0.95 935	9.99 740	44	1	2.0	1.9	1.9	1.9
17	9.03 920	114	9.04 181	116	0.95 819	9.99 738	43	2	3.9	3.9	3.8	3.8
18	9.04 034	115	9.04 297	116	0.95 703	9.99 737	42	3	5.8	5.8	5.8	5.7
19	9.04 149	113	9.04 413	115	0.95 587	9.99 736	41	4	7.8	7.7	7.7	7.6
20	9.04 262	114	9.04 528	115	0.95 472	9.99 734	40	5	9.8	9.7	9.6	9.5
21	9.04 376	114	9.04 643	115	0.95 357	9.99 733	39	6	11.7	11.6	11.5	11.4
22	9.04 490	113	9.04 758	115	0.95 242	9.99 731	38	7	13.6	13.5	13.4	13.3
23	9.04 603	112	9.04 873	114	0.95 127	9.99 730	37	8	15.6	15.5	15.3	15.2
24	9.04 715	113	9.04 987	114	0.95 013	9.99 728	36	9	17.6	17.4	17.2	17.1
25	9.04 828	112	9.05 101	113	0.94 899	9.99 727	35	10	19.5	19.3	19.2	19.0
26	9.04 940	112	9.05 214	114	0.94 786	9.99 726	34	20	39.0	38.7	38.3	38.0
27	9.05 052	112	9.05 328	113	0.94 672	9.99 724	33	30	58.5	58.0	57.5	57.0
28	9.05 164	111	9.05 441	112	0.94 559	9.99 723	32	40	78.0	77.3	76.7	76.0
29	9.05 275	111	9.05 553	113	0.94 447	9.99 721	31	50	97.5	96.7	95.8	95.0
30	9.05 386	111	9.05 666	112	0.94 334	9.99 720	30	″	113	112	111	110
31	9.05 497	110	9.05 778	112	0.94 222	9.99 718	29	1	1.9	1.9	1.8	1.8
32	9.05 607	110	9.05 890	112	0.94 110	9.99 717	28	2	3.8	3.7	3.7	3.7
33	9.05 717	110	9.06 002	111	0.93 998	9.99 716	27	3	5.6	5.6	5.6	5.5
34	9.05 827	110	9.06 113	111	0.93 887	9.99 714	26	4	7.5	7.5	7.4	7.3
35	9.05 937	109	9.06 224	111	0.93 776	9.99 713	25	5	9.4	9.3	9.2	9.2
36	9.06 046	109	9.06 335	110	0.93 665	9.99 711	24	6	11.3	11.2	11.1	11.0
37	9.06 155	109	9.06 445	111	0.93 555	9.99 710	23	7	13.2	13.1	13.0	12.8
38	9.06 264	108	9.06 556	110	0.93 444	9.99 708	22	8	15.1	14.9	14.8	14.7
39	9.06 372	109	9.06 666	109	0.93 334	9.99 707	21	9	17.0	16.8	16.6	16.5
40	9.06 481	108	9.06 775	110	0.93 225	9.99 705	20	10	18.8	18.7	18.5	18.3
41	9.06 589	107	9.06 885	109	0.93 115	9.99 704	19	20	37.7	37.3	37.0	36.7
42	9.06 696	108	9.06 994	109	0.93 006	9.99 702	18	30	56.5	56.0	55.5	55.0
43	9.06 804	107	9.07 103	108	0.92 897	9.99 701	17	40	75.3	74.7	74.0	73.3
44	9.06 911	107	9.07 211	109	0.92 789	9.99 699	16	50	94.2	93.3	92.5	91.7
45	9.07 018	106	9.07 320	108	0.92 680	9.99 698	15	″	109	108	107	106
46	9.07 124	107	9.07 428	108	0.92 572	9.99 696	14	1	1.8	1.8	1.8	1.8
47	9.07 231	106	9.07 536	107	0.92 464	9.99 695	13	2	3.6	3.6	3.6	3.5
48	9.07 337	105	9.07 643	108	0.92 357	9.99 693	12	3	5.4	5.4	5.4	5.3
49	9.07 442	106	9.07 751	107	0.92 249	9.99 692	11	4	7.3	7.2	7.1	7.1
50	9.07 548	105	9.07 858	106	0.92 142	9.99 690	10	5	9.1	9.0	8.9	8.8
51	9.07 653	105	9.07 964	107	0.92 036	9.99 689	9	6	10.9	10.8	10.7	10.6
52	9.07 758	105	9.08 071	106	0.91 929	9.99 687	8	7	12.7	12.6	12.5	12.4
53	9.07 863	105	9.08 177	106	0.91 823	9.99 686	7	8	14.5	14.4	14.3	14.1
54	9.07 968	104	9.08 283	106	0.91 717	9.99 684	6	9	16.4	16.2	16.0	15.9
55	9.08 072	104	9.08 389	106	0.91 611	9.99 683	5	10	18.2	18.0	17.8	17.7
56	9.08 176	104	9.08 495	105	0.91 505	9.99 681	4	20	36.3	36.0	35.7	35.3
57	9.08 280	103	9.08 600	105	0.91 400	9.99 680	3	30	54.5	54.0	53.5	53.0
58	9.08 383	103	9.08 705	105	0.91 295	9.99 678	2	40	72.7	72.0	71.3	70.7
59	9.08 486	103	9.08 810	104	0.91 190	9.99 677	1	50	90.8	90.0	89.2	88.3
60	9.08 589		9.08 914		0.91 086	9.99 675	0					
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	′		P. P.			

96° (276°) (263°) 83°

LOGARITHMS OF THE FUNCTIONS (Continued)

7° (187°) (352°) 172°

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	′
0	9.08 589	103	9.08 914	105	0.91 086	9.99 675	60
1	9.08 692	103	9.09 019	104	0.90 981	9.99 674	59
2	9.08 795	102	9.09 123	104	0.90 877	9.99 672	58
3	9.08 897	102	9.09 227	103	0.90 773	9.99 670	57
4	9.08 999	102	9.09 330	104	0.90 670	9.99 669	56
5	9.09 101	101	9.09 434	103	0.90 566	9.99 667	55
6	9.09 202	102	9.09 537	103	0.90 463	9.99 666	54
7	9.09 304	101	9.09 640	102	0.90 360	9.99 664	53
8	9.09 405	101	9.09 742	103	0.90 258	9.99 663	52
9	9.09 506	100	9.09 845	102	0.90 155	9.99 661	51
10	9.09 606	101	9.09 947	102	0.90 053	9.99 659	50
11	9.09 707	100	9.10 049	101	0.89 951	9.99 658	49
12	9.09 807	100	9.10 150	102	0.89 850	9.99 656	48
13	9.09 907	99	9.10 252	101	0.89 748	9.99 655	47
14	9.10 006	100	9.10 353	101	0.89 647	9.99 653	46
15	9.10 106	99	9.10 454	101	0.89 546	9.99 651	45
16	9.10 205	99	9.10 555	101	0.89 445	9.99 650	44
17	9.10 304	98	9.10 656	100	0.89 344	9.99 648	43
18	9.10 402	99	9.10 756	100	0.89 244	9.99 647	42
19	9.10 501	98	9.10 856	100	0.89 144	9.99 645	41
20	9.10 599	98	9.10 956	100	0.89 044	9.99 643	40
21	9.10 697	98	9.11 056	99	0.88 944	9.99 642	39
22	9.10 795	98	9.11 155	99	0.88 845	9.99 640	38
23	9.10 893	97	9.11 254	99	0.88 746	9.99 638	37
24	9.10 990	97	9.11 353	99	0.88 647	9.99 637	36
25	9.11 087	97	9.11 452	99	0.88 548	9.99 635	35
26	9.11 184	97	9.11 551	98	0.88 449	9.99 633	34
27	9.11 281	96	9.11 649	98	0.88 351	9.99 632	33
28	9.11 377	97	9.11 747	98	0.88 253	9.99 630	32
29	9.11 474	96	9.11 845	98	0.88 155	9.99 629	31
30	9.11 570	96	9.11 943	97	0.88 057	9.99 627	30
31	9.11 666	95	9.12 040	98	0.87 960	9.99 626	29
32	9.11 761	96	9.12 138	97	0.87 862	9.99 624	28
33	9.11 857	95	9.12 235	97	0.87 765	9.99 622	27
34	9.11 952	95	9.12 332	96	0.87 668	9.99 620	26
35	9.12 047	95	9.12 428	97	0.87 572	9.99 618	25
36	9.12 142	94	9.12 525	96	0.87 475	9.99 617	24
37	9.12 236	95	9.12 621	96	0.87 379	9.99 615	23
38	9.12 331	94	9.12 717	96	0.87 283	9.99 613	22
39	9.12 425	94	9.12 813	96	0.87 187	9.99 612	21
40	9.12 519	93	9.12 909	95	0.87 091	9.99 610	20
41	9.12 612	94	9.13 004	95	0.86 996	9.99 608	19
42	9.12 706	93	9.13 099	95	0.86 901	9.99 607	18
43	9.12 799	93	9.13 194	95	0.86 806	9.99 605	17
44	9.12 892	93	9.13 289	95	0.86 711	9.99 603	16
45	9.12 985	93	9.13 384	94	0.86 616	9.99 601	15
46	9.13 078	93	9.13 478	95	0.86 522	9.99 600	14
47	9.13 171	92	9.13 573	94	0.86 427	9.99 598	13
48	9.13 263	92	9.13 667	94	0.86 333	9.99 596	12
49	9.13 355	92	9.13 761	93	0.86 239	9.99 595	11
50	9.13 447	92	9.13 854	94	0.86 146	9.99 593	10
51	9.13 539	91	9.13 948	93	0.86 052	9.99 591	9
52	9.13 630	92	9.14 041	93	0.85 959	9.99 589	8
53	9.13 722	91	9.14 134	93	0.85 866	9.99 588	7
54	9.13 813	91	9.14 227	93	0.85 773	9.99 586	6
55	9.13 904	90	9.14 320	92	0.85 680	9.99 584	5
56	9.13 994	91	9.14 412	92	0.85 588	9.99 582	4
57	9.14 085	90	9.14 504	93	0.85 496	9.99 581	3
58	9.14 175	91	9.14 597	91	0.85 403	9.99 579	2
59	9.14 266	90	9.14 688	92	0.85 312	9.99 577	1
60	9.14 356		9.14 780		0.85 220	9.99 575	0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	′

P. P.

″	105	104	103	102
1	1.8	1.7	1.7	1.7
2	3.5	3.5	3.4	3.4
3	5.2	5.2	5.2	5.1
4	7.0	6.9	6.9	6.8
5	8.8	8.7	8.6	8.5
6	10.5	10.4	10.3	10.2
7	12.2	12.1	12.0	11.9
8	14.0	13.9	13.7	13.6
9	15.8	15.6	15.4	15.3
10	17.5	17.3	17.2	17.0
20	35.0	34.7	34.3	34.0
30	52.5	52.0	51.5	51.0
40	70.0	69.3	68.7	68.0
50	87.5	86.7	85.8	85.0
″	101	100	99	98
1	1.7	1.7	1.6	1.6
2	3.4	3.3	3.3	3.3
3	5.0	5.0	5.0	4.9
4	6.7	6.7	6.6	6.5
5	8.4	8.3	8.2	8.2
6	10.1	10.0	9.9	9.8
7	11.8	11.7	11.6	11.4
8	13.5	13.3	13.2	13.1
9	15.2	15.0	14.8	14.7
10	16.8	16.7	16.5	16.3
20	33.7	33.3	33.0	32.7
30	50.5	50.0	49.5	49.0
40	67.3	66.7	66.0	65.3
50	84.2	83.3	82.5	81.7
″	97	96	95	94
1	1.6	1.6	1.6	1.6
2	3.2	3.2	3.2	3.1
3	4.8	4.8	4.8	4.7
4	6.5	6.4	6.3	6.3
5	8.1	8.0	7.9	7.8
6	9.7	9.6	9.5	9.4
7	11.3	11.2	11.1	11.0
8	12.9	12.8	12.7	12.5
9	14.6	14.4	14.2	14.1
10	16.2	16.0	15.8	15.7
20	32.3	32.0	31.7	31.3
30	48.5	48.0	47.5	47.0
40	64.7	64.0	63.3	62.7
50	80.8	80.0	79.2	78.3
″	93	92	91	90
1	1.6	1.5	1.5	1.5
2	3.1	3.1	3.0	3.0
3	4.6	4.6	4.6	4.5
4	6.2	6.1	6.1	6.0
5	7.8	7.7	7.6	7.5
6	9.3	9.2	9.1	9.0
7	10.8	10.7	10.6	10.5
8	12.4	12.3	12.1	12.0
9	14.0	13.8	13.6	13.5
10	15.5	15.3	15.2	15.0
20	31.0	30.7	30.3	30.0
30	46.5	46.0	45.5	45.0
40	62.0	61.3	60.7	60.0
50	77.5	76.7	75.8	75.0

97° (277°) (262°) 82°

8° (188°) (351°) **171°**

′	L. Sin.	d.	L. Tan.	c. d.	L. Cot.	L. Cos.	′
0	9.14 356	89	9.14 780	92	0.85 220	9.99 575	**60**
1	9.14 445	90	9.14 872	91	0.85 128	9.99 574	59
2	9.14 535	89	9.14 963	91	0.85 037	9.99 572	58
3	9.14 624	90	9.15 054	91	0.84 946	9.99 570	57
4	9.14 714	89	9.15 145	91	0.84 855	9.99 568	56
5	9.14 803	88	9.15 236	91	0.84 764	9.99 566	55
6	9.14 891	89	9.15 327	90	0.84 673	9.99 565	54
7	9.14 980	89	9.15 417	91	0.84 583	9.99 563	53
8	9.15 069	88	9.15 508	90	0.84 492	9.99 561	52
9	9.15 157	88	9.15 598	90	0.84 402	9.99 559	51
10	9.15 245	88	9.15 688	89	0.84 312	9.99 557	**50**
11	9.15 333	88	9.15 777	90	0.84 223	9.99 556	49
12	9.15 421	87	9.15 867	89	0.84 133	9.99 554	48
13	9.15 508	88	9.15 956	90	0.84 044	9.99 552	47
14	9.15 596	87	9.16 046	89	0.83 954	9.99 550	46
15	9.15 683	87	9.16 135	89	0.83 865	9.99 548	45
16	9.15 770	87	9.16 224	88	0.83 776	9.99 546	44
17	9.15 857	87	9.16 312	89	0.83 688	9.99 545	43
18	9.15 944	86	9.16 401	88	0.83 599	9.99 543	42
19	9.16 030	86	9.16 489	88	0.83 511	9.99 541	41
20	9.16 116	87	9.16 577	88	0.83 423	9.99 539	**40**
21	9.16 203	86	9.16 665	88	0.83 335	9.99 537	39
22	9.16 289	85	9.16 753	88	0.83 247	9.99 535	38
23	9.16 374	86	9.16 841	87	0.83 159	9.99 533	37
24	9.16 460	85	9.16 928	88	0.83 072	9.99 532	36
25	9.16 545	86	9.17 016	87	0.82 984	9.99 530	35
26	9.16 631	85	9.17 103	87	0.82 897	9.99 528	34
27	9.16 716	85	9.17 190	87	0.82 810	9.99 526	33
28	9.16 801	85	9.17 277	86	0.82 723	9.99 524	32
29	9.16 886	84	9.17 363	87	0.82 637	9.99 522	31
30	9.16 970	85	9.17 450	86	0.82 550	9.99 520	**30**
31	9.17 055	84	9.17 536	86	0.82 464	9.99 518	29
32	9.17 139	84	9.17 622	86	0.82 378	9.99 517	28
33	9.17 223	84	9.17 708	86	0.82 292	9.99 515	27
34	9.17 307	84	9.17 794	86	0.82 206	9.99 513	26
35	9.17 391	83	9.17 880	85	0.82 120	9.99 511	25
36	9.17 474	84	9.17 965	86	0.82 035	9.99 509	24
37	9.17 558	83	9.18 051	85	0.81 949	9.99 507	23
38	9.17 641	83	9.18 136	85	0.81 864	9.99 505	22
39	9.17 724	83	9.18 221	85	0.81 779	9.99 503	21
40	9.17 807	83	9.18 306	85	0.81 694	9.99 501	**20**
41	9.17 890	83	9.18 391	84	0.81 609	9.99 499	19
42	9.17 973	82	9.18 475	85	0.81 525	9.99 497	18
43	9.18 055	82	9.18 560	84	0.81 440	9.99 495	17
44	9.18 137	83	9.18 644	84	0.81 356	9.99 494	16
45	9.18 220	82	9.18 728	84	0.81 272	9.99 492	15
46	9.18 302	81	9.18 812	84	0.81 188	9.99 490	14
47	9.18 383	82	9.18 896	83	0.81 104	9.99 488	13
48	9.18 465	82	9.18 979	84	0.81 021	9.99 486	12
49	9.18 547	81	9.19 063	83	0.80 937	9.99 484	11
50	9.18 628	81	9.19 146	83	0.80 854	9.99 482	**10**
51	9.18 709	81	9.19 229	83	0.80 771	9.99 480	9
52	9.18 790	81	9.19 312	83	0.80 688	9.99 478	8
53	9.18 871	81	9.19 395	83	0.80 605	9.99 476	7
54	9.18 952	81	9.19 478	83	0.80 522	9.99 474	6
55	9.19 033	80	9.19 561	82	0.80 439	9.99 472	5
56	9.19 113	80	9.19 643	82	0.80 357	9.99 470	4
57	9.19 193	80	9.19 725	82	0.80 275	9.99 468	3
58	9.19 273	80	9.19 807	82	0.80 193	9.99 466	2
59	9.19 353	80	9.19 889	82	0.80 111	9.99 464	1
60	9.19 433		9.19 971		0.80 029	9.99 462	**0**
′	L. Cos.	d.	L. Cot.	c. d.	L. Tan.	L. Sin.	′

P. P.

″	**92**	**91**	**90**
1	1.5	1.5	1.5
2	3.1	3.0	3.0
3	4.6	4.6	4.5
4	6.1	6.1	6.0
5	7.7	7.6	7.5
6	9.2	9.1	9.0
7	10.7	10.6	10.5
8	12.3	12.1	12.0
9	13.8	13.6	13.5
10	15.3	15.2	15.0
20	30.7	30.3	30.0
30	46.0	45.5	45.0
40	61.3	60.7	60.0
50	76.7	75.8	75.0
″	**89**	**88**	**87**
1	1.5	1.5	1.4
2	3.0	2.9	2.9
3	4.4	4.4	4.4
4	5.9	5.9	5.8
5	7.4	7.3	7.2
6	8.9	8.8	8.7
7	10.4	10.3	10.2
8	11.9	11.7	11.6
9	13.4	13.2	13.0
10	14.8	14.7	14.5
20	29.7	29.3	29.0
30	44.5	44.0	43.5
40	59.3	58.7	58.0
50	74.2	73.3	72.5
″	**86**	**85**	**84**
1	1.4	1.4	1.4
2	2.9	2.8	2.8
3	4.3	4.2	4.2
4	5.7	5.7	5.6
5	7.2	7.1	7.0
6	8.6	8.5	8.4
7	10.0	9.9	9.8
8	11.5	11.3	11.2
9	12.9	12.8	12.6
10	14.3	14.2	14.0
20	28.7	28.3	28.0
30	43.0	42.5	42.0
40	57.3	56.7	56.0
50	71.7	70.8	70.0
″	**83**	**82**	**81**
1	1.4	1.4	1.4
2	2.8	2.7	2.7
3	4.2	4.1	4.0
4	5.5	5.5	5.4
5	6.9	6.8	6.8
6	8.3	8.2	8.1
7	9.7	9.6	9.4
8	11.1	10.9	10.8
9	12.4	12.3	12.2
10	13.8	13.7	13.5
20	27.7	27.3	27.0
30	41.5	41.0	40.5
30	55.3	54.7	54.0
50	69.2	68.3	67.5

P. P.

98° (278°) (261°) **81°**

9° (189°) (350°) **170°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	′
0	9 19 433	80	9 19 971	82	0.80 029	9.99 462	**60**
1	9 19 513	79	9 20 053	81	0 79 947	9 99 460	59
2	9 19 592	80	9 20 134	82	0 79 866	9 99 458	58
3	9 19 672	79	9 20 216	81	0 79 784	9 99 456	57
4	9 19 751	79	9 20 297	81	0 79 703	9 99 454	56
5	9 19 830	79	9 20 378	81	0.79 622	9 99 452	55
6	9 19 909	79	9 20 459	81	0 79 541	9 99 450	54
7	9 19 988	79	9 20 540	81	0 79 460	9 99 448	53
8	9 20 067	78	9 20 621	80	0.79 379	9 99 446	52
9	9 20 145	78	9 20 701	81	0 79 299	9 99 444	51
10	9 20 223	79	9 20 782	80	0 79 218	9 99 442	**50**
11	9 20 302	78	9 20 862	80	0.79 138	9 99 440	49
12	9 20 380	78	9 20 942	80	0.79 058	9.99 438	48
13	9 20 458	77	9 21 022	80	0 78 978	9 99 436	47
14	9 20 535	78	9 21 102	80	0 78 898	9 99 434	46
15	9 20 613	78	9 21 182	79	0 78 818	9 99 432	45
16	9 20 691	77	9 21 261	80	0 78 739	9 99 429	44
17	9 20 768	77	9 21 341	79	0.78 659	9 99 427	43
18	9 20 845	77	9 21 420	79	0.78 580	9 99 425	42
19	9 20 922	77	9 21 499	79	0 78 501	9 99 423	41
20	9 20 999	77	9 21 578	79	0.78 422	9 99 421	**40**
21	9 21 076	77	9 21 657	79	0.78 343	9 99 419	39
22	9 21 153	76	9 21 736	78	0.78 264	9 99 417	38
23	9 21 229	77	9 21 814	79	0.78 186	9.99 415	37
24	9 21 306	76	9 21 893	78	0 78 107	9.99 413	36
25	9 21 382	76	9 21 971	78	0.78 029	9 99 411	35
26	9 21 458	76	9 22 049	78	0.77 951	9 99 409	34
27	9 21 534	76	9 22 127	78	0.77 873	9 99 407	33
28	9 21 610	75	9 22 205	78	0.77 795	9 99 404	32
29	9 21 685	76	9 22 283	78	0 77 717	9.99 402	31
30	9 21 761	75	9 22 361	77	0 77 639	9 99 400	**30**
31	9 21 836	76	9 22 438	78	0.77 562	9 99 398	29
32	9 21 912	75	9 22 516	77	0 77 484	9 99 396	28
33	9 21 987	75	9 22 593	77	0.77 407	9.99 394	27
34	9 22 062	75	9 22 670	77	0.77 330	9 99 392	26
35	9 22 137	74	9 22 747	77	0 77 253	9 99 390	25
36	9 22 211	75	9 22 824	77	0.77 176	9 99 388	24
37	9 22 286	75	9 22 901	76	0 77 099	9 99 385	23
38	9 22 361	74	9 22 977	77	0.77 023	9 99 383	22
39	9 22 435	74	9 23 054	76	0 76 946	9 99 381	21
40	9 22 509	74	9 23 130	76	0.76 870	9 99 379	**20**
41	9 22 583	74	9 23 206	77	0 76 794	9 99 377	19
42	9 22 657	74	9 23 283	76	0 76 717	9 99 375	18
43	9 22 731	74	9 23 359	76	0 76 641	9 99 372	17
44	9 22 805	73	9 23 435	75	0 76 565	9 99 370	16
45	9 22 878	74	9 23 510	76	0 76 490	9 99 368	15
46	9 22 952	73	9 23 586	75	0 76 414	9.99 366	14
47	9 23 025	73	9 23 661	76	0 76 339	9 99 364	13
48	9 23 098	73	9 23 737	75	0 76 263	9 99 362	12
49	9 23 171	73	9 23 812	75	0 76 188	9.99 359	11
50	9 23 244	73	9 23 887	75	0 76 113	9 99 357	**10**
51	9 23 317	73	9 23 962	75	0 76 038	9.99 355	9
52	9 23 390	72	9 24 037	75	0 75 963	9.99 353	8
53	9 23 462	73	9 24 112	74	0 75 888	9 99 351	7
54	9 23 535	72	9 24 186	75	0 75 814	9 99 348	6
55	9 23 607	72	9 24 261	74	0 75 739	9 99 346	5
56	9 23 679	73	9 24 335	75	0 75 665	9.99 344	4
57	9 23 752	71	9 24 410	74	0 75 590	9 99 342	3
58	9 23 823	72	9 24 484	74	0.75 516	9 99 340	2
59	9 23 895	72	9 24 558	74	0 75 442	9 99 337	1
60	9 23 967		9 24 632		0 75 368	9 99 335	**0**
′	L. Cos	d	L. Cot.	c.d.	L. Tan.	L. Sin.	′

P. P.

″	**80**	**79**	**78**	**77**
1	1.3	1 3	1.3	1.3
2	2.7	2 6	2 6	2 6
3	4.0	4 0	3 9	3 8
4	5.3	5.3	5 2	5.1
5	6 7	6 6	6.5	6 4
6	8.0	7 9	7 8	7 7
7	9 3	9 2	9 1	9.0
8	10 7	10 5	10 4	10.3
9	12.0	11 8	11 7	11.6
10	13 3	13 2	13 0	12 8
20	26.7	26 3	26 0	25 7
30	40.0	39 5	39.0	38.5
40	53 3	52 7	52 0	51 3
50	66.7	65 8	65 0	64 2

″	**76**	**75**	**74**	**73**
1	1 3	1 2	1 2	1 2
2	2 5	2 5	2 5	2 4
3	3 8	3 8	3 7	3 6
4	5.1	5 0	4 9	4 9
5	6 3	6 2	6 2	6 1
6	7 6	7 5	7 4	7 3
7	8 9	8 8	8 6	8 5
8	10 1	10 0	9 9	9 7
9	11 4	11 2	11.1	11.0
10	12 7	12 5	12 3	12 2
20	25 3	25 0	24.7	24 3
30	38 0	37 5	37 0	36 5
40	50 7	50 0	49 3	48 7
50	63 3	62 5	61.7	60 8

″	**72**	**71**	**3**	**2**
1	1 2	1 2	0 0	0 0
2	2.4	2 4	0 1	0 1
3	3 6	3 6	0 2	0 1
4	4 8	4 7	0 2	0 1
5	6.0	5 9	0.2	0.2
6	7.2	7.1	0.3	0 2
7	8.4	8 3	0.4	0 2
8	9 6	9 5	0.4	0 3
9	10 8	10 6	0 4	0 3
10	12.0	11.8	0.5	0 3
20	24.0	23.7	1.0	0.7
30	36 0	35 5	1.5	1 0
40	48 0	47 3	2.0	1 3
50	60 0	59 2	2 5	1 7

	$\frac{3}{79}$	$\frac{3}{78}$	$\frac{3}{77}$
0			
1	13 2	13 0	12 8
2	39 5	39 0	38 5
3	65.8	65.0	64 2

	$\frac{3}{76}$	$\frac{3}{75}$	$\frac{3}{74}$
0			
1	12 7	12 5	12 3
2	38 0	37 5	37 0
3	63.3	62 5	61.7

P P

99° (279°) (260°) **80°**

10° (190°) (349°) **169°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.23 967	72	9.24 632	74	0.75 368	9.99 335	2	**60**
1	9.24 039	71	9.24 706	73	0.75 294	9.99 333	2	59
2	9.24 110	71	9.24 779	74	0.75 221	9.99 331	3	58
3	9.24 181	72	9.24 853	73	0.75 147	9.99 328	2	57
4	9.24 253	71	9.24 926	74	0.75 074	9.99 326	2	56
5	9.24 324	71	9.25 000	73	0.75 000	9.99 324	2	55
6	9.24 395	71	9.25 073	73	0.74 927	9.99 322	3	54
7	9.24 466	70	9.25 146	73	0.74 854	9.99 319	2	53
8	9.24 536	71	9.25 219	73	0.74 781	9.99 317	2	52
9	9.24 607	70	9.25 292	73	0.74 708	9.99 315	2	51
10	9.24 677	71	9.25 365	72	0.74 635	9.99 313	3	**50**
11	9.24 748	70	9.25 437	73	0.74 563	9.99 310	2	49
12	9.24 818	70	9.25 510	72	0.74 490	9.99 308	2	48
13	9.24 888	70	9.25 582	73	0.74 418	9.99 306	2	47
14	9.24 958	70	9.25 655	72	0.74 345	9.99 304	3	46
15	9.25 028	70	9.25 727	72	0.74 273	9.99 301	2	45
16	9.25 098	70	9.25 799	72	0.74 201	9.99 299	2	44
17	9.25 168	69	9.25 871	72	0.74 129	9.99 297	3	43
18	9.25 237	70	9.25 943	72	0.74 057	9.99 294	2	42
19	9.25 307	69	9.26 015	71	0.73 985	9.99 292	2	41
20	9.25 376	69	9.26 086	72	0.73 914	9.99 290	2	**40**
21	9.25 445	69	9.26 158	71	0.73 842	9.99 288	3	39
22	9.25 514	69	9.26 229	72	0.73 771	9.99 285	2	38
23	9.25 583	69	9.26 301	71	0.73 699	9.99 283	2	37
24	9.25 652	69	9.26 372	71	0.73 628	9.99 281	3	36
25	9.25 721	69	9.26 443	71	0.73 557	9.99 278	2	35
26	9.25 790	68	9.26 514	71	0.73 486	9.99 276	2	34
27	9.25 858	69	9.26 585	70	0.73 415	9.99 274	3	33
28	9.25 927	68	9.26 655	71	0.73 345	9.99 271	2	32
29	9.25 995	68	9.26 726	71	0.73 274	9.99 269	2	31
30	9.26 063	68	9.26 797	70	0.73 203	9.99 267	3	**30**
31	9.26 131	68	9.26 867	70	0.73 133	9.99 264	2	29
32	9.26 199	68	9.26 937	71	0.73 063	9.99 262	2	28
33	9.26 267	68	9.27 008	70	0.72 992	9.99 260	3	27
34	9.26 335	68	9.27 078	70	0.72 922	9.99 257	2	26
35	9.26 403	67	9.27 148	70	0.72 852	9.99 255	3	25
36	9.26 470	68	9.27 218	70	0.72 782	9.99 252	2	24
37	9.26 538	67	9.27 288	69	0.72 712	9.99 250	2	23
38	9.26 605	67	9.27 357	70	0.72 643	9.99 248	3	22
39	9.26 672	67	9.27 427	69	0.72 573	9.99 245	2	21
40	9.26 739	67	9.27 496	70	0.72 504	9.99 243	2	**20**
41	9.26 806	67	9.27 566	69	0.72 434	9.99 241	3	19
42	9.26 873	67	9.27 635	69	0.72 365	9.99 238	2	18
43	9.26 940	67	9.27 704	69	0.72 296	9.99 236	3	17
44	9.27 007	66	9.27 773	69	0.72 227	9.99 233	2	16
45	9.27 073	67	9.27 842	69	0.72 158	9.99 231	2	15
46	9.27 140	66	9.27 911	69	0.72 089	9.99 229	3	14
47	9.27 206	67	9.27 980	69	0.72 020	9.99 226	2	13
48	9.27 273	66	9.28 049	68	0.71 951	9.99 224	3	12
49	9.27 339	66	9.28 117	69	0.71 883	9.99 221	2	11
50	9.27 405	66	9.28 186	68	0.71 814	9.99 219	2	**10**
51	9.27 471	66	9.28 254	69	0.71 746	9.99 217	3	9
52	9.27 537	65	9.28 323	68	0.71 677	9.99 214	2	8
53	9.27 602	66	9.28 391	68	0.71 609	9.99 212	3	7
54	9.27 668	66	9.28 459	68	0.71 541	9.99 209	2	6
55	9.27 734	65	9.28 527	68	0.71 473	9.99 207	3	5
56	9.27 799	65	9.28 595	67	0.71 405	9.99 204	2	4
57	9.27 864	66	9.28 662	68	0.71 338	9.99 202	2	3
58	9.27 930	65	9.28 730	68	0.71 270	9.99 200	3	2
59	9.27 995	65	9.28 798	67	0.71 202	9.99 197	2	1
60	9.28 060		9.28 865		0.71 135	9.99 195		**0**
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

P. P.

″	74	73	72
1	1.2	1.2	1.2
2	2.5	2.4	2.4
3	3.7	3.6	3.6
4	4.9	4.9	4.8
5	6.2	6.1	6.0
6	7.4	7.3	7.2
7	8.6	8.5	8.4
8	9.9	9.7	9.6
9	11.1	11.0	10.8
10	12.3	12.2	12.0
20	24.7	24.3	24.0
30	37.0	36.5	36.0
40	49.3	48.7	48.0
50	61.7	60.8	60.0

″	71	70	69
1	1.2	1.2	1.2
2	2.4	2.3	2.3
3	3.6	3.5	3.4
4	4.7	4.7	4.6
5	5.9	5.8	5.8
6	7.1	7.0	6.9
7	8.3	8.2	8.0
8	9.5	9.3	9.2
9	10.6	10.5	10.4
10	11.8	11.7	11.5
20	23.7	23.3	23.0
30	35.5	35.0	34.5
40	47.3	46.7	46.0
50	59.2	58.3	57.5

″	68	67	66
1	1.1	1.1	1.1
2	2.3	2.2	2.2
3	3.4	3.4	3.3
4	4.5	4.5	4.4
5	5.7	5.6	5.5
6	6.8	6.7	6.6
7	7.9	7.8	7.7
8	9.1	8.9	8.8
9	10.2	10.0	9.9
10	11.3	11.2	11.0
20	22.7	22.3	22.0
30	34.0	33.5	33.0
40	45.3	44.7	44.0
50	56.7	55.8	55.0

	$\frac{3}{74}$	$\frac{3}{73}$	$\frac{3}{72}$
0			
1	12.3	12.2	12.0
2	37.0	36.5	36.0
3	61.7	60.8	60.0

	$\frac{3}{71}$	$\frac{3}{70}$	$\frac{3}{69}$	$\frac{3}{68}$
0				
1	11.8	11.7	11.5	11.3
2	35.5	35.0	34.5	34.0
3	59.2	58.3	57.5	56.7

P. P.

100° (280°) (259°) **79°**

11° (191°) **(348°) 168°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.28 060	65	9.28 865	68	0.71 135	9.99 195	3	60
1	9.28 125	65	9.28 933	67	0.71 067	9.99 192	2	59
2	9.28 190	64	9.29 000	67	0.71 000	9.99 190	3	58
3	9.28 254	65	9.29 067	67	0.70 933	9.99 187	2	57
4	9.28 319	65	9.29 134	67	0.70 866	9.99 185	3	56
5	9.28 384	64	9.29 201	67	0.70 799	9.99 182	2	55
6	9.28 448	64	9.29 268	67	0.70 732	9.99 180	3	54
7	9.28 512	65	9.29 335	67	0.70 665	9.99 177	2	53
8	9.28 577	64	9.29 402	66	0.70 598	9.99 175	3	52
9	9.28 641	64	9.29 468	67	0.70 532	9.99 172	2	51
10	9.28 705	64	9.29 535	66	0.70 465	9.99 170	3	50
11	9.28 769	64	9.29 601	67	0.70 399	9.99 167	2	49
12	9.28 833	63	9.29 668	66	0.70 332	9.99 165	3	48
13	9.28 896	64	9.29 734	66	0.70 266	9.99 162	2	47
14	9.28 960	64	9.29 800	66	0.70 200	9.99 160	3	46
15	9.29 024	63	9.29 866	66	0.70 134	9.99 157	2	45
16	9.29 087	63	9.29 932	66	0.70 068	9.99 155	3	44
17	9.29 150	64	9.29 998	66	0.70 002	9.99 152	2	43
18	9.29 214	63	9.30 064	66	0.69 936	9.99 150	3	42
19	9.29 277	63	9.30 130	65	0.69 870	9.99 147	2	41
20	9.29 340	63	9.30 195	66	0.69 805	9.99 145	3	40
21	9.29 403	63	9.30 261	65	0.69 739	9.99 142	2	39
22	9.29 466	63	9.30 326	65	0.69 674	9.99 140	3	38
23	9.29 529	62	9.30 391	66	0.69 609	9.99 137	2	37
24	9.29 591	63	9.30 457	65	0.69 543	9.99 135	3	36
25	9.29 654	62	9.30 522	65	0.69 478	9.99 132	2	35
26	9.29 716	63	9.30 587	65	0.69 413	9.99 130	3	34
27	9.29 779	62	9.30 652	65	0.69 348	9.99 127	3	33
28	9.29 841	62	9.30 717	65	0.69 283	9.99 124	2	32
29	9.29 903	63	9.30 782	64	0.69 218	9.99 122	3	31
30	9.29 966	62	9.30 846	65	0.69 154	9.99 119	2	30
31	9.30 028	62	9.30 911	64	0.69 089	9.99 117	3	29
32	9.30 090	61	9.30 975	65	0.69 025	9.99 114	2	28
33	9.30 151	62	9.31 040	64	0.68 960	9.99 112	3	27
34	9.30 213	62	9.31 104	64	0.68 896	9.99 109	3	26
35	9.30 275	61	9.31 168	65	0.68 832	9.99 106	2	25
36	9.30 336	62	9.31 233	64	0.68 767	9.99 104	3	24
37	9.30 398	61	9.31 297	64	0.68 703	9.99 101	2	23
38	9.30 459	62	9.31 361	64	0.68 639	9.99 099	3	22
39	9.30 521	61	9.31 425	64	0.68 575	9.99 096	3	21
40	9.30 582	61	9.31 489	63	0.68 511	9.99 093	2	20
41	9.30 643	61	9.31 552	64	0.68 448	9.99 091	3	19
42	9.30 704	61	9.31 616	63	0.68 384	9.99 088	2	18
43	9.30 765	61	9.31 679	64	0.68 321	9.99 086	3	17
44	9.30 826	61	9.31 743	63	0.68 257	9.99 083	3	16
45	9.30 887	60	9.31 806	64	0.68 194	9.99 080	2	15
46	9.30 947	61	9.31 870	63	0.68 130	9.99 078	3	14
47	9.31 008	60	9.31 933	63	0.68 067	9.99 075	3	13
48	9.31 068	61	9.31 996	63	0.68 004	9.99 072	2	12
49	9.31 129	60	9.32 059	63	0.67 941	9.99 070	3	11
50	9.31 189	61	9.32 122	63	0.67 878	9.99 067	3	10
51	9.31 250	60	9.32 185	63	0.67 815	9.99 064	2	9
52	9.31 310	60	9.32 248	63	0.67 752	9.99 062	3	8
53	9.31 370	60	9.32 311	62	0.67 689	9.99 059	3	7
54	9.31 430	60	9.32 373	63	0.67 627	9.99 056	2	6
55	9.31 490	59	9.32 436	62	0.67 564	9.99 054	3	5
56	9.31 549	60	9.32 498	63	0.67 502	9.99 051	3	4
57	9.31 609	60	9.32 561	62	0.67 439	9.99 048	2	3
58	9.31 669	59	9.32 623	62	0.67 377	9.99 046	3	2
59	9.31 728	60	9.32 685	62	0.67 315	9.99 043	3	1
60	9.31 788		9.32 747		0.67 253	9.99 040		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

P. P.

″	65	64	63
1	1.1	1.1	1.0
2	2.2	2.1	2.1
3	3.2	3.2	3.2
4	4.3	4.3	4.2
5	5.4	5.3	5.2
6	6.5	6.4	6.3
7	7.6	7.5	7.4
8	8.7	8.5	8.4
9	9.8	9.6	9.4
10	10.8	10.7	10.5
20	21.7	21.3	21.0
30	32.5	32.0	31.5
40	43.3	42.7	42.0
50	54.2	53.3	52.5

″	62	61	60
1	1.0	1.0	1.0
2	2.1	2.0	2.0
3	3.1	3.0	3.0
4	4.1	4.1	4.0
5	5.2	5.1	5.0
6	6.2	6.1	6.0
7	7.2	7.1	7.0
8	8.3	8.1	8.0
9	9.3	9.2	9.0
10	10.3	10.2	10.0
20	20.7	20.3	20.0
30	31.0	30.5	30.0
40	41.3	40.7	40.0
50	51.7	50.8	50.0

″	59	3	2
1	1.0	0.0	0.0
2	2.0	0.1	0.1
3	3.0	0.2	0.1
4	3.9	0.2	0.1
5	4.9	0.2	0.2
6	5.9	0.3	0.2
7	6.9	0.4	0.2
8	7.9	0.4	0.3
9	8.8	0.4	0.3
10	9.8	0.5	0.3
20	19.7	1.0	0.7
30	29.5	1.5	1.0
40	39.3	2.0	1.3
50	49.2	2.5	1.7

	$\frac{3}{67}$	$\frac{3}{66}$	$\frac{3}{65}$
0			
1	11.2	11.0	10.8
2	33.5	33.0	32.5
3	55.8	55.0	54.2

	$\frac{3}{64}$	$\frac{3}{63}$	$\frac{3}{62}$
0			
1	10.7	10.5	10.3
2	32.0	31.5	31.0
3	53.3	52.5	51.7

101° (281°) **(258°) 78°**

LOGARITHMS OF THE FUNCTIONS (Continued)

12° (192°) (347°) **167°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.31 788	59	9.32 747	63	0.67 253	9.99 040	2	60
1	9.31 847	60	9.32 810	62	0.67 190	9.99 038	3	59
2	9.31 907	59	9.32 872	61	0.67 128	9.99 035	3	58
3	9.31 966	59	9.32 933	62	0.67 067	9.99 032	2	57
4	9.32 025	59	9.32 995	62	0.67 005	9.99 030	3	56
5	9.32 084	59	9.33 057	62	0.66 943	9.99 027	3	55
6	9.32 143	59	9.33 119	61	0.66 881	9.99 024	2	54
7	9.32 202	59	9.33 180	62	0.66 820	9.99 022	3	53
8	9.32 261	58	9.33 242	61	0.66 758	9.99 019	3	52
9	9.32 319	59	9.33 303	62	0.66 697	9.99 016	3	51
10	9.32 378	59	9.33 365	61	0.66 635	9.99 013	2	50
11	9.32 437	58	9.33 426	61	0.66 574	9.99 011	3	49
12	9.32 495	58	9.33 487	61	0.66 513	9.99 008	3	48
13	9.32 553	59	9.33 548	61	0.66 452	9.99 005	3	47
14	9.32 612	58	9.33 609	61	0.66 391	9.99 002	2	46
15	9.32 670	58	9.33 670	61	0.66 330	9.99 000	3	45
16	9.32 728	58	9.33 731	61	0.66 269	9.98 997	3	44
17	9.32 786	58	9.33 792	61	0.66 208	9.98 994	3	43
18	9.32 844	58	9.33 853	60	0.66 147	9.98 991	2	42
19	9.32 902	58	9.33 913	61	0.66 087	9.98 989	3	41
20	9.32 960	58	9.33 974	60	0.66 026	9.98 986	3	40
21	9.33 018	57	9.34 034	61	0.65 966	9.98 983	3	39
22	9.33 075	58	9.34 095	60	0.65 905	9.98 980	2	38
23	9.33 133	57	9.34 155	60	0.65 845	9.98 978	3	37
24	9.33 190	58	9.34 215	61	0.65 785	9.98 975	3	36
25	9.33 248	57	9.34 276	60	0.65 724	9.98 972	3	35
26	9.33 305	57	9.34 336	60	0.65 664	9.98 969	2	34
27	9.33 362	58	9.34 396	60	0.65 604	9.98 967	3	33
28	9.33 420	57	9.34 456	60	0.65 544	9.98 964	3	32
29	9.33 477	57	9.34 516	60	0.65 484	9.98 961	3	31
30	9.33 534	57	9.34 576	59	0.65 424	9.98 958	3	30
31	9.33 591	56	9.34 635	60	0.65 365	9.98 955	2	29
32	9.33 647	57	9.34 695	60	0.65 305	9.98 953	3	28
33	9.33 704	57	9.34 755	59	0.65 245	9.98 950	3	27
34	9.33 761	57	9.34 814	60	0.65 186	9.98 947	3	26
35	9.33 818	56	9.34 874	59	0.65 126	9.98 944	3	25
36	9.33 874	57	9.34 933	59	0.65 067	9.98 941	3	24
37	9.33 931	56	9.34 992	59	0.65 008	9.98 938	2	23
38	9.33 987	56	9.35 051	60	0.64 949	9.98 936	3	22
39	9.34 043	57	9.35 111	59	0.64 889	9.98 933	3	21
40	9.34 100	56	9.35 170	59	0.64 830	9.98 930	3	20
41	9.34 156	56	9.35 229	59	0.64 771	9.98 927	3	19
42	9.34 212	56	9.35 288	59	0.64 712	9.98 924	3	18
43	9.34 268	56	9.35 347	58	0.64 653	9.98 921	2	17
44	9.34 324	56	9.35 405	59	0.64 595	9.98 919	3	16
45	9.34 380	56	9.35 464	59	0.64 536	9.98 916	3	15
46	9.34 436	55	9.35 523	58	0.64 477	9.98 913	3	14
47	9.34 491	56	9.35 581	59	0.64 419	9.98 910	3	13
48	9.34 547	55	9.35 640	58	0.64 360	9.98 907	3	12
49	9.34 602	56	9.35 698	59	0.64 302	9.98 904	3	11
50	9.34 658	55	9.35 757	58	0.64 243	9.98 901	3	10
51	9.34 713	56	9.35 815	58	0.64 185	9.98 898	2	9
52	9.34 769	55	9.35 873	58	0.64 127	9.98 896	3	8
53	9.34 824	55	9.35 931	58	0.64 069	9.98 893	3	7
54	9.34 879	55	9.35 989	58	0.64 011	9.98 890	3	6
55	9.34 934	55	9.36 047	58	0.63 953	9.98 887	3	5
56	9.34 989	55	9.36 105	58	0.63 895	9.98 884	3	4
57	9.35 044	55	9.36 163	58	0.63 837	9.98 881	3	3
58	9.35 099	55	9.36 221	58	0.63 779	9.98 878	3	2
59	9.35 154	55	9.36 279	57	0.63 721	9.98 875	3	1
60	9.35 209		9.36 336		0.63 664	9.98 872		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d	′

P. P.

″	63	62	61
1	1.0	1.0	1 0
2	2.1	2.1	2.0
3	3.2	3.1	3.0
4	4.2	4.1	4.1
5	5.2	5.2	5.1
6	6 3	6.2	6.1
7	7 4	7 2	7.1
8	8.4	8.3	8.1
9	9.4	9.3	9.2
10	10.5	10.3	10.2
20	21.0	20.7	20.3
30	31 5	31 0	30.5
40	42 0	41.3	40.7
50	52 5	51.7	50.8
″	**60**	**59**	**58**
1	1.0	1.0	1 0
2	2 0	2.0	1.9
3	3.0	3.0	2.9
4	4.0	3.9	3.9
5	5.0	4.9	4 8
6	6.0	5.9	5.8
7	7.0	6 9	6 8
8	8.0	7.9	7.7
9	9.0	8.8	8.7
10	10.0	9.8	9 7
20	20.0	19.7	19.3
30	30.0	29.5	29.0
40	40.0	39 3	38 7
50	50.0	49 2	48.3
″	**57**	**56**	**55**
1	1.0	0 9	0.9
2	1.9	1.9	1.8
3	2.8	2 8	2 8
4	3.8	3 7	3.7
5	4 8	4.7	4 6
6	5 7	5.6	5 5
7	6 6	6.5	6.4
8	7 6	7.5	7 3
9	8 6	8 4	8 2
10	9 5	9 3	9 2
20	19 0	18.7	18 3
30	28.5	28.0	27.5
40	38.0	37.3	36.7
50	47.5	46.7	45.8

	$\frac{3}{62}$	$\frac{3}{61}$	$\frac{3}{60}$
0	10 3	10.2	10 0
1	31.0	30.5	30.0
2	51.7	50.8	50.0
3			

	$\frac{3}{59}$	$\frac{3}{58}$	$\frac{3}{57}$
0	9.8	9.7	9 5
1	29.5	29.0	28 5
2	49.2	48.3	47.5
3			

P. P.

102° ([illegible]°) (257°) **77°**

13° (193°) (346°) **166°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d	′
0	9.35 209	54	9.36 336	58	0.63 664	9.98 872	3	60
1	9.35 263	55	9.36 394	58	0.63 606	9.98 869	2	59
2	9.35 318	55	9.36 452	57	0.63 548	9.98 867	3	58
3	9.35 373	54	9.36 509	57	0.63 491	9.98 864	3	57
4	9.35 427	54	9.36 566	58	0.63 434	9.98 861	3	56
5	9.35 481	55	9.36 624	57	0.63 376	9.98 858	3	55
6	9.35 536	54	9.36 681	57	0.63 319	9.98 855	3	54
7	9.35 590	54	9.36 738	57	0.63 262	9.98 852	3	53
8	9.35 644	54	9.36 795	57	0.63 205	9.98 849	3	52
9	9.35 698	54	9.36 852	57	0.63 148	9.98 846	3	51
10	9.35 752	54	9.36 909	57	0.63 091	9.98 843	3	50
11	9.35 806	54	9.36 966	57	0.63 034	9.98 840	3	49
12	9.35 860	54	9.37 023	57	0.62 977	9.98 837	3	48
13	9.35 914	54	9.37 080	57	0.62 920	9.98 834	3	47
14	9.35 968	54	9.37 137	56	0.62 863	9.98 831	3	46
15	9.36 022	53	9.37 193	57	0.62 807	9.98 828	3	45
16	9.36 075	54	9.37 250	56	0.62 750	9.98 825	3	44
17	9.36 129	53	9.37 306	57	0.62 694	9.98 822	3	43
18	9.36 182	54	9.37 363	56	0.62 637	9.98 819	3	42
19	9.36 236	53	9.37 419	57	0.62 581	9.98 816	3	41
20	9.36 289	53	9.37 476	56	0.62 524	9.98 813	3	40
21	9.36 342	53	9.37 532	56	0.62 468	9.98 810	3	39
22	9.36 395	54	9.37 588	56	0.62 412	9.98 807	3	38
23	9.36 449	53	9.37 644	56	0.62 356	9.98 804	3	37
24	9.36 502	53	9.37 700	56	0.62 300	9.98 801	3	36
25	9.36 555	53	9.37 756	56	0.62 244	9.98 798	3	35
26	9.36 608	52	9.37 812	56	0.62 188	9.98 795	3	34
27	9.36 660	53	9.37 868	56	0.62 132	9.98 792	3	33
28	9.36 713	53	9.37 924	56	0.62 076	9.98 789	3	32
29	9.36 766	53	9.37 980	55	0.62 020	9.98 786	3	31
30	9.36 819	52	9.38 035	56	0.61 965	9.98 783	3	30
31	9.36 871	53	9.38 091	56	0.61 909	9.98 780	3	29
32	9.36 924	52	9.38 147	55	0.61 853	9.98 777	3	28
33	9.36 976	52	9.38 202	55	0.61 798	9.98 774	3	27
34	9.37 028	53	9.38 257	56	0.61 743	9.98 771	3	26
35	9.37 081	52	9.38 313	55	0.61 687	9.98 768	3	25
36	9.37 133	52	9.38 368	55	0.61 632	9.98 765	3	24
37	9.37 185	52	9.38 423	56	0.61 577	9.98 762	3	23
38	9.37 237	52	9.38 479	55	0.61 521	9.98 759	3	22
39	9.37 289	52	9.38 534	55	0.61 466	9.98 756	3	21
40	9.37 341	52	9.38 589	55	0.61 411	9.98 753	3	20
41	9.37 393	52	9.38 644	55	0.61 356	9.98 750	4	19
42	9.37 445	52	9.38 699	55	0.61 301	9.98 746	3	18
43	9.37 497	52	9.38 754	54	0.61 246	9.98 743	3	17
44	9.37 549	51	9.38 808	55	0.61 192	9.98 740	3	16
45	9.37 600	52	9.38 863	55	0.61 137	9.98 737	3	15
46	9.37 652	51	9.38 918	54	0.61 082	9.98 734	3	14
47	9.37 703	52	9.38 972	55	0.61 028	9.98 731	3	13
48	9.37 755	51	9.39 027	55	0.60 973	9.98 728	3	12
49	9.37 806	52	9.39 082	54	0.60 918	9.98 725	3	11
50	9.37 858	51	9.39 136	54	0.60 864	9.98 722	3	10
51	9.37 909	51	9.39 190	55	0.60 810	9.98 719	4	9
52	9.37 960	51	9.39 245	54	0.60 755	9.98 715	3	8
53	9.38 011	51	9.39 299	54	0.60 701	9.98 712	3	7
54	9.38 062	51	9.39 353	54	0.60 647	9.98 709	3	6
55	9.38 113	51	9.39 407	54	0.60 593	9.98 706	3	5
56	9.38 164	51	9.39 461	54	0.60 539	9.98 703	3	4
57	9.38 215	51	9.39 515	54	0.60 485	9.98 700	3	3
58	9.38 266	51	9.39 569	54	0.60 431	9.98 697	3	2
59	9.38 317	51	9.39 623	54	0.60 377	9.98 694	4	1
60	9.38 368		9.39 677		0.60 323	9.98 690		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d	′

P. P.

″	57	56	55
1	1.0	0.9	0.9
2	1.9	1.9	1.8
3	2.8	2.8	2.8
4	3.8	3.7	3.7
5	4.8	4.7	4.6
6	5.7	5.6	5.5
7	6.6	6.5	6.4
8	7.6	7.5	7.3
9	8.6	8.4	8.2
10	9.5	9.3	9.2
20	19.0	18.7	18.3
30	28.5	28.0	27.5
40	38.0	37.3	36.7
50	47.5	46.7	45.8

″	54	53	52
1	0.9	0.9	0.9
2	1.8	1.8	1.7
3	2.7	2.6	2.6
4	3.6	3.5	3.5
5	4.5	4.4	4.3
6	5.4	5.3	5.2
7	6.3	6.2	6.1
8	7.2	7.1	6.9
9	8.1	8.0	7.8
10	9.0	8.8	8.7
20	18.0	17.7	17.3
30	27.0	26.5	26.0
40	36.0	35.3	34.7
50	45.0	44.2	43.3

″	51	4	3	2
1	0.8	0.1	0.0	0.0
2	1.7	0.1	0.1	0.1
3	2.6	0.2	0.2	0.1
4	3.4	0.3	0.2	0.1
5	4.2	0.3	0.2	0.2
6	5.1	0.4	0.3	0.2
7	6.0	0.5	0.4	0.2
8	6.8	0.5	0.4	0.3
9	7.6	0.6	0.4	0.3
10	8.5	0.7	0.5	0.3
20	17.0	1.3	1.0	0.7
30	25.5	2.0	1.5	1.0
40	34.0	2.7	2.0	1.3
50	42.5	3.3	2.5	1.7

	$\frac{4}{55}$	$\frac{4}{54}$	$\frac{3}{58}$	$\frac{3}{57}$
0	6.9	6.8	9.7	9.5
1	20.6	20.2	29.0	28.5
2	34.4	33.8	48.3	47.5
3	48.1	47.2	—	—

	$\frac{3}{56}$	$\frac{3}{55}$	$\frac{3}{54}$
0	9.3	9.2	9.0
1	28.0	27.5	27.0
2	46.7	45.8	45.0

P. P.

103° (283°) (256°) **76°**

14° (194°) (345°) **165°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.38 368	50	9.39 677	54	0.60 323	9.98 690	3	**60**
1	9.38 418	51	9.39 731	54	0.60 269	9.98 687	3	59
2	9.38 469	50	9.39 785	53	0.60 215	9.98 684	3	58
3	9.38 519	51	9.39 838	54	0.60 162	9.98 681	3	57
4	9.38 570	50	9.39 892	53	0.60 108	9.98 678	3	56
5	9.38 620	50	9.39 945	54	0.60 055	9.98 675	4	55
6	9.38 670	51	9.39 999	53	0.60 001	9.98 671	3	54
7	9.38 721	50	9.40 052	54	0.59 948	9.98 668	3	53
8	9.38 771	50	9.40 106	53	0.59 894	9.98 665	3	52
9	9.38 821	50	9.40 159	53	0.59 841	9.98 662	3	51
10	9.38 871	50	9.40 212	54	0.59 788	9.98 659	3	**50**
11	9.38 921	50	9.40 266	53	0.59 734	9.98 656	4	49
12	9.38 971	50	9.40 319	53	0.59 681	9.98 652	3	48
13	9.39 021	50	9.40 372	53	0.59 628	9.98 649	3	47
14	9.39 071	50	9.40 425	53	0.59 575	9.98 646	3	46
15	9.39 121	49	9.40 478	53	0.59 522	9.98 643	3	45
16	9.39 170	50	9.40 531	53	0.59 469	9.98 640	4	44
17	9.39 220	50	9.40 584	52	0.59 416	9.98 636	3	43
18	9.39 270	49	9.40 636	53	0.59 364	9.98 633	3	42
19	9.39 319	50	9.40 689	53	0.59 311	9.98 630	3	41
20	9.39 369	49	9.40 742	53	0.59 258	9.98 627	4	**40**
21	9.39 418	49	9.40 795	52	0.59 205	9.98 623	3	39
22	9.39 467	50	9.40 847	53	0.59 153	9.98 620	3	38
23	9.39 517	49	9.40 900	52	0.59 100	9.98 617	3	37
24	9.39 566	49	9.40 952	53	0.59 048	9.98 614	4	36
25	9.39 615	49	9.41 005	52	0.58 995	9.98 610	3	35
26	9.39 664	49	9.41 057	52	0.58 943	9.98 607	3	34
27	9.39 713	49	9.41 109	52	0.58 891	9.98 604	3	33
28	9.39 762	49	9.41 161	53	0.58 839	9.98 601	4	32
29	9.39 811	49	9.41 214	52	0.58 786	9.98 597	3	31
30	9.39 860	49	9.41 266	52	0.58 734	9.98 594	3	**30**
31	9.39 909	49	9.41 318	52	0.58 682	9.98 591	3	29
32	9.39 958	48	9.41 370	52	0.58 630	9.98 588	4	28
33	9.40 006	49	9.41 422	52	0.58 578	9.98 584	3	27
34	9.40 055	48	9.41 474	52	0.58 526	9.98 581	3	26
35	9.40 103	49	9.41 526	52	0.58 474	9.98 578	4	25
36	9.40 152	48	9.41 578	51	0.58 422	9.98 574	3	24
37	9.40 200	49	9.41 629	52	0.58 371	9.98 571	3	23
38	9.40 249	48	9.41 681	52	0.58 319	9.98 568	3	22
39	9.40 297	49	9.41 733	51	0.58 267	9.98 565	4	21
40	9.40 346	48	9.41 784	52	0.58 216	9.98 561	3	**20**
41	9.40 394	48	9.41 836	51	0.58 164	9.98 558	3	19
42	9.40 442	48	9.41 887	52	0.58 113	9.98 555	4	18
43	9.40 490	48	9.41 939	51	0.58 061	9.98 551	3	17
44	9.40 538	48	9.41 990	51	0.58 010	9.98 548	3	16
45	9.40 586	48	9.42 041	52	0.57 959	9.98 545	4	15
46	9.40 634	48	9.42 093	51	0.57 907	9.98 541	3	14
47	9.40 682	48	9.42 144	51	0.57 856	9.98 538	3	13
48	9.40 730	48	9.42 195	51	0.57 805	9.98 535	4	12
49	9.40 778	47	9.42 246	51	0.57 754	9.98 531	3	11
50	9.40 825	48	9.42 297	51	0.57 703	9.98 528	3	**10**
51	9.40 873	48	9.42 348	51	0.57 652	9.98 525	4	9
52	9.40 921	47	9.42 399	51	0.57 601	9.98 521	3	8
53	9.40 968	48	9.42 450	51	0.57 550	9.98 518	3	7
54	9.41 016	47	9.42 501	51	0.57 499	9.98 515	4	6
55	9.41 063	48	9.42 552	51	0.57 448	9.98 511	3	5
56	9.41 111	47	9.42 603	50	0.57 397	9.98 508	3	4
57	9.41 158	47	9.42 653	51	0.57 347	9.98 505	4	3
58	9.41 205	47	9.42 704	51	0.57 296	9.98 501	3	2
59	9.41 252	48	9.42 755	50	0.57 245	9.98 498	4	1
60	9.41 300		9.42 805		0.57 195	9.98 494		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

P. P.

″	54	53	52
1	0.9	0.9	0.9
2	1.8	1.8	1.7
3	2.7	2.6	2.6
4	3.6	3.5	3.5
5	4.5	4.4	4.3
6	5.4	5.3	5.2
7	6.3	6.2	6.1
8	7.2	7.1	6.9
9	8.1	8.0	7.8
10	9.0	8.8	8.7
20	18.0	17.7	17.3
30	27.0	26.5	26.0
40	36.0	35.3	34.7
50	45.0	44.2	43.3

″	51	50	49
1	0.8	0.8	0.8
2	1.7	1.7	1.6
3	2.6	2.5	2.4
4	3.4	3.3	3.3
5	4.2	4.2	4.1
6	5.1	5.0	4.9
7	6.0	5.8	5.7
8	6.8	6.7	6.5
9	7.6	7.5	7.4
10	8.5	8.3	8.2
20	17.0	16.7	16.3
30	25.5	25.0	24.5
40	34.0	33.3	32.7
50	42.5	41.7	40.8

″	48	47	4	3
1	0.8	0.8	0.1	0.0
2	1.6	1.6	0.1	0.1
3	2.4	2.4	0.2	0.2
4	3.2	3.1	0.3	0.2
5	4.0	3.9	0.3	0.2
6	4.8	4.7	0.4	0.3
7	5.6	5.5	0.5	0.4
8	6.4	6.3	0.5	0.4
9	7.2	7.0	0.6	0.4
10	8.0	7.8	0.7	0.5
20	16.0	15.7	1.3	1.0
30	24.0	23.5	2.0	1.5
40	32.0	31.3	2.7	2.0
50	40.0	39.2	3.3	2.5

	4/54	4/53	4/52	4/51
0	6.8	6.6	6.5	6.4
1	20.2	19.9	19.5	19.1
2	33.8	33.1	32.5	31.9
3	47.2	46.4	45.5	44.6

	3/54	3/53	3/52	3/51
0	9.0	8.8	8.7	8.5
1	27.0	26.5	26.0	25.5
2	45.0	44.2	43.3	42.5

104° (284°) (255°) **75°**

LOGARITHMS OF THE FUNCTIONS (Continued)

15° (195°) (344°) **164°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.41 300	47	9.42 805	51	0.57 195	9.98 494	3	**60**
1	9.41 347	47	9.42 856	50	0.57 144	9.98 491	3	59
2	9.41 394	47	9.42 906	51	0.57 094	9.98 488	4	58
3	9.41 441	47	9.42 957	50	0.57 043	9.98 484	3	57
4	9.41 488	47	9.43 007	50	0.56 993	9.98 481	4	56
5	9.41 535	47	9.43 057	51	0.56 943	9.98 477	3	55
6	9.41 582	46	9.43 108	50	0.56 892	9.98 474	3	54
7	9.41 628	47	9.43 158	50	0.56 842	9.98 471	4	53
8	9.41 675	47	9.43 208	50	0.56 792	9.98 467	3	52
9	9.41 722	46	9.43 258	50	0.56 742	9.98 464	4	51
10	9.41 768	47	9.43 308	50	0.56 692	9.98 460	3	**50**
11	9.41 815	46	9.43 358	50	0.56 642	9.98 457	4	49
12	9.41 861	47	9.43 408	50	0.56 592	9.98 453	3	48
13	9.41 908	46	9.43 458	50	0.56 542	9.98 450	3	47
14	9.41 954	47	9.43 508	50	0.56 492	9.98 447	4	46
15	9.42 001	46	9.43 558	49	0.56 442	9.98 443	3	45
16	9.42 047	46	9.43 607	50	0.56 393	9.98 440	4	44
17	9.42 093	47	9.43 657	50	0.56 343	9.98 436	3	43
18	9.42 140	46	9.43 707	49	0.56 293	9.98 433	4	42
19	9.42 186	46	9.43 756	50	0.56 244	9.98 429	3	41
20	9.42 232	46	9.43 806	49	0.56 194	9.98 426	4	**40**
21	9.42 278	46	9.43 855	50	0.56 145	9.98 422	3	39
22	9.42 324	46	9.43 905	49	0.56 095	9.98 419	4	38
23	9.42 370	46	9.43 954	50	0.56 046	9.98 415	3	37
24	9.42 416	45	9.44 004	49	0.55 996	9.98 412	3	36
25	9.42 461	46	9.44 053	49	0.55 947	9.98 409	4	35
26	9.42 507	46	9.44 102	49	0.55 898	9.98 405	3	34
27	9.42 553	46	9.44 151	50	0.55 849	9.98 402	4	33
28	9.42 599	45	9.44 201	49	0.55 799	9.98 398	3	32
29	9.42 644	46	9.44 250	49	0.55 750	9.98 395	4	31
30	9.42 690	45	9.44 299	49	0.55 701	9.98 391	3	**30**
31	9.42 735	46	9.44 348	49	0.55 652	9.98 388	4	29
32	9.42 781	45	9.44 397	49	0.55 603	9.98 384	3	28
33	9.42 826	46	9.44 446	49	0.55 554	9.98 381	4	27
34	9.42 872	45	9.44 495	49	0.55 505	9.98 377	4	26
35	9.42 917	45	9 44 544	48	0.55 456	9.98 373	3	25
36	9.42 962	46	9.44 592	49	0.55 408	9.98 370	4	24
37	9.43 008	45	9.44 641	49	0.55 359	9.98 366	3	23
38	9.43 053	45	9.44 690	48	0.55 310	9.98 363	4	22
39	9.43 098	45	9.44 738	49	0.55 262	9.98 359	3	21
40	9.43 143	45	9.44 787	49	0.55 213	9.98 356	4	**20**
41	9.43 188	45	9.44 836	48	0.55 164	9.98 352	3	19
42	9.43 233	45	9.44 884	49	0.55 116	9.98 349	4	18
43	9.43 278	45	9.44 933	48	0.55 067	9.98 345	3	17
44	9.43 323	44	9.44 981	48	0.55 019	9.98 342	4	16
45	9.43 367	45	9.45 029	49	0.54 971	9.98 338	4	15
46	9.43 412	45	9.45 078	48	0.54 922	9.98 334	3	14
47	9.43 457	45	9 45 126	48	0.54 874	9.98 331	4	13
48	9.43 502	44	9.45 174	48	0.54 826	9.98 327	3	12
49	9.43 546	45	9.45 222	49	0.54 778	9.98 324	4	11
50	9.43 591	44	9.45 271	48	0.54 729	9.98 320	3	**10**
51	9.43 635	45	9.45 319	48	0.54 681	9.98 317	4	9
52	9.43 680	44	9.45 367	48	0.54 633	9.98 313	4	8
53	9.43 724	45	9.45 415	48	0.54 585	9.98 309	3	7
54	9 43 769	44	9.45 463	48	0.54 537	9.98 306	4	6
55	9.43 813	44	9.45 511	48	0.54 489	9.98 302	3	5
56	9.43 857	44	9.45 559	47	0.54 441	9.98 299	4	4
57	9.43 901	45	9.45 606	48	0.54 394	9.98 295	4	3
58	9.43 946	44	9.45 654	48	0 54 346	9.98 291	3	2
59	9.43 990	44	9.45 702	48	0.54 298	9.98 288	4	1
60	9.44 034		9.45 750		0.54 250	9.98 284		**0**
′	L. Cos.	d.	L. Cot.	c d.	L. Tan.	L. Sin.	d.	′

P. P.

″	**51**	**50**	**49**
1	0.8	0.8	0.8
2	1.7	1.7	1.6
3	2.6	2.5	2.4
4	3.4	3.3	3.3
5	4.2	4.2	4.1
6	5.1	5.0	4.9
7	6.0	5.8	5.7
8	6.8	6.7	6.5
9	7.6	7.5	7.4
10	8.5	8.3	8.2
20	17.0	16.7	16.3
30	25.5	25.0	24.5
40	34.0	33.3	32.7
50	42.5	41.7	40.8

″	**48**	**47**	**46**
1	0.8	0.8	0.8
2	1.6	1.6	1.5
3	2.4	2.4	2.3
4	3.2	3.1	3.1
5	4.0	3.9	3.8
6	4.8	4.7	4.6
7	5.6	5.5	5.4
8	6.4	6.3	6.1
9	7.2	7.0	6.9
10	8.0	7.8	7.7
20	16.0	15.7	15.3
30	24.0	23.5	23.0
40	32.0	31.3	30.7
50	40.0	39.2	38.3

″	**45**	**44**	**4**	**3**
1	0.8	0.7	0.1	0.0
2	1.5	1.5	0.1	0.1
3	2.2	2.2	0.2	0.2
4	3.0	2.9	0.3	0.2
5	3.8	3.7	0.3	0.2
6	4.5	4.4	0.4	0.3
7	5.2	5.1	0.5	0.4
8	6.0	5.9	0.5	0.4
9	6.8	6.6	0.6	0.4
10	7.5	7.3	0.7	0.5
20	15.0	14.7	1.3	1.0
30	22.5	22.0	2.0	1.5
40	30.0	29.3	2.7	2.0
50	37.5	36.7	3.3	2.5

	$\frac{4}{50}$	$\frac{4}{49}$	$\frac{4}{48}$	$\frac{4}{47}$
0	6.2	6.1	6.0	5.9
1	18.8	18.4	18.0	17.6
2	31.2	30.6	30.0	29.4
3	43.8	42.9	42.0	41.1
4				

	$\frac{3}{51}$	$\frac{3}{50}$	$\frac{3}{49}$	$\frac{3}{48}$
0	8.5	8.3	8.2	8.0
1	25.5	25.0	24.5	24.0
2	42.5	41.7	40.8	40.0
3				

P. P.

105° (285°) (254°) **74°**

16° (196°) (343°) **163°**

′	L. Sin.	d.	L. Tan.	c d	L. Cot.	L. Cos.	d.	′
0	9.44 034	44	9.45 750	47	0.54 250	9.98 284	3	60
1	9.44 078	44	9.45 797	48	0.54 203	9.98 281	4	59
2	9.44 122	44	9.45 845	47	0.54 155	9.98 277	4	58
3	9.44 166	44	9.45 892	48	0.54 108	9.98 273	3	57
4	9.44 210	43	9.45 940	47	0.54 060	9.98 270	4	56
5	9.44 253	44	9.45 987	48	0.54 013	9.98 266	4	55
6	9.44 297	44	9.46 035	47	0.53 965	9.98 262	3	54
7	9.44 341	44	9.46 082	48	0.53 918	9.98 259	4	53
8	9.44 385	43	9.46 130	47	0.53 870	9.98 255	4	52
9	9.44 428	44	9.46 177	47	0.53 823	9.98 251	3	51
10	9.44 472	44	9.46 224	47	0.53 776	9.98 248	4	50
11	9.44 516	43	9.46 271	48	0.53 729	9.98 244	4	49
12	9.44 559	43	9.46 319	47	0.53 681	9.98 240	3	48
13	9.44 602	44	9.46 366	47	0.53 634	9.98 237	4	47
14	9.44 646	43	9.46 413	47	0.53 587	9.98 233	4	46
15	9.44 689	44	9.46 460	47	0.53 540	9.98 229	3	45
16	9.44 733	43	9.46 507	47	0.53 493	9.98 226	4	44
17	9.44 776	43	9.46 554	47	0.53 446	9.98 222	4	43
18	9.44 819	43	9.46 601	47	0.53 399	9.98 218	3	42
19	9.44 862	43	9.46 648	46	0.53 352	9.98 215	4	41
20	9.44 905	43	9.46 694	47	0.53 306	9.98 211	4	40
21	9.44 948	44	9.46 741	47	0.53 259	9.98 207	3	39
22	9.44 992	43	9.46 788	47	0.53 212	9.98 204	4	38
23	9.45 035	42	9.46 835	46	0.53 165	9.98 200	4	37
24	9.45 077	43	9.46 881	47	0.53 119	9.98 196	4	36
25	9.45 120	43	9.46 928	47	0.53 072	9.98 192	3	35
26	9.45 163	43	9.46 975	46	0.53 025	9.98 189	4	34
27	9.45 206	43	9.47 021	47	0.52 979	9.98 185	4	33
28	9.45 249	43	9.47 068	46	0.52 932	9.98 181	4	32
29	9.45 292	42	9.47 114	46	0.52 886	9.98 177	3	31
30	9.45 334	43	9.47 160	47	0.52 840	9.98 174	4	30
31	9.45 377	42	9.47 207	46	0.52 793	9.98 170	4	29
32	9.45 419	43	9.47 253	46	0.52 747	9.98 166	4	28
33	9.45 462	42	9.47 299	47	0.52 701	9.98 162	3	27
34	9.45 504	43	9.47 346	46	0.52 654	9.98 159	4	26
35	9.45 547	42	9.47 392	46	0.52 608	9.98 155	4	25
36	9.45 589	43	9.47 438	46	0.52 562	9.98 151	4	24
37	9.45 632	42	9.47 484	46	0.52 516	9.98 147	3	23
38	9.45 674	42	9.47 530	46	0.52 470	9.98 144	4	22
39	9.45 716	42	9.47 576	46	0.52 424	9.98 140	4	21
40	9.45 758	43	9.47 622	46	0.52 378	9.98 136	4	20
41	9.45 801	42	9.47 668	46	0.52 332	9.98 132	3	19
42	9.45 843	42	9.47 714	46	0.52 286	9.98 129	4	18
43	9.45 885	42	9.47 760	46	0.52 240	9.98 125	4	17
44	9.45 927	42	9.47 806	46	0.52 194	9.98 121	4	16
45	9.45 969	42	9.47 852	45	0.52 148	9.98 117	4	15
46	9.46 011	42	9.47 897	46	0.52 103	9.98 113	3	14
47	9.46 053	42	9.47 943	46	0.52 057	9.98 110	4	13
48	9.46 095	41	9.47 989	46	0.52 011	9.98 106	4	12
49	9.46 136	42	9.48 035	45	0.51 965	9.98 102	4	11
50	9.46 178	42	9.48 080	46	0.51 920	9.98 098	4	10
51	9.46 220	42	9.48 126	45	0.51 874	9.98 094	4	9
52	9.46 262	41	9.48 171	46	0.51 829	9.98 090	3	8
53	9.46 303	42	9.48 217	45	0.51 783	9.98 087	4	7
54	9.46 345	41	9.48 262	45	0.51 738	9.98 083	4	6
55	9.46 386	42	9.48 307	46	0.51 693	9.98 079	4	5
56	9.46 428	41	9.48 353	45	0.51 647	9.98 075	4	4
57	9.46 469	42	9.48 398	45	0.51 602	9.98 071	4	3
58	9.46 511	41	9.48 443	46	0.51 557	9.98 067	4	2
59	9.46 552	42	9.48 489	45	0.51 511	9.98 063	3	1
60	9.46 594		9.48 534		0.51 466	9.98 060		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan	L. Sin.	d	′

P.P.

″	48	47	46
1	0.8	0.8	0.8
2	1.6	1.6	1.5
3	2.4	2.4	2.3
4	3.2	3.1	3.1
5	4.0	3.9	3.8
6	4.8	4.7	4.6
7	5.6	5.5	5.4
8	6.4	6.3	6.1
9	7.2	7.0	6.9
10	8.0	7.8	7.7
20	16.0	15.7	15.3
30	24.0	23.5	23.0
40	32.0	31.3	30.7
50	40.0	39.2	38.3
″	45	44	43
1	0.8	0.7	0.7
2	1.5	1.5	1.4
3	2.2	2.2	2.2
4	3.0	2.9	2.9
5	3.8	3.7	3.6
6	4.5	4.4	4.3
7	5.2	5.1	5.0
8	6.0	5.9	5.7
9	6.8	6.6	6.4
10	7.5	7.3	7.2
20	15.0	14.7	14.3
30	22.5	22.0	21.5
40	30.0	29.3	28.7
50	37.5	36.7	35.8

″	42	41	4	3
1	0.7	0.7	0.1	0.0
2	1.4	1.4	0.1	0.1
3	2.1	2.0	0.2	0.2
4	2.8	2.7	0.3	0.2
5	3.5	3.4	0.3	0.2
6	4.2	4.1	0.4	0.3
7	4.9	4.8	0.5	0.4
8	5.6	5.5	0.5	0.4
9	6.3	6.2	0.6	0.4
10	7.0	6.8	0.7	0.5
20	14.0	13.7	1.3	1.0
30	21.0	20.5	2.0	1.5
40	28.0	27.3	2.7	2.0
50	35.0	34.2	3.3	2.5

	$\frac{4}{48}$	$\frac{4}{47}$	$\frac{4}{46}$	$\frac{4}{45}$
0	6.0	5.9	5.8	5.6
1	18.0	17.6	17.2	16.9
2	30.0	29.4	28.8	28.1
3	42.0	41.1	40.2	39.4

	$\frac{3}{48}$	$\frac{3}{47}$	$\frac{3}{46}$	$\frac{3}{45}$
0	8.0	7.8	7.7	7.5
1	24.0	23.5	23.0	22.5
2	40.0	39.2	38.3	37.5

P.P.

106° (286°) (253°) **73°**

17° (197°) (342°) **162°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot	L. Cos.	d.	′
0	9.46 594	41	9.48 534	45	0.51 466	9.98 060	4	**60**
1	9.46 635	41	9.48 579	45	0.51 421	9.98 056	4	59
2	9.46 676	41	9.48 624	45	0.51 376	9.98 052	4	58
3	9.46 717	41	9.48 669	45	0.51 331	9.98 048	4	57
4	9.46 758	42	9.48 714	45	0.51 286	9.98 044	4	56
5	9.46 800	41	9.48 759	45	0.51 241	9.98 040	4	55
6	9.46 841	41	9.48 804	45	0.51 196	9.98 036	4	54
7	9.46 882	41	9.48 849	45	0.51 151	9.98 032	3	53
8	9.46 923	41	9.48 894	45	0.51 106	9.98 029	4	52
9	9.46 964	41	9.48 939	45	0.51 061	9.98 025	4	51
10	9.47 005	40	9.48 984	45	0.51 016	9.98 021	4	**50**
11	9.47 045	41	9.49 029	44	0.50 971	9.98 017	4	49
12	9.47 086	41	9.49 073	45	0.50 927	9.98 013	4	48
13	9.47 127	41	9.49 118	45	0.50 882	9.98 009	4	47
14	9.47 168	41	9.49 163	44	0.50 837	9.98 005	4	46
15	9.47 209	40	9.49 207	45	0.50 793	9.98 001	4	45
16	9.47 249	41	9.49 252	44	0.50 748	9.97 997	4	44
17	9.47 290	40	9.49 296	45	0.50 704	9.97 993	4	43
18	9.47 330	41	9.49 341	44	0.50 659	9.97 989	3	42
19	9.47 371	40	9.49 385	45	0.50 615	9.97 986	4	41
20	9.47 411	41	9.49 430	44	0.50 570	9.97 982	4	**40**
21	9.47 452	40	9.49 474	45	0.50 526	9.97 978	4	39
22	9.47 492	41	9.49 519	44	0.50 481	9.97 974	4	38
23	9.47 533	40	9.49 563	44	0.50 437	9.97 970	4	37
24	9.47 573	40	9.49 607	45	0.50 393	9.97 966	4	36
25	9.47 613	41	9.49 652	44	0.50 348	9.97 962	4	35
26	9.47 654	40	9.49 696	44	0.50 304	9.97 958	4	34
27	9.47 694	40	9.49 740	44	0.50 260	9.97 954	4	33
28	9.47 734	40	9.49 784	44	0.50 216	9.97 950	4	32
29	9.47 774	40	9.49 828	44	0.50 172	9.97 946	4	31
30	9.47 814	40	9.49 872	44	0.50 128	9.97 942	4	**30**
31	9.47 854	40	9.49 916	44	0.50 084	9.97 938	4	29
32	9.47 894	40	9.49 960	44	0.50 040	9.97 934	4	28
33	9.47 934	40	9.50 004	44	0.49 996	9.97 930	4	27
34	9.47 974	40	9.50 048	44	0.49 952	9.97 926	4	26
35	9.48 014	40	9.50 092	44	0.49 908	9.97 922	4	25
36	9.48 054	40	9.50 136	44	0.49 864	9.97 918	4	24
37	9.48 094	39	9.50 180	43	0.49 820	9.97 914	4	23
38	9.48 133	40	9.50 223	44	0.49 777	9.97 910	4	22
39	9.48 173	40	9.50 267	44	0.49 733	9.97 906	4	21
40	9.48 213	39	9.50 311	44	0.49 689	9.97 902	4	**20**
41	9.48 252	40	9.50 355	43	0.49 645	9.97 898	4	19
42	9.48 292	40	9.50 398	44	0.49 602	9.97 894	4	18
43	9.48 332	39	9.50 442	43	0.49 558	9.97 890	4	17
44	9.48 371	40	9.50 485	44	0.49 515	9.97 886	4	16
45	9.48 411	39	9.50 529	43	0.49 471	9.97 882	4	15
46	9.48 450	40	9.50 572	44	0.49 428	9.97 878	4	14
47	9.48 490	39	9.50 616	43	0.49 384	9.97 874	4	13
48	9.48 529	39	9.50 659	44	0.49 341	9.97 870	4	12
49	9.48 568	39	9.50 703	43	0.49 297	9.97 866	5	11
50	9.48 607	40	9.50 746	43	0.49 254	9.97 861	4	**10**
51	9.48 647	39	9.50 789	44	0.49 211	9.97 857	4	9
52	9.48 686	39	9.50 833	43	0.49 167	9.97 853	4	8
53	9.48 725	39	9.50 876	43	0.49 124	9.97 849	4	7
54	9.48 764	39	9.50 919	43	0.49 081	9.97 845	4	6
55	9.48 803	39	9.50 962	43	0.49 038	9.97 841	4	5
56	9.48 842	39	9.51 005	43	0.48 995	9.97 837	4	4
57	9.48 881	39	9.51 048	44	0.48 952	9.97 833	4	3
58	9.48 920	39	9.51 092	43	0.48 908	9.97 829	4	2
59	9.48 959	39	9.51 135	43	0.48 865	9.97 825	4	1
60	9.48 998		9.51 178		0.48 822	9.97 821		**0**
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan	L. Sin.	d.	′

P.P.

″	45	44	43
1	0.8	0.7	0.7
2	1.5	1.5	1.4
3	2.2	2.2	2.2
4	3.0	2.9	2.9
5	3.8	3.7	3.6
6	4.5	4.4	4.3
7	5.2	5.1	5.0
8	6.0	5.9	5.7
9	6.8	6.6	6.4
10	7.5	7.3	7.2
20	15.0	14.7	14.3
30	22.5	22.0	21.5
40	30.0	29.3	28.7
50	37.5	36.7	35.8

″	42	41	40
1	0.7	0.7	0.7
2	1.4	1.4	1.3
3	2.1	2.0	2.0
4	2.8	2.7	2.7
5	3.5	3.4	3.3
6	4.2	4.1	4.0
7	4.9	4.8	4.7
8	5.6	5.5	5.3
9	6.3	6.2	6.0
10	7.0	6.8	6.7
20	14.0	13.7	13.3
30	21.0	20.5	20.0
40	28.0	27.3	26.7
50	35.0	34.2	33.3

″	39	5	4	3
1	0.6	0.1	0.1	0.0
2	1.3	0.2	0.1	0.1
3	2.0	0.2	0.2	0.2
4	2.6	0.3	0.3	0.2
5	3.2	0.4	0.3	0.2
6	3.9	0.5	0.4	0.3
7	4.6	0.6	0.5	0.4
8	5.2	0.7	0.5	0.4
9	5.8	0.8	0.6	0.4
10	6.5	0.8	0.7	0.5
20	13.0	1.7	1.3	1.0
30	19.5	2.5	2.0	1.5
40	26.0	3.3	2.7	2.0
50	32.5	4.2	3.3	2.5

	$\frac{5}{43}$	$\frac{4}{45}$	$\frac{4}{44}$
0	4.3	5.6	5.5
1	12.9	16.9	16.5
2	21.5	28.1	27.5
3	30.1	39.4	38.5
4	38.7	—	—
5			

	$\frac{4}{43}$	$\frac{3}{45}$	$\frac{3}{44}$
0	5.4	7.5	7.3
1	16.1	22.5	22.0
2	26.9	37.5	36.7
3	37.6	—	—
4			

P.P.

107° (287°) (252°) **72°**

18° (198°) (341°) **161°**

′	L. Sin.	d	L. Tan.	c.d.	L. Cot.	L. Cos.	d	′
0	9.48 998	39	9.51 178	43	0.48 822	9.97 821	4	**60**
1	9.49 037	39	9.51 221	43	0.48 779	9.97 817	5	59
2	9.49 076	39	9.51 264	42	0.48 736	9.97 812	4	58
3	9.49 115	38	9.51 306	43	0.48 694	9.97 808	4	57
4	9.49 153	39	9.51 349	43	0.48 651	9.97 804	4	56
5	9.49 192	39	9.51 392	43	0.48 608	9.97 800	4	55
6	9.49 231	38	9.51 435	43	0.48 565	9.97 796	4	54
7	9.49 269	39	9.51 478	42	0.48 522	9.97 792	4	53
8	9.49 308	39	9.51 520	43	0.48 480	9.97 788	4	52
9	9.49 347	38	9.51 563	43	0.48 437	9.97 784	5	51
10	9.49 385	39	9.51 606	42	0.48 394	9.97 779	4	**50**
11	9.49 424	38	9.51 648	43	0.48 352	9.97 775	4	49
12	9.49 462	38	9.51 691	43	0.48 309	9.97 771	4	48
13	9.49 500	39	9.51 734	42	0.48 266	9.97 767	4	47
14	9.49 539	38	9.51 776	43	0.48 224	9.97 763	4	46
15	9.49 577	38	9.51 819	42	0.48 181	9.97 759	5	45
16	9.49 615	39	9.51 861	42	0.48 139	9.97 754	4	44
17	9.49 654	38	9.51 903	43	0.48 097	9.97 750	4	43
18	9.49 692	38	9.51 946	42	0.48 054	9.97 746	4	42
19	9.49 730	38	9.51 988	43	0.48 012	9.97 742	4	41
20	9.49 768	38	9.52 031	42	0.47 969	9.97 738	4	**40**
21	9.49 806	38	9.52 073	42	0.47 927	9.97 734	5	39
22	9.49 844	38	9.52 115	42	0.47 885	9.97 729	4	38
23	9.49 882	38	9.52 157	43	0.47 843	9.97 725	4	37
24	9.49 920	38	9.52 200	42	0.47 800	9.97 721	4	36
25	9.49 958	38	9.52 242	42	0.47 758	9.97 717	4	35
26	9.49 996	38	9.52 284	42	0.47 716	9.97 713	5	34
27	9.50 034	38	9.52 326	42	0.47 674	9.97 708	4	33
28	9.50 072	38	9.52 368	42	0.47 632	9.97 704	4	32
29	9.50 110	38	9.52 410	42	0.47 590	9.97 700	4	31
30	9.50 148	37	9.52 452	42	0.47 548	9.97 696	5	**30**
31	9.50 185	38	9.52 494	42	0.47 506	9.97 691	4	29
32	9.50 223	38	9.52 536	42	0.47 464	9.97 687	4	28
33	9.50 261	37	9.52 578	42	0.47 422	9.97 683	4	27
34	9.50 298	38	9.52 620	41	0.47 380	9.97 679	5	26
35	9.50 336	38	9.52 661	42	0.47 339	9.97 674	4	25
36	9.50 374	37	9.52 703	42	0.47 297	9.97 670	4	24
37	9.50 411	38	9.52 745	42	0.47 255	9.97 666	4	23
38	9.50 449	37	9.52 787	42	0.47 213	9.97 662	5	22
39	9.50 486	37	9.52 829	41	0.47 171	9.97 657	4	21
40	9.50 523	38	9.52 870	42	0.47 130	9.97 653	4	**20**
41	9.50 561	37	9.52 912	41	0.47 088	9.97 649	4	19
42	9.50 598	37	9.52 953	42	0.47 047	9.97 645	5	18
43	9.50 635	38	9.52 995	42	0.47 005	9.97 640	4	17
44	9.50 673	37	9.53 037	41	0.46 963	9.97 636	4	16
45	9.50 710	37	9.53 078	42	0.46 922	9.97 632	4	15
46	9.50 747	37	9.53 120	41	0.46 880	9.97 628	5	14
47	9.50 784	37	9.53 161	41	0.46 839	9.97 623	4	13
48	9.50 821	37	9.53 202	42	0.46 798	9.97 619	4	12
49	9.50 858	38	9.53 244	41	0.46 756	9.97 615	5	11
50	9.50 896	37	9.53 285	42	0.46 715	9.97 610	4	**10**
51	9.50 933	37	9.53 327	41	0.46 673	9.97 606	4	9
52	9.50 970	37	9.53 368	41	0.46 632	9.97 602	5	8
53	9.51 007	36	9.53 409	41	0.46 591	9.97 597	4	7
54	9.51 043	37	9.53 450	42	0.46 550	9.97 593	4	6
55	9.51 080	37	9.53 492	41	0.46 508	9.97 589	5	5
56	9.51 117	37	9.53 533	41	0.46 467	9.97 584	4	4
57	9.51 154	37	9.53 574	41	0.46 426	9.97 580	4	3
58	9.51 191	36	9.53 615	41	0.46 385	9.97 576	5	2
59	9.51 227	37	9.53 656	41	0.46 344	9.97 571	4	1
60	9.51 264		9.53 697		0.46 303	9.97 567		**0**
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d	′

P. P.

″	43	42	41
1	0.7	0.7	0.7
2	1.4	1.4	1.4
3	2.2	2.1	2.0
4	2.9	2.8	2.7
5	3.6	3.5	3.4
6	4.3	4.2	4.1
7	5.0	4.9	4.8
8	5.7	5.6	5.5
9	6.4	6.3	6.2
10	7.2	7.0	6.8
20	14.3	14.0	13.7
30	21.5	21.0	20.5
40	28.7	28.0	27.3
50	35.8	35.0	34.2

″	39	38	37
1	0.6	0.6	0.6
2	1.3	1.3	1.2
3	2.0	1.9	1.8
4	2.6	2.5	2.5
5	3.2	3.2	3.1
6	3.9	3.8	3.7
7	4.6	4.4	4.3
8	5.2	5.1	4.9
9	5.8	5.7	5.6
10	6.5	6.3	6.2
20	13.0	12.7	12.3
30	19.5	19.0	18.5
40	26.0	25.3	24.7
50	32.5	31.7	30.8

″	36	5	4
1	0.6	0.1	0.1
2	1.2	0.2	0.1
3	1.8	0.2	0.2
4	2.4	0.3	0.3
5	3.0	0.4	0.3
6	3.6	0.5	0.4
7	4.2	0.6	0.5
8	4.8	0.7	0.5
9	5.4	0.8	0.6
10	6.0	0.8	0.7
20	12.0	1.7	1.3
30	18.0	2.5	2.0
40	24.0	3.3	2.7
50	30.0	4.2	3.3

	$\frac{5}{43}$	$\frac{5}{42}$	$\frac{5}{41}$
0	4.3	4.2	4.1
1	12.9	12.6	12.3
2	21.5	21.0	20.5
3	30.1	29.4	28.7
4	38.7	37.8	36.9
5			

	$\frac{4}{43}$	$\frac{4}{42}$	$\frac{4}{41}$
0	5.4	5.2	5.1
1	16.1	15.8	15.4
2	26.9	26.2	25.6
3	37.6	36.8	35.9
4			

108° (288°) (251°) **71°**

19° **(199°)** **(340°)** **160°**

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d	'
0	9.51 264	37	9.53 697	41	0.46 303	9.97 567	4	60
1	9.51 301	37	9.53 738	41	0.46 262	9.97 563	5	59
2	9.51 338	36	9.53 779	41	0.46 221	9.97 558	4	58
3	9.51 374	37	9.53 820	41	0.46 180	9.97 554	4	57
4	9.51 411	36	9.53 861	41	0.46 139	9.97 550	5	56
5	9.51 447	37	9.53 902	41	0.46 098	9.97 545	4	55
6	9.51 484	36	9.53 943	41	0.46 057	9.97 541	5	54
7	9.51 520	37	9.53 984	41	0.46 016	9.97 536	4	53
8	9.51 557	36	9.54 025	40	0.45 975	9.97 532	4	52
9	9.51 593	36	9.54 065	41	0.45 935	9.97 528	5	51
10	9.51 629	37	9.54 106	41	0.45 894	9.97 523	4	50
11	9.51 666	36	9.54 147	40	0.45 853	9.97 519	4	49
12	9.51 702	36	9.54 187	41	0.45 813	9.97 515	5	48
13	9.51 738	36	9.54 228	41	0.45 772	9.97 510	4	47
14	9.51 774	37	9.54 269	40	0.45 731	9.97 506	5	46
15	9.51 811	36	9.54 309	41	0.45 691	9.97 501	4	45
16	9.51 847	36	9.54 350	40	0.45 650	9.97 497	5	44
17	9.51 883	36	9.54 390	41	0.45 610	9.97 492	4	43
18	9.51 919	36	9.54 431	40	0.45 569	9.97 488	4	42
19	9.51 955	36	9.54 471	41	0.45 529	9.97 484	5	41
20	9.51 991	36	9.54 512	40	0.45 488	9.97 479	4	40
21	9.52 027	36	9.54 552	41	0.45 448	9.97 475	5	39
22	9.52 063	36	9.54 593	40	0.45 407	9.97 470	4	38
23	9.52 099	36	9.54 633	40	0.45 367	9.97 466	5	37
24	9.52 135	36	9.54 673	41	0.45 327	9.97 461	4	36
25	9.52 171	36	9.54 714	40	0.45 286	9.97 457	4	35
26	9.52 207	35	9.54 754	40	0.45 246	9.97 453	5	34
27	9.52 242	36	9.54 794	41	0.45 206	9.97 448	4	33
28	9.52 278	36	9.54 835	40	0.45 165	9.97 444	5	32
29	9.52 314	36	9.54 875	40	0.45 125	9.97 439	4	31
30	9.52 350	35	9.54 915	40	0.45 085	9.97 435	5	30
31	9.52 385	36	9.54 955	40	0.45 045	9.97 430	4	29
32	9.52 421	35	9.54 995	40	0.45 005	9.97 426	5	28
33	9.52 456	36	9.55 035	40	0.44 965	9.97 421	4	27
34	9.52 492	35	9.55 075	40	0.44 925	9.97 417	5	26
35	9.52 527	36	9.55 115	40	0.44 885	9.97 412	4	25
36	9.52 563	35	9.55 155	40	0.44 845	9.97 408	5	24
37	9.52 598	36	9.55 195	40	0.44 805	9.97 403	4	23
38	9.52 634	35	9.55 235	40	0.44 765	9.97 399	5	22
39	9.52 669	36	9.55 275	40	0.44 725	9.97 394	4	21
40	9.52 705	35	9.55 315	40	0.44 685	9.97 390	5	20
41	9.52 740	35	9.55 355	40	0.44 645	9.97 385	4	19
42	9.52 775	36	9.55 395	39	0.44 605	9.97 381	5	18
43	9.52 811	35	9.55 434	40	0.44 566	9.97 376	4	17
44	9.52 846	35	9.55 474	40	0.44 526	9.97 372	5	16
45	9.52 881	35	9.55 514	40	0.44 486	9.97 367	4	15
46	9.52 916	35	9.55 554	39	0.44 446	9.97 363	5	14
47	9.52 951	35	9.55 593	40	0.44 407	9.97 358	5	13
48	9.52 986	35	9.55 633	40	0.44 367	9.97 353	4	12
49	9.53 021	35	9.55 673	39	0.44 327	9.97 349	5	11
50	9.53 056	36	9.55 712	40	0.44 288	9.97 344	4	10
51	9.53 092	34	9.55 752	39	0.44 248	9.97 340	5	9
52	9.53 126	35	9.55 791	40	0.44 209	9.97 335	4	8
53	9.53 161	35	9.55 831	39	0.44 169	9.97 331	5	7
54	9.53 196	35	9.55 870	40	0.44 130	9.97 326	4	6
55	9.53 231	35	9.55 910	39	0.44 090	9.97 322	5	5
56	9.53 266	35	9.55 949	40	0.44 051	9.97 317	5	4
57	9.53 301	35	9.55 989	39	0.44 011	9.97 312	4	3
58	9.53 336	34	9.56 028	39	0.43 972	9.97 308	5	2
59	9.53 370	35	9.56 067	40	0.43 933	9.97 303	4	1
60	9.53 405		9.56 107		0.43 893	9.97 299		0
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin	d	'

P. P.

"	41	40	39
1	0.7	0.7	0.6
2	1.4	1.3	1.3
3	2.0	2.0	2.0
4	2.7	2.7	2.6
5	3.4	3.3	3.2
6	4.1	4.0	3.9
7	4.8	4.7	4.6
8	5.5	5.3	5.2
9	6.2	6.0	5.8
10	6.8	6.7	6.5
20	13.7	13.3	13.0
30	20.5	20.0	19.5
40	27.3	26.7	26.0
50	34.2	33.3	32.5

"	37	36	35
1	0.6	0.6	0.6
2	1.2	1.2	1.2
3	1.8	1.8	1.8
4	2.5	2.4	2.3
5	3.1	3.0	2.9
6	3.7	3.6	3.5
7	4.3	4.2	4.1
8	4.9	4.8	4.7
9	5.6	5.4	5.2
10	6.2	6.0	5.8
20	12.3	12.0	11.7
30	18.5	18.0	17.5
40	24.7	24.0	23.3
50	30.8	30.0	29.2

"	34	5	4
1	0.6	0.1	0.1
2	1.1	0.2	0.1
3	1.7	0.2	0.2
4	2.3	0.3	0.3
5	2.8	0.4	0.3
6	3.4	0.5	0.4
7	4.0	0.6	0.5
8	4.5	0.7	0.6
9	5.1	0.8	0.6
10	5.7	0.8	0.7
20	11.3	1.7	1.3
30	17.0	2.5	2.0
40	22.7	3.3	2.7
50	28.3	4.2	3.3

	5/41	5/40	5/39
0–1	4.1	4.0	3.9
1–2	12.3	12.0	11.7
2–3	20.5	20.0	19.5
3–4	28.7	28.0	27.3
4–5	36.9	36.0	35.1

	4/41	4/40	4/39
0–1	5.1	5.0	4.9
1–2	15.4	15.0	14.6
2–3	25.6	25.0	24.4
3–4	35.9	35.0	34.1

109° **(289°)** **(250°)** **70°**

LOGARITHMS OF THE FUNCTIONS (Continued)

20° (200°) (339°) **159°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.53 405	35	9.56 107	39	0.43 893	9.97 299	5	60
1	9.53 440	35	9.56 146	39	0.43 854	9.97 294	5	59
2	9.53 475	34	9.56 185	39	0.43 815	9.97 289	4	58
3	9.53 509	35	9.56 224	40	0.43 776	9.97 285	5	57
4	9.53 544	34	9.56 264	39	0.43 736	9.97 280	4	56
5	9.53 578	35	9.56 303	39	0.43 697	9.97 276	5	55
6	9.53 613	34	9.56 342	39	0.43 658	9.97 271	5	54
7	9.53 647	35	9.56 381	39	0.43 619	9.97 266	4	53
8	9.53 682	34	9.56 420	39	0.43 580	9.97 262	5	52
9	9.53 716	35	9.56 459	39	0.43 541	9.97 257	5	51
10	9.53 751	34	9.56 498	39	0.43 502	9.97 252	4	50
11	9.53 785	34	9.56 537	39	0.43 463	9.97 248	5	49
12	9.53 819	35	9.56 576	39	0.43 424	9.97 243	5	48
13	9.53 854	34	9.56 615	39	0.43 385	9.97 238	4	47
14	9.53 888	34	9.56 654	39	0.43 346	9.97 234	5	46
15	9.53 922	35	9.56 693	39	0.43 307	9.97 229	5	45
16	9.53 957	34	9.56 732	39	0.43 268	9.97 224	4	44
17	9.53 991	34	9.56 771	39	0.43 229	9.97 220	5	43
18	9.54 025	34	9.56 810	39	0.43 190	9.97 215	5	42
19	9.54 059	34	9.56 849	38	0.43 151	9.97 210	4	41
20	9.54 093	34	9.56 887	39	0.43 113	9.97 206	5	40
21	9.54 127	34	9.56 926	39	0.43 074	9.97 201	5	39
22	9.54 161	34	9.56 965	39	0.43 035	9.97 196	4	38
23	9.54 195	34	9.57 004	38	0.42 996	9.97 192	5	37
24	9.54 229	34	9.57 042	39	0.42 958	9.97 187	5	36
25	9.54 263	34	9.57 081	39	0.42 919	9.97 182	4	35
26	9.54 297	34	9.57 120	38	0.42 880	9.97 178	5	34
27	9.54 331	34	9.57 158	39	0.42 842	9.97 173	5	33
28	9.54 365	34	9.57 197	38	0.42 803	9.97 168	5	32
29	9.54 399	34	9.57 235	39	0.42 765	9.97 163	4	31
30	9.54 433	33	9.57 274	38	0.42 726	9.97 159	5	30
31	9.54 466	34	9.57 312	39	0.42 688	9.97 154	5	29
32	9.54 500	34	9.57 351	38	0.42 649	9.97 149	4	28
33	9.54 534	33	9.57 389	39	0.42 611	9.97 145	5	27
34	9.54 567	34	9.57 428	38	0.42 572	9.97 140	5	26
35	9.54 601	34	9.57 466	38	0.42 534	9.97 135	5	25
36	9.54 635	33	9.57 504	39	0.42 496	9.97 130	4	24
37	9.54 668	34	9.57 543	38	0.42 457	9.97 126	5	23
38	9.54 702	33	9.57 581	38	0.42 419	9.97 121	5	22
39	9.54 735	34	9.57 619	39	0.42 381	9.97 116	5	21
40	9.54 769	33	9.57 658	38	0.42 342	9.97 111	4	20
41	9.54 802	34	9.57 696	38	0.42 304	9.97 107	5	19
42	9.54 836	33	9.57 734	38	0.42 266	9.97 102	5	18
43	9.54 869	34	9.57 772	38	0.42 228	9.97 097	5	17
44	9.54 903	33	9.57 810	39	0.42 190	9.97 092	5	16
45	9.54 936	33	9.57 849	38	0.42 151	9.97 087	4	15
46	9.54 969	34	9.57 887	38	0.42 113	9.97 083	5	14
47	9.55 003	33	9.57 925	38	0.42 075	9.97 078	5	13
48	9.55 036	33	9.57 963	38	0.42 037	9.97 073	5	12
49	9.55 069	33	9.58 001	38	0.41 999	9.97 068	5	11
50	9.55 102	34	9.58 039	38	0.41 961	9.97 063	4	10
51	9.55 136	33	9.58 077	38	0.41 923	9.97 059	5	9
52	9.55 169	33	9.58 115	38	0.41 885	9.97 054	5	8
53	9.55 202	33	9.58 153	38	0.41 847	9.97 049	5	7
54	9.55 235	33	9.58 191	38	0.41 809	9.97 044	5	6
55	9.55 268	33	9.58 229	38	0.41 771	9.97 039	4	5
56	9.55 301	33	9.58 267	37	0.41 733	9.97 035	5	4
57	9.55 334	33	9.58 304	38	0.41 696	9.97 030	5	3
58	9.55 367	33	9.58 342	38	0.41 658	9.97 025	5	2
59	9.55 400	33	9.58 380	38	0.41 620	9.97 020	5	1
60	9.55 433		9.58 418		0.41 582	9.97 015		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

P.P.

″	40	39	38
1	0.7	0.6	0.6
2	1.3	1.3	1.3
3	2.0	2.0	1.9
4	2.7	2.6	2.5
5	3.3	3.2	3.2
6	4.0	3.9	3.8
7	4.7	4.6	4.4
8	5.3	5.2	5.1
9	6.0	5.8	5.7
10	6.7	6.5	6.3
20	13.3	13.0	12.7
30	20.0	19.5	19.0
40	26.7	26.0	25.3
50	33.3	32.5	31.7
″	**37**	**35**	**34**
1	0.6	0.6	0.6
2	1.2	1.2	1.1
3	1.8	1.8	1.7
4	2.5	2.3	2.3
5	3.1	2.9	2.8
6	3.7	3.5	3.4
7	4.3	4.1	4.0
8	4.9	4.7	4.5
9	5.6	5.2	5.1
10	6.2	5.8	5.7
20	12.3	11.7	11.3
30	18.5	17.5	17.0
40	24.7	23.3	22.7
50	30.8	29.2	28.3
″	**33**	**5**	**4**
1	0.6	0.1	0.1
2	1.1	0.2	0.1
3	1.6	0.2	0.2
4	2.2	0.3	0.3
5	2.8	0.4	0.3
6	3.3	0.5	0.4
7	3.8	0.6	0.5
8	4.4	0.7	0.5
9	5.0	0.8	0.6
10	5.5	0.8	0.7
20	11.0	1.7	1.3
30	16.5	2.5	2.0
40	22.0	3.3	2.7
50	27.5	4.2	3.3

	5/40	5/39	5/38
0			
1	4.0	3.9	3.8
2	12.0	11.7	11.4
3	20.0	19.5	19.0
4	28.0	27.3	26.6
5	36.0	35.1	34.2

	5/37	4/39	4/38
0			
1	3.7	4.9	4.8
2	11.1	14.6	14.2
3	18.5	24.4	23.8
4	25.9	34.1	33.2
5	33.3	—	—

110° (290°) (249°) **69°**

21° (201°) (338°) **158°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.55 433	33	9.58 418	37	0.41 582	9.97 015	5	60
1	9.55 466	33	9.58 455	38	0.41 545	9.97 010	5	59
2	9.55 499	33	9.58 493	38	0.41 507	9.97 005	4	58
3	9.55 532	32	9.58 531	38	0.41 469	9.97 001	5	57
4	9.55 564	33	9.58 569	37	0.41 431	9.96 996	5	56
5	9.55 597	33	9.58 606	38	0.41 394	9.96 991	5	55
6	9.55 630	33	9.58 644	37	0.41 356	9.96 986	5	54
7	9.55 663	32	9.58 681	38	0.41 319	9.96 981	5	53
8	9.55 695	33	9.58 719	38	0.41 281	9.96 976	5	52
9	9.55 728	33	9.58 757	37	0.41 243	9.96 971	5	51
10	9.55 761	32	9.58 794	38	0.41 206	9.96 966	4	50
11	9.55 793	33	9.58 832	37	0.41 168	9.96 962	5	49
12	9.55 826	32	9.58 869	38	0.41 131	9.96 957	5	48
13	9.55 858	33	9.58 907	37	0.41 093	9.96 952	5	47
14	9.55 891	32	9.58 944	37	0.41 056	9.96 947	5	46
15	9.55 923	33	9.58 981	38	0.41 019	9.96 942	5	45
16	9.55 956	32	9.59 019	37	0.40 981	9.96 937	5	44
17	9.55 988	33	9.59 056	38	0.40 944	9.96 932	5	43
18	9.56 021	32	9.59 094	37	0.40 906	9.96 927	5	42
19	9.56 053	32	9.59 131	37	0.40 869	9.96 922	5	41
20	9.56 085	33	9.59 168	37	0.40 832	9.96 917	5	40
21	9.56 118	32	9.59 205	38	0.40 795	9.96 912	5	39
22	9.56 150	32	9.59 243	37	0.40 757	9.96 907	4	38
23	9.56 182	33	9.59 280	37	0.40 720	9.96 903	5	37
24	9.56 215	32	9.59 317	37	0.40 683	9.96 898	5	36
25	9.56 247	32	9.59 354	37	0.40 646	9.96 893	5	35
26	9.56 279	32	9.59 391	38	0.40 609	9.96 888	5	34
27	9.56 311	32	9.59 429	37	0.40 571	9.96 883	5	33
28	9.56 343	32	9.59 466	37	0.40 534	9.96 878	5	32
29	9.56 375	33	9.59 503	37	0.40 497	9.96 873	5	31
30	9.56 408	32	9.59 540	37	0.40 460	9.96 868	5	30
31	9.56 440	32	9.59 577	37	0.40 423	9.96 863	5	29
32	9.56 472	32	9.59 614	37	0.40 386	9.96 858	5	28
33	9.56 504	32	9.59 651	37	0.40 349	9.96 853	5	27
34	9.56 536	32	9.59 688	37	0.40 312	9.96 848	5	26
35	9.56 568	31	9.59 725	37	0.40 275	9.96 843	5	25
36	9.56 599	32	9.59 762	37	0.40 238	9.96 838	5	24
37	9.56 631	32	9.59 799	36	0.40 201	9.96 833	5	23
38	9.56 663	32	9.59 835	37	0.40 165	9.96 828	5	22
39	9.56 695	32	9.59 872	37	0.40 128	9.96 823	5	21
40	9.56 727	32	9.59 909	37	0.40 091	9.96 818	5	20
41	9.56 759	31	9.59 946	37	0.40 054	9.96 813	5	19
42	9.56 790	32	9.59 983	36	0.40 017	9.96 808	5	18
43	9.56 822	32	9.60 019	37	0.39 981	9.96 803	5	17
44	9.56 854	32	9.60 056	37	0.39 944	9.96 798	5	16
45	9.56 886	31	9.60 093	37	0.39 907	9.96 793	5	15
46	9.56 917	32	9.60 130	36	0.39 870	9.96 788	5	14
47	9.56 949	31	9.60 166	37	0.39 834	9.96 783	5	13
48	9.56 980	32	9.60 203	37	0.39 797	9.96 778	6	12
49	9.57 012	32	9.60 240	36	0.39 760	9.96 772	5	11
50	9.57 044	31	9.60 276	37	0.39 724	9.96 767	5	10
51	9.57 075	32	9.60 313	36	0.39 687	9.96 762	5	9
52	9.57 107	31	9.60 349	37	0.39 651	9.96 757	5	8
53	9.57 138	31	9.60 386	36	0.39 614	9.96 752	5	7
54	9.57 169	32	9.60 422	37	0.39 578	9.96 747	5	6
55	9.57 201	31	9.60 459	36	0.39 541	9.96 742	5	5
56	9.57 232	32	9.60 495	37	0.39 505	9.96 737	5	4
57	9.57 264	31	9.60 532	36	0.39 468	9.96 732	5	3
58	9.57 295	31	9.60 568	37	0.39 432	9.96 727	5	2
59	9.57 326	32	9.60 605	36	0.39 395	9.96 722	5	1
60	9.57 358		9.60 641		0.39 359	9.96 717		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

P.P.

″	38	37	36
1	0.6	0.6	0.6
2	1.3	1.2	1.2
3	1.9	1.8	1.8
4	2.5	2.5	2.4
5	3.2	3.1	3.0
6	3.8	3.7	3.6
7	4.4	4.3	4.2
8	5.1	4.9	4.8
9	5.7	5.6	5.4
10	6.3	6.2	6.0
20	12.7	12.3	12.0
30	19.0	18.5	18.0
40	25.3	24.7	24.0
50	31.7	30.8	30.0

″	33	32	31
1	0.6	0.5	0.5
2	1.1	1.1	1.0
3	1.6	1.6	1.6
4	2.2	2.1	2.1
5	2.8	2.7	2.6
6	3.3	3.2	3.1
7	3.8	3.7	3.6
8	4.4	4.3	4.1
9	5.0	4.8	4.6
10	5.5	5.3	5.2
20	11.0	10.7	10.3
30	16.5	16.0	15.5
40	22.0	21.3	20.7
50	27.5	26.7	25.8

″	6	5	4
1	0.1	0.1	0.1
2	0.2	0.2	0.1
3	0.3	0.2	0.2
4	0.4	0.3	0.3
5	0.5	0.4	0.3
6	0.6	0.5	0.4
7	0.7	0.6	0.5
8	0.8	0.7	0.5
9	0.9	0.8	0.6
10	1.0	0.8	0.7
20	2.0	1.7	1.3
30	3.0	2.5	2.0
40	4.0	3.3	2.7
50	5.0	4.2	3.3

	$\frac{6}{37}$	$\frac{5}{38}$	$\frac{5}{37}$
0	3.1	3.8	3.7
1	9.2	11.4	11.1
2	15.4	19.0	18.5
3	21.6	26.6	25.9
4	27.8	34.2	33.3
5	33.9	—	—
6			

	$\frac{5}{36}$	$\frac{4}{38}$	$\frac{4}{37}$
0	3.6	4.8	4.6
1	10.8	14.2	13.9
2	18.0	23.8	23.1
3	25.2	33.2	32.4
4	32.4	—	—
5			

111° (291°) (248°) **68°**

22° (202°) (337°) **157°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.57 358	31	9.60 641	36	0.39 359	9.96 717	6	60
1	9.57 389	31	9.60 677	37	0.39 323	9.96 711	5	59
2	9.57 420	31	9.60 714	36	0.39 286	9.96 706	5	58
3	9.57 451	31	9.60 750	36	0.39 250	9.96 701	5	57
4	9.57 482	32	9.60 786	37	0.39 214	9.96 696	5	56
5	9.57 514	31	9.60 823	36	0.39 177	9.96 691	5	55
6	9.57 545	31	9.60 859	36	0.39 141	9.96 686	5	54
7	9.57 576	31	9.60 895	36	0.39 105	9.96 681	5	53
8	9.57 607	31	9.60 931	36	0.39 069	9.96 676	6	52
9	9.57 638	31	9.60 967	37	0.39 033	9.96 670	5	51
10	9.57 669	31	9.61 004	36	0.38 996	9.96 665	5	50
11	9.57 700	31	9.61 040	36	0.38 960	9.96 660	5	49
12	9.57 731	31	9.61 076	36	0.38 924	9.96 655	5	48
13	9.57 762	31	9.61 112	36	0.38 888	9.96 650	5	47
14	9.57 793	31	9.61 148	36	0.38 852	9.96 645	5	46
15	9.57 824	31	9.61 184	36	0.38 816	9.96 640	6	45
16	9.57 855	30	9.61 220	36	0.38 780	9.96 634	5	44
17	9.57 885	31	9.61 256	36	0.38 744	9.96 629	5	43
18	9.57 916	31	9.61 292	36	0.38 708	9.96 624	5	42
19	9.57 947	31	9.61 328	36	0.38 672	9.96 619	5	41
20	9.57 978	30	9.61 364	36	0.38 636	9.96 614	6	40
21	9.58 008	31	9.61 400	36	0.38 600	9.96 608	5	39
22	9.58 039	31	9.61 436	36	0.38 564	9.96 603	5	38
23	9.58 070	31	9.61 472	36	0.38 528	9.96 598	5	37
24	9.58 101	30	9.61 508	36	0.38 492	9.96 593	5	36
25	9.58 131	31	9.61 544	35	0.38 456	9.96 588	6	35
26	9.58 162	30	9.61 579	36	0.38 421	9.96 582	5	34
27	9.58 192	31	9.61 615	36	0.38 385	9.96 577	5	33
28	9.58 223	30	9.61 651	36	0.38 349	9.96 572	5	32
29	9.58 253	31	9.61 687	35	0.38 313	9.96 567	5	31
30	9.58 284	30	9.61 722	36	0.38 278	9.96 562	6	30
31	9.58 314	31	9.61 758	36	0.38 242	9.96 556	5	29
32	9.58 345	30	9.61 794	36	0.38 206	9.96 551	5	28
33	9.58 375	31	9.61 830	35	0.38 170	9.96 546	5	27
34	9.58 406	30	9.61 865	36	0.38 135	9.96 541	6	26
35	9.58 436	31	9.61 901	35	0.38 099	9.96 535	5	25
36	9.58 467	30	9.61 936	36	0.38 064	9.96 530	5	24
37	9.58 497	30	9.61 972	36	0.38 028	9.96 525	5	23
38	9.58 527	30	9.62 008	35	0.37 992	9.96 520	6	22
39	9.58 557	31	9.62 043	36	0.37 957	9.96 514	5	21
40	9.58 588	30	9.62 079	35	0.37 921	9.96 509	5	20
41	9.58 618	30	9.62 114	36	0.37 886	9.96 504	6	19
42	9.58 648	30	9.62 150	35	0.37 850	9.96 498	5	18
43	9.58 678	31	9.62 185	36	0.37 815	9.96 493	5	17
44	9.58 709	30	9.62 221	35	0.37 779	9.96 488	5	16
45	9.58 739	30	9.62 256	36	0.37 744	9.96 483	6	15
46	9.58 769	30	9.62 292	35	0.37 708	9.96 477	5	14
47	9.58 799	30	9.62 327	35	0.37 673	9.96 472	5	13
48	9.58 829	30	9.62 362	36	0.37 638	9.96 467	6	12
49	9.58 859	30	9.62 398	35	0.37 602	9.96 461	5	11
50	9.58 889	30	9.62 433	35	0.37 567	9.96 456	5	10
51	9.58 919	30	9.62 468	36	0.37 532	9.96 451	6	9
52	9.58 949	30	9.62 504	35	0.37 496	9.96 445	5	8
53	9.58 979	30	9.62 539	35	0.37 461	9.96 440	5	7
54	9.59 009	30	9.62 574	35	0.37 426	9.96 435	6	6
55	9.59 039	30	9.62 609	36	0.37 391	9.96 429	5	5
56	9.59 069	29	9.62 645	35	0.37 355	9.96 424	5	4
57	9.59 098	30	9.62 680	35	0.37 320	9.96 419	6	3
58	9.59 128	30	9.62 715	35	0.37 285	9.96 413	5	2
59	9.59 158	30	9.62 750	35	0.37 250	9.96 408	5	1
60	9.59 188		9.62 786		0.37 215	9.96 403		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

P. P.

″	37	36	35
1	0.6	0.6	0.6
2	1.2	1.2	1.2
3	1.8	1.8	1.8
4	2.5	2.4	2.3
5	3.1	3.0	2.9
6	3.7	3.6	3.5
7	4.3	4.2	4.1
8	4.9	4.8	4.7
9	5.6	5.4	5.2
10	6.2	6.0	5.8
20	12.3	12.0	11.7
30	18.5	18.0	17.5
40	24.7	24.0	23.3
50	30.8	30.0	29.2
″	32	31	30
1	0.5	0.5	0.5
2	1.1	1.0	1.0
3	1.6	1.6	1.5
4	2.1	2.1	2.0
5	2.7	2.6	2.5
6	3.2	3.1	3.0
7	3.7	3.6	3.5
8	4.3	4.1	4.0
9	4.8	4.6	4.5
10	5.3	5.2	5.0
20	10.7	10.3	10.0
30	16.0	15.5	15.0
40	21.3	20.7	20.0
50	26.7	25.8	25.0
″	29	6	5
1	0.5	0.1	0.1
2	1.0	0.2	0.2
3	1.4	0.3	0.2
4	1.9	0.4	0.3
5	2.4	0.5	0.4
6	2.9	0.6	0.5
7	3.4	0.7	0.6
8	3.9	0.8	0.7
9	4.4	0.9	0.8
10	4.8	1.0	0.8
20	9.7	2.0	1.7
30	14.5	3.0	2.5
40	19.3	4.0	3.3
50	24.2	5.0	4.2

	6/36	6/35
0		
1	3.0	2.9
2	9.0	8.8
3	15.0	14.6
4	21.0	20.4
5	27.0	26.2
6	33.0	32.1

	5/37	5/36	5/35
0			
1	3.7	3.6	3.5
2	11.1	10.8	10.5
3	18.5	18.0	17.5
4	25.9	25.2	24.5
5	33.3	32.4	31.5

P. P.

112° (292°) (247°) **67°**

23° (203°) (336°) **156°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.59 188	30	9.62 785	35	0.37 215	9.96 403	6	60
1	9.59 218	29	9.62 820	35	0.37 180	9.96 397	5	59
2	9.59 247	30	9.62 855	35	0.37 145	9.96 392	5	58
3	9.59 277	30	9.62 890	36	0.37 110	9.96 387	6	57
4	9.59 307	29	9.62 926	35	0.37 074	9.96 381	5	56
5	9.59 336	30	9.62 961	35	0.37 039	9.96 376	6	55
6	9.59 366	30	9.62 996	35	0.37 004	9.96 370	5	54
7	9.59 396	29	9.63 031	35	0.36 969	9.96 365	5	53
8	9.59 425	30	9.63 066	35	0.36 934	9.96 360	6	52
9	9.59 455	29	9.63 101	34	0.36 899	9.96 354	5	51
10	9.59 484	30	9.63 135	35	0.36 865	9.96 349	6	50
11	9.59 514	29	9.63 170	35	0.36 830	9.96 343	5	49
12	9.59 543	30	9.63 205	35	0.36 795	9.96 338	5	48
13	9.59 573	29	9.63 240	35	0.36 760	9.96 333	6	47
14	9.59 602	30	9.63 275	35	0.36 725	9.96 327	5	46
15	9.59 632	29	9.63 310	35	0.36 690	9.96 322	6	45
16	9.59 661	29	9.63 345	34	0.36 655	9.96 316	5	44
17	9.59 690	30	9.63 379	35	0.36 621	9.96 311	6	43
18	9.59 720	29	9.63 414	35	0.36 586	9.96 305	5	42
19	9.59 749	29	9.63 449	35	0.36 551	9.96 300	6	41
20	9.59 778	30	9.63 484	35	0.36 516	9.96 294	5	40
21	9.59 808	29	9.63 519	34	0.36 481	9.96 289	5	39
22	9.59 837	29	9.63 553	35	0.36 447	9.96 284	6	38
23	9.59 866	29	9.63 588	35	0.36 412	9.96 278	5	37
24	9.59 895	29	9.63 623	34	0.36 377	9.96 273	6	36
25	9.59 924	30	9.63 657	35	0.36 343	9.96 267	5	35
26	9.59 954	29	9.63 692	34	0.36 308	9.96 262	6	34
27	9.59 983	29	9.63 726	35	0.36 274	9.96 256	5	33
28	9.60 012	29	9.63 761	35	0.36 239	9.96 251	6	32
29	9.60 041	29	9.63 796	34	0.36 204	9.96 245	5	31
30	9.60 070	29	9.63 830	35	0.36 170	9.96 240	6	30
31	9.60 099	29	9.63 865	34	0.36 135	9.96 234	5	29
32	9.60 128	29	9.63 899	35	0.36 101	9.96 229	6	28
33	9.60 157	29	9.63 934	34	0.36 066	9.96 223	5	27
34	9.60 186	29	9.63 968	35	0.36 032	9.96 218	6	26
35	9.60 215	29	9.64 003	34	0.35 997	9.96 212	5	25
36	9.60 244	29	9.64 037	35	0.35 963	9.96 207	6	24
37	9.60 273	29	9.64 072	34	0.35 928	9.96 201	5	23
38	9.60 302	29	9.64 106	34	0.35 894	9.96 196	6	22
39	9.60 331	28	9.64 140	35	0.35 860	9.96 190	5	21
40	9.60 359	29	9.64 175	34	0.35 825	9.96 185	6	20
41	9.60 388	29	9.64 209	34	0.35 791	9.96 179	5	19
42	9.60 417	29	9.64 243	35	0.35 757	9.96 174	6	18
43	9.60 446	28	9.64 278	34	0.35 722	9.96 168	6	17
44	9.60 474	29	9.64 312	34	0.35 688	9.96 162	5	16
45	9.60 503	29	9.64 346	35	0.35 654	9.96 157	6	15
46	9.60 532	29	9.64 381	34	0.35 619	9.96 151	5	14
47	9.60 561	28	9.64 415	34	0.35 585	9.96 146	6	13
48	9.60 589	29	9.64 449	34	0.35 551	9.96 140	5	12
49	9.60 618	28	9.64 483	34	0.35 517	9.96 135	6	11
50	9.60 646	29	9.64 517	35	0.35 483	9.96 129	6	10
51	9.60 675	29	9.64 552	34	0.35 448	9.96 123	5	9
52	9.60 704	28	9.64 586	34	0.35 414	9.96 118	6	8
53	9.60 732	29	9.64 620	34	0.35 380	9.96 112	5	7
54	9.60 761	28	9.64 654	34	0.35 346	9.96 107	6	6
55	9.60 789	29	9.64 688	34	0.35 312	9.96 101	6	5
56	9.60 818	28	9.64 722	34	0.35 278	9.96 095	5	4
57	9.60 846	29	9.64 756	34	0.35 244	9.96 090	6	3
58	9.60 875	28	9.64 790	34	0.35 210	9.96 084	5	2
59	9.60 903	28	9.64 824	34	0.35 176	9.96 079	6	1
60	9.60 931		9.64 858		0.35 142	9.96 073		0
′	L. Cos.	d.	L. Cot	c d	L. Tan.	L. Sin.	d	′

P. P.

″	36	35	34
1	0.6	0.6	0.6
2	1.2	1.2	1.1
3	1.8	1.8	1.7
4	2.4	2.3	2.3
5	3.0	2.9	2.8
6	3.6	3.5	3.4
7	4.2	4.1	4.0
8	4.8	4.7	4.5
9	5.4	5.2	5.1
10	6.0	5.8	5.7
20	12.0	11.7	11.3
30	18.0	17.5	17.0
40	24.0	23.3	22.7
50	30.0	29.2	28.3

″	30	29	28
1	0.5	0.5	0.5
2	1.0	1.0	0.9
3	1.5	1.4	1.4
4	2.0	1.9	1.9
5	2.5	2.4	2.3
6	3.0	2.9	2.8
7	3.5	3.4	3.3
8	4.0	3.9	3.7
9	4.5	4.4	4.2
10	5.0	4.8	4.7
20	10.0	9.7	9.3
30	15.0	14.5	14.0
40	20.0	19.3	18.7
50	25.0	24.2	23.3

″	6	5
1	0.1	0.1
2	0.2	0.2
3	0.3	0.2
4	0.4	0.3
5	0.5	0.4
6	0.6	0.5
7	0.7	0.6
8	0.8	0.7
9	0.9	0.8
10	1.0	0.8
20	2.0	1.7
30	3.0	2.5
40	4.0	3.3
50	5.0	4.2

	$\frac{6}{36}$	$\frac{6}{35}$	$\frac{6}{34}$
0			
1	3.0	2.9	2.8
2	9.0	8.8	8.5
3	15.0	14.6	14.2
4	21.0	20.4	19.8
5	27.0	26.2	25.5
6	33.0	32.1	31.2

	$\frac{5}{35}$	$\frac{5}{34}$
0		
1	3.5	3.4
2	10.5	10.2
3	17.5	17.0
4	24.5	23.8
5	31.5	30.6

113° (293°) (246°) **66°**

24° (204°) (335°) **155°**

′	L. Sin.	d	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.60 931	29	9.64 858	34	0.35 142	9.96 073	6	60
1	9.60 960	28	9.64 892	34	0.35 108	9.96 067	5	59
2	9.60 988	28	9.64 926	34	0.35 074	9.96 062	6	58
3	9.61 016	29	9.64 960	34	0.35 040	9.96 056	6	57
4	9.61 045	28	9.64 994	34	0.35 006	9.96 050	5	56
5	9.61 073	28	9.65 028	34	0.34 972	9.96 045	6	55
6	9.61 101	28	9.65 062	34	0.34 938	9.96 039	5	54
7	9.61 129	29	9.65 096	34	0.34 904	9.96 034	6	53
8	9.61 158	28	9.65 130	34	0.34 870	9.96 028	6	52
9	9.61 186	28	9.65 164	33	0.34 836	9.96 022	5	51
10	9.61 214	28	9.65 197	34	0.34 803	9.96 017	6	50
11	9.61 242	28	9.65 231	34	0.34 769	9.96 011	6	49
12	9.61 270	28	9.65 265	34	0.34 735	9.96 005	5	48
13	9.61 298	28	9.65 299	34	0.34 701	9.96 000	6	47
14	9.61 326	28	9.65 333	33	0.34 667	9.95 994	6	46
15	9.61 354	28	9.65 366	34	0.34 634	9.95 988	6	45
16	9.61 382	29	9.65 400	34	0.34 600	9.95 982	5	44
17	9.61 411	27	9.65 434	33	0.34 566	9.95 977	6	43
18	9.61 438	28	9.65 467	34	0.34 533	9.95 971	6	42
19	9.61 466	28	9.65 501	34	0.34 499	9.95 965	5	41
20	9.61 494	28	9.65 535	33	0.34 465	9.95 960	6	40
21	9.61 522	28	9.65 568	34	0.34 432	9.95 954	6	39
22	9.61 550	28	9.65 602	34	0.34 398	9.95 948	6	38
23	9.61 578	28	9.65 636	33	0.34 364	9.95 942	5	37
24	9.61 606	28	9.65 669	34	0.34 331	9.95 937	6	36
25	9.61 634	28	9.65 703	33	0.34 297	9.95 931	6	35
26	9.61 662	27	9.65 736	34	0.34 264	9.95 925	5	34
27	9.61 689	28	9.65 770	33	0.34 230	9.95 920	6	33
28	9.61 717	28	9.65 803	34	0.34 197	9.95 914	6	32
29	9.61 745	28	9.65 837	33	0.34 163	9.95 908	6	31
30	9.61 773	27	9.65 870	34	0.34 130	9.95 902	5	30
31	9.61 800	28	9.65 904	33	0.34 096	9.95 897	6	29
32	9.61 828	28	9.65 937	34	0.34 063	9.95 891	6	28
33	9.61 856	27	9.65 971	33	0.34 029	9.95 885	6	27
34	9.61 883	28	9.66 004	34	0.33 996	9.95 879	6	26
35	9.61 911	28	9.66 038	33	0.33 962	9.95 873	5	25
36	9.61 939	27	9.66 071	33	0.33 929	9.95 868	6	24
37	9.61 966	28	9.66 104	34	0.33 896	9.95 862	6	23
38	9.61 994	27	9.66 138	33	0.33 862	9.95 856	6	22
39	9.62 021	28	9.66 171	33	0.33 829	9.95 850	6	21
40	9.62 049	27	9.66 204	34	0.33 796	9.95 844	5	20
41	9.62 076	28	9.66 238	33	0.33 762	9.95 839	6	19
42	9.62 104	27	9.66 271	33	0.33 729	9.95 833	6	18
43	9.62 131	28	9.66 304	33	0.33 696	9.95 827	6	17
44	9.62 159	27	9.66 337	34	0.33 663	9.95 821	6	16
45	9.62 186	28	9.66 371	33	0.33 629	9.95 815	5	15
46	9.62 214	27	9.66 404	33	0.33 596	9.95 810	6	14
47	9.62 241	27	9.66 437	33	0.33 563	9.95 804	6	13
48	9.62 268	28	9.66 470	33	0.33 530	9.95 798	6	12
49	9.62 296	27	9.66 503	34	0.33 497	9.95 792	6	11
50	9.62 323	27	9.66 537	33	0.33 463	9.95 786	6	10
51	9.62 350	27	9.66 570	33	0.33 430	9.95 780	5	9
52	9.62 377	28	9.66 603	33	0.33 397	9.95 775	6	8
53	9.62 405	27	9.66 636	33	0.33 364	9.95 769	6	7
54	9.62 432	27	9.66 669	33	0.33 331	9.95 763	6	6
55	9.62 459	27	9.66 702	33	0.33 298	9.95 757	6	5
56	9.62 486	27	9.66 735	33	0.33 265	9.95 751	6	4
57	9.62 513	28	9.66 768	33	0.33 232	9.95 745	6	3
58	9.62 541	27	9.66 801	33	0.33 199	9.95 739	6	2
59	9.62 568	27	9.66 834	33	0.33 166	9.95 733	5	1
60	9.62 595		9.66 867		0.33 133	9.95 728		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin	d	′

P.P.

″	34	33
1	0.6	0.6
2	1.1	1.1
3	1.7	1.6
4	2.3	2.2
5	2.8	2.8
6	3.4	3.3
7	4.0	3.8
8	4.5	4.4
9	5.1	5.0
10	5.7	5.5
20	11.3	11.0
30	17.0	16.5
40	22.7	22.0
50	28.3	27.5

″	29	28	27
1	0.5	0.5	0.4
2	1.0	0.9	0.9
3	1.4	1.4	1.4
4	1.9	1.9	1.8
5	2.4	2.3	2.2
6	2.9	2.8	2.7
7	3.4	3.3	3.2
8	3.9	3.7	3.6
9	4.4	4.2	4.0
10	4.8	4.7	4.5
20	9.7	9.3	9.0
30	14.5	14.0	13.5
40	19.3	18.7	18.0
50	24.2	23.3	22.5

″	6	5
1	0.1	0.1
2	0.2	0.2
3	0.3	0.2
4	0.4	0.3
5	0.5	0.4
6	0.6	0.5
7	0.7	0.6
8	0.8	0.7
9	0.9	0.8
10	1.0	0.8
20	2.0	1.7
30	3.0	2.5
40	4.0	3.3
50	5.0	4.2

	6/34	6/33	5/34
0	2.8	2.8	3.4
1	8.5	8.2	10.2
2	14.2	13.8	17.0
3	19.8	19.2	23.8
4	25.5	24.8	30.6
5	31.2	30.2	—
6			

P.P.

114° (294°) (245°) **65°**

25° (205°) (334°) **154°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot	L. Cos.	d.	′
0	9.62 595	27	9.66 867	33	0.33 133	9.95 728	6	**60**
1	9.62 622	27	9.66 900	33	0.33 100	9.95 722	6	59
2	9.62 649	27	9.66 933	33	0.33 067	9.95 716	6	58
3	9.62 676	27	9.66 966	33	0.33 034	9.95 710	6	57
4	9.62 703	27	9.66 999	33	0.33 001	9.95 704	6	56
5	9.62 730	27	9.67 032	33	0.32 968	9.95 698	6	55
6	9.62 757	27	9.67 065	33	0.32 935	9.95 692	6	54
7	9.62 784	27	9.67 098	33	0.32 902	9.95 686	6	53
8	9.62 811	27	9.67 131	32	0.32 869	9.95 680	6	52
9	9.62 838	27	9.67 163	33	0.32 837	9.95 674	6	51
10	9.62 865	27	9.67 196	33	0.32 804	9.95 668	5	**50**
11	9.62 892	26	9.67 229	33	0.32 771	9.95 663	6	49
12	9.62 918	27	9.67 262	33	0.32 738	9.95 657	6	48
13	9.62 945	27	9.67 295	32	0.32 705	9.95 651	6	47
14	9.62 972	27	9.67 327	33	0.32 673	9.95 645	6	46
15	9.62 999	27	9.67 360	33	0.32 640	9.95 639	6	45
16	9.63 026	26	9.67 393	33	0.32 607	9.95 633	6	44
17	9.63 052	27	9.67 426	32	0.32 574	9.95 627	6	43
18	9.63 079	27	9.67 458	33	0.32 542	9.95 621	6	42
19	9.63 106	27	9.67 491	33	0.32 509	9.95 615	6	41
20	9.63 133	26	9.67 524	32	0.32 476	9.95 609	6	**40**
21	9.63 159	27	9.67 556	33	0.32 444	9.95 603	6	39
22	9.63 186	27	9.67 589	33	0.32 411	9.95 597	6	38
23	9.63 213	26	9.67 622	32	0.32 378	9.95 591	6	37
24	9.63 239	27	9.67 654	33	0.32 346	9.95 585	6	36
25	9.63 266	26	9.67 687	32	0.32 313	9.95 579	6	35
26	9.63 292	27	9.67 719	33	0.32 281	9.95 573	6	34
27	9.63 319	26	9.67 752	33	0.32 248	9.95 567	6	33
28	9.63 345	27	9.67 785	32	0.32 215	9.95 561	6	32
29	9.63 372	26	9.67 817	33	0.32 183	9.95 555	6	31
30	9.63 398	27	9.67 850	32	0.32 150	9.95 549	6	**30**
31	9.63 425	26	9.67 882	33	0.32 118	9.95 543	6	29
32	9.63 451	27	9.67 915	32	0.32 085	9.95 537	6	28
33	9.63 478	26	9.67 947	33	0.32 053	9.95 531	6	27
34	9.63 504	27	9.67 980	32	0.32 020	9.95 525	6	26
35	9.63 531	26	9.68 012	32	0.31 988	9.95 519	6	25
36	9.63 557	26	9.68 044	33	0.31 956	9.95 513	6	24
37	9.63 583	27	9.68 077	32	0.31 923	9.95 507	7	23
38	9.63 610	26	9.68 109	33	0.31 891	9.95 500	6	22
39	9.63 636	26	9.68 142	32	0.31 858	9.95 494	6	21
40	9.63 662	27	9.68 174	32	0.31 826	9.95 488	6	**20**
41	9.63 689	26	9.68 206	33	0.31 794	9.95 482	6	19
42	9.63 715	26	9.68 239	32	0.31 761	9.95 476	6	18
43	9.63 741	26	9.68 271	32	0.31 729	9.95 470	6	17
44	9.63 767	27	9.68 303	33	0.31 697	9.95 464	6	16
45	9.63 794	26	9.68 336	32	0.31 664	9.95 458	6	15
46	9.63 820	26	9.68 368	32	0.31 632	9.95 452	6	14
47	9.63 846	26	9.68 400	32	0.31 600	9.95 446	6	13
48	9.63 872	26	9.68 432	33	0.31 568	9.95 440	6	12
49	9.63 898	26	9.68 465	32	0.31 535	9.95 434	7	11
50	9.63 924	26	9.68 497	32	0.31 503	9.95 427	6	**10**
51	9.63 950	26	9.68 529	32	0.31 471	9.95 421	6	9
52	9.63 976	26	9.68 561	32	0.31 439	9.95 415	6	8
53	9.64 002	26	9.68 593	33	0.31 407	9.95 409	6	7
54	9.64 028	26	9.68 626	32	0.31 374	9.95 403	6	6
55	9.64 054	26	9.68 658	32	0.31 342	9.95 397	6	5
56	9.64 080	26	9.68 690	32	0.31 310	9.95 391	7	4
57	9.64 106	26	9.68 722	32	0.31 278	9.95 384	6	3
58	9.64 132	26	9.68 754	32	0.31 246	9.95 378	6	2
59	9.64 158	26	9.68 786	32	0.31 214	9.95 372	6	1
60	9.64 184		9.68 818		0.31 182	9.95 366		**0**
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin	d	′

P.P.

″	33	32
1	0.6	0.5
2	1.1	1.1
3	1.6	1.6
4	2.2	2.1
5	2.8	2.7
6	3.3	3.2
7	3.8	3.7
8	4.4	4.3
9	5.0	4.8
10	5.5	5.3
20	11.0	10.7
30	16.5	16.0
40	22.0	21.3
50	27.5	26.7

″	27	26
1	0.4	0.4
2	0.9	0.9
3	1.4	1.3
4	1.8	1.7
5	2.2	2.2
6	2.7	2.6
7	3.2	3.0
8	3.6	3.5
9	4.0	3.9
10	4.5	4.3
20	9.0	8.7
30	13.5	13.0
40	18.0	17.3
50	22.5	21.7

″	7	6	5
1	0.1	0.1	0.1
2	0.2	0.2	0.2
3	0.4	0.3	0.2
4	0.5	0.4	0.3
5	0.6	0.5	0.4
6	0.7	0.6	0.5
7	0.8	0.7	0.6
8	0.9	0.8	0.7
9	1.0	0.9	0.8
10	1.2	1.0	0.8
20	2.3	2.0	1.7
30	3.5	3.0	2.5
40	4.7	4.0	3.3
50	5.8	5.0	4.2

	7/32	6/32	5/33
0	2.3	2.7	3.3
1	6.9	8.0	9.9
2	11.4	13.3	16.5
3	16.0	18.7	23.1
4	20.6	24.0	29.7
5	25.1	29.3	—
6	29.7	—	—
7			

P.P.

115° (295°) (244°) **64°**

26° (206°) (333°) **153°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.64 184	26	9.68 818	32	0.31 182	9.95 366	6	60
1	9.64 210	26	9.68 850	32	0.31 150	9.95 360	6	59
2	9.64 236	26	9.68 882	32	0.31 118	9.95 354	6	58
3	9.64 262	26	9.68 914	32	0.31 086	9.95 348	7	57
4	9.64 288	25	9.68 946	32	0.31 054	9.95 341	6	56
5	9.64 313	26	9.68 978	32	0.31 022	9.95 335	6	55
6	9.64 339	26	9.69 010	32	0.30 990	9.95 329	6	54
7	9.64 365	26	9.69 042	32	0.30 958	9.95 323	6	53
8	9.64 391	26	9.69 074	32	0.30 926	9.95 317	7	52
9	9.64 417	25	9.69 106	32	0.30 894	9.95 310	6	51
10	9.64 442	26	9.69 138	32	0.30 862	9.95 304	6	50
11	9.64 468	26	9.69 170	32	0.30 830	9.95 298	6	49
12	9.64 494	25	9.69 202	32	0.30 798	9.95 292	6	48
13	9.64 519	26	9.69 234	32	0.30 766	9.95 286	7	47
14	9.64 545	26	9.69 266	32	0.30 734	9.95 279	6	46
15	9.64 571	25	9.69 298	31	0.30 702	9.95 273	6	45
16	9.64 596	26	9.69 329	32	0.30 671	9.95 267	6	44
17	9.64 622	25	9.69 361	32	0.30 639	9.95 261	7	43
18	9.64 647	26	9.69 393	32	0.30 607	9.95 254	6	42
19	9.64 673	25	9.69 425	32	0.30 575	9.95 248	6	41
20	9.64 698	26	9.69 457	31	0.30 543	9.95 242	6	40
21	9.64 724	25	9.69 488	32	0.30 512	9.95 236	7	39
22	9.64 749	26	9.69 520	32	0.30 480	9.95 229	6	38
23	9.64 775	25	9.69 552	32	0.30 448	9.95 223	6	37
24	9.64 800	26	9.69 584	31	0.30 416	9.95 217	6	36
25	9.64 826	25	9.69 615	32	0.30 385	9.95 211	7	35
26	9.64 851	26	9.69 647	32	0.30 353	9.95 204	6	34
27	9.64 877	25	9.69 679	31	0.30 321	9.95 198	6	33
28	9.64 902	25	9.69 710	32	0.30 290	9.95 192	7	32
29	9.64 927	26	9.69 742	32	0.30 258	9.95 185	6	31
30	9.64 953	25	9.69 774	31	0.30 226	9.95 179	6	30
31	9.64 978	25	9.69 805	32	0.30 195	9.95 173	6	29
32	9.65 003	26	9.69 837	31	0.30 163	9.95 167	7	28
33	9.65 029	25	9.69 868	32	0.30 132	9.95 160	6	27
34	9.65 054	25	9.69 900	32	0.30 100	9.95 154	6	26
35	9.65 079	25	9.69 932	31	0.30 068	9.95 148	7	25
36	9.65 104	26	9.69 963	32	0.30 037	9.95 141	6	24
37	9.65 130	25	9.69 995	31	0.30 005	9.95 135	6	23
38	9.65 155	25	9.70 026	32	0.29 974	9.95 129	7	22
39	9.65 180	25	9.70 058	31	0.29 942	9.95 122	6	21
40	9.65 205	25	9.70 089	32	0.29 911	9.95 116	6	20
41	9.65 230	25	9.70 121	31	0.29 879	9.95 110	7	19
42	9.65 255	26	9.70 152	32	0.29 848	9.95 103	6	18
43	9.65 281	25	9.70 184	31	0.29 816	9.95 097	7	17
44	9.65 306	25	9.70 215	32	0.29 785	9.95 090	6	16
45	9.65 331	25	9.70 247	31	0.29 753	9.95 084	6	15
46	9.65 356	25	9.70 278	31	0.29 722	9.95 078	7	14
47	9.65 381	25	9.70 309	32	0.29 691	9.95 071	6	13
48	9.65 406	25	9.70 341	31	0.29 659	9.95 065	6	12
49	9.65 431	25	9.70 372	32	0.29 628	9.95 059	7	11
50	9.65 456	25	9.70 404	31	0.29 596	9.95 052	6	10
51	9.65 481	25	9.70 435	31	0.29 565	9.95 046	7	9
52	9.65 506	25	9.70 466	32	0.29 534	9.95 039	6	8
53	9.65 531	25	9.70 498	31	0.29 502	9.95 033	6	7
54	9.65 556	24	9.70 529	31	0.29 471	9.95 027	7	6
55	9.65 580	25	9.70 560	32	0.29 440	9.95 020	6	5
56	9.65 605	25	9.70 592	31	0.29 408	9.95 014	7	4
57	9.65 630	25	9.70 623	31	0.29 377	9.95 007	6	3
58	9.65 655	25	9.70 654	31	0.29 346	9.95 001	6	2
59	9.65 680	25	9.70 685	32	0.29 315	9.94 995	7	1
60	9.65 705		9.70 717		0.29 283	9.94 988		0
′	L. Cos.	d.	L. Cot.	c d.	L. Tan.	L. Sin.	d.	′

P.P.

″	32	31
1	0.5	0.5
2	1.1	1 0
3	1.6	1.6
4	2.1	2.1
5	2.7	2.6
6	3 2	3.1
7	3.7	3 6
8	4.3	4.1
9	4.8	4.6
10	5 3	5.2
20	10 7	10.3
30	16 0	15.5
40	21.3	20.7
50	26.7	25.8

″	26	25	24
1	0 4	0.4	0.4
2	0.9	0.8	0.8
3	1 3	1 2	1.2
4	1.7	1.7	1.6
5	2 2	2.1	2.0
6	2 6	2 5	2.4
7	3.0	2.9	2.8
8	3 5	3 3	3 2
9	3.9	3.8	3 6
10	4.3	4.2	4.0
20	8.7	8.3	8.0
30	13 0	12.5	12.0
40	17 3	16 7	16.0
50	21.7	20.8	20.0

″	7	6
1	0 1	0.1
2	0 2	0 2
3	0.4	0.3
4	0.5	0 4
5	0 6	0 5
6	0 7	0 6
7	0 8	0 7
8	0.9	0.8
9	1.0	0.9
10	1.2	1.0
20	2 3	2 0
30	3.5	3.0
40	4 7	4.0
50	5.8	5.0

	$\frac{7}{32}$	$\frac{7}{31}$	$\frac{6}{32}$
0			
1	2 3	2.2	2.7
2	6 9	6.6	8.0
3	11.4	11.1	13 3
4	16 0	15 5	18.7
5	20 6	19.9	24.0
6	25 1	24.4	29.3
7	29.7	28.8	—

P.P.

116° (296°) (243°) **63°**

27° (207°) (332°) **152°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.65 705	24	9.70 717	31	0.29 283	9.94 988	6	**60**
1	9.65 729	25	9.70 748	31	0.29 252	9.94 982	7	59
2	9.65 754	25	9.70 779	31	0.29 221	9.94 975	6	58
3	9.65 779	25	9.70 810	31	0.29 190	9.94 969	7	57
4	9.65 804	24	9.70 841	32	0.29 159	9.94 962	6	56
5	9.65 828	25	9.70 873	31	0.29 127	9.94 956	7	55
6	9.65 853	25	9.70 904	31	0.29 096	9.94 949	6	54
7	9.65 878	24	9.70 935	31	0.29 065	9.94 943	7	53
8	9.65 902	25	9.70 966	31	0.29 034	9.94 936	6	52
9	9.65 927	25	9.70 997	31	0.29 003	9.94 930	7	51
10	9.65 952	24	9.71 028	31	0.28 972	9.94 923	6	**50**
11	9.65 976	25	9.71 059	31	0.28 941	9.94 917	6	49
12	9.66 001	24	9.71 090	31	0.28 910	9.94 911	7	48
13	9.66 025	25	9.71 121	32	0.28 879	9.94 904	6	47
14	9.66 050	25	9.71 153	31	0.28 847	9.94 898	7	46
15	9.66 075	24	9.71 184	31	0.28 816	9.94 891	6	45
16	9.66 099	25	9.71 215	31	0.28 785	9.94 885	7	44
17	9.66 124	24	9.71 246	31	0.28 754	9.94 878	7	43
18	9.66 148	25	9.71 277	31	0.28 723	9.94 871	6	42
19	9.66 173	24	9.71 308	31	0.28 692	9.94 865	7	41
20	9.66 197	24	9.71 339	31	0.28 661	9.94 858	6	**40**
21	9.66 221	25	9.71 370	31	0.28 630	9.94 852	7	39
22	9.66 246	24	9.71 401	30	0.28 599	9.94 845	6	38
23	9.66 270	25	9.71 431	31	0.28 569	9.94 839	7	37
24	9.66 295	24	9.71 462	31	0.28 538	9.94 832	6	36
25	9.66 319	24	9.71 493	31	0.28 507	9.94 826	7	35
26	9.66 343	25	9.71 524	31	0.28 476	9.94 819	6	34
27	9.66 368	24	9.71 555	31	0.28 445	9.94 813	7	33
28	9.66 392	24	9.71 586	31	0.28 414	9.94 806	7	32
29	9.66 416	25	9.71 617	31	0.28 383	9.94 799	6	31
30	9.66 441	24	9.71 648	31	0.28 352	9.94 793	7	**30**
31	9.66 465	24	9.71 679	30	0.28 321	9.94 786	6	29
32	9.66 489	24	9.71 709	31	0.28 291	9.94 780	7	28
33	9.66 513	24	9.71 740	31	0.28 260	9.94 773	6	27
34	9.66 537	25	9.71 771	31	0.28 229	9.94 767	7	26
35	9.66 562	24	9.71 802	31	0.28 198	9.94 760	7	25
36	9.66 586	24	9.71 833	30	0.28 167	9.94 753	6	24
37	9.66 610	24	9.71 863	31	0.28 137	9.94 747	7	23
38	9.66 634	24	9.71 894	31	0.28 106	9.94 740	6	22
39	9.66 658	24	9.71 925	30	0.28 075	9.94 734	7	21
40	9.66 682	24	9.71 955	31	0.28 045	9.94 727	7	**20**
41	9.66 706	25	9.71 986	31	0.28 014	9.94 720	6	19
42	9.66 731	24	9.72 017	31	0.27 983	9.94 714	7	18
43	9.66 755	24	9.72 048	30	0.27 952	9.94 707	7	17
44	9.66 779	24	9.72 078	31	0.27 922	9.94 700	6	16
45	9.66 803	24	9.72 109	31	0.27 891	9.94 694	7	15
46	9.66 827	24	9.72 140	30	0.27 860	9.94 687	7	14
47	9.66 851	24	9.72 170	31	0.27 830	9.94 680	6	13
48	9.66 875	24	9.72 201	30	0.27 799	9.94 674	7	12
49	9.66 899	23	9.72 231	31	0.27 769	9.94 667	7	11
50	9.66 922	24	9.72 262	31	0.27 738	9.94 660	6	**10**
51	9.66 946	24	9.72 293	30	0.27 707	9.94 654	7	9
52	9.66 970	24	9.72 323	31	0.27 677	9.94 647	7	8
53	9.66 994	24	9.72 354	30	0.27 646	9.94 640	6	7
54	9.67 018	24	9.72 384	31	0.27 616	9.94 634	7	6
55	9.67 042	24	9.72 415	30	0.27 585	9.94 627	7	5
56	9.67 066	24	9.72 445	31	0.27 555	9.94 620	6	4
57	9.67 090	23	9.72 476	30	0.27 524	9.94 614	7	3
58	9.67 113	24	9.72 506	31	0.27 494	9.94 607	7	2
59	9.67 137	24	9.72 537	30	0.27 463	9.94 600	7	1
60	9.67 161		9.72 567		0.27 433	9.94 593		**0**
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

P.P.

″	32	31	30
1	0.5	0.5	0.5
2	1.1	1.0	1.0
3	1.6	1.6	1.5
4	2.1	2.1	2.0
5	2.7	2.6	2.5
6	3.2	3.1	3.0
7	3.7	3.6	3.5
8	4.3	4.1	4.0
9	4.8	4.6	4.5
10	5.3	5.2	5.0
20	10.7	10.3	10.0
30	16.0	15.5	15.0
40	21.3	20.7	20.0
50	26.7	25.8	25.0

″	25	24	23
1	0.4	0.4	0.4
2	0.8	0.8	0.8
3	1.2	1.2	1.2
4	1.7	1.6	1.5
5	2.1	2.0	1.9
6	2.5	2.4	2.3
7	2.9	2.8	2.7
8	3.3	3.2	3.1
9	3.8	3.6	3.4
10	4.2	4.0	3.8
20	8.3	8.0	7.7
30	12.5	12.0	11.5
40	16.7	16.0	15.3
50	20.8	20.0	19.2

″	7	6
1	0.1	0.1
2	0.2	0.2
3	0.4	0.3
4	0.5	0.4
5	0.6	0.5
6	0.7	0.6
7	0.8	0.7
8	0.9	0.8
9	1.0	0.9
10	1.2	1.0
20	2.3	2.0
30	3.5	3.0
40	4.7	4.0
50	5.8	5.0

	7/30	6/31	6/30
0	2.1	2.6	2.5
1	6.4	7.8	7.5
2	10.7	12.9	12.5
3	15.0	18.1	17.5
4	19.3	23.2	22.5
5	23.6	28.4	27.5
6	27.9	—	—
7			

117° (297°) (242°) **62°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.67 161	24	9.72 567	31	0.27 433	9.94 593	6	60
1	9.67 185	23	9.72 598	30	0.27 402	9.94 587	7	59
2	9.67 208	24	9.72 628	31	0.27 372	9.94 580	7	58
3	9.67 232	24	9.72 659	30	0.27 341	9.94 573	6	57
4	9.67 256	24	9.72 689	31	0.27 311	9.94 567	7	56
5	9.67 280	23	9.72 720	30	0.27 280	9.94 560	7	55
6	9.67 303	24	9.72 750	30	0.27 250	9.94 553	7	54
7	9.67 327	23	9.72 780	31	0.27 220	9.94 546	6	53
8	9.67 350	24	9.72 811	30	0.27 189	9.94 540	7	52
9	9.67 374	24	9.72 841	31	0.27 159	9.94 533	7	51
10	9.67 398	23	9.72 872	30	0.27 128	9.94 526	7	50
11	9.67 421	24	9.72 902	30	0.27 098	9.94 519	6	49
12	9.67 445	23	9.72 932	31	0.27 068	9.94 513	7	48
13	9.67 468	24	9.72 963	30	0.27 037	9.94 506	7	47
14	9.67 492	23	9.72 993	30	0.27 007	9.94 499	7	46
15	9.67 515	24	9.73 023	31	0.26 977	9.94 492	7	45
16	9.67 539	23	9.73 054	30	0.26 946	9.94 485	6	44
17	9.67 562	24	9.73 084	30	0.26 916	9.94 479	7	43
18	9.67 586	23	9.73 114	30	0.26 886	9.94 472	7	42
19	9.67 609	24	9.73 144	31	0.26 856	9.94 465	7	41
20	9.67 633	23	9.73 175	30	0.26 825	9.94 458	7	40
21	9.67 656	24	9.73 205	30	0.26 795	9.94 451	6	39
22	9.67 680	23	9.73 235	30	0.26 765	9.94 445	7	38
23	9.67 703	23	9.73 265	30	0.26 735	9.94 438	7	37
24	9.67 726	24	9.73 295	31	0.26 705	9.94 431	7	36
25	9.67 750	23	9.73 326	30	0.26 674	9.94 424	7	35
26	9.67 773	23	9.73 356	30	0.26 644	9.94 417	7	34
27	9.67 796	24	9.73 386	30	0.26 614	9.94 410	6	33
28	9.67 820	23	9.73 416	30	0.26 584	9.94 404	7	32
29	9.67 843	23	9.73 446	30	0.26 554	9.94 397	7	31
30	9.67 866	24	9.73 476	31	0.26 524	9.94 390	7	30
31	9.67 890	23	9.73 507	30	0.26 493	9.94 383	7	29
32	9.67 913	23	9.73 537	30	0.26 463	9.94 376	7	28
33	9.67 936	23	9.73 567	30	0.26 433	9.94 369	7	27
34	9.67 959	23	9.73 597	30	0.26 403	9.94 362	7	26
35	9.67 982	24	9.73 627	30	0.26 373	9.94 355	6	25
36	9.68 006	23	9.73 657	30	0.26 343	9.94 349	7	24
37	9.68 029	23	9.73 687	30	0.26 313	9.94 342	7	23
38	9.68 052	23	9.73 717	30	0.26 283	9.94 335	7	22
39	9.68 075	23	9.73 747	30	0.26 253	9.94 328	7	21
40	9.68 098	23	9.73 777	30	0.26 223	9.94 321	7	20
41	9.68 121	23	9.73 807	30	0.26 193	9.94 314	7	19
42	9.68 144	23	9.73 837	30	0.26 163	9.94 307	7	18
43	9.68 167	23	9.73 867	30	0.26 133	9.94 300	7	17
44	9.68 190	23	9.73 897	30	0.26 103	9.94 293	7	16
45	9.68 213	24	9.73 927	30	0.26 073	9.94 286	7	15
46	9.68 237	23	9.73 957	30	0.26 043	9.94 279	6	14
47	9.68 260	23	9.73 987	30	0.26 013	9.94 273	7	13
48	9.68 283	22	9.74 017	30	0.25 983	9.94 266	7	12
49	9.68 305	23	9.74 047	30	0.25 953	9.94 259	7	11
50	9.68 328	23	9.74 077	30	0.25 923	9.94 252	7	10
51	9.68 351	23	9.74 107	30	0.25 893	9.94 245	7	9
52	9.68 374	23	9.74 137	29	0.25 863	9.94 238	7	8
53	9.68 397	23	9.74 166	30	0.25 834	9.94 231	7	7
54	9.68 420	23	9.74 196	30	0.25 804	9.94 224	7	6
55	9.68 443	23	9.74 226	30	0.25 774	9.94 217	7	5
56	9.68 466	23	9.74 256	30	0.25 744	9.94 210	7	4
57	9.68 489	23	9.74 286	30	0.25 714	9.94 203	7	3
58	9.68 512	22	9.74 316	29	0.25 684	9.94 196	7	2
59	9.68 534	23	9.74 345	30	0.25 655	9.94 189	7	1
60	9.68 557		9.74 375		0.25 625	9.94 182		0
′	L. Cos.	d	L. Cot	c.d.	L. Tan.	L. Sin.	d	′

P. P.

″	31	30	29
1	0.5	0.5	0.5
2	1.0	1.0	1.0
3	1.6	1.5	1.4
4	2.1	2.0	1.9
5	2.6	2.5	2.4
6	3.1	3.0	2.9
7	3.6	3.5	3.4
8	4.1	4.0	3.9
9	4.6	4.5	4.4
10	5.2	5.0	4.8
20	10.3	10.0	9.7
30	15.5	15.0	14.5
40	20.7	20.0	19.3
50	25.8	25.0	24.2

″	24	23	22
1	0.4	0.4	0.4
2	0.8	0.8	0.7
3	1.2	1.2	1.1
4	1.6	1.5	1.5
5	2.0	1.9	1.8
6	2.4	2.3	2.2
7	2.8	2.7	2.6
8	3.2	3.1	2.9
9	3.6	3.4	3.3
10	4.0	3.8	3.7
20	8.0	7.7	7.3
30	12.0	11.5	11.0
40	16.0	15.3	14.7
50	20.0	19.2	18.3

″	7	6
1	0.1	0.1
2	0.2	0.2
3	0.4	0.3
4	0.5	0.4
5	0.6	0.5
6	0.7	0.6
7	0.8	0.7
8	0.9	0.8
9	1.0	0.9
10	1.2	1.0
20	2.3	2.0
30	3.5	3.0
40	4.7	4.0
50	5.8	5.0

	7/31	6/31	6/30
0	2.2	2.6	2.5
1	6.6	7.8	7.5
2	11.1	12.9	12.5
3	15.5	18.1	17.5
4	19.9	23.2	22.5
5	24.4	28.4	27.5
6	28.8	—	—
7			

P. P.

29° (209°) (330°) **150°**

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d	'
0	9.68 557	23	9.74 375	30	0.25 625	9.94 182	7	**60**
1	9.68 580	23	9.74 405	30	0.25 595	9.94 175	7	59
2	9.68 603	22	9.74 435	30	0.25 565	9.94 168	7	58
3	9.68 626	23	9.74 465	29	0.25 535	9.94 161	7	57
4	9.68 648	23	9.74 494	30	0.25 506	9.94 154	7	56
5	9.68 671	23	9.74 524	30	0.25 476	9.94 147	7	55
6	9.68 694	22	9.74 554	29	0.25 446	9.94 140	7	54
7	9.68 716	23	9.74 583	30	0.25 417	9.94 133	7	53
8	9.68 739	23	9.74 613	30	0.25 387	9.94 126	7	52
9	9.68 762	22	9.74 643	30	0.25 357	9.94 119	7	51
10	9.68 784	23	9.74 673	29	0.25 327	9.94 112	7	**50**
11	9.68 807	22	9.74 702	30	0.25 298	9.94 105	7	49
12	9.68 829	23	9.74 732	30	0.25 268	9.94 098	8	48
13	9.68 852	23	9.74 762	29	0.25 238	9.94 090	7	47
14	9.68 875	22	9.74 791	30	0.25 209	9.94 083	7	46
15	9.68 897	23	9.74 821	30	0.25 179	9.94 076	7	45
16	9.68 920	22	9.74 851	29	0.25 149	9.94 069	7	44
17	9.68 942	23	9.74 880	30	0.25 120	9.94 062	7	43
18	9.68 965	22	9.74 910	29	0.25 090	9.94 055	7	42
19	9.68 987	23	9.74 939	30	0.25 061	9.94 048	7	41
20	9.69 010	22	9.74 969	29	0.25 031	9.94 041	7	**40**
21	9.69 032	23	9.74 998	30	0.25 002	9.94 034	7	39
22	9.69 055	22	9.75 028	30	0.24 972	9.94 027	7	38
23	9.69 077	23	9.75 058	29	0.24 942	9.94 020	8	37
24	9.69 100	22	9.75 087	30	0.24 913	9.94 012	7	36
25	9.69 122	22	9.75 117	29	0.24 883	9.94 005	7	35
26	9.69 144	23	9.75 146	30	0.24 854	9.93 998	7	34
27	9.69 167	22	9.75 176	29	0.24 824	9.93 991	7	33
28	9.69 189	23	9.75 205	30	0.24 795	9.93 984	7	32
29	9.69 212	22	9.75 235	29	0.24 765	9.93 977	7	31
30	9.69 234	22	9.75 264	30	0.24 736	9.93 970	7	**30**
31	9.69 256	23	9.75 294	29	0.24 706	9.93 963	8	29
32	9.69 279	22	9.75 323	30	0.24 677	9.93 955	7	28
33	9.69 301	22	9.75 353	29	0.24 647	9.93 948	7	27
34	9.69 323	22	9.75 382	29	0.24 618	9.93 941	7	26
35	9.69 345	23	9.75 411	30	0.24 589	9.93 934	7	25
36	9.69 368	22	9.75 441	29	0.24 559	9.93 927	7	24
37	9.69 390	22	9.75 470	30	0.24 530	9.93 920	8	23
38	9.69 412	22	9.75 500	29	0.24 500	9.93 912	7	22
39	9.69 434	22	9.75 529	29	0.24 471	9.93 905	7	21
40	9.69 456	23	9.75 558	30	0.24 442	9.93 898	7	**20**
41	9.69 479	22	9.75 588	29	0.24 412	9.93 891	7	19
42	9.69 501	22	9.75 617	30	0.24 383	9.93 884	8	18
43	9.69 523	22	9.75 647	29	0.24 353	9.93 876	7	17
44	9.69 545	22	9.75 676	29	0.24 324	9.93 869	7	16
45	9.69 567	22	9.75 705	30	0.24 295	9.93 862	7	15
46	9.69 589	22	9.75 735	29	0.24 265	9.93 855	8	14
47	9.69 611	22	9.75 764	29	0.24 236	9.93 847	7	13
48	9.69 633	22	9.75 793	29	0.24 207	9.93 840	7	12
49	9.69 655	22	9.75 822	30	0.24 178	9.93 833	7	11
50	9.69 677	22	9.75 852	29	0.24 148	9.93 826	7	**10**
51	9.69 699	22	9.75 881	29	0.24 119	9.93 819	8	9
52	9.69 721	22	9.75 910	29	0.24 090	9.93 811	7	8
53	9.69 743	22	9.75 939	30	0.24 061	9.93 804	7	7
54	9.69 765	22	9.75 969	29	0.24 031	9.93 797	8	6
55	9.69 787	22	9.75 998	29	0.24 002	9.93 789	7	5
56	9.69 809	22	9.76 027	29	0.23 973	9.93 782	7	4
57	9.69 831	22	9.76 056	30	0.23 944	9.93 775	7	3
58	9.69 853	22	9.76 086	29	0.23 914	9.93 768	8	2
59	9.69 875	22	9.76 115	29	0.23 885	9.93 760	7	1
60	9.69 897		9.76 144		0.23 856	9.93 753		**0**
'	L. Cos	d.	L. Cot	c d.	L. Tan.	L. Sin.	d.	'

P. P.

"	30	29	23
1	0.5	0.5	0.4
2	1.0	1.0	0.8
3	1.5	1.4	1.2
4	2.0	1.9	1.5
5	2.5	2.4	1.9
6	3.0	2.9	2.3
7	3.5	3.4	2.7
8	4.0	3.9	3.1
9	4.5	4.4	3.4
10	5.0	4.8	3.8
20	10.0	9.7	7.7
30	15.0	14.5	11.5
40	20.0	19.3	15.3
50	25.0	24.2	19.2

"	22	8	7
1	0.4	0.1	0.1
2	0.7	0.3	0.2
3	1.1	0.4	0.4
4	1.5	0.5	0.5
5	1.8	0.7	0.6
6	2.2	0.8	0.7
7	2.6	0.9	0.8
8	2.9	1.1	0.9
9	3.3	1.2	1.0
10	3.7	1.3	1.2
20	7.3	2.7	2.3
30	11.0	4.0	3.5
40	14.7	5.3	4.7
50	18.3	6.7	5.8

	8/30	8/29
0		
1	1.9	1.8
2	5.6	5.4
3	9.4	9.1
4	13.1	12.7
5	16.9	16.3
6	20.6	19.9
7	24.4	23.6
8	28.1	27.2

	7/30	7/29
0		
1	2.1	2.1
2	6.4	6.2
3	10.7	10.4
4	15.0	14.5
5	19.3	18.6
6	23.6	22.8
7	27.9	26.9

P. P.

119° (299°) (240°) **60°**

30° (210°) (329°) 149°

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'
0	9.69 897	22	9.76 144	29	0.23 856	9.93 753	7	60
1	9.69 919	22	9.76 173	29	0.23 827	9.93 746	8	59
2	9.69 941	22	9.76 202	29	0.23 798	9.93 738	7	58
3	9.69 963	21	9.76 231	30	0.23 769	9.93 731	7	57
4	9.69 984	22	9.76 261	29	0.23 739	9.93 724	7	56
5	9.70 006	22	9.76 290	29	0.23 710	9.93 717	8	55
6	9.70 028	22	9.76 319	29	0.23 681	9.93 709	7	54
7	9.70 050	22	9.76 348	29	0.23 652	9.93 702	7	53
8	9.70 072	21	9.76 377	29	0.23 623	9.93 695	8	52
9	9.70 093	22	9.76 406	29	0.23 594	9.93 687	7	51
10	9.70 115	22	9.76 435	29	0.23 565	9.93 680	7	50
11	9.70 137	22	9.76 464	29	0.23 536	9.93 673	8	49
12	9.70 159	21	9.76 493	29	0.23 507	9.93 665	7	48
13	9.70 180	22	9.76 522	29	0.23 478	9.93 658	8	47
14	9.70 202	22	9.76 551	29	0.23 449	9.93 650	7	46
15	9.70 224	21	9.76 580	29	0.23 420	9.93 643	7	45
16	9.70 245	22	9.76 609	30	0.23 391	9.93 636	8	44
17	9.70 267	21	9.76 639	29	0.23 361	9.93 628	7	43
18	9.70 288	22	9.76 668	29	0.23 332	9.93 621	7	42
19	9.70 310	22	9.76 697	28	0.23 303	9.93 614	8	41
20	9.70 332	21	9.76 725	29	0.23 275	9.93 606	7	40
21	9.70 353	22	9.76 754	29	0.23 246	9.93 599	8	39
22	9.70 375	21	9.76 783	29	0.23 217	9.93 591	7	38
23	9.70 396	22	9.76 812	29	0.23 188	9.93 584	7	37
24	9.70 418	21	9.76 841	29	0.23 159	9.93 577	8	36
25	9.70 439	22	9.76 870	29	0.23 130	9.93 569	7	35
26	9.70 461	21	9.76 899	29	0.23 101	9.93 562	8	34
27	9.70 482	22	9.76 928	29	0.23 072	9.93 554	7	33
28	9.70 504	21	9.76 957	29	0.23 043	9.93 547	8	32
29	9.70 525	22	9.76 986	29	0.23 014	9.93 539	7	31
30	9.70 547	21	9.77 015	29	0.22 985	9.93 532	7	30
31	9.70 568	22	9.77 044	29	0.22 956	9.93 525	8	29
32	9.70 590	21	9.77 073	28	0.22 927	9.93 517	7	28
33	9.70 611	22	9.77 101	29	0.22 899	9.93 510	8	27
34	9.70 633	21	9.77 130	29	0.22 870	9.93 502	7	26
35	9.70 654	21	9.77 159	29	0.22 841	9.93 495	8	25
36	9.70 675	22	9.77 188	29	0.22 812	9.93 487	7	24
37	9.70 697	21	9.77 217	29	0.22 783	9.93 480	8	23
38	9.70 718	21	9.77 246	28	0.22 754	9.93 472	7	22
39	9.70 739	22	9.77 274	29	0.22 726	9.93 465	8	21
40	9.70 761	21	9.77 303	29	0.22 697	9.93 457	7	20
41	9.70 782	21	9.77 332	29	0.22 668	9.93 450	8	19
42	9.70 803	21	9.77 361	29	0.22 639	9.93 442	7	18
43	9.70 824	22	9.77 390	28	0.22 610	9.93 435	8	17
44	9.70 846	21	9.77 418	29	0.22 582	9.93 427	7	16
45	9.70 867	21	9.77 447	29	0.22 553	9.93 420	8	15
46	9.70 888	21	9.77 476	29	0.22 524	9.93 412	7	14
47	9.70 909	22	9.77 505	28	0.22 495	9.93 405	8	13
48	9.70 931	21	9.77 533	29	0.22 467	9.93 397	7	12
49	9.70 952	21	9.77 562	29	0.22 438	9.93 390	8	11
50	9.70 973	21	9.77 591	28	0.22 409	9.93 382	7	10
51	9.70 994	21	9.77 619	29	0.22 381	9.93 375	8	9
52	9.71 015	21	9.77 648	29	0.22 352	9.93 367	7	8
53	9.71 036	22	9.77 677	29	0.22 323	9.93 360	8	7
54	9.71 058	21	9.77 706	28	0.22 294	9.93 352	8	6
55	9.71 079	21	9.77 734	29	0.22 266	9.93 344	7	5
56	9.71 100	21	9.77 763	28	0.22 237	9.93 337	8	4
57	9.71 121	21	9.77 791	29	0.22 209	9.93 329	7	3
58	9.71 142	21	9.77 820	29	0.22 180	9.93 322	8	2
59	9.71 163	21	9.77 849	28	0.22 151	9.93 314	7	1
60	9.71 184		9.77 877		0.22 123	9.93 307		0
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'

P.P.

"	30	29	28
1	0.5	0.5	0.5
2	1.0	1.0	0.9
3	1.5	1.4	1.4
4	2.0	1.9	1.9
5	2.5	2.4	2.3
6	3.0	2.9	2.8
7	3.5	3.4	3.3
8	4.0	3.9	3.7
9	4.5	4.4	4.2
10	5.0	4.8	4.7
20	10.0	9.7	9.3
30	15.0	14.5	14.0
40	20.0	19.3	18.7
50	25.0	24.2	23.3

"	22	21
1	0.4	0.4
2	0.7	0.7
3	1.1	1.0
4	1.5	1 4
5	1.8	1.8
6	2.2	2.1
7	2.6	2.4
8	2.9	2 8
9	3.3	3.2
10	3.7	3.5
20	7.3	7.0
30	11.0	10.5
40	14.7	14.0
50	18 3	17 5

"	8	7
1	0.1	0.1
2	0.3	0.2
3	0.4	0 4
4	0.5	0.5
5	0.7	0.6
6	0.8	0.7
7	0.9	0.8
8	1 1	0.9
9	1.2	1.0
10	1.3	1.2
20	2 7	2.3
30	4.0	3.5
40	5.3	4.7
50	6.7	5.8

	7/30	7/29	7/28
0			
1	2 1	2.1	2.0
2	6.4	6.2	6.0
3	10.7	10.4	10.0
4	15 0	14.5	14.0
5	19.3	18.6	18.0
6	23.6	22.8	22.0
7	27.9	26.9	26.0

P.P.

120° (300°) (239°) 59°

31° (211°) (328°) **148°**

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	'
0	9.71 184	21	9.77 877	29	0.22 123	9.93 307	8	**60**
1	9.71 205	21	9.77 906	29	0.22 094	9.93 299	8	59
2	9.71 226	21	9.77 935	28	0.22 065	9.93 291	7	58
3	9.71 247	21	9.77 963	29	0.22 037	9.93 284	8	57
4	9.71 268	21	9.77 992	28	0.22 008	9.93 276	7	56
5	9.71 289	21	9.78 020	29	0.21 980	9.93 269	8	55
6	9.71 310	21	9.78 049	28	0.21 951	9.93 261	8	54
7	9.71 331	21	9.78 077	29	0.21 923	9.93 253	7	53
8	9.71 352	21	9.78 106	29	0.21 894	9.93 246	8	52
9	9.71 373	20	9.78 135	28	0.21 865	9.93 238	8	51
10	9.71 393	21	9.78 163	29	0.21 837	9.93 230	7	**50**
11	9.71 414	21	9.78 192	28	0.21 808	9.93 223	8	49
12	9.71 435	21	9.78 220	29	0.21 780	9.93 215	8	48
13	9.71 456	21	9.78 249	28	0.21 751	9.93 207	7	47
14	9.71 477	21	9.78 277	29	0.21 723	9.93 200	8	46
15	9.71 498	21	9.78 306	28	0.21 694	9.93 192	8	45
16	9.71 519	20	9.78 334	29	0.21 666	9.93 184	7	44
17	9.71 539	21	9.78 363	28	0.21 637	9.93 177	8	43
18	9.71 560	21	9.78 391	28	0.21 609	9.93 169	8	42
19	9.71 581	21	9.78 419	29	0.21 581	9.93 161	7	41
20	9.71 602	20	9.78 448	28	0.21 552	9.93 154	8	**40**
21	9.71 622	21	9.78 476	29	0.21 524	9.93 146	8	39
22	9.71 643	21	9.78 505	28	0.21 495	9.93 138	7	38
23	9.71 664	21	9.78 533	29	0.21 467	9.93 131	8	37
24	9.71 685	20	9.78 562	28	0.21 438	9.93 123	8	36
25	9.71 705	21	9.78 590	28	0.21 410	9.93 115	7	35
26	9.71 726	21	9.78 618	29	0.21 382	9.93 108	8	34
27	9.71 747	20	9.78 647	28	0.21 353	9.93 100	8	33
28	9.71 767	21	9.78 675	29	0.21 325	9.93 092	8	32
29	9.71 788	21	9.78 704	28	0.21 296	9.93 084	7	31
30	9.71 809	20	9.78 732	28	0.21 268	9.93 077	8	**30**
31	9.71 829	21	9.78 760	29	0.21 240	9.93 069	8	29
32	9.71 850	20	9.78 789	28	0.21 211	9.93 061	8	28
33	9.71 870	21	9.78 817	28	0.21 183	9.93 053	7	27
34	9.71 891	20	9.78 845	29	0.21 155	9.93 046	8	26
35	9.71 911	21	9.78 874	28	0.21 126	9.93 038	8	25
36	9.71 932	20	9.78 902	28	0.21 098	9.93 030	8	24
37	9.71 952	21	9.78 930	29	0.21 070	9.93 022	8	23
38	9.71 973	21	9.78 959	28	0.21 041	9.93 014	7	22
39	9.71 994	20	9.78 987	28	0.21 013	9.93 007	8	21
40	9.72 014	20	9.79 015	28	0.20 985	9.92 999	8	**20**
41	9.72 034	21	9.79 043	29	0.20 957	9.92 991	8	19
42	9.72 055	20	9.79 072	28	0.20 928	9.92 983	7	18
43	9.72 075	21	9.79 100	28	0.20 900	9.92 976	8	17
44	9.72 096	20	9.79 128	28	0.20 872	9.92 968	8	16
45	9.72 116	21	9.79 156	29	0.20 844	9.92 960	8	15
46	9.72 137	20	9.79 185	28	0.20 815	9.92 952	8	14
47	9.72 157	20	9.79 213	28	0.20 787	9.92 944	8	13
48	9.72 177	21	9.79 241	28	0.20 759	9.92 936	7	12
49	9.72 198	20	9.79 269	28	0.20 731	9.92 929	8	11
50	9.72 218	20	9.79 297	29	0.20 703	9.92 921	8	**10**
51	9.72 238	21	9.79 326	28	0.20 674	9.92 913	8	9
52	9.72 259	20	9.79 354	28	0.20 646	9.92 905	8	8
53	9.72 279	20	9.79 382	28	0.20 618	9.92 897	8	7
54	9.72 299	21	9.79 410	28	0.20 590	9.92 889	8	6
55	9.72 320	20	9.79 438	28	0.20 562	9.92 881	7	5
56	9.72 340	20	9.79 466	29	0.20 534	9.92 874	8	4
57	9.72 360	21	9.79 495	28	0.20 505	9.92 866	8	3
58	9.72 381	20	9.79 523	28	0.20 477	9.92 858	8	2
59	9.72 401	20	9.79 551	28	0.20 449	9.92 850	8	1
60	9.72 421		9.79 579		0.20 421	9.92 842		**0**
'	L. Cos	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'

P.P.

"	29	28
1	0.5	0.5
2	1.0	0.9
3	1.4	1.4
4	1.9	1.9
5	2.4	2.3
6	2.9	2.8
7	3.4	3.3
8	3.9	3.7
9	4.4	4.2
10	4.8	4.7
20	9.7	9.3
30	14.5	14.0
40	19.3	18.7
50	24.2	23.3

"	21	20
1	0.4	0.3
2	0.7	0.7
3	1.0	1.0
4	1.4	1.3
5	1.8	1.7
6	2.1	2.0
7	2.4	2.3
8	2.8	2.7
9	3.2	3.0
10	3.5	3.3
20	7.0	6.7
30	10.5	10.0
40	14.0	13.3
50	17.5	16.7

"	8	7
1	0.1	0.1
2	0.3	0.2
3	0.4	0.4
4	0.5	0.5
5	0.7	0.6
6	0.8	0.7
7	0.9	0.8
8	1.1	0.9
9	1.2	1.0
10	1.3	1.2
20	2.7	2.3
30	4.0	3.5
40	5.3	4.7
50	6.7	5.8

	$\frac{8}{30}$	$\frac{8}{29}$	$\frac{8}{28}$
0	1.9	1.8	1.8
1	5.6	5.4	5.3
2	9.4	9.1	8.8
3	13.1	12.7	12.3
4	16.9	16.3	15.8
5	20.6	19.9	19.3
6	24.4	23.6	22.8
7	28.1	27.2	26.3
8			

P.P.

121° (**301°**) (**238°**) **58°**

LOGARITHMS OF THE FUNCTIONS (Continued)

32° (212°) (327°) **147°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.72 421	20	9.79 579	28	0.20 421	9.92 842	8	60
1	9.72 441	20	9.79 607	28	0.20 393	9.92 834	8	59
2	9.72 461	21	9.79 635	28	0.20 365	9.92 826	8	58
3	9.72 482	20	9.79 663	28	0.20 337	9.92 818	8	57
4	9.72 502	20	9.79 691	28	0.20 309	9.92 810	7	56
5	9.72 522	20	9.79 719	28	0.20 281	9.92 803	8	55
6	9.72 542	20	9.79 747	29	0.20 253	9.92 795	8	54
7	9.72 562	20	9.79 776	28	0.20 224	9.92 787	8	53
8	9.72 582	20	9.79 804	28	0.20 196	9.92 779	8	52
9	9.72 602	20	9.79 832	28	0.20 168	9.92 771	8	51
10	9.72 622	21	9.79 860	28	0.20 140	9.92 763	8	50
11	9.72 643	20	9.79 888	28	0.20 112	9.92 755	8	49
12	9.72 663	20	9.79 916	28	0.20 084	9.92 747	8	48
13	9.72 683	20	9.79 944	28	0.20 056	9.92 739	8	47
14	9.72 703	20	9.79 972	28	0.20 028	9.92 731	8	46
15	9.72 723	20	9.80 000	28	0.20 000	9.92 723	8	45
16	9.72 743	20	9.80 028	28	0.19 972	9.92 715	8	44
17	9.72 763	20	9.80 056	28	0.19 944	9.92 707	8	43
18	9.72 783	20	9.80 084	28	0.19 916	9.92 699	8	42
19	9.72 803	20	9.80 112	28	0.19 888	9.92 691	8	41
20	9.72 823	20	9.80 140	28	0.19 860	9.92 683	8	40
21	9.72 843	20	9.80 168	27	0.19 832	9.92 675	8	39
22	9.72 863	20	9.80 195	28	0.19 805	9.92 667	8	38
23	9.72 883	19	9.80 223	28	0.19 777	9.92 659	8	37
24	9.72 902	20	9.80 251	28	0.19 749	9.92 651	8	36
25	9.72 922	20	9.80 279	28	0.19 721	9.92 643	8	35
26	9.72 942	20	9.80 307	28	0.19 693	9.92 635	8	34
27	9.72 962	20	9.80 335	28	0.19 665	9.92 627	8	33
28	9.72 982	20	9.80 363	28	0.19 637	9.92 619	8	32
29	9.73 002	20	9.80 391	28	0.19 609	9.92 611	8	31
30	9.73 022	19	9.80 419	28	0.19 581	9.92 603	8	30
31	9.73 041	20	9.80 447	27	0.19 553	9.92 595	8	29
32	9.73 061	20	9.80 474	28	0.19 526	9.92 587	8	28
33	9.73 081	20	9.80 502	28	0.19 498	9.92 579	8	27
34	9.73 101	20	9.80 530	28	0.19 470	9.92 571	8	26
35	9.73 121	19	9.80 558	28	0.19 442	9.92 563	8	25
36	9.73 140	20	9.80 586	28	0.19 414	9.92 555	9	24
37	9.73 160	20	9.80 614	28	0.19 386	9.92 546	8	23
38	9.73 180	20	9.80 642	27	0.19 358	9.92 538	8	22
39	9.73 200	19	9.80 669	28	0.19 331	9.92 530	8	21
40	9.73 219	20	9.80 697	28	0.19 303	9.92 522	8	20
41	9.73 239	20	9.80 725	28	0.19 275	9.92 514	8	19
42	9.73 259	19	9.80 753	28	0.19 247	9.92 506	8	18
43	9.73 278	20	9.80 781	27	0.19 219	9.92 498	8	17
44	9.73 298	20	9.80 808	28	0.19 192	9.92 490	8	16
45	9.73 318	19	9.80 836	28	0.19 164	9.92 482	9	15
46	9.73 337	20	9.80 864	28	0.19 136	9.92 473	8	14
47	9.73 357	20	9.80 892	27	0.19 108	9.92 465	8	13
48	9.73 377	19	9.80 919	28	0.19 081	9.92 457	8	12
49	9.73 396	20	9.80 947	28	0.19 053	9.92 449	8	11
50	9.73 416	19	9.80 975	28	0.19 025	9.92 441	8	10
51	9.73 435	20	9.81 003	27	0.18 997	9.92 433	8	9
52	9.73 455	19	9.81 030	28	0.18 970	9.92 425	9	8
53	9.73 474	20	9.81 058	28	0.18 942	9.92 416	8	7
54	9.73 494	19	9.81 086	27	0.18 914	9.92 408	8	6
55	9.73 513	20	9.81 113	28	0.18 887	9.92 400	8	5
56	9.73 533	19	9.81 141	28	0.18 859	9.92 392	8	4
57	9.73 552	20	9.81 169	27	0.18 831	9.92 384	8	3
58	9.73 572	19	9.81 196	28	0.18 804	9.92 376	9	2
59	9.73 591	20	9.81 224	28	0.18 776	9.92 367	8	1
60	9.73 611		9.81 252		0.18 748	9.92 359		0
′	L. Cos.	d.	L. Cot.	c.d	L. Tan.	L. Sin.	d.	′

P. P.

″	29	28	27
1	0.5	0.5	0.4
2	1.0	0.9	0.9
3	1.4	1.4	1.4
4	1.9	1.9	1.8
5	2.4	2.3	2.2
6	2.9	2.8	2.7
7	3.4	3.3	3.2
8	3.9	3.7	3.6
9	4.4	4.2	4.0
10	4.8	4.7	4.5
20	9.7	9.3	9.0
30	14.5	14.0	13.5
40	19.3	18.7	18.0
50	24.2	23.3	22.5
″	21	20	19
1	0.4	0.3	0.3
2	0.7	0.7	0.6
3	1.0	1.0	1.0
4	1.4	1.3	1.3
5	1.8	1.7	1.6
6	2.1	2.0	1.9
7	2.4	2.3	2.2
8	2.8	2.7	2.5
9	3.2	3.0	2.8
10	3.5	3.3	3.2
20	7.0	6.7	6.3
30	10.5	10.0	9.5
40	14.0	13.3	12.7
50	17.5	16.7	15.8
″	9	8	7
1	0.2	0.1	0.1
2	0.3	0.3	0.2
3	0.4	0.4	0.4
4	0.6	0.5	0.5
5	0.8	0.7	0.6
6	0.9	0.8	0.7
7	1.0	0.9	0.8
8	1.2	1.1	0.9
9	1.4	1.2	1.0
10	1.5	1.3	1.2
20	3.0	2.7	2.3
30	4.5	4.0	3.5
40	6.0	5.3	4.7
50	7.5	6.7	5.8

	$\frac{8}{29}$	$\frac{8}{28}$	$\frac{7}{28}$
0	1.8	1.8	2.0
1	5.4	5.2	6.0
2	9.1	8.8	10.0
3	12.7	12.2	14.0
4	16.3	15.8	18.0
5	19.9	19.2	22.0
6	23.6	22.8	26.0
7	27.2	26.2	—
8			

P. P.

122° (302°) (237°) **57°**

33° (213°) (326°) **146°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.73 611	19	9.81 252	27	0.18 748	9.92 359	8	60
1	9.73 630	20	9.81 279	28	0.18 721	9.92 351	8	59
2	9.73 650	19	9.81 307	28	0.18 693	9.92 343	8	58
3	9.73 669	20	9.81 335	27	0.18 665	9.92 335	9	57
4	9.73 689	19	9.81 362	28	0.18 638	9.92 326	8	56
5	9.73 708	19	9.81 390	28	0.18 610	9.92 318	8	55
6	9.73 727	20	9.81 418	27	0.18 582	9.92 310	8	54
7	9.73 747	19	9.81 445	28	0.18 555	9.92 302	9	53
8	9.73 766	19	9.81 473	27	0.18 527	9.92 293	8	52
9	9.73 785	20	9.81 500	28	0.18 500	9.92 285	8	51
10	9.73 805	19	9.81 528	28	0.18 472	9.92 277	8	50
11	9.73 824	19	9.81 556	27	0.18 444	9.92 269	9	49
12	9.73 843	20	9.81 583	28	0.18 417	9.92 260	8	48
13	9.73 863	19	9.81 611	27	0.18 389	9.92 252	8	47
14	9.73 882	19	9.81 638	28	0.18 362	9.92 244	9	46
15	9.73 901	20	9.81 666	27	0.18 334	9.92 235	8	45
16	9.73 921	19	9.81 693	28	0.18 307	9.92 227	8	44
17	9.73 940	19	9.81 721	27	0.18 279	9.92 219	8	43
18	9.73 959	19	9.81 748	28	0.18 252	9.92 211	9	42
19	9.73 978	19	9.81 776	27	0.18 224	9.92 202	8	41
20	9.73 997	20	9.81 803	28	0.18 197	9.92 194	8	40
21	9.74 017	19	9.81 831	27	0.18 169	9.92 186	9	39
22	9.74 036	19	9.81 858	28	0.18 142	9.92 177	8	38
23	9.74 055	19	9.81 886	27	0.18 114	9.92 169	8	37
24	9.74 074	19	9.81 913	28	0.18 087	9.92 161	9	36
25	9.74 093	20	9.81 941	27	0.18 059	9.92 152	8	35
26	9.74 113	19	9.81 968	28	0.18 032	9.92 144	8	34
27	9.74 132	19	9.81 996	27	0.18 004	9.92 136	9	33
28	9.74 151	19	9.82 023	28	0.17 977	9.92 127	8	32
29	9.74 170	19	9.82 051	27	0.17 949	9.92 119	8	31
30	9.74 189	19	9.82 078	28	0.17 922	9.92 111	9	30
31	9.74 208	19	9.82 106	27	0.17 894	9.92 102	8	29
32	9.74 227	19	9.82 133	28	0.17 867	9.92 094	8	28
33	9.74 246	19	9.82 161	27	0.17 839	9.92 086	9	27
34	9.74 265	19	9.82 188	27	0.17 812	9.92 077	8	26
35	9.74 284	19	9.82 215	28	0.17 785	9.92 069	9	25
36	9.74 303	19	9.82 243	27	0.17 757	9.92 060	8	24
37	9.74 322	19	9.82 270	28	0.17 730	9.92 052	8	23
38	9.74 341	19	9.82 298	27	0.17 702	9.92 044	9	22
39	9.74 360	19	9.82 325	27	0.17 675	9.92 035	8	21
40	9.74 379	19	9.82 352	28	0.17 648	9.92 027	9	20
41	9.74 398	19	9.82 380	27	0.17 620	9.92 018	8	19
42	9.74 417	19	9.82 407	28	0.17 593	9.92 010	8	18
43	9.74 436	19	9.82 435	27	0.17 565	9.92 002	9	17
44	9.74 455	19	9.82 462	27	0.17 538	9.91 993	8	16
45	9.74 474	19	9.82 489	28	0.17 511	9.91 985	9	15
46	9.74 493	19	9.82 517	27	0.17 483	9.91 976	8	14
47	9.74 512	19	9.82 544	27	0.17 456	9.91 968	9	13
48	9.74 531	18	9.82 571	28	0.17 429	9.91 959	8	12
49	9.74 549	19	9.82 599	27	0.17 401	9.91 951	9	11
50	9.74 568	19	9.82 626	27	0.17 374	9.91 942	8	10
51	9.74 587	19	9.82 653	28	0.17 347	9.91 934	9	9
52	9.74 606	19	9.82 681	27	0.17 319	9.91 925	8	8
53	9.74 625	19	9.82 708	27	0.17 292	9.91 917	9	7
54	9.74 644	18	9.82 735	27	0.17 265	9.91 908	8	6
55	9.74 662	19	9.82 762	28	0.17 238	9.91 900	9	5
56	9.74 681	19	9.82 790	27	0.17 210	9.91 891	8	4
57	9.74 700	19	9.82 817	27	0.17 183	9.91 883	9	3
58	9.74 719	18	9.82 844	27	0.17 156	9.91 874	8	2
59	9.74 737	19	9.82 871	28	0.17 129	9.91 866	9	1
60	9.74 756		9.82 899		0.17 101	9.91 857		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

P. P.

″	28	27
1	0.5	0.4
2	0.9	0.9
3	1.4	1.4
4	1.9	1.8
5	2.3	2.2
6	2.8	2.7
7	3.3	3.2
8	3.7	3.6
9	4.2	4.0
10	4.7	4.5
20	9.3	9.0
30	14.0	13.5
40	18.7	18.0
50	23.3	22.5

″	20	19	18
1	0.3	0.3	0.3
2	0.7	0.6	0.6
3	1.0	1.0	0.9
4	1.3	1.3	1.2
5	1.7	1.6	1.5
6	2.0	1.9	1.8
7	2.3	2.2	2.1
8	2.7	2.5	2.4
9	3.0	2.8	2.7
10	3.3	3.2	3.0
20	6.7	6.3	6.0
30	10.0	9.5	9.0
40	13.3	12.7	12.0
50	16.7	15.8	15.0

″	9	8
1	0.2	0.1
2	0.3	0.3
3	0.4	0.4
4	0.6	0.5
5	0.8	0.7
6	0.9	0.8
7	1.0	0.9
8	1.2	1.1
9	1.4	1.2
10	1.5	1.3
20	3.0	2.7
30	4.5	4.0
40	6.0	5.3
50	7.5	6.7

	$\frac{9}{28}$	$\frac{9}{27}$	$\frac{8}{27}$
0	1.6	1.5	1.7
1	4.7	4.5	5.1
2	7.8	7.5	8.4
3	10.9	10.5	11.8
4	14.0	13.5	15.2
5	17.1	16.5	18.6
6	20.2	19.5	21.9
7	23.3	22.5	25.3
8	26.4	25.5	—
9			

P. P.

123° (303°) (236°) **56°**

LOGARITHMS OF THE FUNCTIONS (Continued)

34° (214°) (325°) **145°**

′	L. Sin.	d.	L. Tan.	c d.	L. Cot.	L. Cos.	d	′
0	9.74 756	19	9.82 899	27	0.17 101	9.91 857	8	**60**
1	9.74 775	19	9.82 926	27	0.17 074	9.91 849	9	59
2	9.74 794	18	9.82 953	27	0.17 047	9.91 840	8	58
3	9.74 812	19	9.82 980	28	0.17 020	9.91 832	9	57
4	9.74 831	19	9.83 008	27	0.16 992	9.91 823	8	56
5	9.74 850	18	9.83 035	27	0.16 965	9.91 815	9	55
6	9.74 868	19	9.83 062	27	0.16 938	9.91 806	8	54
7	9.74 887	19	9.83 089	28	0.16 911	9.91 798	9	53
8	9.74 906	18	9.83 117	27	0.16 883	9.91 789	8	52
9	9.74 924	19	9.83 144	27	0.16 856	9.91 781	9	51
10	9.74 943	18	9.83 171	27	0.16 829	9.91 772	9	**50**
11	9.74 961	19	9.83 198	27	0.16 802	9.91 763	8	49
12	9.74 980	19	9.83 225	27	0.16 775	9.91 755	9	48
13	9.74 999	18	9.83 252	28	0.16 748	9.91 746	8	47
14	9.75 017	19	9.83 280	27	0.16 720	9.91 738	9	46
15	9.75 036	18	9.83 307	27	0.16 693	9.91 729	9	45
16	9.75 054	19	9.83 334	27	0.16 666	9.91 720	8	44
17	9.75 073	18	9.83 361	27	0.16 639	9.91 712	9	43
18	9.75 091	19	9.83 388	27	0.16 612	9.91 703	8	42
19	9.75 110	18	9.83 415	27	0.16 585	9.91 695	9	41
20	9.75 128	19	9.83 442	28	0.16 558	9.91 686	9	**40**
21	9.75 147	18	9.83 470	27	0.16 530	9.91 677	8	39
22	9.75 165	19	9.83 497	27	0.16 503	9.91 669	9	38
23	9.75 184	18	9.83 524	27	0.16 476	9.91 660	9	37
24	9.75 202	19	9.83 551	27	0.16 449	9.91 651	8	36
25	9.75 221	18	9.83 578	27	0.16 422	9.91 643	9	35
26	9.75 239	19	9.83 605	27	0.16 395	9.91 634	9	34
27	9.75 258	18	9.83 632	27	0.16 368	9.91 625	8	33
28	9.75 276	18	9.83 659	27	0.16 341	9.91 617	9	32
29	9.75 294	19	9.83 686	27	0.16 314	9.91 608	9	31
30	9.75 313	18	9.83 713	27	0.16 287	9.91 599	8	**30**
31	9.75 331	19	9.83 740	28	0.16 260	9.91 591	9	29
32	9.75 350	18	9.83 768	27	0.16 232	9.91 582	9	28
33	9.75 368	18	9.83 795	27	0.16 205	9.91 573	8	27
34	9.75 386	19	9.83 822	27	0.16 178	9.91 565	9	26
35	9.75 405	18	9.83 849	27	0.16 151	9.91 556	9	25
36	9.75 423	18	9.83 876	27	0.16 124	9.91 547	9	24
37	9.75 441	18	9.83 903	27	0.16 097	9.91 538	8	23
38	9.75 459	19	9.83 930	27	0.16 070	9.91 530	9	22
39	9.75 478	18	9.83 957	27	0.16 043	9.91 521	9	21
40	9.75 496	18	9.83 984	27	0.16 016	9.91 512	8	**20**
41	9.75 514	19	9.84 011	27	0.15 989	9.91 504	9	19
42	9.75 533	18	9.84 038	27	0.15 962	9.91 495	9	18
43	9.75 551	18	9.84 065	27	0.15 935	9.91 486	9	17
44	9.75 569	18	9.84 092	27	0.15 908	9.91 477	8	16
45	9.75 587	18	9.84 119	27	0.15 881	9.91 469	9	15
46	9.75 605	19	9.84 146	27	0.15 854	9.91 460	9	14
47	9.75 624	18	9.84 173	27	0.15 827	9.91 451	9	13
48	9.75 642	18	9.84 200	27	0.15 800	9.91 442	9	12
49	9.75 660	18	9.84 227	27	0.15 773	9.91 433	8	11
50	9.75 678	18	9.84 254	26	0.15 746	9.91 425	9	**10**
51	9.75 696	18	9.84 280	27	0.15 720	9.91 416	9	9
52	9.75 714	19	9.84 307	27	0.15 693	9.91 407	9	8
53	9.75 733	18	9.84 334	27	0.15 666	9.91 398	9	7
54	9.75 751	18	9.84 361	27	0.15 639	9.91 389	8	6
55	9.75 769	18	9.84 388	27	0.15 612	9.91 381	9	5
56	9.75 787	18	9.84 415	27	0.15 585	9.91 372	9	4
57	9.75 805	18	9.84 442	27	0.15 558	9.91 363	9	3
58	9.75 823	18	9.84 469	27	0.15 531	9.91 354	9	2
59	9.75 841	18	9.84 496	27	0.15 504	9.91 345	9	1
60	9.75 859		9.84 523		0.15 477	9.91 336		**0**
′	L. Cos.	d.	L. Cot.	c d	L. Tan	L. Sin	d.	′

P.P.

″	28	27	26
1	0.5	0.4	0.4
2	0.9	0.9	0.9
3	1.4	1.4	1.3
4	1.9	1.8	1.7
5	2.3	2.2	2.2
6	2.8	2.7	2.6
7	3.3	3.2	3.0
8	3.7	3.6	3.5
9	4.2	4.0	3.9
10	4.7	4.5	4.3
20	9.3	9.0	8.7
30	14.0	13.5	13.0
40	18.7	18.0	17.3
50	23.3	22.5	21.7

″	19	18
1	0.3	0.3
2	0.6	0.6
3	1.0	0.9
4	1.3	1.2
5	1.6	1.5
6	1.9	1.8
7	2.2	2.1
8	2.5	2.4
9	2.8	2.7
10	3.2	3.0
20	6.3	6.0
30	9.5	9.0
40	12.7	12.0
50	15.8	15.0

″	9	8
1	0.2	0.1
2	0.3	0.3
3	0.4	0.4
4	0.6	0.5
5	0.8	0.7
6	0.9	0.8
7	1.0	0.9
8	1.2	1.1
9	1.4	1.2
10	1.5	1.3
20	3.0	2.7
30	4.5	4.0
40	6.0	5.3
50	7.5	6.7

	9/28	8/28	8/27
0	1.6	1.8	1.7
1	4.7	5.2	5.1
2	7.8	8.8	8.4
3	10.9	12.2	11.8
4	14.0	15.8	15.2
5	17.1	19.2	18.6
6	20.2	22.8	21.9
7	23.3	26.2	25.3
8	26.4	—	—
9			

P.P.

124° (304°) (235°) **55°**

′	L. Sin.	d.	L. Tan.	c d.	L. Cot.	L. Cos	d	′
0	9.75 859	18	9.84 523	27	0.15 477	9.91 336	8	60
1	9.75 877	18	9.84 550	26	0.15 450	9.91 328	9	59
2	9.75 895	18	9.84 576	27	0.15 424	9.91 319	9	58
3	9.75 913	18	9.84 603	27	0.15 397	9.91 310	9	57
4	9.75 931	18	9.84 630	27	0.15 370	9.91 301	9	56
5	9.75 949	18	9.84 657	27	0.15 343	9.91 292	9	55
6	9.75 967	18	9.84 684	27	0.15 316	9.91 283	9	54
7	9.75 985	18	9.84 711	27	0.15 289	9.91 274	8	53
8	9.76 003	18	9.84 738	26	0.15 262	9.91 266	9	52
9	9.76 021	18	9.84 764	27	0.15 236	9.91 257	9	51
10	9.76 039	18	9.84 791	27	0.15 209	9.91 248	9	50
11	9.76 057	18	9.84 818	27	0.15 182	9.91 239	9	49
12	9.76 075	18	9.84 845	27	0.15 155	9.91 230	9	48
13	9.76 093	18	9.84 872	27	0.15 128	9.91 221	9	47
14	9.76 111	18	9.84 899	26	0.15 101	9.91 212	9	46
15	9.76 129	17	9.84 925	27	0.15 075	9.91 203	9	45
16	9.76 146	18	9.84 952	27	0.15 048	9.91 194	9	44
17	9.76 164	18	9.84 979	27	0.15 021	9.91 185	9	43
18	9.76 182	18	9.85 006	27	0.14 994	9.91 176	9	42
19	9.76 200	18	9.85 033	26	0.14 967	9.91 167	9	41
20	9.76 218	18	9.85 059	27	0.14 941	9.91 158	9	40
21	9.76 236	17	9.85 086	27	0.14 914	9.91 149	8	39
22	9.76 253	18	9.85 113	27	0.14 887	9.91 141	9	38
23	9.76 271	18	9.85 140	26	0.14 860	9.91 132	9	37
24	9.76 289	18	9.85 166	27	0.14 834	9.91 123	9	36
25	9.76 307	17	9.85 193	27	0.14 807	9.91 114	9	35
26	9.76 324	18	9.85 220	27	0.14 780	9.91 105	9	34
27	9.76 342	18	9.85 247	26	0.14 753	9.91 096	9	33
28	9.76 360	18	9.85 273	27	0.14 727	9.91 087	9	32
29	9.76 378	17	9.85 300	27	0.14 700	9.91 078	9	31
30	9.76 395	18	9.85 327	27	0.14 673	9.91 069	9	30
31	9.76 413	18	9.85 354	26	0.14 646	9.91 060	9	29
32	9.76 431	17	9.85 380	27	0.14 620	9.91 051	9	28
33	9.76 448	18	9.85 407	27	0.14 593	9.91 042	9	27
34	9.76 466	18	9.85 434	26	0.14 566	9.91 033	10	26
35	9.76 484	17	9.85 460	27	0.14 540	9.91 023	9	25
36	9.76 501	18	9.85 487	27	0.14 513	9.91 014	9	24
37	9.76 519	18	9.85 514	26	0.14 486	9.91 005	9	23
38	9.76 537	17	9.85 540	27	0.14 460	9.90 996	9	22
39	9.76 554	18	9.85 567	27	0.14 433	9.90 987	9	21
40	9.76 572	18	9.85 594	26	0.14 406	9.90 978	9	20
41	9.76 590	17	9.85 620	27	0.14 380	9.90 969	9	19
42	9.76 607	18	9.85 647	27	0.14 353	9.90 960	9	18
43	9.76 625	17	9.85 674	26	0.14 326	9.90 951	9	17
44	9.76 642	18	9.85 700	27	0.14 300	9.90 942	9	16
45	9.76 660	17	9.85 727	27	0.14 273	9.90 933	9	15
46	9.76 677	18	9.85 754	26	0.14 246	9.90 924	9	14
47	9.76 695	17	9.85 780	27	0.14 220	9.90 915	9	13
48	9.76 712	18	9.85 807	27	0.14 193	9.90 906	10	12
49	9.76 730	17	9.85 834	26	0.14 166	9.90 896	9	11
50	9.76 747	18	9.85 860	27	0.14 140	9.90 887	9	10
51	9.76 765	17	9.85 887	26	0.14 113	9.90 878	9	9
52	9.76 782	18	9.85 913	27	0.14 087	9.90 869	9	8
53	9.76 800	17	9.85 940	27	0.14 060	9.90 860	9	7
54	9.76 817	18	9.85 967	26	0.14 033	9.90 851	9	6
55	9.76 835	17	9.85 993	27	0.14 007	9.90 842	10	5
56	9.76 852	18	9.86 020	26	0.13 980	9.90 832	9	4
57	9.76 870	17	9.86 046	27	0.13 954	9.90 823	9	3
58	9.76 887	17	9.86 073	27	0.13 927	9.90 814	9	2
59	9.76 904	18	9.86 100	26	0.13 900	9.90 805	9	1
60	9.76 922		9.86 126		0.13 874	9.90 796		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin	d	′

P.P.

″	27	26	18
1	0.4	0.4	0.3
2	0.9	0.9	0.6
3	1.4	1.3	0.9
4	1.8	1.7	1.2
5	2.2	2.2	1.5
6	2.7	2.6	1.8
7	3.2	3.0	2.1
8	3.6	3.5	2.4
9	4.0	3.9	2.7
10	4.5	4.3	3.0
20	9.0	8.7	6.0
30	13.5	13.0	9.0
40	18.0	17.3	12.0
50	22.5	21.7	15.0

″	17	10	9	8
1	0.3	0.2	0.2	0.1
2	0.6	0.3	0.3	0.3
3	0.8	0.5	0.4	0.4
4	1.1	0.7	0.6	0.5
5	1.4	0.8	0.8	0.7
6	1.7	1.0	0.9	0.8
7	2.0	1.2	1.0	0.9
8	2.3	1.3	1.2	1.1
9	2.6	1.5	1.4	1.2
10	2.8	1.7	1.5	1.3
20	5.7	3.3	3.0	2.7
30	8.5	5.0	4.5	4.0
40	11.3	6.7	6.0	5.3
50	14.2	8.3	7.5	6.7

	10/27	10/26
0	1.4	1.3
1	4.1	3.9
2	6.8	6.5
3	9.4	9.1
4	12.2	11.7
5	14.8	14.3
6	17.6	16.9
7	20.2	19.5
8	22.9	22.1
9	25.6	24.7
10		

	9/27	9/26
0	1.5	1.4
1	4.5	4.3
2	7.5	7.2
3	10.5	10.1
4	13.5	13.0
5	16.5	15.9
6	19.5	18.8
7	22.5	21.7
8	25.5	24.6
9		

P.P.

36° (216°) **(323°) 143°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.76 922	17	9.86 126	27	0.13 874	9.90 796	9	60
1	9.76 939	18	9.86 153	26	0.13 847	9.90 787	10	59
2	9.76 957	17	9.86 179	27	0.13 821	9.90 777	9	58
3	9.76 974	17	9.86 206	26	0.13 794	9.90 768	9	57
4	9.76 991	18	9.86 232	27	0.13 768	9.90 759	9	56
5	9.77 009	17	9.86 259	26	0.13 741	9.90 750	9	55
6	9.77 026	17	9.86 285	27	0.13 715	9.90 741	10	54
7	9.77 043	18	9.86 312	26	0.13 688	9.90 731	9	53
8	9.77 061	17	9.86 338	27	0.13 662	9.90 722	9	52
9	9.77 078	17	9.86 365	27	0.13 635	9.90 713	9	51
10	9.77 095	17	9.86 392	26	0.13 608	9.90 704	10	50
11	9.77 112	18	9.86 418	27	0.13 582	9.90 694	9	49
12	9.77 130	17	9.86 445	26	0.13 555	9.90 685	9	48
13	9.77 147	17	9.86 471	27	0.13 529	9.90 676	9	47
14	9.77 164	17	9.86 498	26	0.13 502	9.90 667	10	46
15	9.77 181	18	9.86 524	27	0.13 476	9.90 657	9	45
16	9.77 199	17	9.86 551	26	0.13 449	9.90 648	9	44
17	9.77 216	17	9.86 577	26	0.13 423	9.90 639	9	43
18	9.77 233	17	9.86 603	27	0.13 397	9.90 630	10	42
19	9.77 250	18	9.86 630	26	0.13 370	9.90 620	9	41
20	9.77 268	17	9.86 656	27	0.13 344	9.90 611	9	40
21	9.77 285	17	9.86 683	26	0.13 317	9.90 602	10	39
22	9.77 302	17	9.86 709	27	0.13 291	9.90 592	9	38
23	9.77 319	17	9.86 736	26	0.13 264	9.90 583	9	37
24	9.77 336	17	9.86 762	27	0.13 238	9.90 574	9	36
25	9.77 353	17	9.86 789	26	0.13 211	9.90 565	10	35
26	9.77 370	17	9.86 815	27	0.13 185	9.90 555	9	34
27	9.77 387	18	9.86 842	26	0.13 158	9.90 546	9	33
28	9.77 405	17	9.86 868	26	0.13 132	9.90 537	10	32
29	9.77 422	17	9.86 894	27	0.13 106	9.90 527	9	31
30	9.77 439	17	9.86 921	26	0.13 079	9.90 518	9	30
31	9.77 456	17	9.86 947	27	0.13 053	9.90 509	10	29
32	9.77 473	17	9.86 974	26	0.13 026	9.90 499	9	28
33	9.77 490	17	9.87 000	27	0.13 000	9.90 490	10	27
34	9.77 507	17	9.87 027	26	0.12 973	9.90 480	9	26
35	9.77 524	17	9.87 053	26	0.12 947	9.90 471	9	25
36	9.77 541	17	9.87 079	27	0.12 921	9.90 462	10	24
37	9.77 558	17	9.87 106	26	0.12 894	9.90 452	9	23
38	9.77 575	17	9.87 132	26	0.12 868	9.90 443	9	22
39	9.77 592	17	9.87 158	27	0.12 842	9.90 434	10	21
40	9.77 609	17	9.87 185	26	0.12 815	9.90 424	9	20
41	9.77 626	17	9.87 211	27	0.12 789	9.90 415	10	19
42	9.77 643	17	9.87 238	26	0.12 762	9.90 405	9	18
43	9.77 660	17	9.87 264	26	0.12 736	9.90 396	10	17
44	9.77 677	17	9.87 290	27	0.12 710	9.90 386	9	16
45	9.77 694	17	9.87 317	26	0.12 683	9.90 377	9	15
46	9.77 711	17	9.87 343	26	0.12 657	9.90 368	10	14
47	9.77 728	16	9.87 369	27	0.12 631	9.90 358	9	13
48	9.77 744	17	9.87 396	26	0.12 604	9.90 349	10	12
49	9.77 761	17	9.87 422	26	0.12 578	9.90 339	9	11
50	9.77 778	17	9.87 448	27	0.12 552	9.90 330	10	10
51	9.77 795	17	9.87 475	26	0.12 525	9.90 320	9	9
52	9.77 812	17	9.87 501	26	0.12 499	9.90 311	10	8
53	9.77 829	17	9.87 527	27	0.12 473	9.90 301	9	7
54	9.77 846	16	9.87 554	26	0.12 446	9.90 292	10	6
55	9.77 862	17	9.87 580	26	0.12 420	9.90 282	9	5
56	9.77 879	17	9.87 606	27	0.12 394	9.90 273	10	4
57	9.77 896	17	9.87 633	26	0.12 367	9.90 263	9	3
58	9.77 913	17	9.87 659	26	0.12 341	9.90 254	10	2
59	9.77 930	16	9.87 685	26	0.12 315	9.90 244	9	1
60	9.77 946		9.87 711		0.12 289	9.90 235		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

126° (306°) **(233°) 53°**

P. P.

″	27	26
1	0.4	0.4
2	0.9	0.9
3	1.4	1.3
4	1.8	1.7
5	2.2	2.2
6	2.7	2.6
7	3.2	3.0
8	3.6	3.5
9	4.0	3.9
10	4.5	4.3
20	9.0	8.7
30	13.5	13.0
40	18.0	17.3
50	22.5	21.7

″	18	17	16
1	0.3	0.3	0.3
2	0.6	0.6	0.5
3	0.9	0.8	0.8
4	1.2	1.1	1.1
5	1.5	1.4	1.3
6	1.8	1.7	1.6
7	2.1	2.0	1.9
8	2.4	2.3	2.1
9	2.7	2.6	2.4
10	3.0	2.8	2.7
20	6.0	5.7	5.3
30	9.0	8.5	8.0
40	12.0	11.3	10.7
50	15.0	14.2	13.3

″	10	9
1	0.2	0.2
2	0.3	0.3
3	0.5	0.4
4	0.7	0.6
5	0.8	0.8
6	1.0	0.9
7	1.2	1.0
8	1.3	1.2
9	1.5	1.4
10	1.7	1.5
20	3.3	3.0
30	5.0	4.5
40	6.7	6.0
50	8.3	7.5

	9/27	9/26
0	1.5	1.4
1	4.5	4.3
2	7.5	7.2
3	10.5	10.1
4	13.5	13.0
5	16.5	15.9
6	19.5	18.8
7	22.5	21.7
8	25.5	24.6

P. P.

37° (217°) (322°) **142°**

′	L Sin	d	L Tan	c d	L Cot	L Cos	d.	′
0	9.77 946	17	9.87 711	27	0.12 289	9.90 235	10	**60**
1	9.77 963	17	9.87 738	26	0.12 262	9.90 225	9	59
2	9.77 980	17	9.87 764	26	0.12 236	9.90 216	10	58
3	9.77 997	16	9.87 790	27	0.12 210	9.90 206	9	57
4	9.78 013	17	9.87 817	26	0.12 183	9.90 197	10	56
5	9.78 030	17	9.87 843	26	0.12 157	9.90 187	9	55
6	9.78 047	16	9.87 869	26	0.12 131	9.90 178	10	54
7	9.78 063	17	9.87 895	27	0.12 105	9.90 168	9	53
8	9.78 080	17	9.87 922	26	0.12 078	9.90 159	10	52
9	9.78 097	16	9.87 948	26	0.12 052	9.90 149	10	51
10	9.78 113	17	9.87 974	26	0.12 026	9.90 139	9	**50**
11	9.78 130	17	9.88 000	27	0.12 000	9.90 130	10	49
12	9.78 147	16	9.88 027	26	0.11 973	9.90 120	9	48
13	9.78 163	17	9.88 053	26	0.11 947	9.90 111	10	47
14	9.78 180	17	9.88 079	26	0.11 921	9.90 101	10	46
15	9.78 197	16	9.88 105	26	0.11 895	9.90 091	9	45
16	9.78 213	17	9.88 131	27	0.11 869	9.90 082	10	44
17	9.78 230	16	9.88 158	26	0.11 842	9.90 072	9	43
18	9.78 246	17	9.88 184	26	0.11 816	9.90 063	10	42
19	9.78 263	17	9.88 210	26	0.11 790	9.90 053	10	41
20	9.78 280	16	9.88 236	26	0.11 764	9.90 043	9	**40**
21	9.78 296	17	9.88 262	27	0.11 738	9.90 034	10	39
22	9.78 313	16	9.88 289	26	0.11 711	9.90 024	10	38
23	9.78 329	17	9.88 315	26	0.11 685	9.90 014	9	37
24	9.78 346	16	9.88 341	26	0.11 659	9.90 005	10	36
25	9.78 362	17	9.88 367	26	0.11 633	9.89 995	10	35
26	9.78 379	16	9.88 393	27	0.11 607	9.89 985	9	34
27	9.78 395	17	9.88 420	26	0.11 580	9.89 976	10	33
28	9.78 412	16	9.88 446	26	0.11 554	9.89 966	10	32
29	9.78 428	17	9.88 472	26	0.11 528	9.89 956	9	31
30	9.78 445	16	9.88 498	26	0.11 502	9.89 947	10	**30**
31	9.78 461	17	9.88 524	26	0.11 476	9.89 937	10	29
32	9.78 478	16	9.88 550	27	0.11 450	9.89 927	9	28
33	9.78 494	16	9.88 577	26	0.11 423	9.89 918	10	27
34	9.78 510	17	9.88 603	26	0.11 397	9.89 908	10	26
35	9.78 527	16	9.88 629	26	0.11 371	9.89 898	10	25
36	9.78 543	17	9.88 655	26	0.11 345	9.89 888	9	24
37	9.78 560	16	9.88 681	26	0.11 319	9.89 879	10	23
38	9.78 576	16	9.88 707	26	0.11 293	9.89 869	10	22
39	9.78 592	17	9.88 733	26	0.11 267	9.89 859	10	21
40	9.78 609	16	9.88 759	27	0.11 241	9.89 849	9	**20**
41	9.78 625	17	9.88 786	26	0.11 214	9.89 840	10	19
42	9.78 642	16	9.88 812	26	0.11 188	9.89 830	10	18
43	9.78 658	16	9.88 838	26	0.11 162	9.89 820	10	17
44	9.78 674	17	9.88 864	26	0.11 136	9.89 810	9	16
45	9.78 691	16	9.88 890	26	0.11 110	9.89 801	10	15
46	9.78 707	16	9.88 916	26	0.11 084	9.89 791	10	14
47	9.78 723	16	9.88 942	26	0.11 058	9.89 781	10	13
48	9.78 739	17	9.88 968	26	0.11 032	9.89 771	10	12
49	9.78 756	16	9.88 994	26	0.11 006	9.89 761	9	11
50	9.78 772	16	9.89 020	26	0.10 980	9.89 752	10	**10**
51	9.78 788	17	9.89 046	27	0.10 954	9.89 742	10	9
52	9.78 805	16	9.89 073	26	0.10 927	9.89 732	10	8
53	9.78 821	16	9.89 099	26	0.10 901	9.89 722	10	7
54	9.78 837	16	9.89 125	26	0.10 875	9.89 712	10	6
55	9.78 853	16	9.89 151	26	0.10 849	9.89 702	9	5
56	9.78 869	17	9.89 177	26	0.10 823	9.89 693	10	4
57	9.78 886	16	9.89 203	26	0.10 797	9.89 683	10	3
58	9.78 902	16	9.89 229	26	0.10 771	9.89 673	10	2
59	9.78 918	16	9.89 255	26	0.10 745	9.89 663	10	1
60	9.78 934		9.89 281		0.10 719	9.89 653		**0**
′	L Cos	d.	L. Cot.	c.d	L. Tan.	L. Sin	d	′

P. P.

″	**27**	**26**
1	0.4	0.4
2	0.9	0.9
3	1.4	1.3
4	1.8	1.7
5	2.2	2.2
6	2.7	2.6
7	3.2	3.0
8	3.6	3.5
9	4.0	3.9
10	4.5	4.3
20	9.0	8.7
30	13.5	13.0
40	18.0	17.3
50	22.5	21.7

″	**17**	**16**
1	0.3	0.3
2	0.6	0.5
3	0.8	0.8
4	1.1	1.1
5	1.4	1.3
6	1.7	1.6
7	2.0	1.9
8	2.3	2.1
9	2.6	2.4
10	2.8	2.7
20	5.7	5.3
30	8.5	8.0
40	11.3	10.7
50	14.2	13.3

″	**10**	**9**
1	0.2	0.2
2	0.3	0.3
3	0.5	0.4
4	0.7	0.6
5	0.8	0.8
6	1.0	0.9
7	1.2	1.0
8	1.3	1.2
9	1.5	1.4
10	1.7	1.5
20	3.3	3.0
30	5.0	4.5
40	6.7	6.0
50	8.3	7.5

	10/27	**10/26**
0	1.4	1.3
1	4.1	3.9
2	6.8	6.5
3	9.4	9.1
4	12.2	11.7
5	14.8	14.3
6	17.6	16.9
7	20.2	19.5
8	22.9	22.1
9	25.6	24.7
10		

P. P.

127° (307°) (232°) **52°**

'	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d	'
0	9.78 934	16	9.89 281	26	0.10 719	9.89 653	10	60
1	9.78 950	17	9.89 307	26	0.10 693	9.89 643	10	59
2	9.78 967	16	9.89 333	26	0.10 667	9.89 633	9	58
3	9.78 983	16	9.89 359	26	0.10 641	9.89 624	10	57
4	9.78 999	16	9.89 385	26	0.10 615	9.89 614	10	56
5	9.79 015	16	9.89 411	26	0.10 589	9.89 604	10	55
6	9.79 031	16	9.89 437	26	0.10 563	9.89 594	10	54
7	9.79 047	16	9.89 463	26	0.10 537	9.89 584	10	53
8	9.79 063	16	9.89 489	26	0.10 511	9.89 574	10	52
9	9.79 079	16	9.89 515	26	0.10 485	9.89 564	10	51
10	9.79 095	16	9.89 541	26	0.10 459	9.89 554	10	50
11	9.79 111	17	9.89 567	26	0.10 433	9.89 544	10	49
12	9.79 128	16	9.89 593	26	0.10 407	9.89 534	10	48
13	9.79 144	16	9.89 619	26	0.10 381	9.89 524	10	47
14	9.79 160	16	9.89 645	26	0.10 355	9.89 514	10	46
15	9.79 176	16	9.89 671	26	0.10 329	9.89 504	9	45
16	9.79 192	16	9.89 697	26	0.10 303	9.89 495	10	44
17	9.79 208	16	9.89 723	26	0.10 277	9.89 485	10	43
18	9.79 224	16	9.89 749	26	0.10 251	9.89 475	10	42
19	9.79 240	16	9.89 775	26	0.10 225	9.89 465	10	41
20	9.79 256	16	9.89 801	26	0.10 199	9.89 455	10	40
21	9.79 272	16	9.89 827	26	0.10 173	9.89 445	10	39
22	9.79 288	16	9.89 853	26	0.10 147	9.89 435	10	38
23	9.79 304	15	9.89 879	26	0.10 121	9.89 425	10	37
24	9.79 319	16	9.89 905	26	0.10 095	9.89 415	10	36
25	9.79 335	16	9.89 931	26	0.10 069	9.89 405	10	35
26	9.79 351	16	9.89 957	26	0.10 043	9.89 395	10	34
27	9.79 367	16	9.89 983	26	0.10 017	9.89 385	10	33
28	9.79 383	16	9.90 009	26	0.09 991	9.89 375	11	32
29	9.79 399	16	9.90 035	26	0.09 965	9.89 364	10	31
30	9.79 415	16	9.90 061	25	0.09 939	9.89 354	10	30
31	9.79 431	16	9.90 086	26	0.09 914	9.89 344	10	29
32	9.79 447	16	9.90 112	26	0.09 888	9.89 334	10	28
33	9.79 463	15	9.90 138	26	0.09 862	9.89 324	10	27
34	9.79 478	16	9.90 164	26	0.09 836	9.89 314	10	26
35	9.79 494	16	9.90 190	26	0.09 810	9.89 304	10	25
36	9.79 510	16	9.90 216	26	0.09 784	9.89 294	10	24
37	9.79 526	16	9.90 242	26	0.09 758	9.89 284	10	23
38	9.79 542	16	9.90 268	26	0.09 732	9.89 274	10	22
39	9.79 558	15	9.90 294	26	0.09 706	9.89 264	10	21
40	9.79 573	16	9.90 320	26	0.09 680	9.89 254	10	20
41	9.79 589	16	9.90 346	25	0.09 654	9.89 244	11	19
42	9.79 605	16	9.90 371	26	0.09 629	9.89 233	10	18
43	9.79 621	15	9.90 397	26	0.09 603	9.89 223	10	17
44	9.79 636	16	9.90 423	26	0.09 577	9.89 213	10	16
45	9.79 652	16	9.90 449	26	0.09 551	9.89 203	10	15
46	9.79 668	16	9.90 475	26	0.09 525	9.89 193	10	14
47	9.79 684	15	9.90 501	26	0.09 499	9.89 183	10	13
48	9.79 699	16	9.90 527	26	0.09 473	9.89 173	11	12
49	9.79 715	16	9.90 553	25	0.09 447	9.89 162	10	11
50	9.79 731	15	9.90 578	26	0.09 422	9.89 152	10	10
51	9.79 746	16	9.90 604	26	0.09 396	9.89 142	10	9
52	9.79 762	16	9.90 630	26	0.09 370	9.89 132	10	8
53	9.79 778	15	9.90 656	26	0.09 344	9.89 122	10	7
54	9.79 793	16	9.90 682	26	0.09 318	9.89 112	11	6
55	9.79 809	16	9.90 708	26	0.09 292	9.89 101	10	5
56	9.79 825	15	9.90 734	25	0.09 266	9.89 091	10	4
57	9.79 840	16	9.90 759	26	0.09 241	9.89 081	10	3
58	9.79 856	16	9.90 785	26	0.09 215	9.89 071	11	2
59	9.79 872	15	9.90 811	26	0.09 189	9.89 060	10	1
60	9.79 887		9.90 837		0.09 163	9.89 050		0
'	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	'

P. P.

"	26	25
1	0.4	0.4
2	0.9	0.8
3	1.3	1.2
4	1.7	1.7
5	2.2	2.1
6	2.6	2.5
7	3.0	2.9
8	3.5	3.3
9	3.9	3.8
10	4.3	4.2
20	8.7	8.3
30	13.0	12.5
40	17.3	16.7
50	21.7	20.8

"	17	16	15
1	0.3	0.3	0.2
2	0.6	0.5	0.5
3	0.8	0.8	0.8
4	1.1	1.1	1.0
5	1.4	1.3	1.2
6	1.7	1.6	1.5
7	2.0	1.9	1.8
8	2.3	2.1	2.0
9	2.6	2.4	2.2
10	2.8	2.7	2.5
20	5.7	5.3	5.0
30	8.5	8.0	7.5
40	11.3	10.7	10.0
50	14.2	13.3	12.5

"	11	10	9
1	0.2	0.2	0.2
2	0.4	0.3	0.3
3	0.6	0.5	0.4
4	0.7	0.7	0.6
5	0.9	0.8	0.8
6	1.1	1.0	0.9
7	1.3	1.2	1.0
8	1.5	1.3	1.2
9	1.6	1.5	1.4
10	1.8	1.7	1.5
20	3.7	3.3	3.0
30	5.5	5.0	4.5
40	7.3	6.7	6.0
50	9.2	8.3	7.5

	10/26	10/25	9/26
0	1.3	1.2	1.4
1	3.9	3.8	4.3
2	6.5	6.2	7.2
3	9.1	8.8	10.1
4	11.7	11.2	13.0
5	14.3	13.8	15.9
6	16.9	16.2	18.8
7	19.5	18.8	21.7
8	22.1	21.2	24.6
9	24.7	23.8	—
10			

P. P.

39° (219°) (320°) **140°**

′	L. Sin.	d	L. Tan.	c.d	L. Cot	L. Cos	d	′
0	9.79 887	16	9.90 837	26	0.09 163	9.89 050	10	60
1	9.79 903	15	9.90 863	26	0.09 137	9.89 040	10	59
2	9.79 918	16	9.90 889	25	0.09 111	9.89 030	10	58
3	9.79 934	16	9.90 914	26	0.09 086	9.89 020	11	57
4	9.79 950	15	9.90 940	26	0.09 060	9.89 009	10	56
5	9.79 965	16	9.90 966	26	0.09 034	9.88 999	10	55
6	9.79 981	15	9.90 992	26	0.09 008	9.88 989	11	54
7	9.79 996	16	9.91 018	25	0.08 982	9.88 978	10	53
8	9.80 012	15	9.91 043	26	0.08 957	9.88 968	10	52
9	9.80 027	16	9.91 069	26	0.08 931	9.88 958	10	51
10	9.80 043	15	9.91 095	26	0.08 905	9.88 948	11	50
11	9.80 058	16	9.91 121	26	0.08 879	9.88 937	10	49
12	9.80 074	15	9.91 147	25	0.08 853	9.88 927	10	48
13	9.80 089	16	9.91 172	26	0.08 828	9.88 917	11	47
14	9.80 105	15	9.91 198	26	0.08 802	9.88 906	10	46
15	9.80 120	16	9.91 224	26	0.08 776	9.88 896	10	45
16	9.80 136	15	9.91 250	26	0.08 750	9.88 886	11	44
17	9.80 151	15	9.91 276	25	0.08 724	9.88 875	10	43
18	9.80 166	16	9.91 301	26	0.08 699	9.88 865	10	42
19	9.80 182	15	9.91 327	26	0.08 673	9.88 855	11	41
20	9.80 197	16	9.91 353	26	0.08 647	9.88 844	10	40
21	9.80 213	15	9.91 379	25	0.08 621	9.88 834	10	39
22	9.80 228	16	9.91 404	26	0.08 596	9.88 824	11	38
23	9.80 244	15	9.91 430	26	0.08 570	9.88 813	10	37
24	9.80 259	15	9.91 456	26	0.08 544	9.88 803	10	36
25	9.80 274	16	9.91 482	25	0.08 518	9.88 793	11	35
26	9.80 290	15	9.91 507	26	0.08 493	9.88 782	10	34
27	9.80 305	15	9.91 533	26	0.08 467	9.88 772	11	33
28	9.80 320	16	9.91 559	26	0.08 441	9.88 761	10	32
29	9.80 336	15	9.91 585	25	0.08 415	9.88 751	10	31
30	9.80 351	15	9.91 610	26	0.08 390	9.88 741	11	30
31	9.80 366	16	9.91 636	26	0.08 364	9.88 730	10	29
32	9.80 382	15	9.91 662	26	0.08 338	9.88 720	11	28
33	9.80 397	15	9.91 688	25	0.08 312	9.88 709	10	27
34	9.80 412	16	9.91 713	26	0.08 287	9.88 699	11	26
35	9.80 428	15	9.91 739	26	0.08 261	9.88 688	10	25
36	9.80 443	15	9.91 765	26	0.08 235	9.88 678	10	24
37	9.80 458	15	9.91 791	25	0.08 209	9.88 668	11	23
38	9.80 473	16	9.91 816	26	0.08 184	9.88 657	10	22
39	9.80 489	15	9.91 842	26	0.08 158	9.88 647	11	21
40	9.80 504	15	9.91 868	25	0.08 132	9.88 636	10	20
41	9.80 519	15	9.91 893	26	0.08 107	9.88 626	11	19
42	9.80 534	16	9.91 919	26	0.08 081	9.88 615	10	18
43	9.80 550	15	9.91 945	26	0.08 055	9.88 605	11	17
44	9.80 565	15	9.91 971	25	0.08 029	9.88 594	10	16
45	9.80 580	15	9.91 996	26	0.08 004	9.88 584	11	15
46	9.80 595	15	9.92 022	26	0.07 978	9.88 573	10	14
47	9.80 610	15	9.92 048	25	0.07 952	9.88 563	11	13
48	9.80 625	16	9.92 073	26	0.07 927	9.88 552	10	12
49	9.80 641	15	9.92 099	26	0.07 901	9.88 542	11	11
50	9.80 656	15	9.92 125	25	0.07 875	9.88 531	10	10
51	9.80 671	15	9.92 150	26	0.07 850	9.88 521	11	9
52	9.80 686	15	9.92 176	26	0.07 824	9.88 510	11	8
53	9.80 701	15	9.92 202	25	0.07 798	9.88 499	10	7
54	9.80 716	15	9.92 227	26	0.07 773	9.88 489	11	6
55	9.80 731	15	9.92 253	26	0.07 747	9.88 478	10	5
56	9.80 746	16	9.92 279	25	0.07 721	9.88 468	11	4
57	9.80 762	15	9.92 304	26	0.07 696	9.88 457	10	3
58	9.80 777	15	9.92 330	26	0.07 670	9.88 447	11	2
59	9.80 792	15	9.92 356	25	0.07 644	9.88 436	11	1
60	9.80 807		9.92 381		0.07 619	9.88 425		0
′	L. Cos.	d.	L. Cot.	c d.	L. Tan	L. Sin	d	′

P. P.

″	26	25
1	0.4	0.4
2	0.9	0.8
3	1.3	1.2
4	1.7	1.7
5	2.2	2.1
6	2.6	2.5
7	3.0	2.9
8	3.5	3.3
9	3.9	3.8
10	4.3	4.2
20	8.7	8.3
30	13.0	12.5
40	17.3	16.7
50	21.7	20.8

″	16	15
1	0.3	0.2
2	0.5	0.5
3	0.8	0.8
4	1.1	1.0
5	1.3	1.2
6	1.6	1.5
7	1.9	1.8
8	2.1	2.0
9	2.4	2.2
10	2.7	2.5
20	5.3	5.0
30	8.0	7.5
40	10.7	10.0
50	13.3	12.5

″	11	10
1	0.2	0.2
2	0.4	0.3
3	0.6	0.5
4	0.7	0.7
5	0.9	0.8
6	1.1	1.0
7	1.3	1.2
8	1.5	1.3
9	1.6	1.5
10	1.8	1.7
20	3.7	3.3
30	5.5	5.0
40	7.3	6.7
50	9.2	8.3

	11/26	11/25
0	1.2	1.1
1	3.5	3.4
2	5.9	5.7
3	8.3	7.9
4	10.6	10.2
5	13.0	12.5
6	15.4	14.8
7	17.7	17.1
8	20.1	19.3
9	22.5	21.6
10	24.8	23.9
11		

P. P.

40° (220°) (319°) **139°**

′	L. Sin.	d.	L. Tan.	c.d.	L. Cot.	L. Cos.	d.	′
0	9.80 807	15	9.92 381	26	0.07 619	9.88 425	10	60
1	9.80 822	15	9.92 407	26	0.07 593	9.88 415	11	59
2	9.80 837	15	9.92 433	25	0.07 567	9.88 404	10	58
3	9.80 852	15	9.92 458	26	0.07 542	9.88 394	11	57
4	9.80 867	15	9.92 484	26	0.07 516	9.88 383	11	56
5	9.80 882	15	9.92 510	25	0.07 490	9.88 372	10	55
6	9.80 897	15	9.92 535	26	0.07 465	9.88 362	11	54
7	9.80 912	15	9.92 561	26	0.07 439	9.88 351	11	53
8	9.80 927	15	9.92 587	25	0.07 413	9.88 340	10	52
9	9.80 942	15	9.92 612	26	0.07 388	9.88 330	11	51
10	9.80 957	15	9.92 638	25	0.07 362	9.88 319	11	50
11	9.80 972	15	9.92 663	26	0.07 337	9.88 308	10	49
12	9.80 987	15	9.92 689	26	0.07 311	9.88 298	11	48
13	9.81 002	15	9.92 715	25	0.07 285	9.88 287	11	47
14	9.81 017	15	9.92 740	26	0.07 260	9.88 276	10	46
15	9.81 032	15	9.92 766	26	0.07 234	9.88 266	11	45
16	9.81 047	14	9.92 792	25	0.07 208	9.88 255	11	44
17	9.81 061	15	9.92 817	26	0.07 183	9.88 244	10	43
18	9.81 076	15	9.92 843	25	0.07 157	9.88 234	11	42
19	9.81 091	15	9.92 868	26	0.07 132	9.88 223	11	41
20	9.81 106	15	9.92 894	26	0.07 106	9.88 212	11	40
21	9.81 121	15	9.92 920	25	0.07 080	9.88 201	10	39
22	9.81 136	15	9.92 945	26	0.07 055	9.88 191	11	38
23	9.81 151	15	9.92 971	25	0.07 029	9.88 180	11	37
24	9.81 166	14	9.92 996	26	0.07 004	9.88 169	11	36
25	9.81 180	15	9.93 022	26	0.06 978	9.88 158	10	35
26	9.81 195	15	9.93 048	25	0.06 952	9.88 148	11	34
27	9.81 210	15	9.93 073	26	0.06 927	9.88 137	11	33
28	9.81 225	15	9.93 099	25	0.06 901	9.88 126	11	32
29	9.81 240	14	9.93 124	26	0.06 876	9.88 115	10	31
30	9.81 254	15	9.93 150	25	0.06 850	9.88 105	11	30
31	9.81 269	15	9.93 175	26	0.06 825	9.88 094	11	29
32	9.81 284	15	9.93 201	26	0.06 799	9.88 083	11	28
33	9.81 299	15	9.93 227	25	0.06 773	9.88 072	11	27
34	9.81 314	14	9.93 252	26	0.06 748	9.88 061	10	26
35	9.81 328	15	9.93 278	25	0.06 722	9.88 051	11	25
36	9.81 343	15	9.93 303	26	0.06 697	9.88 040	11	24
37	9.81 358	14	9.93 329	25	0.06 671	9.88 029	11	23
38	9.81 372	15	9.93 354	26	0.06 646	9.88 018	11	22
39	9.81 387	15	9.93 380	26	0.06 620	9.88 007	11	21
40	9.81 402	15	9.93 406	25	0.06 594	9.87 996	11	20
41	9.81 417	14	9.93 431	26	0.06 569	9.87 985	10	19
42	9.81 431	15	9.93 457	25	0.06 543	9.87 975	11	18
43	9.81 446	15	9.93 482	26	0.06 518	9.87 964	11	17
44	9.81 461	14	9.93 508	25	0.06 492	9.87 953	11	16
45	9.81 475	15	9.93 533	26	0.06 467	9.87 942	11	15
46	9.81 490	15	9.93 559	25	0.06 441	9.87 931	11	14
47	9.81 505	14	9.93 584	26	0.06 416	9.87 920	11	13
48	9.81 519	15	9.93 610	26	0.06 390	9.87 909	11	12
49	9.81 534	15	9.93 636	25	0.06 364	9.87 898	11	11
50	9.81 549	14	9.93 661	26	0.06 339	9.87 887	10	10
51	9.81 563	15	9.93 687	25	0.06 313	9.87 877	11	9
52	9.81 578	14	9.93 712	26	0.06 288	9.87 866	11	8
53	9.81 592	15	9.93 738	25	0.06 262	9.87 855	11	7
54	9.81 607	15	9.93 763	26	0.06 237	9.87 844	11	6
55	9.81 622	14	9.93 789	25	0.06 211	9.87 833	11	5
56	9.81 636	15	9.93 814	26	0.06 186	9.87 822	11	4
57	9.81 651	14	9.93 840	25	0.06 160	9.87 811	11	3
58	9.81 665	15	9.93 865	26	0.06 135	9.87 800	11	2
59	9.81 680	14	9.93 891	25	0.06 109	9.87 789	11	1
60	9.81 694		9.93 916		0.06 084	9.87 778		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin	d.	′

P. P.

″	26	25
1	0.4	0.4
2	0.9	0.8
3	1.3	1.2
4	1.7	1.7
5	2.2	2.1
6	2.6	2.5
7	3.0	2.9
8	3.5	3.3
9	3.9	3.8
10	4.3	4.2
20	8.7	8.3
30	13.0	12.5
40	17.3	16.7
50	21.7	20.8

″	15	14
1	0.2	0.2
2	0.5	0.5
3	0.8	0.7
4	1.0	0.9
5	1.2	1.2
6	1.5	1.4
7	1.8	1.6
8	2.0	1.9
9	2.2	2.1
10	2.5	2.3
20	5.0	4.7
30	7.5	7.0
40	10.0	9.3
50	12.5	11.7

″	11	10
1	0.2	0.2
2	0.4	0.3
3	0.6	0.5
4	0.7	0.7
5	0.9	0.8
6	1.1	1.0
7	1.3	1.2
8	1.5	1.3
9	1.6	1.5
10	1.8	1.7
20	3.7	3.3
30	5.5	5.0
40	7.3	6.7
50	9.2	8.3

	11/26	10/26	10/25
0			
1	1.2	1.3	1.2
2	3.5	3.9	3.8
3	5.9	6.5	6.2
4	8.3	9.1	8.8
5	10.6	11.7	11.2
6	13.0	14.3	13.8
7	15.4	16.9	16.3
8	17.7	19.5	18.8
9	20.1	22.1	21.2
10	22.5	24.7	23.8
11	24.8	—	—

P. P.

130° (310°) (229°) **49°**

41° (221°) (318°) **138°**

′	L. Sin.	d.	L. Tan.	c d	L. Cot.	L. Cos.	d	′
0	9.81 694	15	9.93 916	26	0.06 084	9.87 778	11	60
1	9.81 709	14	9.93 942	25	0.06 058	9.87 767	11	59
2	9.81 723	15	9.93 967	26	0.06 033	9.87 756	11	58
3	9.81 738	14	9.93 993	25	0.06 007	9.87 745	11	57
4	9.81 752	15	9.94 018	26	0.05 982	9.87 734	11	56
5	9.81 767	14	9.94 044	25	0.05 956	9.87 723	11	55
6	9.81 781	15	9.94 069	26	0.05 931	9.87 712	11	54
7	9.81 796	14	9.94 095	25	0.05 905	9.87 701	11	53
8	9.81 810	15	9.94 120	26	0.05 880	9.87 690	11	52
9	9.81 825	14	9.94 146	25	0.05 854	9.87 679	11	51
10	9.81 839	15	9.94 171	26	0.05 829	9.87 668	11	50
11	9.81 854	14	9.94 197	25	0.05 803	9.87 657	11	49
12	9.81 868	14	9.94 222	26	0.05 778	9.87 646	11	48
13	9.81 882	15	9.94 248	25	0.05 752	9.87 635	11	47
14	9.81 897	14	9.94 273	26	0.05 727	9.87 621	11	46
15	9.81 911	15	9.94 299	25	0.05 701	9.87 613	12	45
16	9.81 926	14	9.94 324	26	0.05 676	9.87 601	11	44
17	9.81 940	15	9.94 350	25	0.05 650	9.87 590	11	43
18	9.81 955	14	9.94 375	26	0.05 625	9.87 579	11	42
19	9.81 969	14	9.94 401	25	0.05 599	9.87 568	11	41
20	9.81 983	15	9.94 426	26	0.05 574	9.87 557	11	40
21	9.81 998	14	9.94 452	25	0.05 548	9.87 546	11	39
22	9.82 012	14	9.94 477	26	0.05 523	9.87 535	11	38
23	9.82 026	15	9.94 503	25	0.05 497	9.87 524	11	37
24	9.82 041	14	9.94 528	26	0.05 472	9.87 513	12	36
25	9.82 055	14	9.94 554	25	0.05 446	9.87 501	11	35
26	9.82 069	15	9.94 579	25	0.05 421	9.87 490	11	34
27	9.82 084	14	9.94 604	26	0.05 396	9.87 479	11	33
28	9.82 098	14	9.94 630	25	0.05 370	9.87 468	11	32
29	9.82 112	14	9.94 655	26	0.05 345	9.87 457	11	31
30	9.82 126	15	9.94 681	25	0.05 319	9.87 446	12	30
31	9.82 141	14	9.94 706	26	0.05 294	9.87 434	11	29
32	9.82 155	14	9.94 732	25	0.05 268	9.87 423	11	28
33	9.82 169	15	9.94 757	26	0.05 243	9.87 412	11	27
34	9.82 184	14	9.94 783	25	0.05 217	9.87 401	11	26
35	9.82 198	14	9.94 808	26	0.05 192	9.87 390	12	25
36	9.82 212	14	9.94 834	25	0.05 166	9.87 378	11	24
37	9.82 226	14	9.94 859	25	0.05 141	9.87 367	11	23
38	9.82 240	15	9.94 884	26	0.05 116	9.87 356	11	22
39	9.82 255	14	9.94 910	25	0.05 090	9.87 345	11	21
40	9.82 269	14	9.94 935	26	0.05 065	9.87 334	12	20
41	9.82 283	14	9.94 961	25	0.05 039	9.87 322	11	19
42	9.82 297	14	9.94 986	26	0.05 014	9.87 311	11	18
43	9.82 311	15	9.95 012	25	0.04 988	9.87 300	12	17
44	9.82 326	14	9.95 037	25	0.04 963	9.87 288	11	16
45	9.82 340	14	9.95 062	26	0.04 938	9.87 277	11	15
46	9.82 354	14	9.95 088	25	0.04 912	9.87 266	11	14
47	9.82 368	14	9.95 113	26	0.04 887	9.87 255	12	13
48	9.82 382	14	9.95 139	25	0.04 861	9.87 243	11	12
49	9.82 396	14	9.95 164	26	0.04 836	9.87 232	11	11
50	9.82 410	14	9.95 190	25	0.04 810	9.87 221	12	10
51	9.82 424	15	9.95 215	25	0.04 785	9.87 209	11	9
52	9.82 439	14	9.95 240	26	0.04 760	9.87 198	11	8
53	9.82 453	14	9.95 266	25	0.04 734	9.87 187	12	7
54	9.82 467	14	9.95 291	26	0.04 709	9.87 175	11	6
55	9.82 481	14	9.95 317	25	0.04 683	9.87 164	11	5
56	9.82 495	14	9.95 342	26	0.04 658	9.87 153	12	4
57	9.82 509	14	9.95 368	25	0.04 632	9.87 141	11	3
58	9.82 523	14	9.95 393	25	0.04 607	9.87 130	11	2
59	9.82 537	14	9.95 418	26	0.04 582	9.87 119	12	1
60	9.82 551		9.95 444		0.04 556	9.87 107		0
′	L. Cos.	d.	L. Cot.	c d	L. Tan.	L. Sin	d	′

P. P.

″	26	25
1	0.4	0.4
2	0.9	0.8
3	1.3	1.2
4	1.7	1.7
5	2.2	2.1
6	2.6	2.5
7	3.0	2.9
8	3.5	3.3
9	3.9	3.8
10	4.3	4.2
20	8.7	8.3
30	13.0	12.5
40	17.3	16.7
50	21.7	20.8

″	15	14
1	0.2	0.2
2	0.5	0.5
3	0.8	0.7
4	1.0	0.9
5	1.2	1.2
6	1.5	1.4
7	1.8	1.6
8	2.0	1.9
9	2.2	2.1
10	2.5	2.3
20	5.0	4.7
30	7.5	7.0
40	10.0	9.3
50	12.5	11.7

″	12	11
1	0.2	0.2
2	0.4	0.4
3	0.6	0.6
4	0.8	0.7
5	1.0	0.9
6	1.2	1.1
7	1.4	1.3
8	1.6	1.5
9	1.8	1.6
10	2.0	1.8
20	4.0	3.7
30	6.0	5.5
40	8.0	7.3
50	10.0	9.2

	12/26	12/25	11/25
0	1.1	1.1	1.1
1	3.2	3.1	3.4
2	5.4	5.2	5.7
3	7.6	7.3	7.9
4	9.8	9.4	10.2
5	11.9	11.5	12.5
6	14.1	13.5	14.8
7	16.2	15.6	17.1
8	18.4	17.7	19.3
9	20.6	19.8	21.6
10	22.8	21.9	23.9
11	24.9	23.9	—
12			

P. P.

131° (311°) (228°) **48°**

LOGARITHMS OF THE FUNCTIONS (Continued)

42° (222°) (317°) **137°**

′	L. Sin	d.	L. Tan.	c d.	L. Cot.	L. Cos.	d.	′
0	9.82 551	14	9.95 444	25	0.04 556	9.87 107	11	**60**
1	9.82 565	14	9.95 469	26	0.04 531	9.87 096	11	59
2	9.82 579	14	9.95 495	25	0.04 505	9.87 085	12	58
3	9.82 593	14	9.95 520	25	0.04 480	9.87 073	11	57
4	9.82 607	14	9.95 545	26	0.04 455	9.87 062	12	56
5	9.82 621	14	9.95 571	25	0.04 429	9.87 050	11	55
6	9.82 635	14	9.95 596	26	0.04 404	9.87 039	11	54
7	9.82 649	14	9.95 622	25	0.04 378	9.87 028	12	53
8	9.82 663	14	9.95 647	25	0.04 353	9.87 016	11	52
9	9.82 677	14	9.95 672	26	0.04 328	9.87 005	12	51
10	9.82 691	14	9.95 698	25	0.04 302	9.86 993	11	**50**
11	9.82 705	14	9.95 723	25	0.04 277	9.86 982	12	49
12	9.82 719	14	9.95 748	26	0.04 252	9.86 970	11	48
13	9.82 733	14	9.95 774	25	0.04 226	9.86 959	12	47
14	9.82 747	14	9.95 799	26	0.04 201	9.86 947	11	46
15	9.82 761	14	9.95 825	25	0.04 175	9.86 936	12	45
16	9.82 775	13	9.95 850	25	0.04 150	9.86 924	11	44
17	9.82 788	14	9.95 875	26	0.04 125	9.86 913	11	43
18	9.82 802	14	9.95 901	25	0.04 099	9.86 902	12	42
19	9.82 816	14	9.95 926	26	0.04 074	9.86 890	11	41
20	9.82 830	14	9.95 952	25	0.04 048	9.86 879	12	**40**
21	9.82 844	14	9.95 977	25	0.04 023	9.86 867	12	39
22	9.82 858	14	9.96 002	26	0.03 998	9.86 855	11	38
23	9.82 872	13	9.96 028	25	0.03 972	9.86 844	12	37
24	9.82 885	14	9.96 053	25	0.03 947	9.86 832	11	36
25	9.82 899	14	9.96 078	26	0.03 922	9.86 821	12	35
26	9.82 913	14	9.96 104	25	0.03 896	9.86 809	11	34
27	9.82 927	14	9.96 129	26	0.03 871	9.86 798	12	33
28	9.82 941	14	9.96 155	25	0.03 845	9.86 786	11	32
29	9.82 955	13	9.96 180	25	0.03 820	9.86 775	12	31
30	9.82 968	14	9.96 205	26	0.03 795	9.86 763	11	**30**
31	9.82 982	14	9.96 231	25	0.03 769	9.86 752	12	29
32	9.82 996	14	9.96 256	25	0.03 744	9.86 740	12	28
33	9.83 010	13	9.96 281	26	0.03 719	9.86 728	11	27
34	9.83 023	14	9.96 307	25	0.03 693	9.86 717	12	26
35	9.83 037	14	9.96 332	25	0.03 668	9.86 705	11	25
36	9.83 051	14	9.96 357	26	0.03 643	9.86 694	12	24
37	9.83 065	13	9.96 383	25	0.03 617	9.86 682	12	23
38	9.83 078	14	9.96 408	25	0.03 592	9.86 670	11	22
39	9.83 092	14	9.96 433	26	0.03 567	9.86 659	12	21
40	9.83 106	14	9.96 459	25	0.03 541	9.86 647	12	**20**
41	9.83 120	13	9.96 484	26	0.03 516	9.86 635	11	19
42	9.83 133	14	9.96 510	25	0.03 490	9.86 624	12	18
43	9.83 147	14	9.96 535	25	0.03 465	9.86 612	12	17
44	9.83 161	13	9.96 560	26	0.03 440	9.86 600	11	16
45	9.83 174	14	9.96 586	25	0.03 414	9.86 589	12	15
46	9.83 188	14	9.96 611	25	0.03 389	9.86 577	12	14
47	9.83 202	13	9.96 636	26	0.03 364	9.86 565	11	13
48	9.83 215	14	9.96 662	25	0.03 338	9.86 554	12	12
49	9.83 229	13	9.96 687	25	0.03 313	9.86 542	12	11
50	9.83 242	14	9.96 712	26	0.03 288	9.86 530	12	**10**
51	9.83 256	14	9.96 738	25	0.03 262	9.86 518	11	9
52	9.83 270	13	9.96 763	25	0.03 237	9.86 507	12	8
53	9.83 283	14	9.96 788	26	0.03 212	9.86 495	12	7
54	9.83 297	13	9.96 814	25	0.03 186	9.86 483	11	6
55	9.83 310	14	9.96 839	25	0.03 161	9.86 472	12	5
56	9.83 324	14	9.96 864	26	0.03 136	9.86 460	12	4
57	9.83 338	13	9.96 890	25	0.03 110	9.86 448	12	3
58	9.83 351	14	9.96 915	25	0.03 085	9.86 436	11	2
59	9.83 365	13	9.96 940	26	0.03 060	9.86 425	12	1
60	9.83 378		9.96 966		0.03 034	9.86 413		**0**
′	L. Cos.	d.	L. Cot.	c d.	L. Tan.	L. Sin	d.	′

P. P.

″	**26**	**25**
1	0.4	0.4
2	0.9	0.8
3	1.3	1.2
4	1.7	1.7
5	2.2	2.1
6	2.6	2.5
7	3.0	2.9
8	3.5	3.3
9	3.9	3.8
10	4.3	4.2
20	8.7	8.3
30	13.0	12.5
40	17.3	16.7
50	21.7	20.8

″	**14**	**13**
1	0.2	0.2
2	0.5	0.4
3	0.7	0.6
4	0.9	0.9
5	1.2	1.1
6	1.4	1.3
7	1.6	1.5
8	1.9	1.7
9	2.1	2.0
10	2.3	2.2
20	4.7	4.3
30	7.0	6.5
40	9.3	8.7
50	11.7	10.8

″	**12**	**11**
1	0.2	0.2
2	0.4	0.4
3	0.6	0.6
4	0.8	0.7
5	1.0	0.9
6	1.2	1.1
7	1.4	1.3
8	1.6	1.5
9	1.8	1.6
10	2.0	1.8
20	4.0	3.7
30	6.0	5.5
40	8.0	7.3
50	10.0	9.2

	12/26	**11/26**	**11/25**
0	1.1	1.2	1.1
1	3.2	3.6	3.4
2	5.4	5.9	5.7
3	7.6	8.3	7.9
4	9.8	10.6	10.2
5	11.9	13.0	12.5
6	14.1	15.4	14.8
7	16.2	17.7	17.1
8	18.4	20.1	19.3
9	20.6	22.5	21.6
10	22.8	24.8	23.9
11	24.9	—	—
12			

P. P.

132° (312°) (227°) **47°**

'	L. Sin.	d.	L. Tan.	c d.	L. Cot.	L. Cos.	d	'
0	9.83 378	14	9.96 966	25	0.03 034	9.86 413	12	**60**
1	9.83 392	13	9.96 991	25	0.03 009	9.86 401	12	59
2	9.83 405	14	9.97 016	26	0.02 984	9.86 389	12	58
3	9.83 419	13	9.97 042	25	0.02 958	9.86 377	11	57
4	9.83 432	14	9.97 067	25	0.02 933	9.86 366	12	56
5	9.83 446	13	9.97 092	26	0.02 908	9.86 354	12	55
6	9.83 459	14	9.97 118	25	0.02 882	9.86 342	12	54
7	9.83 473	13	9.97 143	25	0.02 857	9.86 330	12	53
8	9.83 486	14	9.97 168	25	0.02 832	9.86 318	12	52
9	9.83 500	13	9.97 193	26	0.02 807	9.86 306	11	51
10	9.83 513	14	9.97 219	25	0.02 781	9.86 295	12	**50**
11	9.83 527	13	9.97 244	25	0.02 756	9.86 283	12	49
12	9.83 540	14	9.97 269	26	0.02 731	9.86 271	12	48
13	9.83 554	13	9.97 295	25	0.02 705	9.86 259	12	47
14	9.83 567	14	9.97 320	25	0.02 680	9.86 217	12	46
15	9.83 581	13	9.97 345	26	0.02 655	9.86 235	12	45
16	9.83 594	14	9.97 371	25	0.02 629	9.86 223	12	44
17	9.83 608	13	9.97 396	25	0.02 604	9.86 211	11	43
18	9.83 621	13	9.97 421	26	0.02 579	9.86 200	12	42
19	9.83 634	14	9.97 447	25	0.02 553	9.86 188	12	41
20	9.83 648	13	9.97 472	25	0.02 528	9.86 176	12	**40**
21	9.83 661	13	9.97 497	26	0.02 503	9.86 164	12	39
22	9.83 674	14	9.97 523	25	0.02 477	9.86 152	12	38
23	9.83 688	13	9.97 548	25	0.02 452	9.86 140	12	37
24	9.83 701	14	9.97 573	25	0.02 427	9.86 128	12	36
25	9.83 715	13	9.97 598	26	0.02 402	9.86 116	12	35
26	9.83 728	13	9.97 624	25	0.02 376	9.86 104	12	34
27	9.83 741	14	9.97 649	25	0.02 351	9.86 092	12	33
28	9.83 755	13	9.97 674	26	0.02 326	9.86 080	12	32
29	9.83 768	13	9.97 700	25	0.02 300	9.86 068	12	31
30	9.83 781	14	9.97 725	25	0.02 275	9.86 056	12	**30**
31	9.83 795	13	9.97 750	26	0.02 250	9.86 044	12	29
32	9.83 808	13	9.97 776	25	0.02 224	9.86 032	12	28
33	9.83 821	13	9.97 801	25	0.02 199	9.86 020	12	27
34	9.83 834	14	9.97 826	25	0.02 174	9.86 008	12	26
35	9.83 848	13	9.97 851	26	0.02 149	9.85 996	12	25
36	9.83 861	13	9.97 877	25	0.02 123	9.85 984	12	24
37	9.83 874	13	9.97 902	25	0.02 098	9.85 972	12	23
38	9.83 887	14	9.97 927	26	0.02 073	9.85 960	12	22
39	9.83 901	13	9.97 953	25	0.02 047	9.85 948	12	21
40	9.83 914	13	9.97 978	25	0.02 022	9.85 936	12	**20**
41	9.83 927	13	9.98 003	26	0.01 997	9.85 924	12	19
42	9.83 940	14	9.98 029	25	0.01 971	9.85 912	12	18
43	9.83 954	13	9.98 054	25	0.01 946	9.85 900	12	17
44	9.83 967	13	9.98 079	25	0.01 921	9.85 888	12	16
45	9.83 980	13	9.98 104	26	0.01 896	9.85 876	12	15
46	9.83 993	13	9.98 130	25	0.01 870	9.85 864	13	14
47	9.84 006	14	9.98 155	25	0.01 845	9.85 851	12	13
48	9.84 020	13	9.98 180	26	0.01 820	9.85 839	12	12
49	9.84 033	13	9.98 206	25	0.01 794	9.85 827	12	11
50	9.84 046	13	9.98 231	25	0.01 769	9.85 815	12	**10**
51	9.84 059	13	9.98 256	25	0.01 744	9.85 803	12	9
52	9.84 072	13	9.98 281	26	0.01 719	9.85 791	12	8
53	9.84 085	13	9.98 307	25	0.01 693	9.85 779	13	7
54	9.84 098	14	9.98 332	25	0.01 668	9.85 766	12	6
55	9.84 112	13	9.98 357	26	0.01 643	9.85 754	12	5
56	9.84 125	13	9.98 383	25	0.01 617	9.85 742	12	4
57	9.84 138	13	9.98 408	25	0.01 592	9.85 730	12	3
58	9.84 151	13	9.98 433	25	0.01 567	9.85 718	12	2
59	9.84 164	13	9.98 458	26	0.01 542	9.85 706	13	1
60	9.84 177		9.98 484		0.01 516	9.85 693		**0**
'	L. Cos	d.	L. Cot.	c.d	L. Tan.	L. Sin.	d	'

P. P.

"	**26**	**25**
1	0.4	0.4
2	0.9	0.8
3	1.3	1.2
4	1.7	1.7
5	2.2	2.1
6	2.6	2.5
7	3.0	2.9
8	3.5	3.3
9	3.9	3.8
10	4.3	4.2
20	8.7	8.3
30	13.0	12.5
40	17.3	16.7
50	21.7	20.8

"	**14**	**13**
1	0.2	0.2
2	0.5	0.4
3	0.7	0.6
4	0.9	0.9
5	1.2	1.1
6	1.4	1.3
7	1.6	1.5
8	1.9	1.7
9	2.1	2.0
10	2.3	2.2
20	4.7	4.3
30	7.0	6.5
40	9.3	8.7
50	11.7	10.8

"	**12**	**11**
1	0.2	0.2
2	0.4	0.4
3	0.6	0.6
4	0.8	0.7
5	1.0	0.9
6	1.2	1.1
7	1.4	1.3
8	1.6	1.5
9	1.8	1.6
10	2.0	1.8
20	4.0	3.7
30	6.0	5.5
40	8.0	7.3
50	10.0	9.2

	13 / **26**	**13** / **25**	**12** / **25**
0	1.0	0.9	1.1
1	3.0	2.9	3.1
2	5.0	4.8	5.2
3	7.0	6.7	7.3
4	9.0	8.7	9.4
5	11.0	10.6	11.5
6	13.0	12.5	13.6
7	15.0	14.4	15.6
8	17.0	16.3	17.7
9	19.0	18.3	19.8
10	21.0	20.2	21.9
11	23.0	22.1	23.9
12	25.0	24.1	—
13			

P. P.

44° (224°) (315°) **135°**

′	L. Sin.	d.	L. Tan.	c d.	L. Cot.	L. Cos.	d.	′
0	9.84 177	13	9.98 484	25	0.01 516	9.85 693	12	60
1	9.84 190	13	9.98 509	25	0.01 491	9.85 681	12	59
2	9 84 203	13	9.98 534	26	0.01 466	9.85 669	12	58
3	9.84 216	13	9.98 560	25	0.01 440	9.85 657	12	57
4	9.84 229	13	9.98 585	25	0.01 415	9 85 645	13	56
5	9.84 242	13	9.98 610	25	0.01 390	9.85 632	12	55
6	9.84 255	14	9.98 635	26	0.01 365	9.85 620	12	54
7	9.84 269	13	9.98 661	25	0.01 339	9.85 608	12	53
8	9.84 282	13	9.98 686	25	0.01 314	9.85 596	13	52
9	9.84 295	13	9.98 711	26	0.01 289	9.85 583	12	51
10	9.84 308	13	9.98 737	25	0 01 263	9.85 571	12	50
11	9.84 321	13	9.98 762	25	0.01 238	9.85 559	12	49
12	9 84 334	13	9.98 787	25	0.01 213	9.85 547	13	48
13	9.84 347	13	9.98 812	26	0.01 188	9.85 534	12	47
14	9 84 360	13	9.98 838	25	0.01 162	9.85 522	12	46
15	9.84 373	12	9.98 863	25	0.01 137	9.85 510	13	45
16	9.84 385	13	9.98 888	25	0 01 112	9.85 497	12	44
17	9.84 398	13	9.98 913	26	0.01 087	9 85 485	12	43
18	9.84 411	13	9.98 939	25	0.01 061	9.85 473	13	42
19	9.84 424	13	9.98 964	25	0 01 036	9.85 460	12	41
20	9.84 437	13	9.98 989	26	0.01 011	9.85 448	12	40
21	9.84 450	13	9.99 015	25	0 00 985	9.85 436	13	39
22	9.84 463	13	9.99 040	25	0.00 960	9.85 423	12	38
23	9.84 476	13	9.99 065	25	0 00 935	9 85 411	12	37
24	9.84 489	13	9.99 090	26	0 00 910	9 85 399	13	36
25	9 84 502	13	9 99 116	25	0 00 884	9 85 386	12	35
26	9.84 515	13	9.99 141	25	0.00 859	9.85 374	13	34
27	9.84 528	12	9.99 166	25	0.00 834	9.85 361	12	33
28	9.84 540	13	9.99 191	26	0.00 809	9 85 349	12	32
29	9.84 553	13	9.99 217	25	0 00 783	9 85 337	13	31
30	9.84 566	13	9.99 242	25	0 00 758	9.85 324	12	30
31	9.84 579	13	9.99 267	26	0.00 733	9 85 312	13	29
32	9.84 592	13	9.99 293	25	0 00 707	9.85 299	12	28
33	9.84 605	13	9.99 318	25	0 00 682	9.85 287	13	27
34	9.84 618	12	9 99 343	25	0 00 657	9.85 274	12	26
35	9.84 630	13	9 99 368	26	0 00 632	9.85 262	12	25
36	9.84 643	13	9 99 394	25	0 00 606	9 85 250	13	24
37	9.84 656	13	9 99 419	25	0.00 581	9 85 237	12	23
38	9.84 669	13	9.99 444	25	0.00 556	9 85 225	13	22
39	9.84 682	12	9 99 469	26	0.00 531	9.85 212	12	21
40	9 84 694	13	9.99 495	25	0.00 505	9.85 200	13	20
41	9.84 707	13	9.99 520	25	0.00 480	9 85 187	12	19
42	9.84 720	13	9.99 545	25	0.00 455	9 85 175	13	18
43	9.84 733	12	9.99 570	26	0 00 430	9.85 162	12	17
44	9.84 745	13	9.99 596	25	0 00 404	9.85 150	13	16
45	9 84 758	13	9.99 621	25	0.00 379	9.85 137	12	15
46	9.84 771	13	9 99 646	26	0 00 354	9.85 125	13	14
47	9.84 784	12	9.99 672	25	0 00 328	9.85 112	12	13
48	9.84 796	13	9 99 697	25	0.00 303	9.85 100	13	12
49	9.84 809	13	9.99 722	25	0.00 278	9 85 087	13	11
50	9.84 822	13	9 99 747	26	0.00 253	9.85 074	12	10
51	9.84 835	12	9.99 773	25	0.00 227	9.85 062	13	9
52	9.84 847	13	9 99 798	25	0 00 202	9.85 049	12	8
53	9.84 860	13	9.99 823	25	0 00 177	9.85 037	13	7
54	9.84 873	12	9 99 848	26	0 00 152	9.85 024	12	6
55	9.84 885	13	9.99 874	25	0.00 126	9.85 012	13	5
56	9.84 898	13	9.99 899	25	0.00 101	9.84 999	13	4
57	9.84 911	12	9.99 924	25	0.00 076	9.84 986	12	3
58	9.84 923	13	9.99 949	26	0.00 051	9.84 974	13	2
59	9.84 936	13	9.99 975	25	0.00 025	9.84 961	12	1
60	9.84 949		0.00 000		0.00 000	9.84 949		0
′	L. Cos.	d.	L. Cot.	c.d.	L. Tan.	L. Sin.	d.	′

P P.

″	26	25
1	0.4	0.4
2	0.9	0.8
3	1.3	1 2
4	1.7	1.7
5	2.2	2.1
6	2.6	2 5
7	3 0	2 9
8	3 5	3.3
9	3.9	3 8
10	4.3	4 2
20	8 7	8.3
30	13 0	12.5
40	17.3	16 7
50	21.7	20 8

″	14	13	12
1	0.2	0 2	0 2
2	0 5	0 4	0 4
3	0.7	0 6	0 6
4	0.9	0.9	0 8
5	1.2	1.1	1 0
6	1.4	1 3	1.2
7	1 6	1 5	1.4
8	1.9	1 7	1.6
9	2.1	2 0	1.8
10	2 3	2 2	2 0
20	4.7	4.3	4 0
30	7.0	6.5	6.0
40	9.3	8.7	8.0
50	11.7	10.8	10 0

	13/26	13/25
0		
1	1.0	0 9
2	3 0	2 9
3	5 0	4 8
4	7 0	6 7
5	9 0	8 7
6	11.0	10 6
7	13 0	12 5
8	15 0	14 4
9	17 0	16 3
10	19 0	18 3
11	21 0	20 2
12	23 0	22 1
13	25.0	24.1

	12/26	12/25
0		
1	1.1	1.1
2	3.2	3 1
3	5.4	5.2
4	7.6	7.3
5	9.8	9.4
6	11.9	11 5
7	14.1	13.6
8	16.2	15 6
9	18 4	17.7
10	20 6	19.8
11	22 8	21.9
12	24.9	23.9

P P.

134° (314°) (225°) **45°**

NATURAL TRIGONOMETRIC FUNCTIONS

Values of the trigonometric functions of angles for each minute from 0–360°.

For degrees indicated at the top of the page use the column headings at the top. For degrees indicated at the bottom use the column indications at the bottom.

With degrees at the left of each block (top or bottom), use the minute column at the left and with degrees at the right of each block use the minute column at the right.

NATURAL FUNCTIONS (Continued)

0° (180°) (359°) **179°**

′	Sin	Tan	Cot	Cos	′
0	.00000	.00000	———	1.0000	**60**
1	.00029	.00029	3437.7	1.0000	59
2	.00058	.00058	1718.9	1.0000	58
3	.00087	.00087	1145.9	1.0000	57
4	.00116	.00116	859.44	1.0000	56
5	.00145	.00145	687.55	1.0000	**55**
6	.00175	.00175	572.96	1.0000	54
7	.00204	.00204	491.11	1.0000	53
8	.00233	.00233	429.72	1.0000	52
9	.00262	.00262	381.97	1.0000	51
10	.00291	.00291	343.77	1 0000	**50**
11	.00320	.00320	312.52	.99999	49
12	.00349	.00349	286.48	.99999	48
13	.00378	.00378	264.44	.99999	47
14	.00407	.00407	245.55	.99999	46
15	.00436	.00436	229.18	.99999	**45**
16	.00465	.00465	214.86	.99999	44
17	.00495	.00495	202.22	.99999	43
18	.00524	.00524	190.98	.99999	42
19	.00553	00553	180.93	.99998	41
20	00582	.00582	171.89	.99998	**40**
21	.00611	.00611	163.70	.99998	39
22	.00640	.00640	156.26	.99998	38
23	.00669	.00669	149.47	.99998	37
24	.00698	.00698	143.24	.99998	36
25	.00727	.00727	137.51	99997	**35**
26	00756	.00756	132 22	99997	34
27	.00785	.00785	127.32	.99997	33
28	.00814	.00815	122.77	.99997	32
29	.00844	.00844	118.54	99996	31
30	.00873	00873	114.59	.99996	**30**
31	.00902	00902	110.89	.99996	29
32	.00931	.00931	107.43	.99996	28
33	.00960	.00960	104.17	.99995	27
34	.00989	.00989	101.11	.99995	26
35	.01018	.01018	98.218	99995	**25**
36	.01047	.01047	95.489	.99995	24
37	.01076	.01076	92.908	.99994	23
38	01105	.01105	90.463	.99994	22
39	.01134	.01135	88.144	.99994	21
40	.01164	.01164	85.940	.99993	**20**
41	.01193	.01193	83.844	.99993	19
42	.01222	.01222	81.847	.99993	18
43	.01251	.01251	79.943	.99992	17
44	.01280	.01280	78.126	.99992	16
45	.01309	.01309	76 390	.99991	**15**
46	.01338	.01338	74.729	.99991	14
47	.01367	.01367	73.139	.99991	13
48	.01396	.01396	71.615	.99990	12
49	.01425	.01425	70.153	.99990	11
50	.01454	.01455	68.750	.99989	**10**
51	.01483	.01484	67.402	.99989	9
52	.01513	.01513	66.105	.99989	8
53	.01542	.01542	64.858	.99988	7
54	.01571	.01571	63.657	.99988	6
55	.01600	.01600	62.499	.99987	**5**
56	.01629	.01629	61.383	.99987	4
57	.01658	.01658	60.306	.99986	3
58	.01687	.01687	59.266	.99986	2
59	.01716	.01716	58.261	.99985	1
60	01745	.01746	57.290	.99985	**0**
′	Cos	Cot	Tan	Sin	′

90° (270°) (269°) **89°**

1° (181°) (358°) **178°**

′	Sin	Tan	Cot	Cos	′
0	01745	.01746	57.290	.99985	**60**
1	.01774	.01775	56.351	.99984	59
2	.01803	.01804	55.442	.99984	58
3	.01832	.01833	54.561	.99983	57
4	.01862	.01862	53.709	.99983	56
5	.01891	.01891	52.882	.99982	**55**
6	.01920	.01920	52.081	.99982	54
7	.01949	.01949	51.303	.99981	53
8	.01978	.01978	50.549	.99980	52
9	.02007	.02007	49.816	.99980	51
10	.02036	.02036	49 104	.99979	**50**
11	.02065	.02066	48.412	.99979	49
12	.02094	.02095	47 740	.99978	48
13	.02123	.02124	47.085	.99977	47
14	.02152	.02153	46.449	.99977	46
15	.02181	.02182	45 829	.99976	**45**
16	.02211	.02211	45.226	.99976	44
17	.02240	.02240	44.639	.99975	43
18	.02269	.02269	44.066	.99974	42
19	.02298	.02298	43 508	.99974	41
20	.02327	.02328	42.964	.99973	**40**
21	.02356	.02357	42.433	.99972	39
22	.02385	.02386	41.916	.99972	38
23	.02414	.02415	41.411	.99971	37
24	.02443	.02444	40.917	.99970	36
25	02472	.02473	40.436	.99969	**35**
26	.02501	.02502	39.965	.99969	34
27	.02530	.02531	39.506	.99968	33
28	.02560	.02560	39 057	.99967	32
29	.02589	.02589	38.618	.99966	31
30	.02618	.02619	38.188	.99966	**30**
31	.02647	.02648	37.769	.99965	29
32	.02676	.02677	37.358	.99964	28
33	.02705	.02706	36.956	.99963	27
34	.02734	.02735	36.563	.99963	26
35	.02763	.02764	36.178	.99962	**25**
36	.02792	.02793	35.801	.99961	24
37	.02821	.02822	35 431	.99960	23
38	.02850	.02851	35.070	.99959	22
39	.02879	.02881	34.715	.99959	21
40	.02908	.02910	34.368	.99958	**20**
41	02938	.02939	34.027	.99957	19
42	.02967	.02968	33.694	.99956	18
43	.02996	.02997	33.366	.99955	17
44	03025	.03026	33.045	.99954	16
45	.03054	.03055	32 730	.99953	**15**
46	03083	.03084	32 421	.99952	14
47	03112	.03114	32 118	.99952	13
48	.03141	.03143	31.821	.99951	12
49	.03170	.03172	31.528	.99950	11
50	.03199	.03201	31 242	.99949	**10**
51	.03228	.03230	30 960	.99948	9
52	.03257	.03259	30.683	.99947	8
53	03286	.03288	30.412	.99946	7
54	03316	.03317	30.145	.99945	6
55	.03345	.03346	29.882	.99944	**5**
56	.03374	.03376	29.624	.99943	4
57	.03403	.03405	29.371	.99942	3
58	.03432	.03434	29.122	.99941	2
59	.03461	.03463	28.877	.99940	1
60	.03490	.03492	28.636	.99939	**0**
′	Cos	Cot	Tan	Sin	′

91° (271°) (268°) **88°**

NATURAL FUNCTIONS (Continued)

2° (182°) (357°) **177°**

′	Sin	Tan	Cot	Cos	′
0	.03490	.03492	28 636	99939	**60**
1	.03519	.03521	28 399	99938	59
2	03548	.03550	28 166	99937	58
3	.03577	03579	27.937	99936	57
4	.03606	03609	27.712	99935	56
5	03635	03638	27.490	.99934	**55**
6	.03664	03667	27 271	.99933	54
7	.03693	.03696	27.057	99932	53
8	.03723	03725	26 845	99931	52
9	.03752	03754	26 637	99930	51
10	.03781	03783	26 432	99929	**50**
11	.03810	.03812	26 230	.99927	49
12	03839	03842	26 031	.99926	48
13	03868	03871	25 835	99925	47
14	.03897	03900	25 642	99924	46
15	03926	03929	25 452	99923	**45**
16	03955	03958	25 264	99922	44
17	.03984	03987	25 080	.99921	43
18	04013	04016	24 898	99919	42
19	04042	04046	24 719	99918	41
20	04071	04075	24 542	99917	**40**
21	04100	.04104	24 368	99916	39
22	04129	04133	24 196	99915	38
23	04159	04162	24 026	99913	37
24	.04188	04191	23 859	99912	36
25	.04217	04220	23 695	99911	**35**
26	.04246	04250	23 532	99910	34
27	04275	04279	23 372	99909	33
28	.04304	04308	23 214	99907	32
29	.04333	04337	23 058	99906	31
30	04362	04366	22 904	99905	**30**
31	04391	04395	22 752	99904	29
32	04420	04424	22 602	99902	28
33	04449	04454	22 454	99901	27
34	04478	04483	22 308	99900	26
35	04507	04512	22 164	99898	**25**
36	04536	04541	22 022	99897	24
37	04565	04570	21 881	99896	23
38	04594	04599	21 743	99894	22
39	·04623	04628	21 606	99893	21
40	04653	.04658	21 470	99892	**20**
41	04682	04687	21 337	99890	19
42	04711	04716	21 205	99889	18
43	04740	04745	21 075	99888	17
44	04769	04774	20 946	99886	16
45	.04798	04803	20 819	99885	**15**
46	.04827	04833	20 693	99883	14
47	04856	04862	20 569	99882	13
48	04885	.04891	20 446	99881	12
49	04914	04920	20 325	99879	11
50	04943	.04949	20 206	99878	**10**
51	.04972	04978	20 087	99876	9
52	05001	05007	19 970	99875	8
53	05030	05037	19 855	.99873	7
54	05059	05066	19 740	.99872	6
55	.05088	.05095	19.627	.99870	**5**
56	05117	05124	19 516	99869	4
57	05146	05153	19 405	99867	3
58	.05175	05182	19.296	99866	2
59	.05205	05212	19 188	.99864	1
60	05234	05241	19 081	99863	**0**
′	Cos	Cot	Tan	Sin	′

92° (272°) (267°) **87°**

3° (183°) (356°) **176°**

′	Sin	Tan	Cot	Cos	′
0	.05234	05241	19 081	.99863	**60**
1	05263	05270	18 976	.99861	59
2	05292	05299	18 871	.99860	58
3	05321	05328	18 768	99858	57
4	05350	05357	18 666	.99857	56
5	05379	.05387	18.564	.99855	**55**
6	05408	05416	18.464	.99854	54
7	05437	05445	18.366	.99852	53
8	05466	05474	18 268	99851	52
9	05495	05503	18 171	99849	51
10	05524	05533	18 075	99847	**50**
11	.05553	.05562	17 980	99846	49
12	.05582	05591	17 886	.99844	48
13	05611	05620	17 793	.99842	47
14	05640	05649	17 702	99841	46
15	05669	05678	17 611	99839	**45**
16	05698	05708	17 521	.99838	44
17	05727	05737	17 431	99836	43
18	05756	05766	17.343	99834	42
19	05785	05795	17 256	99833	41
20	05814	05824	17 169	99831	**40**
21	05844	05854	17 084	99829	39
22	05873	05883	16 999	99827	38
23	05902	05912	16 915	99826	37
24	05931	.05941	16.832	99824	36
25	05960	05970	16 750	99822	**35**
26	05989	05999	16 668	99821	34
27	06018	06029	16 587	99819	33
28	06047	06058	16 507	.99817	32
29	06076	06087	16 428	.99815	31
30	06105	06116	16 350	.99813	**30**
31	06134	06145	16 272	99812	29
32	06163	06175	16 195	99810	28
33	06192	06204	16 119	.99808	27
34	06221	06233	16.043	.99806	26
35	06250	06262	15 969	99804	**25**
36	06279	06291	15 895	99803	24
37	06308	06321	15 821	99801	23
38	06337	06350	15 748	99799	22
39	06366	06379	15 676	99797	21
40	06395	06408	15 605	99795	**20**
41	06424	06438	15 534	99793	19
42	06453	06467	15.464	99792	18
43	06482	06496	15 394	99790	17
44	06511	06525	15 325	99788	16
45	06540	06554	15 257	99786	**15**
46	06569	.06584	15 189	99784	14
47	06598	.06613	15 122	99782	13
48	06627	06642	15 056	99780	12
49	06656	06671	14 990	99778	11
50	06685	06700	14 924	99776	**10**
51	06714	06730	14 860	99774	9
52	06743	06759	14 795	99772	8
53	06773	06788	14 732	99770	7
54	06802	06817	14 669	.99768	6
55	06831	.06847	14 606	99766	**5**
56	06860	.06876	14.544	99764	4
57	06889	06905	14.482	.99762	3
58	.06918	06934	14 421	99760	2
59	.06947	.06963	14.361	.99758	1
60	06976	.06993	14 301	99756	**0**
′	Cos	Cot	Tan	Sin	′

93° (273°) (266°) **86°**

NATURAL FUNCTIONS (Continued)

4° (184°) (355°) 175°

′	Sin	Tan	Cot	Cos	′
0	.06976	.06993	14 301	99756	**60**
1	.07005	.07022	14 241	99754	59
2	.07034	.07051	14 182	.99752	58
3	.07063	.07080	14.124	99750	57
4	07092	.07110	14.065	.99748	56
5	07121	07139	14 008	99746	**55**
6	.07150	.07168	13 951	99744	54
7	.07179	.07197	13 894	99742	53
8	.07208	07227	13 838	99740	52
9	07237	.07256	13 782	99738	51
10	07266	07285	13 727	99736	**50**
11	07295	07314	13 672	99734	49
12	07324	07344	13 617	99731	48
13	07353	07373	13 563	99729	47
14	.07382	07402	13 510	99727	46
15	07411	07431	13 457	99725	**45**
16	07440	07461	13 404	99723	44
17	07469	07490	13 352	99721	43
18	07498	07519	13 300	99719	42
19	07527	07548	13 248	99716	41
20	07556	07578	13.197	99714	**40**
21	07585	07607	13 146	99712	39
22	07614	07636	13 096	99710	38
23	07643	07665	13 046	99708	37
24	07672	07695	12 996	99705	36
25	07701	07724	12 947	99703	**35**
26	07730	07753	12.898	.99701	34
27	07759	07782	12.850	99699	33
28	07788	07812	12 801	99696	32
29	07817	07841	12 754	99694	31
30	07846	07870	12 706	99692	**30**
31	07875	07899	12 659	99689	29
32	07904	07929	12 612	99687	28
33	07933	07958	12 566	99685	27
34	07962	.07987	12 520	99683	26
35	07991	08017	12 474	99680	**25**
36	.08020	08046	12 429	99678	24
37	08049	08075	12 384	99676	23
38	08078	08104	12 339	99673	22
39	08107	08134	12 295	99671	21
40	08136	08163	12 251	99668	**20**
41	08165	08192	12 207	99666	19
42	08194	08221	12 163	99664	18
43	08223	08251	12 120	99661	17
44	08252	08280	12 077	99659	16
45	08281	08309	12 035	99657	**15**
46	.08310	08339	11 992	99654	14
47	.08339	08368	11.950	99652	13
48	.08368	08397	11 909	99649	12
49	08397	08427	11 867	99647	11
50	08426	08456	11 826	99644	**10**
51	.08455	08485	11 785	99642	9
52	.08484	08514	11.745	99639	8
53	08513	08544	11.705	99637	7
54	.08542	08573	11.664	99635	6
55	08571	08602	11.625	99632	**5**
56	.08600	08632	11.585	.99630	4
57	.08629	.08661	11.546	99627	3
58	.08658	08690	11.507	99625	2
59	.08687	.08720	11.468	.99622	1
60	.08716	08749	11.430	99619	**0**
′	Cos	Cot	Tan	Sin	′

94° (274°) (265°) 85°

5° (185°) (354°) 174°

′	Sin	Tan	Cot	Cos	′
0	08716	08749	11.430	.99619	**60**
1	08745	08778	11 392	99617	59
2	08774	08807	11.354	.99614	58
3	.08803	.08837	11.316	.99612	57
4	.08831	.08866	11.279	.99609	56
5	.08860	.08895	11.242	.99607	**55**
6	.08889	08925	11 205	.99604	54
7	.08918	08954	11 168	.99602	53
8	.08947	08983	11 132	99599	52
9	.08976	.09013	11 095	99596	51
10	.09005	09042	11.059	.99594	**50**
11	09034	09071	11 024	.99591	49
12	09063	09101	10.988	.99588	48
13	.09092	09130	10.953	.99586	47
14	.09121	09159	10.918	.99583	46
15	09150	09189	10 883	99580	**45**
16	09179	09218	10.848	99578	44
17	09208	.09247	10 814	.99575	43
18	09237	09277	10 780	.99572	42
19	09266	09306	10 746	.99570	41
20	09295	09335	10 712	99567	**40**
21	09324	09365	10.678	.99564	39
22	.09353	09394	10 645	99562	38
23	09382	09423	10 612	99559	37
24	09411	09453	10 579	99556	36
25	09440	09482	10 546	99553	**35**
26	09469	09511	10 514	99551	34
27	09498	09541	10 481	99548	33
28	09527	09570	10 449	99545	32
29	09556	09600	10 417	99542	31
30	09585	09629	10 385	99540	**30**
31	09614	09658	10 354	.99537	29
32	09642	09688	10 322	99534	28
33	09671	09717	10 291	99531	27
34	09700	09746	10 260	99528	26
35	09729	09776	10.229	.99526	**25**
36	09758	09805	10 199	99523	24
37	09787	09834	10 168	99520	23
38	09816	09864	10 138	99517	22
39	09845	09893	10 108	99514	21
40	09874	09923	10 078	99511	**20**
41	09903	09952	10 048	99508	19
42	09932	09981	10 019	99506	18
43	09961	10011	9 9893	99503	17
44	09990	10040	9 9601	99500	16
45	.10019	10069	9.9310	99497	**15**
46	10048	10099	9.9021	.99494	14
47	10077	10128	9 8734	.99491	13
48	10106	10158	9 8448	99488	12
49	10135	10187	9 8164	99485	11
50	10164	10216	9 7882	99482	**10**
51	.10192	10246	9 7601	99479	9
52	.10221	10275	9 7322	99476	8
53	.10250	10305	9 7044	.99473	7
54	.10279	10334	9 6768	.99470	6
55	.10308	10363	9 6493	99467	**5**
56	.10337	.10393	9 6220	99464	4
57	.10366	10422	9 5949	99461	3
58	10395	.10452	9 5679	99458	2
59	10424	10481	9.5411	.99455	1
60	10453	10510	9 5144	99452	**0**
′	Cos	Cot	Tan	Sin	′

95° (275°) (264°) 84°

6° (186°) (353°) **173°**

′	Sin	Tan	Cot	Cos	′
0	.10453	.10510	9.5144	.99452	**60**
1	.10482	.10540	9.4878	.99449	59
2	.10511	.10569	9.4614	.99446	58
3	.10540	.10599	9.4352	.99443	57
4	.10569	.10628	9.4090	.99440	56
5	.10597	.10657	9.3831	.99437	**55**
6	.10626	.10687	9.3572	.99434	54
7	.10655	.10716	9.3315	.99431	53
8	.10684	.10746	9.3060	.99428	52
9	.10713	.10775	9.2806	.99424	51
10	.10742	.10805	9.2553	.99421	**50**
11	.10771	.10834	9.2302	.99418	49
12	.10800	.10863	9.2052	.99415	48
13	.10829	.10893	9.1803	.99412	47
14	.10858	.10922	9.1555	.99409	46
15	.10887	.10952	9.1309	.99406	**45**
16	.10916	.10981	9.1065	.99402	44
17	.10945	.11011	9.0821	.99399	43
18	.10973	.11040	9.0579	.99396	42
19	.11002	.11070	9.0338	.99393	41
20	.11031	.11099	9.0098	.99390	**40**
21	.11060	.11128	8.9860	.99386	39
22	.11089	.11158	8.9623	.99383	38
23	.11118	.11187	8.9387	.99380	37
24	.11147	.11217	8.9152	.99377	36
25	.11176	.11246	8.8919	.99374	**35**
26	.11205	.11276	8.8686	.99370	34
27	.11234	.11305	8.8455	.99367	33
28	.11263	.11335	8.8225	.99364	32
29	.11291	.11364	8.7996	.99360	31
30	.11320	.11394	8.7769	.99357	**30**
31	.11349	.11423	8.7542	.99354	29
32	.11378	.11452	8.7317	.99351	28
33	.11407	.11482	8.7093	.99347	27
34	.11436	.11511	8.6870	.99344	26
35	.11465	.11541	8.6648	.99341	**25**
36	.11494	.11570	8.6427	.99337	24
37	.11523	.11600	8.6208	.99334	23
38	.11552	.11629	8.5989	.99331	22
39	.11580	.11659	8.5772	.99327	21
40	.11609	.11688	8.5555	.99324	**20**
41	.11638	.11718	8.5340	.99320	19
42	.11667	.11747	8.5126	.99317	18
43	.11696	.11777	8.4913	.99314	17
44	.11725	.11806	8.4701	.99310	16
45	.11754	.11836	8.4490	.99307	**15**
46	.11783	.11865	8.4280	.99303	14
47	.11812	.11895	8.4071	.99300	13
48	.11840	.11924	8.3863	.99297	12
49	.11869	.11954	8.3656	.99293	11
50	.11898	.11983	8.3450	.99290	**10**
51	.11927	.12013	8.3245	.99286	9
52	.11956	.12042	8.3041	.99283	8
53	.11985	.12072	8.2838	.99279	7
54	.12014	.12101	8.2636	.99276	6
55	.12043	.12131	8.2434	.99272	**5**
56	.12071	.12160	8.2234	.99269	4
57	.12100	.12190	8.2035	.99265	3
58	.12129	.12219	8.1837	.99262	2
59	.12158	.12249	8.1640	.99258	1
60	.12187	.12278	8.1443	.99255	**0**
′	Cos	Cot	Tan	Sin	′

96° (276°) (263°) **83°**

7° (187°) (352°) **172°**

′	Sin	Tan	Cot	Cos	′
0	.12187	.12278	8.1443	.99255	**60**
1	.12216	.12308	8.1248	.99251	59
2	.12245	.12338	8.1054	.99248	58
3	.12274	.12367	8.0860	.99244	57
4	.12302	.12397	8.0667	.99240	56
5	.12331	.12426	8.0476	.99237	**55**
6	.12360	.12456	8.0285	.99233	54
7	.12389	.12485	8.0095	.99230	53
8	.12418	.12515	7.9906	.99226	52
9	.12447	.12544	7.9718	.99222	51
10	.12476	.12574	7.9530	.99219	**50**
11	.12504	.12603	7.9344	.99215	49
12	.12533	.12633	7.9158	.99211	48
13	.12562	.12662	7.8973	.99208	47
14	.12591	.12692	7.8789	.99204	46
15	.12620	.12722	7.8606	.99200	**45**
16	.12649	.12751	7.8424	.99197	44
17	.12678	.12781	7.8243	.99193	43
18	.12706	.12810	7.8062	.99189	42
19	.12735	.12840	7.7882	.99186	41
20	.12764	.12869	7.7704	.99182	**40**
21	.12793	.12899	7.7525	.99178	39
22	.12822	.12929	7.7348	.99175	38
23	.12851	.12958	7.7171	.99171	37
24	.12880	.12988	7.6996	.99167	36
25	.12908	.13017	7.6821	.99163	**35**
26	.12937	.13047	7.6647	.99160	34
27	.12966	.13076	7.6473	.99156	33
28	.12995	.13106	7.6301	.99152	32
29	.13024	.13136	7.6129	.99148	31
30	.13053	.13165	7.5958	.99144	**30**
31	.13081	.13195	7.5787	.99141	29
32	.13110	.13224	7.5618	.99137	28
33	.13139	.13254	7.5449	.99133	27
34	.13168	.13284	7.5281	.99129	26
35	.13197	.13313	7.5113	.99125	**25**
36	.13226	.13343	7.4947	.99122	24
37	.13254	.13372	7.4781	.99118	23
38	.13283	.13402	7.4615	.99114	22
39	.13312	.13432	7.4451	.99110	21
40	.13341	.13461	7.4287	.99106	**20**
41	.13370	.13491	7.4124	.99102	19
42	.13399	.13521	7.3962	.99098	18
43	.13427	.13550	7.3800	.99094	17
44	.13456	.13580	7.3639	.99091	16
45	.13485	.13609	7.3479	.99087	**15**
46	.13514	.13639	7.3319	.99083	14
47	.13543	.13669	7.3160	.99079	13
48	.13572	.13698	7.3002	.99075	12
49	.13600	.13728	7.2844	.99071	11
50	.13629	.13758	7.2687	.99067	**10**
51	.13658	.13787	7.2531	.99063	9
52	.13687	.13817	7.2375	.99059	8
53	.13716	.13846	7.2220	.99055	7
54	.13744	.13876	7.2066	.99051	6
55	.13773	.13906	7.1912	.99047	**5**
56	.13802	.13935	7.1759	.99043	4
57	.13831	.13965	7.1607	.99039	3
58	.13860	.13995	7.1455	.99035	2
59	.13889	.14024	7.1304	.99031	1
60	.13917	.14054	7.1154	.99027	**0**
′	Cos	Cot	Tan	Sin	′

97° (277°) (262°) **82°**

NATURAL FUNCTIONS (Continued)

8° (188°) (351°) **171°**

′	Sin	Tan	Cot	Cos	′
0	.13917	.14054	7.1154	.99027	**60**
1	.13946	.14084	7.1004	.99023	59
2	.13975	.14113	7.0855	.99019	58
3	.14004	.14143	7.0706	.99015	57
4	.14033	.14173	7.0558	.99011	56
5	.14061	.14202	7.0410	.99006	**55**
6	.14090	.14232	7.0264	.99002	54
7	.14119	.14262	7.0117	.98998	53
8	.14148	.14291	6.9972	.98994	52
9	.14177	.14321	6.9827	.98990	51
10	.14205	.14351	6.9682	.98986	**50**
11	.14234	.14381	6.9538	.98982	49
12	.14263	.14410	6.9395	.98978	48
13	.14292	.14440	6.9252	.98973	47
14	.14320	.14470	6.9110	.98969	46
15	.14349	.14499	6.8969	.98965	**45**
16	.14378	.14529	6.8828	.98961	44
17	.14407	.14559	6.8687	.98957	43
18	.14436	.14588	6.8548	.98953	42
19	.14464	.14618	6.8408	.98948	41
20	.14493	.14648	6.8269	.98944	**40**
21	.14522	.14678	6.8131	.98940	39
22	.14551	.14707	6.7994	.98936	38
23	.14580	.14737	6.7856	.98931	37
24	.14608	.14767	6.7720	.98927	36
25	.14637	.14796	6.7584	.98923	**35**
26	.14666	.14826	6.7448	.98919	34
27	.14695	.14856	6.7313	.98914	33
28	.14723	.14886	6.7179	.98910	32
29	.14752	.14915	6.7045	.98906	31
30	.14781	.14945	6.6912	.98902	**30**
31	.14810	.14975	6.6779	.98897	29
32	.14838	.15005	6.6646	.98893	28
33	.14867	.15034	6.6514	.98889	27
34	.14896	.15064	6.6383	.98884	26
35	.14925	.15094	6.6252	.98880	**25**
36	.14954	.15124	6.6122	.98876	24
37	.14982	.15153	6.5992	.98871	23
38	.15011	.15183	6.5863	.98867	22
39	.15040	.15213	6.5734	.98863	21
40	.15069	.15243	6.5606	.98858	**20**
41	.15097	.15272	6.5478	.98854	19
42	.15126	.15302	6.5350	.98849	18
43	.15155	.15332	6.5223	.98845	17
44	.15184	.15362	6.5097	.98841	16
45	.15212	.15391	6.4971	.98836	**15**
46	.15241	.15421	6.4846	.98832	14
47	.15270	.15451	6.4721	.98827	13
48	.15299	.15481	6.4596	.98823	12
49	.15327	.15511	6.4472	.98818	11
50	.15356	.15540	6.4348	.98814	**10**
51	.15385	.15570	6.4225	.98809	9
52	.15414	.15600	6.4103	.98805	8
53	.15442	.15630	6.3980	.98800	7
54	.15471	.15660	6.3859	.98796	6
55	.15500	.15689	6.3737	.98791	**5**
56	.15529	.15719	6.3617	.98787	4
57	.15557	.15749	6.3496	.98782	3
58	.15586	.15779	6.3376	.98778	2
59	.15615	.15809	6.3257	.98773	1
60	.15643	.15838	6.3138	.98769	**0**
′	Cos	Cot	Tan	Sin	′

98° (278°) (261°) **81°**

9° (189°) (350°) **170°**

′	Sin	Tan	Cot	Cos	′
0	.15643	.15838	6.3138	.98769	**60**
1	.15672	.15868	6.3019	.98764	59
2	.15701	.15898	6.2901	.98760	58
3	.15730	.15928	6.2783	.98755	57
4	.15758	.15958	6.2666	.98751	56
5	.15787	.15988	6.2549	.98746	**55**
6	.15816	.16017	6.2432	.98741	54
7	.15845	.16047	6.2316	.98737	53
8	.15873	.16077	6.2200	.98732	52
9	.15902	.16107	6.2085	.98728	51
10	.15931	.16137	6.1970	.98723	**50**
11	.15959	.16167	6.1856	.98718	49
12	.15988	.16196	6.1742	.98714	48
13	.16017	.16226	6.1628	.98709	47
14	.16046	.16256	6.1515	.98704	46
15	.16074	.16286	6.1402	.98700	**45**
16	.16103	.16316	6.1290	.98695	44
17	.16132	.16346	6.1178	.98690	43
18	.16160	.16376	6.1066	.98686	42
19	.16189	.16405	6.0955	.98681	41
20	.16218	.16435	6.0844	.98676	**40**
21	.16246	.16465	6.0734	.98671	39
22	.16275	.16495	6.0624	.98667	38
23	.16304	.16525	6.0514	.98662	37
24	.16333	.16555	6.0405	.98657	36
25	.16361	.16585	6.0296	.98652	**35**
26	.16390	.16615	6.0188	.98648	34
27	.16419	.16645	6.0080	.98643	33
28	.16447	.16674	5.9972	.98638	32
29	.16476	.16704	5.9865	.98633	31
30	.16505	.16734	5.9758	.98629	**30**
31	.16533	.16764	5.9651	.98624	29
32	.16562	.16794	5.9545	.98619	28
33	.16591	.16824	5.9439	.98614	27
34	.16620	.16854	5.9333	.98609	26
35	.16648	.16884	5.9228	.98604	**25**
36	.16677	.16914	5.9124	.98600	24
37	.16706	.16944	5.9019	.98595	23
38	.16734	.16974	5.8915	.98590	22
39	.16763	.17004	5.8811	.98585	21
40	.16792	.17033	5.8708	.98580	**20**
41	.16820	.17063	5.8605	.98575	19
42	.16849	.17093	5.8502	.98570	18
43	.16878	.17123	5.8400	.98565	17
44	.16906	.17153	5.8298	.98561	16
45	.16935	.17183	5.8197	.98556	**15**
46	.16964	.17213	5.8095	.98551	14
47	.16992	.17243	5.7994	.98546	13
48	.17021	.17273	5.7894	.98541	12
49	.17050	.17303	5.7794	.98536	11
50	.17078	.17333	5.7694	.98531	**10**
51	.17107	.17363	5.7594	.98526	9
52	.17136	.17393	5.7495	.98521	8
53	.17164	.17423	5.7396	.98516	7
54	.17193	.17453	5.7297	.98511	6
55	.17222	.17483	5.7199	.98506	**5**
56	.17250	.17513	5.7101	.98501	4
57	.17279	.17543	5.7004	.98496	3
58	.17308	.17573	5.6906	.98491	2
59	.17336	.17603	5.6809	.98486	1
60	.17365	.17633	5.6713	.98481	**0**
′	Cos	Cot	Tan	Sin	′

99° (279°) (260°) **80°**

10° (190°) (349°) **169°**

′	Sin	Tan	Cot	Cos	′
0	.17365	.17633	5.6713	98481	60
1	.17393	.17663	5.6617	98476	59
2	.17422	.17693	5.6521	.98471	58
3	.17451	.17723	5.6425	.98466	57
4	.17479	.17753	5.6329	.98461	56
5	.17508	.17783	5.6234	.98455	55
6	.17537	17813	5.6140	.98450	54
7	.17565	.17843	5.6045	.98445	53
8	17594	17873	5.5951	.98440	52
9	.17623	17903	5 5857	.98435	51
10	17651	.17933	5 5764	98430	50
11	17680	.17963	5.5671	.98425	49
12	17708	17993	5.5578	98420	48
13	.17737	18023	5.5485	98414	47
14	17766	18053	5 5393	98409	46
15	17794	18083	5 5301	98404	45
16	.17823	18113	5 5209	98399	44
17	17852	18143	5 5118	98394	43
18	.17880	18173	5 5026	98389	42
19	17909	18203	5 4936	98383	41
20	.17937	.18233	5.4845	98378	40
21	.17966	18263	5.4755	98373	39
22	.17995	18293	5.4665	.98368	38
23	18023	.18323	5 4575	98362	37
24	.18052	.18353	5 4486	98357	36
25	.18081	18384	5.4397	98352	35
26	18109	.18414	5 4308	98347	34
27	18138	.18444	5 4219	98341	33
28	18166	18474	5 4131	98336	32
29	18195	18504	5.4043	98331	31
30	18224	18534	5 3955	98325	30
31	18252	.18564	5.3868	98320	29
32	.18281	18594	5 3781	98315	28
33	.18309	.18624	5.3694	.98310	27
34	.18338	18654	5 3607	98304	26
35	18367	18684	5 3521	.98299	25
36	18395	18714	5 3435	98294	24
37	18424	18745	5 3349	98288	23
38	18452	18775	5.3263	98283	22
39	18481	18805	5.3178	98277	21
40	.18509	18835	5.3093	.98272	20
41	.18538	18865	5 3008	98267	19
42	.18567	18895	5.2924	98261	18
43	18595	18925	5 2839	98256	17
44	.18624	18955	5 2755	98250	16
45	.18652	.18986	5.2672	98245	15
46	18681	19016	5.2588	98240	14
47	.18710	19046	5 2505	98234	13
48	.18738	19076	5.2422	98229	12
49	.18767	19106	5.2339	98223	11
50	18795	19136	5.2257	.98218	10
51	.18824	19166	5.2174	98212	9
52	.18852	19197	5.2092	98207	8
53	.18881	19227	5.2011	98201	7
54	.18910	.19257	5.1929	98196	6
55	.18938	19287	5.1848	98190	5
56	.18967	.19317	5.1767	.98185	4
57	.18995	.19347	5.1686	.98179	3
58	.19024	.19378	5.1606	98174	2
59	.19052	19408	5.1526	98168	1
60	19081	.19438	5.1446	.98163	0
′	Cos	Cot	Tan	Sin	′

100° (280°) (259°) **79°**

11° (191°) (348°) **168°**

′	Sin	Tan	Cot	Cos	′
0	.19081	.19438	5.1446	.98163	60
1	.19109	.19468	5.1366	.98157	59
2	.19138	.19498	5.1286	.98152	58
3	.19167	.19529	5.1207	.98146	57
4	.19195	.19559	5.1128	.98140	56
5	.19224	.19589	5.1049	.98135	55
6	.19252	.19619	5.0970	.98129	54
7	19281	.19649	5.0892	98124	53
8	.19309	.19680	5 0814	98118	52
9	.19338	.19710	5 0736	98112	51
10	.19366	.19740	5 0658	.98107	50
11	.19395	.19770	5.0581	.98101	49
12	19423	.19801	5.0504	.98096	48
13	.19452	.19831	5 0427	.98090	47
14	19481	.19861	5.0350	.98084	46
15	19509	.19891	5 0273	.98079	45
16	19538	.19921	5 0197	.98073	44
17	19566	19952	5.0121	.98067	43
18	19595	.19982	5 0045	.98061	42
19	.19623	.20012	4.9969	.98056	41
20	19652	20042	4 9894	.98050	40
21	19680	20073	4.9819	.98044	39
22	19709	.20103	4.9744	.98039	38
23	19737	20133	4.9669	.98033	37
24	.19766	.20164	4.9594	.98027	36
25	19794	20194	4 9520	.98021	35
26	.19823	20224	4 9446	.98016	34
27	19851	20254	4 9372	98010	33
28	19880	20285	4.9298	.98004	32
29	19908	20315	4.9225	97998	31
30	.19937	20345	4.9152	97992	30
31	.19965	20376	4 9078	97987	29
32	.19994	20406	4.9006	.97981	28
33	.20022	.20436	4.8933	.97975	27
34	.20051	20466	4.8860	.97969	26
35	.20079	20497	4.8788	.97963	25
36	.20108	.20527	4.8716	97958	24
37	.20136	.20557	4.8644	97952	23
38	.20165	.20588	4.8573	.97946	22
39	.20193	.20618	4.8501	.97940	21
40	.20222	.20648	4.8430	.97934	20
41	.20250	.20679	4.8359	.97928	19
42	.20279	.20709	4.8288	.97922	18
43	.20307	.20739	4.8218	.97916	17
44	.20336	.20770	4.8147	.97910	16
45	.20364	.20800	4.8077	.97905	15
46	20393	20830	4.8007	.97899	14
47	.20421	.20861	4.7937	.97893	13
48	.20450	.20891	4.7867	.97887	12
49	.20478	20921	4.7798	.97881	11
50	20507	20952	4.7729	.97875	10
51	20535	.20982	4.7659	.97869	9
52	.20563	.21013	4 7591	.97863	8
53	.20592	.21043	4.7522	.97857	7
54	.20620	21073	4.7453	.97851	6
55	.20649	.21104	4.7385	.97845	5
56	.20677	.21134	4 7317	.97839	4
57	.20706	.21164	4.7249	.97833	3
58	.20734	21195	4.7181	.97827	2
59	20763	.21225	4.7114	.97821	1
60	20791	21256	4.7046	.97815	0
′	Cos	Cot	Tan	Sin	′

101° (281°) (258°) **78°**

NATURAL FUNCTIONS (Continued)

12° (192°) (347°) **167°**

′	Sin	Tan	Cot	Cos	′
0	.20791	.21256	4.7046	.97815	**60**
1	.20820	.21286	4.6979	.97809	59
2	.20848	.21316	4.6912	.97803	58
3	.20877	.21347	4.6845	97797	57
4	.20905	.21377	4.6779	.97791	56
5	.20933	.21408	4.6712	.97784	**55**
6	20962	.21438	4.6646	.97778	54
7	20990	.21469	4.6580	.97772	53
8	21019	.21499	4 6514	.97766	52
9	.21047	.21529	4.6448	.97760	51
10	.21076	.21560	4.6382	.97754	**50**
11	.21104	.21590	4.6317	97748	49
12	.21132	.21621	4.6252	97742	48
13	.21161	.21651	4.6187	.97735	47
14	.21189	.21682	4.6122	97729	46
15	.21218	.21712	4.6057	97723	**45**
16	.21246	.21743	4.5993	97717	44
17	.21275	.21773	4 5928	97711	43
18	.21303	21804	4.5864	97705	42
19	21331	21834	4 5800	97698	41
20	.21360	21864	4.5736	97692	**40**
21	.21388	.21895	4.5673	.97686	39
22	.21417	.21925	4.5609	97680	38
23	21445	.21956	4.5546	97673	37
24	21474	21986	4.5483	.97667	36
25	.21502	22017	4.5420	97661	**35**
26	.21530	22047	4.5357	97655	34
27	.21559	22078	4.5294	97648	33
28	.21587	22108	4 5232	.97642	32
29	21616	22139	4.5169	97636	31
30	.21644	.22169	4.5107	.97630	**30**
31	.21672	22200	4.5045	.97623	29
32	21701	22231	4 4983	97617	28
33	.21729	22261	4 4922	97611	27
34	21758	.22292	4 4860	97604	26
35	21786	22322	4 4799	97598	**25**
36	.21814	22353	4 4737	97592	24
37	.21843	22383	4 4676	.97585	23
38	21871	22414	4 4615	97579	22
39	21899	22444	4 4555	97573	21
40	21928	22475	4.4494	97566	**20**
41	21956	22505	4 4434	97560	19
42	21985	22536	4 4373	97553	18
43	22013	.22567	4 4313	97547	17
44	22041	.22597	4 4253	97541	16
45	22070	.22628	4 4194	97534	**15**
46	22098	22658	4.4134	97528	14
47	22126	22689	4 4075	97521	13
48	22155	22719	4 4015	97515	12
49	22183	22750	4 3956	97508	11
50	22212	22781	4 3897	97502	**10**
51	22240	22811	4 3838	97496	9
52	22268	22842	4 3779	97489	8
53	22297	22872	4 3721	97483	7
54	22325	.22903	4.3662	97476	6
55	22353	.22934	4.3604	97470	**5**
56	22382	22964	4 3546	.97463	4
57	22410	22995	4.3488	.97457	3
58	22438	23026	4.3430	.97450	2
59	22467	.23056	4.3372	.97444	1
60	22495	23087	4.3315	.97437	**0**
′	Cos	Cot	Tan	Sin	′

102° (282°) (257°) **77°**

13° (193°) (346°) **166°**

′	Sin	Tan	Cot	Cos	′
0	.22495	.23087	4.3315	.97437	**60**
1	.22523	.23117	4.3257	.97430	59
2	.22552	.23148	4.3200	.97424	58
3	.22580	23179	4.3143	.97417	57
4	.22608	.23209	4.3086	.97411	56
5	.22637	.23240	4 3029	.97404	**55**
6	22665	.23271	4 2972	.97398	54
7	.22693	.23301	4 2916	.97391	53
8	22722	.23332	4.2859	.97384	52
9	22750	.23363	4.2803	97378	51
10	22778	.23393	4 2747	97371	**50**
11	22807	23424	4 2691	97365	49
12	22835	23455	4.2635	.97358	48
13	22863	.23485	4.2580	.97351	47
14	22892	.23516	4.2524	.97345	46
15	22920	.23547	4 2468	97338	**45**
16	.22948	.23578	4.2413	.97331	44
17	22977	23608	4.2358	.97325	43
18	23005	23639	4 2303	.97318	42
19	.23033	23670	4 2248	.97311	41
20	23062	.23700	4.2193	97304	**40**
21	23090	23731	4.2139	97298	39
22	23118	23762	4.2084	.97291	38
23	23146	23793	4.2030	97284	37
24	23175	.23823	4.1976	97278	36
25	23203	.23854	4.1922	97271	**35**
26	.23231	.23885	4 1868	97264	34
27	23260	23916	4 1814	97257	33
28	23288	23946	4 1760	97251	32
29	23316	.23977	4 1706	97244	31
30	23345	.24008	4 1653	97237	**30**
31	23373	.24039	4 1600	97230	29
32	23401	24069	4 1547	97223	28
33	23429	24100	4 1493	.97217	27
34	23458	24131	4.1441	.97210	26
35	23486	24162	4.1388	.97203	**25**
36	23514	24193	4 1335	.97196	24
37	23542	.24223	4.1282	.97189	23
38	23571	24254	4 1230	.97182	22
39	23599	24285	4.1178	.97176	21
40	23627	24316	4 1126	.97169	**20**
41	23656	24347	4.1074	.97162	19
42	23684	24377	4.1022	.97155	18
43	23712	24408	4.0970	.97148	17
44	23740	24439	4.0918	.97141	16
45	23769	.24470	4.0867	.97134	**15**
46	23797	.24501	4.0815	.97127	14
47	23825	24532	4 0764	97120	13
48	23853	24562	4 0713	97113	12
49	23882	24593	4 0662	.97106	11
50	23910	.24624	4.0611	.97100	**10**
51	23938	.24655	4 0560	.97093	9
52	23966	24686	4.0509	.97086	8
53	23995	24717	4.0459	.97079	7
54	24023	.24747	4.0408	.97072	6
55	24051	.24778	4.0358	.97065	**5**
56	24079	.24809	4.0308	.97058	4
57	24108	.24840	4.0257	.97051	3
58	.24136	.24871	4.0207	.97044	2
59	.24164	.24902	4.0158	.97037	1
60	.24192	.24933	4.0108	.97030	**0**
′	Cos	Cot	Tan	Sin	′

103° (283°) (256°) **76°**

NATURAL FUNCTIONS (Continued)

14° (194°) (345°) **165°**

′	Sin	Tan	Cot	Cos	′
0	24192	.24933	4.0108	97030	**60**
1	24220	.24964	4.0058	97023	59
2	24249	.24995	4.0009	.97015	58
3	.24277	.25026	3.9959	.97008	57
4	.24305	.25056	3.9910	.97001	56
5	.24333	.25087	3.9861	96994	**55**
6	24362	.25118	3.9812	96987	54
7	24390	25149	3.9763	96980	53
8	24418	.25180	3.9714	96973	52
9	24446	.25211	3.9665	96966	51
10	24474	.25242	3.9617	.96959	**50**
11	24503	25273	3.9568	.96952	49
12	24531	25304	3.9520	96945	48
13	24559	25335	3.9471	96937	47
14	24587	25366	3.9423	96930	46
15	24615	25397	3.9375	96923	**45**
16	24644	25428	3.9327	96916	44
17	24672	25459	3.9279	96909	43
18	24700	.25490	3.9232	96902	42
19	24728	25521	3.9184	96894	41
20	24756	25552	3.9136	96887	**40**
21	24784	25583	3.9089	96880	39
22	24813	25614	3.9042	96873	38
23	24841	25645	3.8995	96866	37
24	24869	25676	3.8947	96858	36
25	24897	25707	3.8900	96851	**35**
26	24925	25738	3.8854	96844	34
27	24954	25769	3.8807	96837	33
28	24982	.25800	3.8760	96829	32
29	25010	25831	3.8714	96822	31
30	25038	25862	3.8667	96815	**30**
31	25066	.25893	3.8621	96807	29
32	25094	25924	3.8575	96800	28
33	25122	25955	3.8528	96793	27
34	25151	25986	3.8482	96786	26
35	25179	.26017	3.8436	96778	**25**
36	25207	26048	3.8391	96771	24
37	25235	26079	3.8345	96764	23
38	25263	.26110	3.8299	96756	22
39	25291	26141	3.8254	96749	21
40	25320	26172	3.8208	96742	**20**
41	25348	26203	3.8163	96734	19
42	25376	26235	3.8118	96727	18
43	25404	26266	3.8073	96719	17
44	25432	26297	3.8028	96712	16
45	25460	26328	3.7983	96705	**15**
46	25488	26359	3.7938	96697	14
47	25516	.26390	3.7893	96690	13
48	25545	26421	3.7848	96682	12
49	25573	26452	3.7804	96675	11
50	25601	26483	3.7760	96667	**10**
51	25629	26515	3.7715	96660	9
52	25657	26546	3.7671	96653	8
53	.25685	.26577	3.7627	96645	7
54	.25713	.26608	3.7583	96638	6
55	25741	26639	3.7539	96630	**5**
56	25769	26670	3.7495	96623	4
57	25798	26701	3.7451	96615	3
58	25826	.26733	3.7408	.96608	2
59	25854	26764	3.7364	96600	1
60	25882	26795	3.7321	96593	**0**
′	Cos	Cot	Tan	Sin	′

104° (284°) (255°) **75°**

15° (195°) (344°) **164°**

′	Sin	Tan	Cot	Cos	′
0	.25882	26795	3.7321	.96593	**60**
1	.25910	26826	3.7277	.96585	59
2	25938	.26857	3.7234	96578	58
3	25966	26888	3.7191	96570	57
4	25994	.26920	3.7148	96562	56
5	.26022	.26951	3.7105	96555	**55**
6	26050	26982	3.7062	96547	54
7	26079	27013	3.7019	96540	53
8	26107	27044	3.6976	96532	52
9	26135	27076	3.6933	96524	51
10	26163	27107	3.6891	96517	**50**
11	26191	27138	3.6848	96509	49
12	26219	27169	3.6806	96502	48
13	26247	27201	3.6764	96494	47
14	26275	27232	3.6722	96486	46
15	26303	27263	3.6680	96479	**45**
16	26331	27294	3.6638	96471	44
17	26359	27326	3.6596	96463	43
18	.26387	.27357	3.6554	96456	42
19	26415	.27388	3.6512	96448	41
20	26443	.27419	3.6470	96440	**40**
21	26471	27451	3.6429	96433	39
22	26500	27482	3.6387	96425	38
23	26528	27513	3.6346	96417	37
24	26556	27545	3.6305	96410	36
25	26584	27576	3.6264	96402	**35**
26	26612	27607	3.6222	96394	34
27	26640	27638	3.6181	96386	33
28	26668	27670	3.6140	96379	32
29	26696	27701	3.6100	96371	31
30	26724	27732	3.6059	96363	**30**
31	26752	27764	3.6018	96355	29
32	26780	27795	3.5978	96347	28
33	26808	27826	3.5937	96340	27
34	26836	27858	3.5897	96332	26
35	26864	27889	3.5856	96324	**25**
36	26892	27921	3.5816	96316	24
37	26920	27952	3.5776	96308	23
38	26948	27983	3.5736	96301	22
39	26976	28015	3.5696	96293	21
40	27004	28046	3.5656	96285	**20**
41	27032	28077	3.5616	96277	19
42	27060	28109	3.5576	96269	18
43	27088	28140	3.5536	96261	17
44	27116	28172	3.5497	96253	16
45	27144	28203	3.5457	96246	**15**
46	27172	28234	3.5418	96238	14
47	27200	28266	3.5379	.96230	13
48	27228	28297	3.5339	96222	12
49	27256	28329	3.5300	96214	11
50	27284	28360	3.5261	96206	**10**
51	27312	28391	3.5222	96198	9
52	27340	28423	3.5183	96190	8
53	27368	28454	3.5144	96182	7
54	27396	.28486	3.5105	96174	6
55	27424	28517	3.5067	96166	**5**
56	27452	28549	3.5028	96158	4
57	27480	28580	3.4989	96150	3
58	27508	28612	3.4951	96142	2
59	27536	28643	3.4912	96134	1
60	.27564	28675	3.4874	.96126	**0**
′	Cos	Cot	Tan	Sin	′

105° (285°) (254°) **74°**

16° (196°) (343°) **163°**

′	Sin	Tan	Cot	Cos	′
0	.27564	.28675	3.4874	.96126	**60**
1	.27592	.28706	3.4836	.96118	59
2	.27620	.28738	3.4798	.96110	58
3	.27648	.28769	3.4760	.96102	57
4	.27676	.28801	3.4722	.96094	56
5	.27704	.28832	3.4684	.96086	**55**
6	.27731	.28864	3.4646	.96078	54
7	.27759	.28895	3.4608	.96070	53
8	.27787	.28927	3.4570	.96062	52
9	.27815	.28958	3.4533	.96054	51
10	.27843	.28990	3.4495	.96046	**50**
11	.27871	.29021	3.4458	.96037	49
12	.27899	.29053	3.4420	.96029	48
13	.27927	.29084	3.4383	.96021	47
14	.27955	.29116	3.4346	.96013	46
15	.27983	.29147	3.4308	.96005	**45**
16	.28011	.29179	3.4271	.95997	44
17	.28039	.29210	3.4234	.95989	43
18	.28067	.29242	3.4197	.95981	42
19	.28095	.29274	3.4160	.95972	41
20	.28123	.29305	3.4124	.95964	**40**
21	.28150	.29337	3.4087	.95956	39
22	.28178	.29368	3.4050	.95948	38
23	.28206	.29400	3.4014	.95940	37
24	.28234	.29432	3.3977	.95931	36
25	.28262	.29463	3.3941	.95923	**35**
26	.28290	.29495	3.3904	.95915	34
27	.28318	.29526	3.3868	.95907	33
28	.28346	.29558	3.3832	.95898	32
29	.28374	.29590	3.3796	.95890	31
30	.28402	.29621	3.3759	.95882	**30**
31	.28429	.29653	3.3723	.95874	29
32	.28457	.29685	3.3687	.95865	28
33	.28485	.29716	3.3652	.95857	27
34	.28513	.29748	3.3616	.95849	26
35	.28541	.29780	3.3580	.95841	**25**
36	.28569	.29811	3.3544	.95832	24
37	.28597	.29843	3.3509	.95824	23
38	.28625	.29875	3.3473	.95816	22
39	.28652	.29906	3.3438	.95807	21
40	.28680	.29938	3.3402	.95799	**20**
41	.28708	.29970	3.3367	.95791	19
42	.28736	.30001	3.3332	.95782	18
43	.28764	.30033	3.3297	.95774	17
44	.28792	.30065	3.3261	.95766	16
45	.28820	.30097	3.3226	.95757	**15**
46	.28847	.30128	3.3191	.95749	14
47	.28875	.30160	3.3156	.95740	13
48	.28903	.30192	3.3122	.95732	12
49	.28931	.30224	3.3087	.95724	11
50	.28959	.30255	3.3052	.95715	**10**
51	.28987	.30287	3.3017	.95707	9
52	.29015	.30319	3.2983	.95698	8
53	.29042	.30351	3.2948	.95690	7
54	.29070	.30382	3.2914	.95681	6
55	.29098	.30414	3.2879	.95673	**5**
56	.29126	.30446	3.2845	.95664	4
57	.29154	.30478	3.2811	.95656	3
58	.29182	.30509	3.2777	.95647	2
59	.29209	.30541	3.2743	.95639	1
60	.29237	.30573	3.2709	.95630	**0**
′	Cos	Cot	Tan	Sin	′

106° (286°) (253°) **73°**

17° (197°) (342°) **162°**

′	Sin	Tan	Cot	Cos	′
0	.29237	.30573	3.2709	.95630	**60**
1	.29265	.30605	3.2675	.95622	59
2	.29293	.30637	3.2641	.95613	58
3	.29321	.30669	3.2607	.95605	57
4	.29348	.30700	3.2573	.95596	56
5	.29376	.30732	3.2539	.95588	**55**
6	.29404	.30764	3.2506	.95579	54
7	.29432	.30796	3.2472	.95571	53
8	.29460	.30828	3.2438	.95562	52
9	.29487	.30860	3.2405	.95554	51
10	.29515	.30891	3.2371	.95545	**50**
11	.29543	.30923	3.2338	.95536	49
12	.29571	.30955	3.2305	.95528	48
13	.29599	.30987	3.2272	.95519	47
14	.29626	.31019	3.2238	.95511	46
15	.29654	.31051	3.2205	.95502	**45**
16	.29682	.31083	3.2172	.95493	44
17	.29710	.31115	3.2139	.95485	43
18	.29737	.31147	3.2106	.95476	42
19	.29765	.31178	3.2073	.95467	41
20	.29793	.31210	3.2041	.95459	**40**
21	.29821	.31242	3.2008	.95450	39
22	.29849	.31274	3.1975	.95441	38
23	.29876	.31306	3.1943	.95433	37
24	.29904	.31338	3.1910	.95424	36
25	.29932	.31370	3.1878	.95415	**35**
26	.29960	.31402	3.1845	.95407	34
27	.29987	.31434	3.1813	.95398	33
28	.30015	.31466	3.1780	.95389	32
29	.30043	.31498	3.1748	.95380	31
30	.30071	.31530	3.1716	.95372	**30**
31	.30098	.31562	3.1684	.95363	29
32	.30126	.31594	3.1652	.95354	28
33	.30154	.31626	3.1620	.95345	27
34	.30182	.31658	3.1588	.95337	26
35	.30209	.31690	3.1556	.95328	**25**
36	.30237	.31722	3.1524	.95319	24
37	.30265	.31754	3.1492	.95310	23
38	.30292	.31786	3.1460	.95301	22
39	.30320	.31818	3.1429	.95293	21
40	.30348	.31850	3.1397	.95284	**20**
41	.30376	.31882	3.1366	.95275	19
42	.30403	.31914	3.1334	.95266	18
43	.30431	.31946	3.1303	.95257	17
44	.30459	.31978	3.1271	.95248	16
45	.30486	.32010	3.1240	.95240	**15**
46	.30514	.32042	3.1209	.95231	14
47	.30542	.32074	3.1178	.95222	13
48	.30570	.32106	3.1146	.95213	12
49	.30597	.32139	3.1115	.95204	11
50	.30625	.32171	3.1084	.95195	**10**
51	.30653	.32203	3.1053	.95186	9
52	.30680	.32235	3.1022	.95177	8
53	.30708	.32267	3.0991	.95168	7
54	.30736	.32299	3.0961	.95159	6
55	.30763	.32331	3.0930	.95150	**5**
56	.30791	.32363	3.0899	.95142	4
57	.30819	.32396	3.0868	.95133	3
58	.30846	.32428	3.0838	.95124	2
59	.30874	.32460	3.0807	.95115	1
60	.30902	.32492	3.0777	.95106	**0**
′	Cos	Cot	Tan	Sin	′

107° (287°) (252°) **72°**

NATURAL FUNCTIONS (Continued)

18° (198°) (341°) **161°**

′	Sin	Tan	Cot	Cos	′
0	30902	32492	3 0777	95106	**60**
1	30929	.32524	3 0746	95097	59
2	30957	.32556	3 0716	.95088	58
3	30985	32588	3 0686	95079	57
4	.31012	.32621	3.0655	95070	56
5	.31040	32653	3 0625	.95061	**55**
6	31068	32685	3 0595	95052	54
7	31095	32717	3 0565	95043	53
8	31123	32749	3 0535	95033	52
9	31151	32782	3.0505	95024	51
10	31178	32814	3.0475	95015	**50**
11	31206	32846	3 0445	95006	49
12	31233	.32878	3 0415	.94997	48
13	31261	32911	3 0385	94988	47
14	31289	32943	3 0356	94979	46
15	31316	32975	3 0326	94970	**45**
16	31344	33007	3 0296	94961	44
17	31372	33040	3 0267	94952	43
18	31399	33072	3.0237	94943	42
19	31427	33104	3 0208	94933	41
20	.31454	33136	3 0178	94924	**40**
21	.31482	33169	3.0149	94915	39
22	31510	.33201	3.0120	94906	38
23	31537	33233	3 0090	94897	37
24	31565	33266	3.0061	94888	36
25	31593	33298	3.0032	94878	**35**
26	.31620	33330	3 0003	94869	34
27	31648	33363	2 9974	94860	33
28	31675	33395	2 9945	94851	32
29	31703	33427	2 9916	94842	31
30	31730	33460	2 9887	94832	**30**
31	31758	33492	2 9858	94823	29
32	.31786	33524	2 9829	94814	28
33	.31813	33557	2 9800	94805	27
34	31841	.33589	2 9772	94795	26
35	.31868	33621	2 9743	94786	**25**
36	.31896	33654	2 9714	94777	24
37	.31923	.33686	2 9686	94768	23
38	31951	33718	2 9657	94758	22
39	.31979	33751	2 9629	94749	21
40	32006	33783	2 9600	94740	**20**
41	.32034	33816	2 9572	94730	19
42	.32061	.33848	2 9544	94721	18
43	.32089	.33881	2.9515	.94712	17
44	.32116	.33913	2.9487	.94702	16
45	.32144	33945	2.9459	.94693	**15**
46	.32171	33978	2 9431	94684	14
47	.32199	34010	2.9403	94674	13
48	.32227	34043	2 9375	94665	12
49	.32254	.34075	2 9347	94656	11
50	.32282	34108	2 9319	.94646	**10**
51	32309	34140	2 9291	.94637	9
52	32337	34173	2 9263	.94627	8
53	32364	34205	2 9235	94618	7
54	.32392	34238	2.9208	94609	6
55	32419	.34270	2 9180	.94599	**5**
56	32447	.34303	2 9152	.94590	4
57	32474	.34335	2 9125	94580	3
58	.32502	.34368	2 9097	94571	2
59	.32529	.34400	2.9070	94561	1
60	.32557	.34433	2 9042	94552	**0**
′	Cos	Cot.	Tan	Sin	′

108° (288°) (251°) **71°**

19° (199°) (340°) **160°**

′	Sin	Tan	Cot	Cos	′
0	32557	34433	2.9042	.94552	**60**
1	32584	34465	2 9015	94542	59
2	.32612	34498	2 8987	.94533	58
3	32639	.34530	2.8960	.94523	57
4	.32667	.34563	2.8933	.94514	56
5	32694	.34596	2 8905	94504	**55**
6	32722	34628	2.8878	94495	54
7	.32749	34661	2 8851	94485	53
8	.32777	34693	2.8824	94476	52
9	32804	34726	2 8797	.94466	51
10	.32832	34758	2 8770	.94457	**50**
11	32859	34791	2 8743	94447	49
12	32887	34824	2.8716	94438	48
13	32914	34856	2 8689	94428	47
14	32942	34889	2 8662	94418	46
15	32969	34922	2 8636	94409	**45**
16	32997	34954	2 8609	.94399	44
17	33024	34987	2 8582	94390	43
18	33051	35020	2 8556	.94380	42
19	33079	35052	2 8529	94370	41
20	33106	.35085	2 8502	.94361	**40**
21	33134	.35118	2.8476	94351	39
22	33161	35150	2 8449	94342	38
23	33189	35183	2 8423	94332	37
24	33216	.35216	2 8397	94322	36
25	.33244	35248	2.8370	94313	**35**
26	33271	.35281	2.8344	94303	34
27	.33298	.35314	2.8318	.94293	33
28	33326	35346	2 8291	94284	32
29	33353	.35379	2 8265	94274	31
30	33381	.35412	2 8239	94264	**30**
31	33408	35445	2 8213	94254	29
32	33436	35477	2 8187	.94245	28
33	.33463	35510	2 8161	.94235	27
34	.33490	35543	2.8135	94225	26
35	33518	35576	2 8109	94215	**25**
36	33545	.35608	2 8083	94206	24
37	33573	35641	2.8057	94196	23
38	33600	35674	2.8032	94186	22
39	33627	35707	2 8006	94176	21
40	.33655	35740	2 7980	94167	**20**
41	.33682	.35772	2.7955	94157	19
42	33710	.35805	2.7929	.94147	18
43	.33737	35838	2.7903	.94137	17
44	.33764	35871	2 7878	94127	16
45	.33792	35904	2 7852	94118	**15**
46	33819	35937	2 7827	94108	14
47	33846	35969	2 7801	.94098	13
48	33874	36002	2 7776	94088	12
49	33901	.36035	2 7751	94078	11
50	.33929	.36068	2 7725	94068	**10**
51	.33956	.36101	2.7700	94058	9
52	.33983	36134	2 7675	94049	8
53	.34011	36167	2 7650	94039	7
54	.34038	36199	2 7625	94029	6
55	.34065	36232	2 7600	94019	**5**
56	.34093	.36265	2 7575	.94009	4
57	.34120	36298	2.7550	.93999	3
58	34147	.36331	2 7525	93989	2
59	.34175	.36364	2.7500	.93979	1
60	34202	.36397	2 7475	93969	**0**
′	Cos	Cot	Tan	Sin	′

109° (289°) (250°) **70°**

NATURAL FUNCTIONS (Continued)

20° (200°) (339°) **159°**

′	Sin	Tan	Cot	Cos	′
0	.34202	.36397	2.7475	.93969	**60**
1	.34229	.36430	2.7450	.93959	59
2	.34257	.36463	2.7425	.93949	58
3	.34284	.36496	2.7400	.93939	57
4	.34311	.36529	2.7376	.93929	56
5	.34339	.36562	2.7351	.93919	**55**
6	.34366	.36595	2.7326	.93909	54
7	.34393	.36628	2.7302	.93899	53
8	.34421	.36661	2.7277	.93889	52
9	.34448	.36694	2.7253	.93879	51
10	.34475	.36727	2.7228	.93869	**50**
11	.34503	.36760	2.7204	.93859	49
12	.34530	.36793	2.7179	.93849	48
13	.34557	.36826	2.7155	.93839	47
14	.34584	.36859	2.7130	.93829	46
15	.34612	.36892	2.7106	.93819	**45**
16	.34639	.36925	2.7082	.93809	44
17	.34666	.36958	2.7058	.93799	43
18	.34694	.36991	2.7034	.93789	42
19	.34721	.37024	2.7009	.93779	41
20	.34748	.37057	2.6985	.93769	**40**
21	.34775	.37090	2.6961	.93759	39
22	.34803	.37123	2.6937	.93748	38
23	.34830	.37157	2.6913	.93738	37
24	.34857	.37190	2.6889	.93728	36
25	.34884	.37223	2.6865	.93718	**35**
26	.34912	.37256	2.6841	.93708	34
27	.34939	.37289	2.6818	.93698	33
28	.34966	.37322	2.6794	.93688	32
29	.34993	.37355	2.6770	.93677	31
30	.35021	.37388	2.6746	.93667	**30**
31	.35048	.37422	2.6723	.93657	29
32	.35075	.37455	2.6699	.93647	28
33	.35102	.37488	2.6675	.93637	27
34	.35130	.37521	2.6652	.93626	26
35	.35157	.37554	2.6628	.93616	**25**
36	.35184	.37588	2.6605	.93606	24
37	.35211	.37621	2.6581	.93596	23
38	.35239	.37654	2.6558	.93585	22
39	.35266	.37687	2.6534	.93575	21
40	.35293	.37720	2.6511	.93565	**20**
41	.35320	.37754	2.6488	.93555	19
42	.35347	.37787	2.6464	.93544	18
43	.35375	.37820	2.6441	.93534	17
44	.35402	.37853	2.6418	.93524	16
45	.35429	.37887	2.6395	.93514	**15**
46	.35456	.37920	2.6371	.93503	14
47	.35484	.37953	2.6348	.93493	13
48	.35511	.37986	2.6325	.93483	12
49	.35538	.38020	2.6302	.93472	11
50	.35565	.38053	2.6279	.93462	**10**
51	.35592	.38086	2.6256	.93452	9
52	.35619	.38120	2.6233	.93441	8
53	.35647	.38153	2.6210	.93431	7
54	.35674	.38186	2.6187	.93420	6
55	.35701	.38220	2.6165	.93410	**5**
56	.35728	.38253	2.6142	.93400	4
57	.35755	.38286	2.6119	.93389	3
58	.35782	.38320	2.6096	.93379	2
59	.35810	.38353	2.6074	.93368	1
60	.35837	.38386	2.6051	.93358	**0**
′	Cos	Cot	Tan	Sin	′

110° (290°) (249°) **69°**

21° (201°) (338°) **158°**

′	Sin	Tan	Cot	Cos	′
0	.35837	.38386	2.6051	.93358	**60**
1	.35864	.38420	2.6028	.93348	59
2	.35891	.38453	2.6006	.93337	58
3	.35918	.38487	2.5983	.93327	57
4	.35945	.38520	2.5961	.93316	56
5	.35973	.38553	2.5938	.93306	**55**
6	.36000	.38587	2.5916	.93295	54
7	.36027	.38620	2.5893	.93285	53
8	.36054	.38654	2.5871	.93274	52
9	.36081	.38687	2.5848	.93264	51
10	.36108	.38721	2.5826	.93253	**50**
11	.36135	.38754	2.5804	.93243	49
12	.36162	.38787	2.5782	.93232	48
13	.36190	.38821	2.5759	.93222	47
14	.36217	.38854	2.5737	.93211	46
15	.36244	.38888	2.5715	.93201	**45**
16	.36271	.38921	2.5693	.93190	44
17	.36298	.38955	2.5671	.93180	43
18	.36325	.38988	2.5649	.93169	42
19	.36352	.39022	2.5627	.93159	41
20	.36379	.39055	2.5605	.93148	**40**
21	.36406	.39089	2.5583	.93137	39
22	.36434	.39122	2.5561	.93127	38
23	.36461	.39156	2.5539	.93116	37
24	.36488	.39190	2.5517	.93106	36
25	.36515	.39223	2.5495	.93095	**35**
26	.36542	.39257	2.5473	.93084	34
27	.36569	.39290	2.5452	.93074	33
28	.36596	.39324	2.5430	.93063	32
29	.36623	.39357	2.5408	.93052	31
30	.36650	.39391	2.5386	.93042	**30**
31	.36677	.39425	2.5365	.93031	29
32	.36704	.39458	2.5343	.93020	28
33	.36731	.39192	2.5322	.93010	27
34	.36758	.39526	2.5300	.92999	26
35	.36785	.39559	2.5279	.92988	**25**
36	.36812	.39593	2.5257	.92978	24
37	.36839	.39626	2.5236	.92967	23
38	.36867	.39660	2.5214	.92956	22
39	.36894	.39694	2.5193	.92945	21
40	.36921	.39727	2.5172	.92935	**20**
41	.36948	.39761	2.5150	.92924	19
42	.36975	.39795	2.5129	.92913	18
43	.37002	.39829	2.5108	.92902	17
44	.37029	.39862	2.5086	.92892	16
45	.37056	.39896	2.5065	.92881	**15**
46	.37083	.39930	2.5044	.92870	14
47	.37110	.39963	2.5023	.92859	13
48	.37137	.39997	2.5002	.92849	12
49	.37164	.40031	2.4981	.92838	11
50	.37191	.40065	2.4960	.92827	**10**
51	.37218	.40098	2.4939	.92816	9
52	.37245	.40132	2.4918	.92805	8
53	.37272	.40166	2.4897	.92794	7
54	.37299	.40200	2.4876	.92784	6
55	.37326	.40234	2.4855	.92773	**5**
56	.37353	.40267	2.4834	.92762	4
57	.37380	.40301	2.4813	.92751	3
58	.37407	.40335	2.4792	.92740	2
59	.37434	.40369	2.4772	.92729	1
60	.37461	.40403	2.4751	.92718	**0**
′	Cos	Cot	Tan	Sin	′

111° (291°) (248°) **68°**

NATURAL FUNCTIONS (Continued)

22° (202°) (337°) **157°**

′	Sin	Tan	Cot	Cos	′
0	.37461	.40403	2.4751	.92718	**60**
1	.37488	.40436	2.4730	.92707	59
2	.37515	.40470	2.4709	.92697	58
3	.37542	.40504	2.4689	.92686	57
4	.37569	.40538	2.4668	.92675	56
5	.37595	.40572	2.4648	.92664	**55**
6	.37622	.40606	2.4627	.92653	54
7	.37649	.40640	2.4606	.92642	53
8	.37676	.40674	2.4586	.92631	52
9	.37703	.40707	2.4566	.92620	51
10	.37730	.40741	2.4545	.92609	**50**
11	.37757	.40775	2.4525	.92598	49
12	.37784	.40809	2.4504	.92587	48
13	.37811	.40843	2.4484	.92576	47
14	.37838	.40877	2.4464	.92565	46
15	.37865	.40911	2.4443	.92554	**45**
16	.37892	.40945	2.4423	.92543	44
17	.37919	.40979	2.4403	.92532	43
18	.37946	.41013	2.4383	.92521	42
19	.37973	.41047	2.4362	.92510	41
20	.37999	.41081	2.4342	.92499	**40**
21	.38026	.41115	2.4322	.92488	39
22	.38053	.41149	2.4302	.92477	38
23	.38080	.41183	2.4282	.92466	37
24	.38107	.41217	2.4262	.92455	36
25	.38134	.41251	2.4242	.92444	**35**
26	.38161	.41285	2.4222	.92432	34
27	.38188	.41319	2.4202	.92421	33
28	.38215	.41353	2.4182	.92410	32
29	.38241	.41387	2.4162	.92399	31
30	.38268	.41421	2.4142	.92388	**30**
31	.38295	.41455	2.4122	.92377	29
32	.38322	.41490	2.4102	.92366	28
33	.38349	.41524	2.4083	.92355	27
34	.38376	.41558	2.4063	.92343	26
35	.38403	.41592	2.4043	.92332	**25**
36	.38430	.41626	2.4023	.92321	24
37	.38456	.41660	2.4004	.92310	23
38	.38483	.41694	2.3984	.92299	22
39	.38510	.41728	2.3964	.92287	21
40	.38537	.41763	2.3945	.92276	**20**
41	.38564	.41797	2.3925	.92265	19
42	.38591	.41831	2.3906	.92254	18
43	.38617	.41865	2.3886	.92243	17
44	.38644	.41899	2.3867	.92231	16
45	.38671	.41933	2.3847	.92220	**15**
46	.38698	.41968	2.3828	.92209	14
47	.38725	.42002	2.3808	.92198	13
48	.38752	.42036	2.3789	.92186	12
49	.38778	.42070	2.3770	.92175	11
50	.38805	.42105	2.3750	.92164	**10**
51	.38832	.42139	2.3731	.92152	9
52	.38859	.42173	2.3712	.92141	8
53	.38886	.42207	2.3693	.92130	7
54	.38912	.42242	2.3673	.92119	6
55	.38939	.42276	2.3654	.92107	**5**
56	.38966	.42310	2.3635	.92096	4
57	.38993	.42345	2.3616	.92085	3
58	.39020	.42379	2.3597	.92073	2
59	.39046	.42413	2.3578	.92062	1
60	.39073	.42447	2.3559	.92050	**0**
′	Cos	Cot	Tan	Sin	′

112° (292°) (247°) **67°**

23° (203°) (336°) **156°**

′	Sin	Tan	Cot	Cos	′
0	.39073	.42447	2.3559	.92050	**60**
1	.39100	.42482	2.3539	.92039	59
2	.39127	.42516	2.3520	.92028	58
3	.39153	.42551	2.3501	.92016	57
4	.39180	.42585	2.3483	.92005	56
5	.39207	.42619	2.3464	.91994	**55**
6	.39234	.42654	2.3445	.91982	54
7	.39260	.42688	2.3426	.91971	53
8	.39287	.42722	2.3407	.91959	52
9	.39314	.42757	2.3388	.91948	51
10	.39341	.42791	2.3369	.91936	**50**
11	.39367	.42826	2.3351	.91925	49
12	.39394	.42860	2.3332	.91914	48
13	.39421	.42894	2.3313	.91902	47
14	.39448	.42929	2.3294	.91891	46
15	.39474	.42963	2.3276	.91879	**45**
16	.39501	.42998	2.3257	.91868	44
17	.39528	.43032	2.3238	.91856	43
18	.39555	.43067	2.3220	.91845	42
19	.39581	.43101	2.3201	.91833	41
20	.39608	.43136	2.3183	.91822	**40**
21	.39635	.43170	2.3164	.91810	39
22	.39661	.43205	2.3146	.91799	38
23	.39688	.43239	2.3127	.91787	37
24	.39715	.43274	2.3109	.91775	36
25	.39741	.43308	2.3090	.91764	**35**
26	.39768	.43343	2.3072	.91752	34
27	.39795	.43378	2.3053	.91741	33
28	.39822	.43412	2.3035	.91729	32
29	.39848	.43447	2.3017	.91718	31
30	.39875	.43481	2.2998	.91706	**30**
31	.39902	.43516	2.2980	.91694	29
32	.39928	.43550	2.2962	.91683	28
33	.39955	.43585	2.2944	.91671	27
34	.39982	.43620	2.2925	.91660	26
35	.40008	.43654	2.2907	.91648	**25**
36	.40035	.43689	2.2889	.91636	24
37	.40062	.43724	2.2871	.91625	23
38	.40088	.43758	2.2853	.91613	22
39	.40115	.43793	2.2835	.91601	21
40	.40141	.43828	2.2817	.91590	**20**
41	.40168	.43862	2.2799	.91578	19
42	.40195	.43897	2.2781	.91566	18
43	.40221	.43932	2.2763	.91555	17
44	.40248	.43966	2.2745	.91543	16
45	.40275	.44001	2.2727	.91531	**15**
46	.40301	.44036	2.2709	.91519	14
47	.40328	.44071	2.2691	.91508	13
48	.40355	.44105	2.2673	.91496	12
49	.40381	.44140	2.2655	.91484	11
50	.40408	.44175	2.2637	.91472	**10**
51	.40434	.44210	2.2620	.91461	9
52	.40461	.44244	2.2602	.91449	8
53	.40488	.44279	2.2584	.91437	7
54	.40514	.44314	2.2566	.91425	6
55	.40541	.44349	2.2549	.91414	**5**
56	.40567	.44384	2.2531	.91402	4
57	.40594	.44418	2.2513	.91390	3
58	.40621	.44453	2.2496	.91378	2
59	.40647	.44488	2.2478	.91366	1
60	.40674	.44523	2.2460	.91355	**0**
′	Cos	Cot	Tan	Sin	′

113° (293°) (246°) **66°**

NATURAL FUNCTIONS (Continued)

24° (204°) (335°) **155°**

′	Sin	Tan	Cot	Cos	′
0	.40674	.44523	2.2460	.91355	**60**
1	.40700	.44558	2.2443	.91343	59
2	.40727	.44593	2.2425	.91331	58
3	.40753	.44627	2.2408	.91319	57
4	.40780	.44662	2.2390	.91307	56
5	.40806	.44697	2.2373	.91295	**55**
6	.40833	.44732	2.2355	.91283	54
7	.40860	.44767	2.2338	.91272	53
8	.40886	.44802	2.2320	.91260	52
9	.40913	.44837	2.2303	.91248	51
10	.40939	.44872	2.2286	.91236	**50**
11	.40966	.44907	2.2268	.91224	49
12	.40992	.44942	2.2251	.91212	48
13	.41019	.44977	2.2234	.91200	47
14	.41045	.45012	2.2216	.91188	46
15	.41072	.45047	2.2199	.91176	**45**
16	.41098	.45082	2.2182	.91164	44
17	.41125	.45117	2.2165	.91152	43
18	.41151	.45152	2.2148	.91140	42
19	.41178	.45187	2.2130	.91128	41
20	.41204	.45222	2.2113	.91116	**40**
21	.41231	.45257	2.2096	.91104	39
22	.41257	.45292	2.2079	.91092	38
23	.41284	.45327	2.2062	.91080	37
24	.41310	.45362	2.2045	.91068	36
25	.41337	.45397	2.2028	.91056	**35**
26	.41363	.45432	2.2011	.91044	34
27	.41390	.45467	2.1994	.91032	33
28	.41416	.45502	2.1977	.91020	32
29	.41443	.45538	2.1960	.91008	31
30	.41469	.45573	2.1943	.90996	**30**
31	.41496	.45608	2.1926	.90984	29
32	.41522	.45643	2.1909	.90972	28
33	.41549	.45678	2.1892	.90960	27
34	.41575	.45713	2.1876	.90948	26
35	.41602	.45748	2.1859	.90936	**25**
36	.41628	.45784	2.1842	.90924	24
37	.41655	.45819	2.1825	.90911	23
38	.41681	.45854	2.1808	.90899	22
39	.41707	.45889	2.1792	.90887	21
40	.41734	.45924	2.1775	.90875	**20**
41	.41760	.45960	2.1758	.90863	19
42	.41787	.45995	2.1742	.90851	18
43	.41813	.46030	2.1725	.90839	17
44	.41840	.46065	2.1708	.90826	16
45	.41866	.46101	2.1692	.90814	**15**
46	.41892	.46136	2.1675	.90802	14
47	.41919	.46171	2.1659	.90790	13
48	.41945	.46206	2.1642	.90778	12
49	.41972	.46242	2.1625	.90766	11
50	.41998	.46277	2.1609	.90753	**10**
51	.42024	.46312	2.1592	.90741	9
52	.42051	.46348	2.1576	.90729	8
53	.42077	.46383	2.1560	.90717	7
54	.42104	.46418	2.1543	.90704	6
55	.42130	.46454	2.1527	.90692	**5**
56	.42156	.46489	2.1510	.90680	4
57	.42183	.46525	2.1494	.90668	3
58	.42209	.46560	2.1478	.90655	2
59	.42235	.46595	2.1461	.90643	1
60	.42262	.46631	2.1445	.90631	**0**
′	Cos	Cot	Tan	Sin	′

114° (294°) (245°) **65°**

25° (205°) (334°) **154°**

′	Sin	Tan	Cot	Cos	′
0	.42262	.46631	2.1445	.90631	**60**
1	.42288	.46666	2.1429	.90618	59
2	.42315	.46702	2.1413	.90606	58
3	.42341	.46737	2.1396	.90594	57
4	.42367	.46772	2.1380	.90582	56
5	.42394	.46808	2.1364	.90569	**55**
6	.42420	.46843	2.1348	.90557	54
7	.42446	.46879	2.1332	.90545	53
8	.42473	.46914	2.1315	.90532	52
9	.42499	.46950	2.1299	.90520	51
10	.42525	.46985	2.1283	.90507	**50**
11	.42552	.47021	2.1267	.90495	49
12	.42578	.47056	2.1251	.90483	48
13	.42604	.47092	2.1235	.90470	47
14	.42631	.47128	2.1219	.90458	46
15	.42657	.47163	2.1203	.90446	**45**
16	.42683	.47199	2.1187	.90433	44
17	.42709	.47234	2.1171	.90421	43
18	.42736	.47270	2.1155	.90408	42
19	.42762	.47305	2.1139	.90396	41
20	.42788	.47341	2.1123	.90383	**40**
21	.42815	.47377	2.1107	.90371	39
22	.42841	.47412	2.1092	.90358	38
23	.42867	.47448	2.1076	.90346	37
24	.42894	.47483	2.1060	.90334	36
25	.42920	.47519	2.1044	.90321	**35**
26	.42946	.47555	2.1028	.90309	34
27	.42972	.47590	2.1013	.90296	33
28	.42999	.47626	2.0997	.90284	32
29	.43025	.47662	2.0981	.90271	31
30	.43051	.47698	2.0965	.90259	**30**
31	.43077	.47733	2.0950	.90246	29
32	.43104	.47769	2.0934	.90233	28
33	.43130	.47805	2.0918	.90221	27
34	.43156	.47840	2.0903	.90208	26
35	.43182	.47876	2.0887	.90196	**25**
36	.43209	.47912	2.0872	.90183	24
37	.43235	.47948	2.0856	.90171	23
38	.43261	.47984	2.0840	.90158	22
39	.43287	.48019	2.0825	.90146	21
40	.43313	.48055	2.0809	.90133	**20**
41	.43340	.48091	2.0794	.90120	19
42	.43366	.48127	2.0778	.90108	18
43	.43392	.48163	2.0763	.90095	17
44	.43418	.48198	2.0748	.90082	16
45	.43445	.48234	2.0732	.90070	**15**
46	.43471	.48270	2.0717	.90057	14
47	.43497	.48306	2.0701	.90045	13
48	.43523	.48342	2.0686	.90032	12
49	.43549	.48378	2.0671	.90019	11
50	.43575	.48414	2.0655	.90007	**10**
51	.43602	.48450	2.0640	.89994	9
52	.43628	.48486	2.0625	.89981	8
53	.43654	.48521	2.0609	.89968	7
54	.43680	.48557	2.0594	.89956	6
55	.43706	.48593	2.0579	.89943	**5**
56	.43733	.48629	2.0564	.89930	4
57	.43759	.48665	2.0549	.89918	3
58	.43785	.48701	2.0533	.89905	2
59	.43811	.48737	2.0518	.89892	1
60	.43837	.48773	2.0503	.89879	**0**
′	Cos	Cot	Tan	Sin	′

115° (295°) (244°) **64°**

26° (206°) (333°) **153°**

'	Sin	Tan	Cot	Cos	'
0	.43837	.48773	2.0503	.89879	**60**
1	.43863	.48809	2.0488	.89867	59
2	.43889	.48845	2.0473	.89854	58
3	.43916	.48881	2.0458	.89841	57
4	.43942	.48917	2.0443	.89828	56
5	.43968	.48953	2.0428	.89816	**55**
6	.43994	.48989	2.0413	.89803	54
7	.44020	.49026	2.0398	.89790	53
8	.44046	.49062	2.0383	.89777	52
9	.44072	.49098	2.0368	.89764	51
10	.44098	.49134	2 0353	.89752	**50**
11	.44124	.49170	2.0338	.89739	49
12	.44151	.49206	2.0323	.89726	48
13	44177	.49242	2.0308	89713	47
14	44203	.49278	2 0293	.89700	46
15	.44229	.49315	2.0278	.89687	**45**
16	.44255	.49351	2.0263	.89674	44
17	44281	.49387	2.0248	.89662	43
18	.44307	.49423	2.0233	.89649	42
19	44333	49459	2.0219	.89636	41
20	44359	.49495	2.0204	.89623	**40**
21	44385	.49532	2.0189	.89610	39
22	44411	.49568	2.0174	.89597	38
23	44437	.49604	2.0160	.89584	37
24	44464	.49640	2.0145	.89571	36
25	44490	.49677	2.0130	.89558	**35**
26	44516	.49713	2.0115	.89545	34
27	44542	.49749	2 0101	.89532	33
28	44568	.49786	2 0086	.89519	32
29	44594	.49822	2 0072	.89506	31
30	44620	.49858	2 0057	89493	**30**
31	44646	.49894	2 0042	.89480	29
32	44672	.49931	2 0028	89467	28
33	44698	.49967	2 0013	89454	27
34	.44724	.50004	1 9999	89441	26
35	44750	.50040	1 9984	89428	**25**
36	44776	.50076	1 9970	89415	24
37	44802	.50113	1 9955	89402	23
38	.44828	.50149	1 9941	89389	22
39	44854	.50185	1 9926	89376	21
40	.44880	.50222	1 9912	89363	**20**
41	44906	.50258	1.9897	89350	19
42	44932	.50295	1.9883	89337	18
43	44958	.50331	1 9868	89324	17
44	.44984	.50368	1.9854	.89311	16
45	45010	.50404	1.9840	89298	**15**
46	45036	.50441	1.9825	89285	14
47	45062	50477	1 9811	89272	13
48	45088	.50514	1.9797	89259	12
49	45114	.50550	1.9782	.89245	11
50	45140	.50587	1 9768	.89232	**10**
51	45166	.50623	1 9754	89219	9
52	45192	.50660	1 9740	.89206	8
53	.45218	.50696	1 9725	89193	7
54	.45243	.50733	1 9711	.89180	6
55	.45269	.50769	1 9697	89167	**5**
56	.45295	.50806	1.9683	89153	4
57	.45321	.50843	1.9669	89140	3
58	.45347	.50879	1 9654	.89127	2
59	.45373	.50916	1 9640	.89114	1
60	.45399	.50953	1 9626	89101	**0**
'	Cos	Cot	Tan	Sin	'

116° (296°) (243°) **63°**

27° (207°) (332°) **152°**

'	Sin	Tan	Cot	Cos	'
0	.45399	50953	1.9626	.89101	**60**
1	45425	.50989	1.9612	.89087	59
2	.45451	51026	1 9598	.89074	58
3	.45477	.51063	1.9584	.89061	57
4	45503	.51099	1.9570	.89048	56
5	.45529	.51136	1.9556	.89035	**55**
6	.45554	.51173	1.9542	89021	54
7	.45580	.51209	1.9528	89008	53
8	.45606	.51246	1.9514	.88995	52
9	.45632	.51283	1.9500	.88981	51
10	.45658	.51319	1.9486	88968	**50**
11	.45684	.51356	1.9472	.88955	49
12	.45710	.51393	1.9458	.88942	48
13	.45736	.51430	1.9444	.88928	47
14	.45762	.51467	1.9430	.88915	46
15	.45787	.51503	1.9416	.88902	**45**
16	45813	.51540	1.9402	.88888	44
17	.45839	.51577	1.9388	.88875	43
18	.45865	.51614	1.9375	.88862	42
19	.45891	.51651	1.9361	.88848	41
20	.45917	.51688	1.9347	.88835	**40**
21	.45942	.51724	1.9333	.88822	39
22	.45968	.51761	1.9319	.88808	38
23	45994	.51798	1.9306	.88795	37
24	46020	.51835	1 9292	.88782	36
25	.46046	.51872	1.9278	.88768	**35**
26	46072	.51909	1 9265	.88755	34
27	.46097	.51946	1.9251	.88741	33
28	46123	.51983	1.9237	.88728	32
29	.46149	.52020	1.9223	.88715	31
30	.46175	.52057	1 9210	.88701	**30**
31	.46201	.52094	1 9196	.88688	29
32	.46226	.52131	1 9183	88674	28
33	.46252	.52168	1 9169	.88661	27
34	.46278	.52205	1 9155	.88647	26
35	.46304	.52242	1.9142	.88634	**25**
36	46330	.52279	1.9128	.88620	24
37	.46355	.52316	1.9115	.88607	23
38	46381	52353	1.9101	.88593	22
39	46407	.52390	1.9088	.88580	21
40	46433	52427	1.9074	.88566	**20**
41	46458	52464	1.9061	.88553	19
42	46484	52501	1 9047	.88539	18
43	.46510	.52538	1.9034	.88526	17
44	46536	.52575	1.9020	.88512	16
45	.46561	.52613	1 9007	.88499	**15**
46	46587	52650	1.8993	.88485	14
47	.46613	52687	1 8980	.88472	13
48	46639	.52724	1.8967	.88458	12
49	.46664	.52761	1.8953	.88445	11
50	.46690	.52798	1 8940	.88431	**10**
51	.46716	.52836	1 8927	.88417	9
52	.46742	52873	1 8913	.88404	8
53	46767	.52910	1.8900	.88390	7
54	46793	.52947	1 8887	.88377	6
55	.46819	.52985	1 8873	.88363	**5**
56	.46844	.53022	1 8860	.88349	4
57	.46870	.53059	1.8847	.88336	3
58	.46896	.53096	1.8834	.88322	2
59	46921	.53134	1 8820	.88308	1
60	46947	.53171	1.8807	.88295	**0**
'	Cos	Cot	Tan	Sin	'

117° (297°) (242°) **62°**

28° (208°) (331°) **151°**

′	Sin	Tan	Cot	Cos	′
0	.46947	.53171	1.8807	.88295	**60**
1	.46973	.53208	1.8794	.88281	59
2	.46999	.53246	1.8781	.88267	58
3	.47024	.53283	1.8768	.88254	57
4	.47050	.53320	1.8755	.88240	56
5	.47076	.53358	1.8741	.88226	**55**
6	.47101	.53395	1.8728	.88213	54
7	.47127	.53432	1.8715	.88199	53
8	.47153	.53470	1.8702	.88185	52
9	.47178	.53507	1.8689	.88172	51
10	.47204	.53545	1.8676	.88158	**50**
11	.47229	.53582	1.8663	.88144	49
12	.47255	.53620	1.8650	.88130	48
13	.47281	.53657	1.8637	.88117	47
14	.47306	.53694	1.8624	.88103	46
15	.47332	.53732	1.8611	.88089	**45**
16	.47358	.53769	1.8598	.88075	44
17	.47383	.53807	1.8585	.88062	43
18	.47409	.53844	1.8572	.88048	42
19	.47434	.53882	1.8559	.88034	41
20	.47460	.53920	1.8546	.88020	**40**
21	.47486	.53957	1.8533	.88006	39
22	.47511	.53995	1.8520	.87993	38
23	.47537	.54032	1.8507	.87979	37
24	.47562	.54070	1.8495	.87965	36
25	.47588	.54107	1.8482	.87951	**35**
26	.47614	.54145	1.8469	.87937	34
27	.47639	.54183	1.8456	.87923	33
28	.47665	.54220	1.8443	.87909	32
29	.47690	.54258	1.8430	.87896	31
30	.47716	.54296	1.8418	.87882	**30**
31	.47741	.54333	1.8405	.87868	29
32	.47767	.54371	1.8392	.87854	28
33	.47793	.54409	1.8379	.87840	27
34	.47818	.54446	1.8367	.87826	26
35	.47844	.54484	1.8354	.87812	**25**
36	.47869	.54522	1.8341	.87798	24
37	.47895	.54560	1.8329	.87784	23
38	.47920	.54597	1.8316	.87770	22
39	.47946	.54635	1.8303	.87756	21
40	.47971	.54673	1.8291	.87743	**20**
41	.47997	.54711	1.8278	.87729	19
42	.48022	.54748	1.8265	.87715	18
43	.48048	.54786	1.8253	.87701	17
44	.48073	.54824	1.8240	.87687	16
45	.48099	.54862	1.8228	.87673	**15**
46	.48124	.54900	1.8215	.87659	14
47	.48150	.54938	1.8202	.87645	13
48	.48175	.54975	1.8190	.87631	12
49	.48201	.55013	1.8177	.87617	11
50	.48226	.55051	1.8165	.87603	**10**
51	.48252	.55089	1.8152	.87589	9
52	.48277	.55127	1.8140	.87575	8
53	.48303	.55165	1.8127	.87561	7
54	.48328	.55203	1.8115	.87546	6
55	.48354	.55241	1.8103	.87532	**5**
56	.48379	.55279	1.8090	.87518	4
57	.48405	.55317	1.8078	.87504	3
58	.48430	.55355	1.8065	.87490	2
59	.48456	.55393	1.8053	.87476	1
60	.48481	.55431	1.8040	.87462	**0**
′	Cos	Cot	Tan	Sin	′

118° (298°) (241°) **61°**

29° (209°) (330°) **150°**

′	Sin	Tan	Cot	Cos	′
0	.48481	.55431	1.8040	.87462	**60**
1	.48506	.55469	1.8028	.87448	59
2	.48532	.55507	1.8016	.87434	58
3	.48557	.55545	1.8003	.87420	57
4	.48583	.55583	1.7991	.87406	56
5	.48608	.55621	1.7979	.87391	**55**
6	.48634	.55659	1.7966	.87377	54
7	.48659	.55697	1.7954	.87363	53
8	.48684	.55736	1.7942	.87349	52
9	.48710	.55774	1.7930	.87335	51
10	.48735	.55812	1.7917	.87321	**50**
11	.48761	.55850	1.7905	.87306	49
12	.48786	.55888	1.7893	.87292	48
13	.48811	.55926	1.7881	.87278	47
14	.48837	.55964	1.7868	.87264	46
15	.48862	.56003	1.7856	.87250	**45**
16	.48888	.56041	1.7844	.87235	44
17	.48913	.56079	1.7832	.87221	43
18	.48938	.56117	1.7820	.87207	42
19	.48964	.56156	1.7808	.87193	41
20	.48989	.56194	1.7796	.87178	**40**
21	.49014	.56232	1.7783	.87164	39
22	.49040	.56270	1.7771	.87150	38
23	.49065	.56309	1.7759	.87136	37
24	.49090	.56347	1.7747	.87121	36
25	.49116	.56385	1.7735	.87107	**35**
26	.49141	.56424	1.7723	.87093	34
27	.49166	.56462	1.7711	.87079	33
28	.49192	.56501	1.7699	.87064	32
29	.49217	.56539	1.7687	.87050	31
30	.49242	.56577	1.7675	.87036	**30**
31	.49268	.56616	1.7663	.87021	29
32	.49293	.56654	1.7651	.87007	28
33	.49318	.56693	1.7639	.86993	27
34	.49344	.56731	1.7627	.86978	26
35	.49369	.56769	1.7615	.86964	**25**
36	.49394	.56808	1.7603	.86949	24
37	.49419	.56846	1.7591	.86935	23
38	.49445	.56885	1.7579	.86921	22
39	.49470	.56923	1.7567	.86906	21
40	.49495	.56962	1.7556	.86892	**20**
41	.49521	.57000	1.7544	.86878	19
42	.49546	.57039	1.7532	.86863	18
43	.49571	.57078	1.7520	.86849	17
44	.49596	.57116	1.7508	.86834	16
45	.49622	.57155	1.7496	.86820	**15**
46	.49647	.57193	1.7485	.86805	14
47	.49672	.57232	1.7473	.86791	13
48	.49697	.57271	1.7461	.86777	12
49	.49723	.57309	1.7449	.86762	11
50	.49748	.57348	1.7437	.86748	**10**
51	.49773	.57386	1.7426	.86733	9
52	.49798	.57425	1.7414	.86719	8
53	.49824	.57464	1.7402	.86704	7
54	.49849	.57503	1.7391	.86690	6
55	.49874	.57541	1.7379	.86675	**5**
56	.49899	.57580	1.7367	.86661	4
57	.49924	.57619	1.7355	.86646	3
58	.49950	.57657	1.7344	.86632	2
59	.49975	.57696	1.7332	.86617	1
60	.50000	.57735	1.7321	.86603	**0**
′	Cos	Cot	Tan	Sin	′

119° (299°) (240°) **60°**

NATURAL FUNCTIONS (Continued)

30° (210°) (329°) **149°**

′	Sin	Tan	Cot	Cos	′
0	50000	57735	1.7321	86603	**60**
1	.50025	.57774	1.7309	.86588	59
2	.50050	57813	1.7297	.86573	58
3	.50076	57851	1.7286	.86559	57
4	.50101	57890	1.7274	.86544	56
5	.50126	57929	1.7262	.86530	**55**
6	.50151	57968	1.7251	.86515	54
7	50176	58007	1.7239	.86501	53
8	.50201	.58046	1.7228	86486	52
9	.50227	58085	1.7216	.86471	51
10	.50252	.58124	1.7205	.86457	**50**
11	50277	58162	1.7193	.86442	49
12	50302	.58201	1.7182	86427	48
13	50327	58240	1.7170	.86413	47
14	50352	.58279	1.7159	86398	46
15	50377	58318	1.7147	.86384	**45**
16	50403	.58357	1.7136	86369	44
17	50428	.58396	1.7124	86354	43
18	50453	58435	1.7113	86340	42
19	.50478	.58474	1.7102	86325	41
20	50503	58513	1.7090	86310	**40**
21	50528	.58552	1.7079	86295	39
22	50553	.58591	1.7067	86281	38
23	.50578	58631	1.7056	86266	37
24	50603	58670	1.7045	86251	36
25	50628	.58709	1.7033	86237	**35**
26	50654	.58748	1.7022	86222	34
27	.50679	58787	1.7011	86207	33
28	50704	58826	1.6999	86192	32
29	50729	58865	1.6988	86178	31
30	.50754	58905	1.6977	86163	**30**
31	50779	58944	1.6965	86148	29
32	50804	.58983	1.6954	86133	28
33	50829	59022	1.6943	86119	27
34	50854	59061	1.6932	86104	26
35	.50879	59101	1.6920	86089	**25**
36	50904	59140	1.6909	86074	24
37	50929	.59179	1.6898	86059	23
38	50954	59218	1.6887	86045	22
39	50979	59258	1.6875	.86030	21
40	51004	59297	1.6864	86015	**20**
41	51029	59336	1.6853	86000	19
42	51054	59376	1.6842	85985	18
43	51079	59415	1.6831	.85970	17
44	51104	59454	1.6820	85956	16
45	51129	59494	1.6808	85941	**15**
46	.51154	.59533	1.6797	85926	14
47	.51179	59573	1.6786	85911	13
48	.51204	59612	1.6775	.85896	12
49	51229	59651	1.6764	85881	11
50	51254	59691	1.6753	.85866	**10**
51	.51279	59730	1.6742	.85851	9
52	51304	59770	1.6731	85836	8
53	.51329	59809	1.6720	.85821	7
54	51354	59849	1.6709	85806	6
55	.51379	.59888	1.6698	.85792	**5**
56	.51404	.59928	1.6687	85777	4
57	.51429	.59967	1.6676	.85762	3
58	.51454	60007	1.6665	.85747	2
59	.51479	.60046	1.6654	85732	1
60	.51504	60086	1.6643	85717	**0**
′	Cos	Cot	Tan	Sin	′

120° (300°) (239°) **59°**

31° (211°) (328°) **148°**

′	Sin	Tan	Cot	Cos	′
0	51504	60086	1.6643	85717	**60**
1	51529	60126	1.6632	.85702	59
2	51554	.60165	1.6621	.85687	58
3	.51579	60205	1.6610	85672	57
4	.51604	60245	1.6599	85657	56
5	51628	60284	1.6588	85642	**55**
6	51653	60324	1.6577	85627	54
7	.51678	60364	1.6566	85612	53
8	.51703	60403	1.6555	85597	52
9	.51728	60443	1.6545	.85582	51
10	51753	60483	1.6534	85567	**50**
11	51778	.60522	1.6523	85551	49
12	51803	60562	1.6512	.85536	48
13	51828	60602	1.6501	85521	47
14	51852	60642	1.6490	85506	46
15	51877	.60681	1.6479	85491	**45**
16	51902	60721	1.6469	85476	44
17	51927	60761	1.6458	85461	43
18	51952	60801	1.6447	85446	42
19	51977	60841	1.6436	85431	41
20	52002	60881	1.6426	85416	**40**
21	52026	60921	1.6415	85401	39
22	52051	60960	1.6404	85385	38
23	52076	61000	1.6393	85370	37
24	52101	61040	1.6383	85355	36
25	52126	61080	1.6372	85340	**35**
26	52151	61120	1.6361	85325	34
27	52175	61160	1.6351	85310	33
28	52200	61200	1.6340	85294	32
29	52225	61240	1.6329	85279	31
30	52250	61280	1.6319	85264	**30**
31	52275	61320	1.6308	85249	29
32	52299	61360	1.6297	85234	28
33	52324	61400	1.6287	.85218	27
34	52349	61440	1.6276	.85203	26
35	52374	61480	1.6265	.85188	**25**
36	52399	61520	1.6255	85173	24
37	52423	61561	1.6244	85157	23
38	52448	61601	1.6234	85142	22
39	52473	61641	1.6223	85127	21
40	.52498	61681	1.6212	85112	**20**
41	.52522	61721	1.6202	85096	19
42	52547	61761	1.6191	85081	18
43	52572	61801	1.6181	85066	17
44	52597	61842	1.6170	85051	16
45	52621	61882	1.6160	85035	**15**
46	.52646	61922	1.6149	.85020	14
47	52671	61962	1.6139	85005	13
48	52696	62003	1.6128	84989	12
49	.52720	62043	1.6118	.84974	11
50	52745	62083	1.6107	.84959	**10**
51	52770	.62124	1.6097	.84943	9
52	52794	.62164	1.6087	84928	8
53	.52819	62204	1.6076	.84913	7
54	.52844	62245	1.6066	84897	6
55	52869	62285	1.6055	.84882	**5**
56	52893	62325	1.6045	.84866	4
57	52918	62366	1.6034	84851	3
58	52943	.62406	1.6024	84836	2
59	52967	62446	1.6014	84820	1
60	52992	62487	1.6003	84805	**0**
′	Cos	Cot	Tan	Sin	′

121° (301°) (238°) **58°**

NATURAL FUNCTIONS (Continued)

32° (212°) (327°) **147°**

′	Sin	Tan	Cot	Cos	′
0	.52992	.62487	1.6003	.84805	**60**
1	.53017	.62527	1.5993	.84789	59
2	.53041	.62568	1.5983	.84774	58
3	.53066	.62608	1.5972	.84759	57
4	.53091	62649	1.5962	.84743	56
5	53115	62689	1.5952	.84728	**55**
6	.53140	62730	1.5941	.84712	54
7	53164	62770	1.5931	84697	53
8	.53189	62811	1.5921	.84681	52
9	53214	.62852	1.5911	.84666	51
10	.53238	62892	1.5900	84650	**50**
11	53263	62933	1 5890	84635	49
12	.53288	62973	1 5880	84619	48
13	.53312	.63014	1.5869	.84604	47
14	.53337	.63055	1.5859	.84588	46
15	.53361	63095	1 5849	.84573	**45**
16	53386	63136	1 5839	84557	44
17	.53411	63177	1 5829	84542	43
18	53435	63217	1.5818	84526	42
19	53460	.63258	1.5808	84511	41
20	53484	63299	1.5798	84495	**40**
21	53509	63340	1 5788	84480	39
22	53534	63380	1.5778	84464	38
23	.53558	.63421	1.5768	.84448	37
24	.53583	63462	1.5757	84433	36
25	.53607	63503	1.5747	84417	**35**
26	.53632	63544	1.5737	84402	34
27	.53656	63584	1.5727	84386	33
28	.53681	63625	1 5717	84370	32
29	.53705	63666	1 5707	84355	31
30	53730	63707	1 5697	84339	**30**
31	.53754	63748	1 5687	84324	29
32	.53779	63789	1 5677	84308	28
33	.53804	63830	1 5667	84292	27
34	.53828	63871	1.5657	84277	26
35	53853	63912	1.5647	84261	**25**
36	53877	63953	1.5637	84245	24
37	53902	63994	1.5627	84230	23
38	53926	.64035	1 5617	84214	22
39	.53951	.64076	1.5607	84198	21
40	53975	64117	1.5597	84182	**20**
41	54000	64158	1.5587	84167	19
42	54024	64199	1.5577	84151	18
43	54049	.64240	1 5567	84135	17
44	.54073	.64281	1.5557	84120	16
45	.54097	64322	1.5547	84104	**15**
46	.54122	64363	1.5537	84088	14
47	54146	64404	1.5527	84072	13
48	54171	.64446	1.5517	84057	12
49	.54195	64487	1.5507	84041	11
50	54220	64528	1 5497	84025	**10**
51	.54244	64569	1.5487	84009	9
52	54269	64610	1.5477	83994	8
53	54293	.64652	1.5468	83978	7
54	.54317	64693	1.5458	.83962	6
55	.54342	.64734	1.5448	83946	**5**
56	54366	64775	1 5438	83930	4
57	54391	64817	1.5428	83915	3
58	.54415	64858	1.5418	83899	2
59	.54440	64899	1.5408	83883	1
60	.54464	64941	1 5399	.83867	**0**
′	Cos	Cot	Tan	Sin	′

122° (302°) (237°) **57°**

33° (213°) (326°) **146°**

′	Sin	Tan	Cot	Cos	′
0	.54464	.64941	1.5399	.83867	**60**
1	54488	.64982	1.5389	.83851	59
2	54513	.65024	1.5379	.83835	58
3	54537	65065	1.5369	.83819	57
4	54561	.65106	1.5359	.83804	56
5	.54586	.65148	1.5350	.83788	**55**
6	54610	.65189	1.5340	.83772	54
7	54635	.65231	1.5330	.83756	53
8	54659	.65272	1.5320	.83740	52
9	54683	.65314	1.5311	83724	51
10	.54708	65355	1.5301	.83708	**50**
11	54732	.65397	1.5291	.83692	49
12	54756	65438	1.5282	83676	48
13	54781	.65480	1 5272	83660	47
14	54805	65521	1.5262	.83645	46
15	54829	65563	1 5253	83629	**45**
16	54854	65604	1 5243	.83613	44
17	54878	65646	1.5233	.83597	43
18	54902	65688	1.5224	.83581	42
19	54927	65729	1 5214	.83565	41
20	54951	65771	1 5204	83549	**40**
21	.54975	65813	1 5195	83533	39
22	54999	.65854	1 5185	83517	38
23	55024	65896	1 5175	83501	37
24	55048	.65938	1 5166	83485	36
25	55072	65980	1 5156	83469	**35**
26	.55097	.66021	1 5147	83453	34
27	55121	66063	1 5137	83437	33
28	.55145	.66105	1.5127	83421	32
29	.55169	.66147	1.5118	.83405	31
30	55194	66189	1.5108	83389	**30**
31	55218	.66230	1.5099	83373	29
32	.55242	66272	1 5089	83356	28
33	.55266	.66314	1.5080	.83340	27
34	.55291	.66356	1 5070	.83324	26
35	55315	66398	1.5061	.83308	**25**
36	55339	.66440	1.5051	.83292	24
37	55363	66482	1.5042	83276	23
38	.55388	.66524	1 5032	83260	22
39	55412	.66566	1.5023	83244	21
40	55436	66608	1 5013	.83228	**20**
41	.55460	66650	1 5004	.83212	19
42	.55484	66692	1.4994	.83195	18
43	.55509	66734	1.4985	83179	17
44	.55533	.66776	1.4975	83163	16
45	55557	.66818	1.4966	83147	**15**
46	55581	.66860	1.4957	.83131	14
47	55605	66902	1.4947	.83115	13
48	55630	66944	1.4938	.83098	12
49	55654	.66986	1 4928	.83082	11
50	.55678	.67028	1.4919	.83066	**10**
51	.55702	.67071	1.4910	.83050	9
52	.55726	.67113	1.4900	.83034	8
53	.55750	67155	1.4891	83017	7
54	55775	.67197	1.4882	83001	6
55	55799	.67239	1.4872	82985	**5**
56	55823	67282	1.4863	82969	4
57	55847	.67324	1.4854	82953	3
58	55871	67366	1.4844	.82936	2
59	.55895	67409	1.4835	.82920	1
60	55919	67451	1.4826	82904	**0**
′	Cos	Cot	Tan	Sin	′

123° (303°) (236°) **56°**

34° (214°) (325°) **145°**

′	Sin	Tan	Cot	Cos	′
0	.55919	.67451	1.4826	.82904	**60**
1	.55943	.67493	1.4816	.82887	59
2	.55968	.67536	1.4807	.82871	58
3	.55992	.67578	1.4798	.82855	57
4	.56016	.67620	1.4788	.82839	56
5	.56040	.67663	1.4779	.82822	**55**
6	.56064	.67705	1.4770	.82806	54
7	.56088	.67748	1.4761	.82790	53
8	.56112	.67790	1.4751	.82773	52
9	.56136	.67832	1.4742	.82757	51
10	.56160	.67875	1.4733	.82741	**50**
11	.56184	.67917	1.4724	.82724	49
12	.56208	.67960	1.4715	.82708	48
13	.56232	.68002	1.4705	.82692	47
14	.56256	.68045	1.4696	.82675	46
15	.56280	.68088	1.4687	.82659	**45**
16	.56305	.68130	1.4678	.82643	44
17	.56329	.68173	1.4669	.82626	43
18	.56353	.68215	1.4659	.82610	42
19	.56377	.68258	1.4650	.82593	41
20	.56401	.68301	1.4641	.82577	**40**
21	.56425	.68343	1.4632	.82561	39
22	.56449	.68386	1.4623	.82544	38
23	.56473	.68429	1.4614	.82528	37
24	.56497	.68471	1.4605	.82511	36
25	.56521	.68514	1.4596	.82495	**35**
26	.56545	.68557	1.4586	.82478	34
27	.56569	.68600	1.4577	.82462	33
28	.56593	.68642	1.4568	.82446	32
29	.56617	.68685	1.4559	.82429	31
30	.56641	.68728	1.4550	.82413	**30**
31	.56665	.68771	1.4541	.82396	29
32	.56689	.68814	1.4532	.82380	28
33	.56713	.68857	1.4523	.82363	27
34	.56736	.68900	1.4514	.82347	26
35	.56760	.68942	1.4505	.82330	**25**
36	.56784	.68985	1.4496	.82314	24
37	.56808	.69028	1.4487	.82297	23
38	.56832	.69071	1.4478	.82281	22
39	.56856	.69114	1.4469	.82264	21
40	.56880	.69157	1.4460	.82248	**20**
41	.56904	.69200	1.4451	.82231	19
42	.56928	.69243	1.4442	.82214	18
43	.56952	.69286	1.4433	.82198	17
44	.56976	.69329	1.4424	.82181	16
45	.57000	.69372	1.4415	.82165	**15**
46	.57024	.69416	1.4406	.82148	14
47	.57047	.69459	1.4397	.82132	13
48	.57071	.69502	1.4388	.82115	12
49	.57095	.69545	1.4379	.82098	11
50	.57119	.69588	1.4370	.82082	**10**
51	.57143	.69631	1.4361	.82065	9
52	.57167	.69675	1.4352	.82048	8
53	.57191	.69718	1.4344	.82032	7
54	.57215	.69761	1.4335	.82015	6
55	.57238	.69804	1.4326	.81999	**5**
56	.57262	.69847	1.4317	.81982	4
57	.57286	.69891	1.4308	.81965	3
58	.57310	.69934	1.4299	.81949	2
59	.57334	.69977	1.4290	.81932	1
60	.57358	.70021	1.4281	.81915	**0**
′	Cos	Cot	Tan	Sin	′

124° (304°) (235°) **55°**

35° (215°) (324°) **144°**

′	Sin	Tan	Cot	Cos	′
0	.57358	.70021	1.4281	.81915	**60**
1	.57381	.70064	1.4273	.81899	59
2	.57405	.70107	1.4264	.81882	58
3	.57429	.70151	1.4255	.81865	57
4	.57453	.70194	1.4246	.81848	56
5	.57477	.70238	1.4237	.81832	**55**
6	.57501	.70281	1.4229	.81815	54
7	.57524	.70325	1.4220	.81798	53
8	.57548	.70368	1.4211	.81782	52
9	.57572	.70412	1.4202	.81765	51
10	.57596	.70455	1.4193	.81748	**50**
11	.57619	.70499	1.4185	.81731	49
12	.57643	.70542	1.4176	.81714	48
13	.57667	.70586	1.4167	.81698	47
14	.57691	.70629	1.4158	.81681	46
15	.57715	.70673	1.4150	.81664	**45**
16	.57738	.70717	1.4141	.81647	44
17	.57762	.70760	1.4132	.81631	43
18	.57786	.70804	1.4124	.81614	42
19	.57810	.70848	1.4115	.81597	41
20	.57833	.70891	1.4106	.81580	**40**
21	.57857	.70935	1.4097	.81563	39
22	.57881	.70979	1.4089	.81546	38
23	.57904	.71023	1.4080	.81530	37
24	.57928	.71066	1.4071	.81513	36
25	.57952	.71110	1.4063	.81496	**35**
26	.57976	.71154	1.4054	.81479	34
27	.57999	.71198	1.4045	.81462	33
28	.58023	.71242	1.4037	.81445	32
29	.58047	.71285	1.4028	.81428	31
30	.58070	.71329	1.4019	.81412	**30**
31	.58094	.71373	1.4011	.81395	29
32	.58118	.71417	1.4002	.81378	28
33	.58141	.71461	1.3994	.81361	27
34	.58165	.71505	1.3985	.81344	26
35	.58189	.71549	1.3976	.81327	**25**
36	.58212	.71593	1.3968	.81310	24
37	.58236	.71637	1.3959	.81293	23
38	.58260	.71681	1.3951	.81276	22
39	.58283	.71725	1.3942	.81259	21
40	.58307	.71769	1.3934	.81242	**20**
41	.58330	.71813	1.3925	.81225	19
42	.58354	.71857	1.3916	.81208	18
43	.58378	.71901	1.3908	.81191	17
44	.58401	.71946	1.3899	.81174	16
45	.58425	.71990	1.3891	.81157	**15**
46	.58449	.72034	1.3882	.81140	14
47	.58472	.72078	1.3874	.81123	13
48	.58496	.72122	1.3865	.81106	12
49	.58519	.72167	1.3857	.81089	11
50	.58543	.72211	1.3848	.81072	**10**
51	.58567	.72255	1.3840	.81055	9
52	.58590	.72299	1.3831	.81038	8
53	.58614	.72344	1.3823	.81021	7
54	.58637	.72388	1.3814	.81004	6
55	.58661	.72432	1.3806	.80987	**5**
56	.58684	.72477	1.3798	.80970	4
57	.58708	.72521	1.3789	.80953	3
58	.58731	.72565	1.3781	.80936	2
59	.58755	.72610	1.3772	.80919	1
60	.58779	.72654	1.3764	.80902	**0**
′	Cos	Cot	Tan	Sin	′

125° (305°) (234°) **54°**

NATURAL FUNCTIONS (Continued)

36° (216°) (323°) **143°**

′	Sin	Tan	Cot	Cos	′
0	58779	72654	1.3764	80902	**60**
1	58802	72699	1.3755	80885	59
2	58826	72743	1.3747	80867	58
3	58849	72788	1.3739	80850	57
4	58873	72832	1.3730	80833	56
5	58896	72877	1.3722	80816	**55**
6	58920	72921	1.3713	80799	54
7	58943	72966	1.3705	80782	53
8	58967	73010	1.3697	80765	52
9	58990	73055	1.3688	80748	51
10	59014	73100	1.3680	80730	**50**
11	59037	73144	1.3672	80713	49
12	59061	73189	1.3663	80696	48
13	59084	73234	1.3655	80679	47
14	59108	73278	1.3647	80662	46
15	59131	73323	1.3638	80644	**45**
16	59154	73368	1.3630	80627	44
17	59178	73413	1.3622	80610	43
18	59201	73457	1.3613	80593	42
19	59225	73502	1.3605	80576	41
20	59248	73547	1.3597	80558	**40**
21	59272	73592	1.3588	80541	39
22	59295	73637	1.3580	80524	38
23	59318	73681	1.3572	80507	37
24	59342	73726	1.3564	80489	36
25	59365	73771	1.3555	80472	**35**
26	59389	73816	1.3547	80455	34
27	59412	73861	1.3539	80438	33
28	59436	73906	1.3531	80420	32
29	59459	73951	1.3522	80403	31
30	59482	73996	1.3514	80386	**30**
31	59506	74041	1.3506	80368	29
32	59529	74086	1.3498	80351	28
33	59552	74131	1.3490	80334	27
34	59576	74176	1.3481	80316	26
35	59599	74221	1.3473	80299	**25**
36	59622	74267	1.3465	80282	24
37	59646	74312	1.3457	80264	23
38	59669	74357	1.3449	80247	22
39	59693	74402	1.3440	80230	21
40	59716	74447	1.3432	80212	**20**
41	59739	74492	1.3424	80195	19
42	59763	74538	1.3416	80178	18
43	59786	74583	1.3408	80160	17
44	59809	74628	1.3400	80143	16
45	59832	74674	1.3392	80125	**15**
46	59856	74719	1.3384	80108	14
47	59879	74764	1.3375	80091	13
48	59902	74810	1.3367	80073	12
49	59926	74855	1.3359	80056	11
50	59949	74900	1.3351	80038	**10**
51	59972	74946	1.3343	80021	9
52	59995	74991	1.3335	80003	8
53	60019	75037	1.3327	79986	7
54	60042	75082	1.3319	79968	6
55	60065	75128	1.3311	79951	**5**
56	60089	75173	1.3303	79934	4
57	60112	75219	1.3295	79916	3
58	60135	75264	1.3287	79899	2
59	60158	75310	1.3278	79881	1
60	60182	75355	1.3270	79864	**0**
′	Cos	Cot	Tan	Sin	′

126° (306°) (233°) **53°**

37° (217°) (322°) **142°**

′	Sin	Tan	Cot	Cos	′
0	60182	75355	1.3270	79864	**60**
1	60205	75401	1.3262	79846	59
2	60228	75447	1.3254	79829	58
3	60251	75492	1.3246	79811	57
4	60274	75538	1.3238	79793	56
5	60298	75584	1.3230	79776	**55**
6	60321	75629	1.3222	79758	54
7	60344	75675	1.3214	79741	53
8	60367	75721	1.3206	79723	52
9	60390	75767	1.3198	79706	51
10	60414	75812	1.3190	79688	**50**
11	60437	75858	1.3182	79671	49
12	60460	75904	1.3175	79653	48
13	60483	75950	1.3167	79635	47
14	60506	75996	1.3159	79618	46
15	60529	76042	1.3151	79600	**45**
16	60553	76088	1.3143	79583	44
17	60576	76134	1.3135	79565	43
18	60599	76180	1.3127	79547	42
19	60622	76226	1.3119	79530	41
20	60645	76272	1.3111	79512	**40**
21	60668	76318	1.3103	79494	39
22	60691	76364	1.3095	79477	38
23	60714	76410	1.3087	79459	37
24	60738	76456	1.3079	79441	36
25	60761	76502	1.3072	79424	**35**
26	60784	76548	1.3064	79406	34
27	60807	76594	1.3056	79388	33
28	60830	76640	1.3048	79371	32
29	60853	76686	1.3040	79353	31
30	60876	76733	1.3032	79335	**30**
31	60899	76779	1.3024	79318	29
32	60922	76825	1.3017	79300	28
33	60945	76871	1.3009	79282	27
34	60968	76918	1.3001	79264	26
35	60991	76964	1.2993	79247	**25**
36	61015	77010	1.2985	79229	24
37	61038	77057	1.2977	79211	23
38	61061	77103	1.2970	79193	22
39	61084	77149	1.2962	79176	21
40	61107	77196	1.2954	79158	**20**
41	61130	77242	1.2946	79140	19
42	61153	77289	1.2938	79122	18
43	61176	77335	1.2931	79105	17
44	61199	77382	1.2923	79087	16
45	61222	77428	1.2915	79069	**15**
46	61245	77475	1.2907	79051	14
47	61268	77521	1.2900	79033	13
48	61291	77568	1.2892	79016	12
49	61314	77615	1.2884	78998	11
50	61337	77661	1.2876	78980	**10**
51	61360	77708	1.2869	78962	9
52	61383	77754	1.2861	78944	8
53	61406	77801	1.2853	78926	7
54	61429	77848	1.2846	78908	6
55	61451	77895	1.2838	78891	**5**
56	61474	77941	1.2830	78873	4
57	61497	77988	1.2822	78855	3
58	61520	78035	1.2815	78837	2
59	61543	78082	1.2807	78819	1
60	61566	78129	1.2799	78801	**0**
′	Cos	Cot	Tan	Sin	′

127° (307°) (232°) **52°**

NATURAL FUNCTIONS (Continued)

38° (218°) (321°) **141°**

′	Sin	Tan	Cot	Cos	′
0	61566	.78129	1.2799	.78801	**60**
1	61589	.78175	1.2792	.78783	59
2	.61612	.78222	1.2784	78765	58
3	.61635	.78269	1.2776	.78747	57
4	61658	.78316	1.2769	.78729	56
5	.61681	.78363	1.2761	.78711	**55**
6	.61704	.78410	1 2753	.78694	54
7	61726	.78457	1.2746	.78676	53
8	61749	78504	1 2738	.78658	52
9	61772	.78551	1.2731	.78640	51
10	61795	78598	1.2723	.78622	**50**
11	.61818	.78645	1.2715	.78604	49
12	61841	.78692	1.2708	.78586	48
13	61864	78739	1 2700	.78568	47
14	61887	.78786	1 2693	78550	46
15	.61909	78834	1 2685	78532	**45**
16	.61932	.78881	1 2677	78514	44
17	.61955	.78928	1 2670	78496	43
18	.61978	78975	1.2662	.78478	42
19	.62001	.79022	1 2655	.78460	41
20	.62024	79070	1 2647	78442	**40**
21	62016	79117	1 2640	78424	39
22	62069	79164	1 2632	.78405	38
23	62092	79212	1 2624	78387	37
24	.62115	79259	1 2617	78369	36
25	62138	79306	1 2609	78351	**35**
26	.62160	79354	1 2602	78333	34
27	.62183	79401	1 2594	78315	33
28	62206	79449	1 2587	78297	32
29	.62229	.79496	1 2579	78279	31
30	62251	79544	1 2572	78261	**30**
31	62274	79591	1 2564	78243	29
32	62297	79639	1 2557	78225	28
33	62320	79686	1 2549	78206	27
34	62342	79734	1 2542	78188	26
35	62365	79781	1 2534	78170	**25**
36	62388	79829	1 2527	78152	24
37	62411	.79877	1 2519	78134	23
38	62433	79924	1 2512	78116	22
39	62456	79972	1 2504	78098	21
40	62479	80020	1 2497	78079	**20**
41	62502	80067	1 2489	78061	19
42	62524	80115	1 2482	78043	18
43	62547	.80163	1 2475	78025	17
44	62570	.80211	1 2467	.78007	16
45	62592	80258	1 2460	77988	**15**
46	62615	80306	1 2452	77970	14
47	.62638	80354	1 2445	77952	13
48	62660	80402	1 2437	77934	12
49	.62683	80450	1 2430	77916	11
50	62706	80498	1 2423	77897	**10**
51	62728	80546	1 2415	77879	9
52	.62751	.80594	1 2408	77861	8
53	.62774	80642	1 2401	77843	7
54	.62796	80690	1 2393	.77824	6
55	.62819	80738	1.2386	77806	**5**
56	.62842	.80786	1.2378	.77788	4
57	62864	80834	1 2371	77769	3
58	62887	80882	1 2364	.77751	2
59	.62909	.80930	1.2356	77733	1
60	.62932	80978	1 2349	77715	**0**
′	Cos	Cot	Tan	Sin	′

128° (308°) (231°) **51°**

39° (219°) (320°) **140°**

′	Sin	Tan	Cot	Cos	′
0	.62932	.80978	1.2349	.77715	**60**
1	.62955	.81027	1.2342	.77696	59
2	.62977	.81075	1.2334	.77678	58
3	63000	.81123	1.2327	.77660	57
4	.63022	.81171	1 2320	.77641	56
5	63045	.81220	1.2312	.77623	**55**
6	.63068	81268	1.2305	.77605	54
7	.63090	.81316	1.2298	.77586	53
8	63113	.81364	1.2290	.77568	52
9	.63135	81413	1.2283	77550	51
10	63158	81461	1.2276	77531	**50**
11	.63180	.81510	1.2268	77513	49
12	63203	81558	1 2261	77494	48
13	63225	81606	1.2254	77476	47
14	63248	.81655	1.2247	77458	46
15	63271	.81703	1 2239	.77439	**45**
16	63293	81752	1.2232	.77421	44
17	63316	81800	1.2225	77402	43
18	63338	81849	1 2218	77384	42
19	63361	81898	1 2210	.77366	41
20	63383	81946	1.2203	77347	**40**
21	63406	81995	1 2196	77329	39
22	63428	82044	1 2189	77310	38
23	63451	82092	1 2181	77292	37
24	63473	.82141	1.2174	.77273	36
25	63496	82190	1.2167	.77255	**35**
26	.63518	.82238	1.2160	.77236	34
27	.63540	82287	1.2153	77218	33
28	63563	82336	1 2145	77199	32
29	63585	82385	1 2138	77181	31
30	63608	82434	1 2131	.77162	**30**
31	63630	82483	1 2124	77144	29
32	63653	82531	1 2117	77125	28
33	63675	82580	1.2109	.77107	27
34	63698	.82629	1.2102	77088	26
35	63720	82678	1 2095	77070	**25**
36	63742	82727	1 2088	77051	24
37	63765	.82776	1.2081	77033	23
38	.63787	.82825	1.2074	77014	22
39	63810	.82874	1 2066	76996	21
40	63832	82923	1 2059	76977	**20**
41	63854	.82972	1 2052	76959	19
42	63877	83022	1 2045	76940	18
43	.63899	.83071	1 2038	76921	17
44	.63922	83120	1.2031	76903	16
45	63944	.83169	1 2024	.76884	**15**
46	63966	.83218	1.2017	.76866	14
47	63989	83268	1.2009	.76847	13
48	64011	.83317	1.2002	76828	12
49	.64033	.83366	1.1995	76810	11
50	64056	.83415	1 1988	.76791	**10**
51	64078	.83465	1 1981	.76772	9
52	64100	83514	1.1974	76754	8
53	.64123	83564	1.1967	.76735	7
54	.64145	.83613	1.1960	.76717	6
55	.64167	.83662	1 1953	.76698	**5**
56	64190	.83712	1.1946	.76679	4
57	.64212	83761	1.1939	.76661	3
58	64234	83811	1.1932	.76642	2
59	64256	.83860	1.1925	.76623	1
60	64279	83910	1.1918	.76604	**0**
′	Cos	Cot	Tan	Sin	′

129° (309°) (230°) **50°**

NATURAL FUNCTIONS (Continued)

40° (220°) (319°) **139°**

′	Sin	Tan	Cot	Cos	′
0	.64279	83910	1.1918	76604	**60**
1	64301	83960	1.1910	.76586	59
2	64323	84009	1.1903	76567	58
3	64346	84059	1 1896	76548	57
4	64368	84108	1.1889	.76530	56
5	64390	84158	1.1882	76511	**55**
6	64412	84208	1.1875	.76492	54
7	64435	84258	1.1868	.76473	53
8	64457	84307	1.1861	.76455	52
9	64479	84357	1.1854	.76436	51
10	64501	84407	1.1847	.76417	**50**
11	64524	84457	1.1840	.76398	49
12	.64546	84507	1.1833	76380	48
13	64568	84556	1.1826	.76361	47
14	64590	84606	1.1819	.76342	46
15	64612	84656	1.1812	.76323	**45**
16	64635	84706	1.1806	.76304	44
17	64657	84756	1.1799	76286	43
18	64679	84806	1 1792	76267	42
19	64701	84856	1.1785	.76248	41
20	64723	84906	1.1778	.76229	**40**
21	.64746	84956	1.1771	.76210	39
22	64768	85006	1.1764	.76192	38
23	.64790	85057	1 1757	.76173	37
24	.64812	85107	1 1750	.76154	36
25	.64834	85157	1 1743	.76135	**35**
26	.64856	85207	1 1736	76116	34
27	.61878	85257	1.1729	76097	33
28	64901	85308	1 1722	.76078	32
29	64923	85358	1.1715	.76059	31
30	64945	85408	1.1708	.76041	**30**
31	64967	85458	1 1702	76022	29
32	64989	85509	1 1695	76003	28
33	65011	85559	1.1688	75984	27
34	65033	.85609	1.1681	75965	26
35	65055	85660	1.1674	75946	**25**
36	65077	85710	1 1667	75927	24
37	65100	85761	1 1660	75908	23
38	65122	85811	1 1653	75889	22
39	65144	85862	1.1647	75870	21
40	65166	85912	1 1640	75851	**20**
41	65188	85963	1 1633	75832	19
42	65210	86014	1 1626	75813	18
43	65232	86064	1 1619	75794	17
44	65254	86115	1.1612	75775	16
45	.65276	86166	1 1606	75756	**15**
46	.65298	86216	1.1599	75738	14
47	65320	.86267	1 1592	75719	13
48	65342	.86318	1 1585	75700	12
49	.65364	86368	1.1578	75680	11
50	65386	.86419	1.1571	75661	**10**
51	.65408	86470	1.1565	75642	9
52	65430	86521	1 1558	75623	8
53	.65452	86572	1.1551	.75604	7
54	65474	.86623	1.1544	.75585	6
55	65496	.86674	1.1538	75566	**5**
56	.65518	.86725	1.1531	75547	4
57	65540	.86776	1 1524	.75528	3
58	.65562	86827	1.1517	.75509	2
59	65584	.86878	1.1510	.75490	1
60	65606	86929	1 1504	75471	**0**
′	Cos	Cot	Tan	Sin	′

130° (310°) (229°) **49°**

41° (221°) (318°) **138°**

′	Sin	Tan	Cot	Cos	′
0	65606	.86929	1.1504	.75471	**60**
1	.65628	.86980	1.1497	.75452	59
2	.65650	.87031	1.1490	.75433	58
3	.65672	.87082	1.1483	.75414	57
4	65694	.87133	1.1477	.75395	56
5	65716	.87184	1.1470	.75375	**55**
6	65738	.87236	1.1463	.75356	54
7	65759	.87287	1.1456	.75337	53
8	65781	.87338	1.1450	.75318	52
9	.65803	.87389	1.1443	.75299	51
10	65825	.87441	1.1436	75280	**50**
11	.65847	.87492	1.1430	75261	49
12	65869	.87543	1.1423	.75241	48
13	65891	.87595	1.1416	75222	47
14	.65913	.87646	1.1410	75203	46
15	65935	.87698	1.1403	.75184	**45**
16	65956	87749	1.1396	75165	44
17	65978	.87801	1.1389	75146	43
18	66000	87852	1.1383	75126	42
19	66022	87904	1.1376	75107	41
20	66044	87955	1.1369	75088	**40**
21	66066	88007	1.1363	75069	39
22	66088	88059	1.1356	.75050	38
23	66109	88110	1.1349	.75030	37
24	.66131	88162	1.1343	75011	36
25	66153	88214	1.1336	74992	**35**
26	66175	88265	1.1329	74973	34
27	.66197	.88317	1.1323	74953	33
28	66218	88369	1 1316	74934	32
29	.66240	88421	1 1310	.74915	31
30	.66262	88473	1 1303	74896	**30**
31	66284	.88524	1 1296	.74876	29
32	.66306	.88576	1.1290	74857	28
33	66327	.88628	1.1283	74838	27
34	66349	.88680	1 1276	74818	26
35	.66371	88732	1 1270	74799	**25**
36	.66393	88784	1.1263	.74780	24
37	66414	88836	1 1257	.74760	23
38	.66436	88888	1 1250	.74741	22
39	66458	88940	1 1243	.74722	21
40	.66480	88992	1.1237	.74703	**20**
41	66501	89045	1 1230	.74683	19
42	.66523	.89097	1 1224	74664	18
43	.66545	89149	1 1217	.74644	17
44	66566	89201	1.1211	.74625	16
45	.66588	.89253	1.1204	.74606	**15**
46	.66610	.89306	1 1197	.74586	14
47	.66632	89358	1.1191	.74567	13
48	.66653	89410	1.1184	74548	12
49	.66675	.89463	1 1178	.74528	11
50	66697	.89515	1.1171	.74509	**10**
51	66718	.89567	1 1165	74489	9
52	.66740	.89620	1 1158	.74470	8
53	.66762	.89672	1 1152	74451	7
54	.66783	89725	1 1145	.74431	6
55	.66805	.89777	1.1139	.74412	**5**
56	.66827	.89830	1.1132	74392	4
57	.66848	.89883	1.1126	74373	3
58	.66870	.89935	1.1119	.74353	2
59	.66891	.89988	1.1113	.74334	1
60	.66913	.90040	1.1106	.74314	**0**
′	Cos	Cot	Tan	Sin	′

131° (311°) (228°) **48°**

42° (222°) (317°) **137°**

′	Sin	Tan	Cot	Cos	′
0	.66913	.90040	1.1106	.74314	**60**
1	.66935	.90093	1.1100	.74295	59
2	.66956	.90146	1.1093	.74276	58
3	.66978	.90199	1.1087	.74256	57
4	.66999	.90251	1.1080	.74237	56
5	.67021	.90304	1.1074	.74217	**55**
6	.67043	.90357	1.1067	.74198	54
7	.67064	.90410	1.1061	.74178	53
8	.67086	.90463	1.1054	.74159	52
9	67107	.90516	1.1048	.74139	51
10	.67129	.90569	1.1041	.74120	**50**
11	67151	.90621	1.1035	.74100	49
12	.67172	.90674	1.1028	.74080	48
13	67194	.90727	1.1022	.74061	47
14	67215	.90781	1.1016	.74041	46
15	67237	.90834	1.1009	.74022	**45**
16	67258	.90887	1.1003	.74002	44
17	67280	.90940	1.0996	.73983	43
18	67301	.90993	1.0990	.73963	42
19	.67323	.91046	1.0983	.73944	41
20	67344	91099	1.0977	.73924	**40**
21	67366	.91153	1.0971	.73904	39
22	67387	.91206	1.0964	.73885	38
23	67409	.91259	1.0958	.73865	37
24	67430	.91313	1.0951	.73846	36
25	67452	.91366	1.0945	.73826	**35**
26	.67473	91419	1.0939	.73806	34
27	.67495	.91473	1.0932	.73787	33
28	.67516	.91526	1.0926	.73767	32
29	67538	.91580	1.0919	.73747	31
30	67559	.91633	1.0913	.73728	**30**
31	67580	.91687	1.0907	.73708	29
32	67602	.91740	1.0900	.73688	28
33	67623	.91794	1.0894	.73669	27
34	67645	.91847	1.0888	.73649	26
35	67666	91901	1.0881	.73629	**25**
36	67688	.91955	1.0875	.73610	24
37	67709	.92008	1.0869	.73590	23
38	67730	.92062	1.0862	.73570	22
39	67752	.92116	1.0856	.73551	21
40	67773	.92170	1.0850	.73531	**20**
41	67795	.92224	1.0843	.73511	19
42	67816	.92277	1.0837	.73491	18
43	67837	.92331	1.0831	.73472	17
44	67859	.92385	1.0824	.73452	16
45	.67880	92439	1.0818	.73432	**15**
46	.67901	.92493	1.0812	.73413	14
47	.67923	.92547	1.0805	.73393	13
48	67944	.92601	1.0799	.73373	12
49	67965	.92655	1.0793	.73353	11
50	67987	.92709	1.0786	.73333	**10**
51	68008	.92763	1.0780	.73314	9
52	.68029	.92817	1.0774	.73294	8
53	68051	.92872	1.0768	.73274	7
54	.68072	.92926	1.0761	.73254	6
55	.68093	.92980	1.0755	.73234	**5**
56	68115	.93034	1.0749	.73215	4
57	68136	.93088	1.0742	.73195	3
58	.68157	.93143	1.0736	.73175	2
59	.68179	.93197	1.0730	.73155	1
60	.68200	.93252	1.0724	.73135	**0**
′	Cos	Cot	Tan	Sin	′

132° (312°) (227°) **47°**

43° (223°) (316°) **136**

′	Sin	Tan	Cot	Cos	′
0	.68200	.93252	1.0724	.73135	**60**
1	.68221	.93306	1.0717	.73116	59
2	.68242	.93360	1.0711	.73096	58
3	68264	.93415	1.0705	.73076	57
4	.68285	.93469	1.0699	.73056	56
5	.68306	.93524	1.0692	.73036	**55**
6	.68327	.93578	1.0686	.73016	54
7	.68349	.93633	1.0680	72996	53
8	.68370	.93688	1.0674	.72976	52
9	.68391	.93742	1.0668	72957	51
10	.68412	.93797	1 0661	.72937	**50**
11	.68434	.93852	1.0655	.72917	49
12	.68455	.93906	1.0649	.72897	48
13	.68476	.93961	1.0643	.72877	47
14	.68497	.94016	1.0637	.72857	46
15	.68518	.94071	1.0630	.72837	**45**
16	.68539	.94125	1.0624	72817	44
17	.68561	.94180	1.0618	72797	43
18	.68582	.94235	1.0612	72777	42
19	.68603	.94290	1.0606	72757	41
20	.68624	.94345	1.0599	72737	**40**
21	.68645	.94400	1 0593	72717	39
22	.68666	.94455	1.0587	72697	38
23	.68688	.94510	1.0581	72677	37
24	.68709	.94565	1.0575	.72657	36
25	.68730	.94620	1 0569	72637	**35**
26	.68751	.94676	1.0562	.72617	34
27	.68772	.94731	1.0556	72597	33
28	.68793	.94786	1 0550	72577	32
29	.68814	.94841	1.0544	72557	31
30	.68835	.94896	1.0538	72537	**30**
31	.68857	.94952	1.0532	.72517	29
32	.68878	.95007	1.0526	72497	28
33	.68899	.95062	1.0519	.72477	27
34	.68920	.95118	1.0513	72457	26
35	.68941	.95173	1.0507	.72437	**25**
36	.68962	.95229	1.0501	72417	24
37	.68983	.95284	1.0495	.72397	23
38	.69004	.95340	1.0489	72377	22
39	.69025	.95395	1.0483	72357	21
40	69046	.95451	1.0477	72337	**20**
41	.69067	.95506	1.0470	72317	19
42	.69088	.95562	1.0464	.72297	18
43	.69109	.95618	1.0458	72277	17
44	.69130	.95673	1.0452	.72257	16
45	.69151	.95729	1.0446	72236	**15**
46	.69172	.95785	1.0440	.72216	14
47	.69193	.95841	1.0434	72196	13
48	.69214	.95897	1.0428	72176	12
49	69235	.95952	1.0422	.72156	11
50	.69256	.96008	1.0416	72136	**10**
51	.69277	.96064	1.0410	72116	9
52	.69298	.96120	1.0404	72095	8
53	.69319	.96176	1.0398	72075	7
54	.69340	.96232	1.0392	.72055	6
55	.69361	.96288	1.0385	.72035	**5**
56	.69382	.96344	1.0379	.72015	4
57	.69403	.96400	1.0373	.71995	3
58	.69424	.96457	1.0367	.71974	2
59	.69445	.96513	1.0361	.71954	1
60	69466	.96569	1.0355	.71934	**0**
′	Cos	Cot	Tan	Sin	′

133° (313°) (226°) **46°**

NATURAL FUNCTIONS (Continued)

44° (224°) (315°) **135°**

′	Sin	Tan	Cot	Cos	
0	.69466	96569	1.0355	.71934	**60**
1	.69487	96625	1.0349	.71914	59
2	.69508	96681	1 0343	71894	58
3	69529	96738	1 0337	.71873	57
4	69549	96794	1.0331	.71853	56
5	.69570	96850	1 0325	.71833	**55**
6	.69591	96907	1 0319	.71813	54
7	.69612	96963	1 0313	71792	53
8	69633	97020	1 0307	71772	52
9	69654	.97076	1 0301	71752	51
10	69675	97133	1.0295	71732	**50**
11	.69696	97189	1 0289	.71711	49
12	69717	.97246	1.0283	.71691	48
13	69737	97302	1 0277	.71671	47
14	.69758	.97359	1 0271	71650	46
15	.69779	97416	1.0265	.71630	**45**
16	.69800	97472	1.0259	.71610	44
17	.69821	.97529	1 0253	.71590	43
18	69842	97586	1 0247	71569	42
19	69862	97643	1 0241	.71549	41
20	69883	97700	1 0235	.71529	**40**
21	69904	.97756	1 0230	.71508	39
22	69925	97813	1 0224	71488	38
23	69946	97870	1 0218	71468	37
24	69966	97927	1 0212	71447	36
25	69987	97984	1 0206	71427	**35**
26	70008	98041	1 0200	71407	34
27	70029	98098	1 0194	71386	33
28	70049	98155	1 0188	71366	32
29	70070	98213	1 0182	71345	31
30	70091	.98270	1 0176	71325	**30**
31	70112	98327	1 0170	71305	29
32	70132	98384	1 0164	71284	28
33	70153	98441	1 0158	71264	27
34	70174	98499	1 0152	.71243	26
35	70195	.98556	1 0147	71223	**25**
36	70215	98613	1 0141	71203	24
37	70236	98671	1 0135	71182	23
38	70257	98728	1 0129	71162	22
39	70277	98786	1 0123	.71141	21
40	70298	98843	1 0117	71121	**20**
41	70319	98901	1 0111	71100	19
42	70339	98958	1 0105	71080	18
43	70360	99016	1 0099	71059	17
44	70381	99073	1 0094	71039	16
45	70401	.99131	1 0088	71019	**15**
46	70422	99189	1 0082	.70998	14
47	70443	99247	1 0076	.70978	13
48	70463	.99304	1 0070	.70957	12
49	70484	99362	1 0064	.70937	11
50	70505	99420	1 0058	70916	**10**
51	70525	99478	1 0052	70896	9
52	70546	99536	1 0047	70875	8
53	70567	99594	1 0041	70855	7
54	70587	99652	1 0035	70834	6
55	70608	99710	1.0029	70813	**5**
56	70628	.99768	1 0023	70793	4
57	70649	99826	1.0017	.70772	3
58	70670	99884	1 0012	.70752	2
59	70690	99942	1 0006	.70731	1
60	70711	1 0000	1 0000	.70711	**0**
′	Cos	Cot	Tan	Sin	′

134° (314°) (225°) **45°**

0° (180°) (359°) **179°**

′	Sec	Csc	′
0	1.0000		**60**
1	1.0000	3437 7	59
2	1 0000	1718 9	58
3	1.0000	1145 9	57
4	1.0000	859.44	56
5	1.0000	687.55	**55**
6	1.0000	572 96	54
7	1 0000	491 11	53
8	1 0000	429 72	52
9	1.0000	381.97	51
10	1 0000	343 78	**50**
11	1.0000	312.52	49
12	1.0000	286.48	48
13	1.0000	264.44	47
14	1.0000	245.55	46
15	1.0000	229 18	**45**
16	1.0000	214.86	44
17	1.0000	202 22	43
18	1 0000	190.99	42
19	1.0000	180.93	41
20	1 0000	171.89	**40**
21	1 0000	163.70	39
22	1.0000	156 26	38
23	1 0000	149.47	37
24	1 0000	143.24	36
25	1.0000	137.51	**35**
26	1.0000	132.22	34
27	1 0000	127.33	33
28	1 0000	122.78	32
29	1.0000	118.54	31
30	1 0000	114.59	**30**
31	1 0000	110.90	29
32	1 0000	107.43	28
33	1 0000	104.18	27
34	1.0000	101.11	26
35	1.0001	98.223	**25**
36	1 0001	95.495	24
37	1 0001	92.914	23
38	1.0001	90.469	22
39	1.0001	88.149	21
40	1 0001	85 946	**20**
41	1.0001	83.849	19
42	1.0001	81.853	18
43	1 0001	79.950	17
44	1.0001	78.133	16
45	1.0001	76.397	**15**
46	1.0001	74.736	14
47	1 0001	73.146	13
48	1.0001	71 622	12
49	1.0001	70.160	11
50	1.0001	68.757	**10**
51	1.0001	67 409	9
52	1.0001	66 113	8
53	1.0001	64 866	7
54	1.0001	63 665	6
55	1 0001	62 507	**5**
56	1.0001	61.391	4
57	1.0001	60 314	3
58	1.0001	59 274	2
59	1.0001	58.270	1
60	1 0002	57.209	**0**
′	Csc	Sec	′

90° (270°) (269°) **89°**

1° (181°) (358°) **178°**

′	Sec	Csc	′
0	1 0002	57.299	**60**
1	1.0002	56 359	59
2	1.0002	55.451	58
3	1.0002	54 570	57
4	1 0002	53.718	56
5	1.0002	52 892	**55**
6	1 0002	52 090	54
7	1 0002	51.313	53
8	1.0002	50 558	52
9	1.0002	49.826	51
10	1.0002	49.114	**50**
11	1.0002	48 422	49
12	1 0002	47 750	48
13	1 0002	47 096	47
14	1.0002	46.460	46
15	1 0002	45 840	**45**
16	1 0002	45.237	44
17	1.0003	44 650	43
18	1.0003	44 077	42
19	1.0003	43 520	41
20	1 0003	42 976	**40**
21	1.0003	42 445	39
22	1 0003	41.928	38
23	1 0003	41.423	37
24	1.0003	40.930	36
25	1 0003	40 448	**35**
26	1 0003	39.978	34
27	1 0003	39 519	33
28	1 0003	39 070	32
29	1 0003	38 631	31
30	1 0003	38.202	**30**
31	1 0004	37 782	29
32	1 0004	37 371	28
33	1 0004	36 970	27
34	1.0004	36.576	26
35	1 0004	36.191	**25**
36	1 0004	35.815	24
37	1 0004	35.445	23
38	1 0004	35 084	22
39	1.0004	34 730	21
40	1 0004	34 382	**20**
41	1 0004	34 042	19
42	1.0004	33 708	18
43	1.0004	33 381	17
44	1.0005	33 060	16
45	1 0005	32.746	**15**
46	1.0005	32.437	14
47	1.0005	32 134	13
48	1 0005	31.836	12
49	1.0005	31.544	11
50	1 0005	31 258	**10**
51	1.0005	30 976	9
52	1.0005	30.700	8
53	1.0005	30 428	7
54	1.0006	30.161	6
55	1 0006	29.899	**5**
56	1.0006	29.641	4
57	1.0006	29.388	3
58	1.0006	29 139	2
59	1.0006	28.894	1
60	1 0006	28 654	**0**
′	Csc	Sec	′

91° (271°) (268°) **88°**

2° (182°) (357°) **177°**

′	Sec	Csc	′
0	1 0006	28 654	**60**
1	1 0006	28 417	59
2	1.0006	28.184	58
3	1.0006	27.955	57
4	1 0007	27.730	56
5	1.0007	27.508	**55**
6	1.0007	27.290	54
7	1.0007	27 075	53
8	1 0007	26.864	52
9	1.0007	26.655	51
10	1 0007	26 451	**50**
11	1 0007	26.249	49
12	1 0007	26 050	48
13	1.0007	25 854	47
14	1.0008	25 661	46
15	1.0008	25.471	**45**
16	1.0008	25 284	44
17	1 0008	25 100	43
18	1.0008	24 918	42
19	1.0008	24.739	41
20	1 0008	24 562	**40**
21	1 0008	24 388	39
22	1.0009	24.216	38
23	1 0009	24 047	37
24	1.0009	23 880	36
25	1.0009	23 716	**35**
26	1.0009	23 553	34
27	1 0009	23 393	33
28	1 0009	23 235	32
29	1.0009	23 079	31
30	1 0010	22.926	**30**
31	1 0010	22.774	29
32	1 0010	22.624	28
33	1 0010	22.476	27
34	1.0010	22.330	26
35	1.0010	22.187	**25**
36	1 0010	22 044	24
37	1 0010	21.904	23
38	1.0011	21.766	22
39	1.0011	21.620	21
40	1 0011	21.494	**20**
41	1.0011	21.360	19
42	1.0011	21 229	18
43	1 0011	21 098	17
44	1.0011	20.970	16
45	1.0012	20.843	**15**
46	1 0012	20.717	14
47	1.0012	20.593	13
48	1.0012	20.471	12
49	1.0012	20.350	11
50	1 0012	20.230	**10**
51	1.0012	20.112	9
52	1.0013	19.995	8
53	1.0013	19.880	7
54	1.0013	19 766	6
55	1.0013	19.653	**5**
56	1.0013	19 541	4
57	1.0013	19.431	3
58	1.0013	19.322	2
59	1.0014	19.214	1
60	1 0014	19.107	**0**
′	Csc	Sec	′

92° (272°) (267°) **87°**

3° (183°) (356°) **176°**

′	Sec	Csc	′
0	1.0014	19.107	**60**
1	1.0014	19.002	59
2	1.0014	18.898	58
3	1.0014	18.794	57
4	1.0014	18.692	56
5	1.0014	18.591	**55**
6	1.0015	18.492	54
7	1.0015	18.393	53
8	1.0015	18.295	52
9	1.0015	18.198	51
10	1.0015	18.103	**50**
11	1.0015	18.008	49
12	1.0016	17.914	48
13	1.0016	17.822	47
14	1.0016	17.730	46
15	1.0016	17.639	**45**
16	1.0016	17.549	44
17	1.0016	17.460	43
18	1.0017	17.372	42
19	1.0017	17.285	41
20	1.0017	17.198	**40**
21	1.0017	17.113	39
22	1.0017	17.028	38
23	1.0017	16.945	37
24	1.0018	16.862	36
25	1.0018	16.779	**35**
26	1.0018	16.698	34
27	1.0018	16.618	33
28	1.0018	16.538	32
29	1.0019	16.459	31
30	1.0019	16.380	**30**
31	1.0019	16.303	29
32	1.0019	16.226	28
33	1.0019	16.150	27
34	1.0019	16.075	26
35	1.0020	16.000	**25**
36	1.0020	15.926	24
37	1.0020	15.853	23
38	1.0020	15.780	22
39	1.0020	15.708	21
40	1.0021	15.637	**20**
41	1.0021	15.566	19
42	1.0021	15.496	18
43	1.0021	15.427	17
44	1.0021	15.358	16
45	1.0021	15.290	**15**
46	1.0022	15.222	14
47	1.0022	15.155	13
48	1.0022	15.089	12
49	1.0022	15.023	11
50	1.0022	14.958	**10**
51	1.0023	14.893	9
52	1.0023	14.829	8
53	1.0023	14.766	7
54	1.0023	14.703	6
55	1.0023	14.640	**5**
56	1.0024	14.578	4
57	1.0024	14.517	3
58	1.0024	14.456	2
59	1.0024	14.395	1
60	1.0024	14.336	**0**
′	Csc	Sec	′

93° (273°) (266°) **86°**

4° (184°) (355°) **175°**

′	Sec	Csc	′
0	1.0024	14.336	**60**
1	1.0025	14.276	59
2	1.0025	14.217	58
3	1.0025	14.159	57
4	1.0025	14.101	56
5	1.0025	14.044	**55**
6	1.0026	13.987	54
7	1.0026	13.930	53
8	1.0026	13.874	52
9	1.0026	13.818	51
10	1.0027	13.763	**50**
11	1.0027	13.708	49
12	1.0027	13.654	48
13	1.0027	13.600	47
14	1.0027	13.547	46
15	1.0028	13.494	**45**
16	1.0028	13.441	44
17	1.0028	13.389	43
18	1.0028	13.337	42
19	1.0028	13.286	41
20	1.0029	13.235	**40**
21	1.0029	13.184	39
22	1.0029	13.134	38
23	1.0029	13.084	37
24	1.0030	13.035	36
25	1.0030	12.985	**35**
26	1.0030	12.937	34
27	1.0030	12.888	33
28	1.0030	12.840	32
29	1.0031	12.793	31
30	1.0031	12.745	**30**
31	1.0031	12.699	29
32	1.0031	12.652	28
33	1.0032	12.606	27
34	1.0032	12.560	26
35	1.0032	12.514	**25**
36	1.0032	12.469	24
37	1.0033	12.424	23
38	1.0033	12.379	22
39	1.0033	12.335	21
40	1.0033	12.291	**20**
41	1.0034	12.248	19
42	1.0034	12.204	18
43	1.0034	12.161	17
44	1.0034	12.119	16
45	1.0034	12.076	**15**
46	1.0035	12.034	14
47	1.0035	11.992	13
48	1.0035	11.951	12
49	1.0035	11.909	11
50	1.0036	11.868	**10**
51	1.0036	11.828	9
52	1.0036	11.787	8
53	1.0036	11.747	7
54	1.0037	11.707	6
55	1.0037	11.668	**5**
56	1.0037	11.628	4
57	1.0037	11.589	3
58	1.0038	11.551	2
59	1.0038	11.512	1
60	1.0038	11.474	**0**
′	Csc	Sec	′

94° (274°) (265°) **85°**

5° (185°) (354°) **174°**

′	Sec	Csc	′
0	1.0038	11.474	**60**
1	1.0038	11.436	59
2	1.0039	11.398	58
3	1.0039	11.360	57
4	1.0039	11.323	56
5	1.0039	11.286	**55**
6	1.0040	11.249	54
7	1.0040	11.213	53
8	1.0040	11.176	52
9	1.0041	11.140	51
10	1.0041	11.105	**50**
11	1.0041	11.069	49
12	1.0041	11.034	48
13	1.0042	10.998	47
14	1.0042	10.963	46
15	1.0042	10.929	**45**
16	1.0042	10.894	44
17	1.0043	10.860	43
18	1.0043	10.826	42
19	1.0043	10.792	41
20	1.0043	10.758	**40**
21	1.0044	10.725	39
22	1.0044	10.692	38
23	1.0044	10.659	37
24	1.0045	10.626	36
25	1.0045	10.593	**35**
26	1.0045	10.561	34
27	1.0045	10.529	33
28	1.0046	10.497	32
29	1.0046	10.465	31
30	1.0046	10.433	**30**
31	1.0047	10.402	29
32	1.0047	10.371	28
33	1.0047	10.340	27
34	1.0047	10.309	26
35	1.0048	10.278	**25**
36	1.0048	10.248	24
37	1.0048	10.217	23
38	1.0049	10.187	22
39	1.0049	10.157	21
40	1.0049	10.128	**20**
41	1.0049	10.098	19
42	1.0050	10.068	18
43	1.0050	10.039	17
44	1.0050	10.010	16
45	1.0051	9.9812	**15**
46	1.0051	9.9525	14
47	1.0051	9.9239	13
48	1.0051	9.8955	12
49	1.0052	9.8672	11
50	1.0052	9.8391	**10**
51	1.0052	9.8112	9
52	1.0053	9.7834	8
53	1.0053	9.7558	7
54	1.0053	9.7283	6
55	1.0054	9.7010	**5**
56	1.0054	9.6739	4
57	1.0054	9.6469	3
58	1.0054	9.6200	2
59	1.0055	9.5933	1
60	1.0055	9.5668	**0**
′	Csc	Sec	′

95° (275°) (264°) **84°**

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

6° (186°) (353°) **173°**

′	Sec	Csc	′
0	1.0055	9.5668	**60**
1	1.0055	9.5404	59
2	1.0056	9.5141	58
3	1.0056	9.4880	57
4	1.0056	9.4620	56
5	1.0057	9.4362	**55**
6	1.0057	9.4105	54
7	1.0057	9.3850	53
8	1.0058	9.3596	52
9	1.0058	9.3343	51
10	1.0058	9.3092	**50**
11	1.0059	9.2842	49
12	1.0059	9.2593	48
13	1.0059	9.2346	47
14	1.0059	9.2100	46
15	1.0060	9.1855	**45**
16	1.0060	9.1612	44
17	1.0060	9.1370	43
18	1.0061	9.1129	42
19	1.0061	9.0890	41
20	1.0061	9.0652	**40**
21	1.0062	9.0415	39
22	1.0062	9.0179	38
23	1.0062	8.9944	37
24	1.0063	8.9711	36
25	1.0063	8.9479	**35**
26	1.0063	8.9248	34
27	1.0064	8.9019	33
28	1.0064	8.8790	32
29	1.0064	8.8563	31
30	1.0065	8.8337	**30**
31	1.0065	8.8112	29
32	1.0065	8.7888	28
33	1.0066	8.7665	27
34	1.0066	8.7444	26
35	1.0066	8.7223	**25**
36	1.0067	8.7004	24
37	1.0067	8.6786	23
38	1.0067	8.6569	22
39	1.0068	8.6353	21
40	1.0068	8.6138	**20**
41	1.0068	8.5924	19
42	1.0069	8.5711	18
43	1.0069	8.5500	17
44	1.0069	8.5289	16
45	1.0070	8.5079	**15**
46	1.0070	8.4871	14
47	1.0070	8.4663	13
48	1.0071	8.4457	12
49	1.0071	8.4251	11
50	1.0072	8.4047	**10**
51	1.0072	8.3843	9
52	1.0072	8.3641	8
53	1.0073	8.3439	7
54	1.0073	8.3238	6
55	1.0073	8.3039	**5**
56	1.0074	8.2840	4
57	1.0074	8.2642	3
58	1.0074	8.2446	2
59	1.0075	8.2250	1
60	1.0075	8.2055	**0**
′	Csc	Sec	′

96° (276°) (263°) **83°**

7° (187°) (352°) **172°**

′	Sec	Csc	′
0	1.0075	8.2055	**60**
1	1.0075	8.1861	59
2	1.0076	8.1668	58
3	1.0076	8.1476	57
4	1.0077	8.1285	56
5	1.0077	8.1095	**55**
6	1.0077	8.0905	54
7	1.0078	8.0717	53
8	1.0078	8.0529	52
9	1.0078	8.0342	51
10	1.0079	8.0156	**50**
11	1.0079	7.9971	49
12	1.0079	7.9787	48
13	1.0080	7.9604	47
14	1.0080	7.9422	46
15	1.0081	7.9240	**45**
16	1.0081	7.9059	44
17	1.0081	7.8879	43
18	1.0082	7.8700	42
19	1.0082	7.8522	41
20	1.0082	7.8344	**40**
21	1.0083	7.8168	39
22	1.0083	7.7992	38
23	1.0084	7.7817	37
24	1.0084	7.7642	36
25	1.0084	7.7469	**35**
26	1.0085	7.7296	34
27	1.0085	7.7124	33
28	1.0086	7.6953	32
29	1.0086	7.6783	31
30	1.0086	7.6613	**30**
31	1.0087	7.6444	29
32	1.0087	7.6276	28
33	1.0087	7.6109	27
34	1.0088	7.5942	26
35	1.0088	7.5776	**25**
36	1.0089	7.5611	24
37	1.0089	7.5446	23
38	1.0089	7.5282	22
39	1.0090	7.5119	21
40	1.0090	7.4957	**20**
41	1.0091	7.4795	19
42	1.0091	7.4635	18
43	1.0091	7.4474	17
44	1.0092	7.4315	16
45	1.0092	7.4156	**15**
46	1.0093	7.3998	14
47	1.0093	7.3840	13
48	1.0093	7.3684	12
49	1.0094	7.3527	11
50	1.0094	7.3372	**10**
51	1.0095	7.3217	9
52	1.0095	7.3063	8
53	1.0095	7.2909	7
54	1.0096	7.2757	6
55	1.0096	7.2604	**5**
56	1.0097	7.2453	4
57	1.0097	7.2302	3
58	1.0097	7.2152	2
59	1.0098	7.2002	1
60	1.0098	7.1853	**0**
′	Csc	Sec	′

97° (277°) (262°) **82°**

8° (188°) (351°) **171°**

′	Sec	Csc	′
0	1.0098	7.1853	**60**
1	1.0099	7.1705	59
2	1.0099	7.1557	58
3	1.0100	7.1410	57
4	1.0100	7.1263	56
5	1.0100	7.1117	**55**
6	1.0101	7.0972	54
7	1.0101	7.0827	53
8	1.0102	7.0683	52
9	1.0102	7.0539	51
10	1.0102	7.0396	**50**
11	1.0103	7.0254	49
12	1.0103	7.0112	48
13	1.0104	6.9971	47
14	1.0104	6.9830	46
15	1.0105	6.9690	**45**
16	1.0105	6.9550	44
17	1.0105	6.9411	43
18	1.0106	6.9273	42
19	1.0106	6.9135	41
20	1.0107	6.8998	**40**
21	1.0107	6.8861	39
22	1.0108	6.8725	38
23	1.0108	6.8589	37
24	1.0108	6.8454	36
25	1.0109	6.8320	**35**
26	1.0109	6.8186	34
27	1.0110	6.8052	33
28	1.0110	6.7919	32
29	1.0111	6.7787	31
30	1.0111	6.7655	**30**
31	1.0112	6.7523	29
32	1.0112	6.7392	28
33	1.0112	6.7262	27
34	1.0113	6.7132	26
35	1.0113	6.7003	**25**
36	1.0114	6.6874	24
37	1.0114	6.6745	23
38	1.0115	6.6618	22
39	1.0115	6.6490	21
40	1.0116	6.6363	**20**
41	1.0116	6.6237	19
42	1.0116	6.6111	18
43	1.0117	6.5986	17
44	1.0117	6.5861	16
45	1.0118	6.5736	**15**
46	1.0118	6.5612	14
47	1.0119	6.5489	13
48	1.0119	6.5366	12
49	1.0120	6.5243	11
50	1.0120	6.5121	**10**
51	1.0120	6.4999	9
52	1.0121	6.4878	8
53	1.0121	6.4757	7
54	1.0122	6.4637	6
55	1.0122	6.4517	**5**
56	1.0123	6.4398	4
57	1.0123	6.4279	3
58	1.0124	6.4160	2
59	1.0124	6.4042	1
60	1.0125	6.3925	**0**
′	Csc	Sec	′

98° (278°) (261°) **81°**

9° (189°) (350°) **170°**

′	Sec	Csc	′
0	1.0125	6.3925	60
1	1.0125	6.3807	59
2	1.0126	6.3691	58
3	1.0126	6.3574	57
4	1.0127	6.3458	56
5	1.0127	6.3343	55
6	1.0127	6.3228	54
7	1.0128	6.3113	53
8	1.0128	6.2999	52
9	1.0129	6.2885	51
10	1.0129	6.2772	50
11	1.0130	6.2659	49
12	1.0130	6.2546	48
13	1.0131	6.2434	47
14	1.0131	6.2323	46
15	1.0132	6.2211	45
16	1.0132	6.2100	44
17	1.0133	6.1990	43
18	1.0133	6.1880	42
19	1.0134	6.1770	41
20	1.0134	6.1661	40
21	1.0135	6.1552	39
22	1.0135	6.1443	38
23	1.0136	6.1335	37
24	1.0136	6.1227	36
25	1.0137	6.1120	35
26	1.0137	6.1013	34
27	1.0138	6.0906	33
28	1.0138	6.0800	32
29	1.0139	6.0694	31
30	1.0139	6.0589	30
31	1.0140	6.0483	29
32	1.0140	6.0379	28
33	1.0141	6.0274	27
34	1.0141	6.0170	26
35	1.0142	6.0067	25
36	1.0142	5.9963	24
37	1.0143	5.9860	23
38	1.0143	5.9758	22
39	1.0144	5.9656	21
40	1.0144	5.9554	20
41	1.0145	5.9452	19
42	1.0145	5.9351	18
43	1.0146	5.9250	17
44	1.0146	5.9150	16
45	1.0147	5.9049	15
46	1.0147	5.8950	14
47	1.0148	5.8850	13
48	1.0148	5.8751	12
49	1.0149	5.8652	11
50	1.0149	5.8554	10
51	1.0150	5.8456	9
52	1.0150	5.8358	8
53	1.0151	5.8261	7
54	1.0151	5.8164	6
55	1.0152	5.8067	5
56	1.0152	5.7970	4
57	1.0153	5.7874	3
58	1.0153	5.7778	2
59	1.0154	5.7683	1
60	1.0154	5.7588	0
′	Csc	Sec	′

99° (279°) (260°) **80°**

10° (190°) (349°) **169°**

′	Sec	Csc	′
0	1.0154	5.7588	60
1	1.0155	5.7493	59
2	1.0155	5.7398	58
3	1.0156	5.7304	57
4	1.0156	5.7210	56
5	1.0157	5.7117	55
6	1.0157	5.7023	54
7	1.0158	5.6930	53
8	1.0158	5.6838	52
9	1.0159	5.6745	51
10	1.0160	5.6653	50
11	1.0160	5.6562	49
12	1.0161	5.6470	48
13	1.0161	5.6379	47
14	1.0162	5.6288	46
15	1.0162	5.6198	45
16	1.0163	5.6107	44
17	1.0163	5.6017	43
18	1.0164	5.5928	42
19	1.0164	5.5838	41
20	1.0165	5.5749	40
21	1.0165	5.5660	39
22	1.0166	5.5572	38
23	1.0166	5.5484	37
24	1.0167	5.5396	36
25	1.0168	5.5308	35
26	1.0168	5.5221	34
27	1.0169	5.5134	33
28	1.0169	5.5047	32
29	1.0170	5.4960	31
30	1.0170	5.4874	30
31	1.0171	5.4788	29
32	1.0171	5.4702	28
33	1.0172	5.4617	27
34	1.0173	5.4532	26
35	1.0173	5.4447	25
36	1.0174	5.4362	24
37	1.0174	5.4278	23
38	1.0175	5.4194	22
39	1.0175	5.4110	21
40	1.0176	5.4026	20
41	1.0176	5.3943	19
42	1.0177	5.3860	18
43	1.0178	5.3777	17
44	1.0178	5.3695	16
45	1.0179	5.3612	15
46	1.0179	5.3530	14
47	1.0180	5.3449	13
48	1.0180	5.3367	12
49	1.0181	5.3286	11
50	1.0181	5.3205	10
51	1.0182	5.3124	9
52	1.0183	5.3044	8
53	1.0183	5.2963	7
54	1.0184	5.2883	6
55	1.0184	5.2804	5
56	1.0185	5.2724	4
57	1.0185	5.2645	3
58	1.0186	5.2566	2
59	1.0187	5.2487	1
60	1.0187	5.2408	0
′	Csc	Sec	′

100° (280°) (259°) **79°**

11° (191°) (348°) **168°**

′	Sec	Csc	′
0	1.0187	5.2408	60
1	1.0188	5.2330	59
2	1.0188	5.2252	58
3	1.0189	5.2174	57
4	1.0189	5.2097	56
5	1.0190	5.2019	55
6	1.0191	5.1942	54
7	1.0191	5.1865	53
8	1.0192	5.1789	52
9	1.0192	5.1712	51
10	1.0193	5.1636	50
11	1.0194	5.1560	49
12	1.0194	5.1484	48
13	1.0195	5.1409	47
14	1.0195	5.1333	46
15	1.0196	5.1258	45
16	1.0197	5.1183	44
17	1.0197	5.1109	43
18	1.0198	5.1034	42
19	1.0198	5.0960	41
20	1.0199	5.0886	40
21	1.0199	5.0813	39
22	1.0200	5.0739	38
23	1.0201	5.0666	37
24	1.0201	5.0593	36
25	1.0202	5.0520	35
26	1.0202	5.0447	34
27	1.0203	5.0375	33
28	1.0204	5.0302	32
29	1.0204	5.0230	31
30	1.0205	5.0159	30
31	1.0205	5.0087	29
32	1.0206	5.0016	28
33	1.0207	4.9944	27
34	1.0207	4.9873	26
35	1.0208	4.9803	25
36	1.0209	4.9732	24
37	1.0209	4.9662	23
38	1.0210	4.9591	22
39	1.0210	4.9521	21
40	1.0211	4.9452	20
41	1.0212	4.9382	19
42	1.0212	4.9313	18
43	1.0213	4.9244	17
44	1.0213	4.9175	16
45	1.0214	4.9106	15
46	1.0215	4.9037	14
47	1.0215	4.8969	13
48	1.0216	4.8901	12
49	1.0217	4.8833	11
50	1.0217	4.8765	10
51	1.0218	4.8697	9
52	1.0218	4.8630	8
53	1.0219	4.8563	7
54	1.0220	4.8496	6
55	1.0220	4.8429	5
56	1.0221	4.8362	4
57	1.0222	4.8296	3
58	1.0222	4.8229	2
59	1.0223	4.8163	1
60	1.0223	4.8097	0
′	Csc	Sec	′

101° (281°) (258°) **78°**

12° (192°) (347°) **167°**

′	Sec	Csc	′
0	1.0223	4.8097	**60**
1	1.0224	4.8032	59
2	1.0225	4.7966	58
3	1.0225	4.7901	57
4	1.0226	4.7836	56
5	1.0227	4.7771	**55**
6	1.0227	4.7706	54
7	1.0228	4.7641	53
8	1.0228	4.7577	52
9	1.0229	4.7512	51
10	1.0230	4.7448	**50**
11	1.0230	4.7384	49
12	1.0231	4.7321	48
13	1.0232	4.7257	47
14	1.0232	4.7194	46
15	1.0233	4.7130	**45**
16	1.0234	4.7067	44
17	1.0234	4.7004	43
18	1.0235	4.6942	42
19	1.0236	4.6879	41
20	1.0236	4.6817	**40**
21	1.0237	4.6755	39
22	1.0238	4.6693	38
23	1.0238	4.6631	37
24	1.0239	4.6569	36
25	1.0240	4.6507	**35**
26	1.0240	4.6446	34
27	1.0241	4.6385	33
28	1.0241	4.6324	32
29	1.0242	4.6263	31
30	1.0243	4.6202	**30**
31	1.0243	4.6142	29
32	1.0244	4.6081	28
33	1.0245	4.6021	27
34	1.0245	4.5961	26
35	1.0246	4.5901	**25**
36	1.0247	4.5841	24
37	1.0247	4.5782	23
38	1.0248	4.5722	22
39	1.0249	4.5663	21
40	1.0249	4.5604	**20**
41	1.0250	4.5545	19
42	1.0251	4.5486	18
43	1.0251	4.5428	17
44	1.0252	4.5369	16
45	1.0253	4.5311	**15**
46	1.0253	4.5253	14
47	1.0254	4.5195	13
48	1.0255	4.5137	12
49	1.0256	4.5079	11
50	1.0256	4.5022	**10**
51	1.0257	4.4964	9
52	1.0258	4.4907	8
53	1.0258	4.4850	7
54	1.0259	4.4793	6
55	1.0260	4.4736	**5**
56	1.0260	4.4679	4
57	1.0261	4.4623	3
58	1.0262	4.4566	2
59	1.0262	4.4510	1
60	1.0263	4.4454	**0**
′	Csc	Sec	′

102° (282°) (257°) **77°**

13° (193°) (346°) **166°**

′	Sec	Csc	′
0	1.0263	4.4454	**60**
1	1.0264	4.4398	59
2	1.0264	4.4342	58
3	1.0265	4.4287	57
4	1.0266	4.4231	56
5	1.0266	4.4176	**55**
6	1.0267	4.4121	54
7	1.0268	4.4066	53
8	1.0269	4.4011	52
9	1.0269	4.3956	51
10	1.0270	4.3901	**50**
11	1.0271	4.3847	49
12	1.0271	4.3792	48
13	1.0272	4.3738	47
14	1.0273	4.3684	46
15	1.0273	4.3630	**45**
16	1.0274	4.3576	44
17	1.0275	4.3522	43
18	1.0276	4.3469	42
19	1.0276	4.3415	41
20	1.0277	4.3362	**40**
21	1.0278	4.3309	39
22	1.0278	4.3256	38
23	1.0279	4.3203	37
24	1.0280	4.3150	36
25	1.0281	4.3098	**35**
26	1.0281	4.3045	34
27	1.0282	4.2993	33
28	1.0283	4.2941	32
29	1.0283	4.2889	31
30	1.0284	4.2837	**30**
31	1.0285	4.2785	29
32	1.0286	4.2733	28
33	1.0286	4.2681	27
34	1.0287	4.2630	26
35	1.0288	4.2579	**25**
36	1.0288	4.2527	24
37	1.0289	4.2476	23
38	1.0290	4.2425	22
39	1.0291	4.2375	21
40	1.0291	4.2324	**20**
41	1.0292	4.2273	19
42	1.0293	4.2223	18
43	1.0294	4.2173	17
44	1.0294	4.2122	16
45	1.0295	4.2072	**15**
46	1.0296	4.2022	14
47	1.0297	4.1973	13
48	1.0297	4.1923	12
49	1.0298	4.1873	11
50	1.0299	4.1824	**10**
51	1.0299	4.1774	9
52	1.0300	4.1725	8
53	1.0301	4.1676	7
54	1.0302	4.1627	6
55	1.0302	4.1578	**5**
56	1.0303	4.1529	4
57	1.0304	4.1481	3
58	1.0305	4.1432	2
59	1.0305	4.1384	1
60	1.0306	4.1336	**0**
′	Csc	Sec	′

103° (283°) (256°) **76°**

14° (194°) (345°) **165°**

′	Sec	Csc	′
0	1.0306	4.1336	**60**
1	1.0307	4.1287	59
2	1.0308	4.1239	58
3	1.0308	4.1191	57
4	1.0309	4.1144	56
5	1.0310	4.1096	**55**
6	1.0311	4.1048	54
7	1.0311	4.1001	53
8	1.0312	4.0954	52
9	1.0313	4.0906	51
10	1.0314	4.0859	**50**
11	1.0314	4.0812	49
12	1.0315	4.0765	48
13	1.0316	4.0718	47
14	1.0317	4.0672	46
15	1.0317	4.0625	**45**
16	1.0318	4.0579	44
17	1.0319	4.0532	43
18	1.0320	4.0486	42
19	1.0321	4.0440	41
20	1.0321	4.0394	**40**
21	1.0322	4.0348	39
22	1.0323	4.0302	38
23	1.0324	4.0256	37
24	1.0324	4.0211	36
25	1.0325	4.0165	**35**
26	1.0326	4.0120	34
27	1.0327	4.0075	33
28	1.0327	4.0029	32
29	1.0328	3.9984	31
30	1.0329	3.9939	**30**
31	1.0330	3.9894	29
32	1.0331	3.9850	28
33	1.0331	3.9805	27
34	1.0332	3.9760	26
35	1.0333	3.9716	**25**
36	1.0334	3.9672	24
37	1.0334	3.9627	23
38	1.0335	3.9583	22
39	1.0336	3.9539	21
40	1.0337	3.9495	**20**
41	1.0338	3.9451	19
42	1.0338	3.9408	18
43	1.0339	3.9364	17
44	1.0340	3.9320	16
45	1.0341	3.9277	**15**
46	1.0342	3.9234	14
47	1.0342	3.9190	13
48	1.0343	3.9147	12
49	1.0344	3.9104	11
50	1.0345	3.9061	**10**
51	1.0346	3.9018	9
52	1.0346	3.8976	8
53	1.0347	3.8933	7
54	1.0348	3.8890	6
55	1.0349	3.8848	**5**
56	1.0350	3.8806	4
57	1.0350	3.8763	3
58	1.0351	3.8721	2
59	1.0352	3.8679	1
60	1.0353	3.8637	**0**
′	Csc	Sec	′

104° (284°) (255°) **75°**

15° (195°) (344°) **164°**

′	Sec	Csc	′
0	1.0353	3.8637	**60**
1	1.0354	3.8595	59
2	1.0354	3.8553	58
3	1.0355	3.8512	57
4	1.0356	3.8470	56
5	1.0357	3.8428	**55**
6	1.0358	3.8387	54
7	1.0358	3.8346	53
8	1.0359	3.8304	52
9	1.0360	3.8263	51
10	1.0361	3.8222	**50**
11	1.0362	3.8181	49
12	1.0363	3.8140	48
13	1.0363	3.8100	47
14	1.0364	3.8059	46
15	1.0365	3.8018	**45**
16	1.0366	3.7978	44
17	1.0367	3.7937	43
18	1.0367	3.7897	42
19	1.0368	3.7857	41
20	1.0369	3.7817	**40**
21	1.0370	3.7777	39
22	1.0371	3.7737	38
23	1.0372	3.7697	37
24	1.0372	3.7657	36
25	1.0373	3.7617	**35**
26	1.0374	3.7577	34
27	1.0375	3.7538	33
28	1.0376	3.7498	32
29	1.0377	3.7459	31
30	1.0377	3.7420	**30**
31	1.0378	3.7381	29
32	1.0379	3.7341	28
33	1.0380	3.7302	27
34	1.0381	3.7263	26
35	1.0382	3.7225	**25**
36	1.0382	3.7186	24
37	1.0383	3.7147	23
38	1.0384	3.7108	22
39	1.0385	3.7070	21
40	1.0386	3.7032	**20**
41	1.0387	3.6993	19
42	1.0388	3.6955	18
43	1.0388	3.6917	17
44	1.0389	3.6879	16
45	1.0390	3.6840	**15**
46	1.0391	3.6803	14
47	1.0392	3.6765	13
48	1.0393	3.6727	12
49	1.0394	3.6689	11
50	1.0394	3.6652	**10**
51	1.0395	3.6614	9
52	1.0396	3.6576	8
53	1.0397	3.6539	7
54	1.0398	3.6502	6
55	1.0399	3.6465	**5**
56	1.0400	3.6427	4
57	1.0400	3.6390	3
58	1.0401	3.6353	2
59	1.0402	3.6316	1
60	1.0403	3.6280	**0**
′	Csc	Sec	′

105° (285°) (254°) **74°**

16° (196°) (343°) **163°**

′	Sec	Csc	′
0	1.0403	3.6280	**60**
1	1.0404	3.6243	59
2	1.0405	3.6206	58
3	1.0406	3.6169	57
4	1.0406	3.6133	56
5	1.0407	3.6097	**55**
6	1.0408	3.6060	54
7	1.0409	3.6024	53
8	1.0410	3.5988	52
9	1.0411	3.5951	51
10	1.0412	3.5915	**50**
11	1.0413	3.5879	49
12	1.0413	3.5843	48
13	1.0414	3.5808	47
14	1.0415	3.5772	46
15	1.0416	3.5736	**45**
16	1.0417	3.5700	44
17	1.0418	3.5665	43
18	1.0419	3.5629	42
19	1.0420	3.5594	41
20	1.0421	3.5559	**40**
21	1.0421	3.5523	39
22	1.0422	3.5488	38
23	1.0423	3.5453	37
24	1.0424	3.5418	36
25	1.0425	3.5383	**35**
26	1.0426	3.5348	34
27	1.0427	3.5313	33
28	1.0428	3.5279	32
29	1.0429	3.5244	31
30	1.0429	3.5209	**30**
31	1.0430	3.5175	29
32	1.0431	3.5140	28
33	1.0432	3.5106	27
34	1.0433	3.5072	26
35	1.0434	3.5037	**25**
36	1.0435	3.5003	24
37	1.0436	3.4969	23
38	1.0437	3.4935	22
39	1.0438	3.4901	21
40	1.0439	3.4867	**20**
41	1.0439	3.4833	19
42	1.0440	3.4799	18
43	1.0441	3.4766	17
44	1.0442	3.4732	16
45	1.0443	3.4699	**15**
46	1.0444	3.4665	14
47	1.0445	3.4632	13
48	1.0446	3.4598	12
49	1.0447	3.4565	11
50	1.0448	3.4532	**10**
51	1.0449	3.4499	9
52	1.0450	3.4465	8
53	1.0450	3.4432	7
54	1.0451	3.4399	6
55	1.0452	3.4367	**5**
56	1.0453	3.4334	4
57	1.0454	3.4301	3
58	1.0455	3.4268	2
59	1.0456	3.4236	1
60	1.0457	3.4203	**0**
′	Csc	Sec	′

106° (286°) (253°) **73°**

17° (197°) (342°) **162°**

′	Sec	Csc	′
0	1.0457	3.4203	**60**
1	1.0458	3.4171	59
2	1.0459	3.4138	58
3	1.0460	3.4106	57
4	1.0461	3.4073	56
5	1.0462	3.4041	**55**
6	1.0463	3.4009	54
7	1.0463	3.3977	53
8	1.0464	3.3945	52
9	1.0465	3.3913	51
10	1.0466	3.3881	**50**
11	1.0467	3.3849	49
12	1.0468	3.3817	48
13	1.0469	3.3785	47
14	1.0470	3.3754	46
15	1.0471	3.3722	**45**
16	1.0472	3.3691	44
17	1.0473	3.3659	43
18	1.0474	3.3628	42
19	1.0475	3.3596	41
20	1.0476	3.3565	**40**
21	1.0477	3.3534	39
22	1.0478	3.3502	38
23	1.0479	3.3171	37
24	1.0480	3.3440	36
25	1.0480	3.3409	**35**
26	1.0481	3.3378	34
27	1.0482	3.3347	33
28	1.0483	3.3317	32
29	1.0484	3.3286	31
30	1.0485	3.3255	**30**
31	1.0486	3.3224	29
32	1.0487	3.3194	28
33	1.0488	3.3163	27
34	1.0489	3.3133	26
35	1.0490	3.3102	**25**
36	1.0491	3.3072	24
37	1.0492	3.3042	23
38	1.0493	3.3012	22
39	1.0494	3.2981	21
40	1.0495	3.2951	**20**
41	1.0496	3.2921	19
42	1.0497	3.2891	18
43	1.0498	3.2861	17
44	1.0499	3.2831	16
45	1.0500	3.2801	**15**
46	1.0501	3.2772	14
47	1.0502	3.2742	13
48	1.0503	3.2712	12
49	1.0504	3.2683	11
50	1.0505	3.2653	**10**
51	1.0506	3.2624	9
52	1.0507	3.2594	8
53	1.0508	3.2565	7
54	1.0509	3.2535	6
55	1.0510	3.2506	**5**
56	1.0511	3.2477	4
57	1.0512	3.2448	3
58	1.0513	3.2419	2
59	1.0514	3.2390	1
60	1.0515	3.2361	**0**
′	Csc	Sec	′

107° (287°) (252°) **72°**

18° (198°) (341°) **161°**

′	Sec	Csc	′
0	1.0515	3.2361	**60**
1	1.0516	3.2332	59
2	1.0517	3.2303	58
3	1.0518	3.2274	57
4	1.0519	3.2245	56
5	1.0520	3.2217	**55**
6	1.0521	3.2188	54
7	1.0522	3.2159	53
8	1.0523	3.2131	52
9	1.0524	3.2102	51
10	1.0525	3.2074	**50**
11	1.0526	3.2045	49
12	1.0527	3.2017	48
13	1.0528	3.1989	47
14	1.0529	3.1960	46
15	1.0530	3.1932	**45**
16	1.0531	3.1904	44
17	1.0532	3.1876	43
18	1.0533	3.1848	42
19	1.0534	3.1820	41
20	1.0535	3.1792	**40**
21	1.0536	3.1764	39
22	1.0537	3.1736	38
23	1.0538	3.1708	37
24	1.0539	3.1681	36
25	1.0540	3.1653	**35**
26	1.0541	3.1625	34
27	1.0542	3.1598	33
28	1.0543	3.1570	32
29	1.0544	3.1543	31
30	1.0545	3.1515	**30**
31	1.0546	3.1488	29
32	1.0547	3.1461	28
33	1.0548	3.1433	27
34	1.0549	3.1406	26
35	1.0550	3.1379	**25**
36	1.0551	3.1352	24
37	1.0552	3.1325	23
38	1.0553	3.1298	22
39	1.0554	3.1271	21
40	1.0555	3.1244	**20**
41	1.0556	3.1217	19
42	1.0557	3.1190	18
43	1.0558	3.1163	17
44	1.0559	3.1137	16
45	1.0560	3.1110	**15**
46	1.0561	3.1083	14
47	1.0563	3.1057	13
48	1.0564	3.1030	12
49	1.0565	3.1004	11
50	1.0566	3.0977	**10**
51	1.0567	3.0951	9
52	1.0568	3.0925	8
53	1.0569	3.0898	7
54	1.0570	3.0872	6
55	1.0571	3.0846	**5**
56	1.0572	3.0820	4
57	1.0573	3.0794	3
58	1.0574	3.0768	2
59	1.0575	3.0742	1
60	1.0576	3.0716	**0**
′	Csc	Sec	′

108° (288°) (251°) **71°**

19° (199°) (340°) **160°**

′	Sec	Csc	′
0	1.0576	3.0716	**60**
1	1.0577	3.0690	59
2	1.0578	3.0664	58
3	1.0579	3.0638	57
4	1.0580	3.0612	56
5	1.0582	3.0586	**55**
6	1.0583	3.0561	54
7	1.0584	3.0535	53
8	1.0585	3.0509	52
9	1.0586	3.0484	51
10	1.0587	3.0458	**50**
11	1.0588	3.0433	49
12	1.0589	3.0407	48
13	1.0590	3.0382	47
14	1.0591	3.0357	46
15	1.0592	3.0331	**45**
16	1.0593	3.0306	44
17	1.0594	3.0281	43
18	1.0595	3.0256	42
19	1.0597	3.0231	41
20	1.0598	3.0206	**40**
21	1.0599	3.0181	39
22	1.0600	3.0156	38
23	1.0601	3.0131	37
24	1.0602	3.0106	36
25	1.0603	3.0081	**35**
26	1.0604	3.0056	34
27	1.0605	3.0031	33
28	1.0606	3.0007	32
29	1.0607	2.9982	31
30	1.0608	2.9957	**30**
31	1.0610	2.9933	29
32	1.0611	2.9908	28
33	1.0612	2.9884	27
34	1.0613	2.9859	26
35	1.0614	2.9835	**25**
36	1.0615	2.9811	24
37	1.0616	2.9786	23
38	1.0617	2.9762	22
39	1.0618	2.9738	21
40	1.0619	2.9713	**20**
41	1.0621	2.9689	19
42	1.0622	2.9665	18
43	1.0623	2.9641	17
44	1.0624	2.9617	16
45	1.0625	2.9593	**15**
46	1.0626	2.9569	14
47	1.0627	2.9545	13
48	1.0628	2.9521	12
49	1.0629	2.9498	11
50	1.0631	2.9474	**10**
51	1.0632	2.9450	9
52	1.0633	2.9426	8
53	1.0634	2.9403	7
54	1.0635	2.9379	6
55	1.0636	2.9355	**5**
56	1.0637	2.9332	4
57	1.0638	2.9308	3
58	1.0640	2.9285	2
59	1.0641	2.9261	1
60	1.0642	2.9238	**0**
′	Csc	Sec	′

109° (289°) (250°) **70°**

20° (200°) (339°) **159°**

′	Sec	Csc	′
0	1.0642	2.9238	**60**
1	1.0643	2.9215	59
2	1.0644	2.9101	58
3	1.0645	2.9168	57
4	1.0646	2.9145	56
5	1.0647	2.9122	**55**
6	1.0649	2.9099	54
7	1.0650	2.9075	53
8	1.0651	2.9052	52
9	1.0652	2.9029	51
10	1.0653	2.9006	**50**
11	1.0654	2.8983	49
12	1.0655	2.8960	48
13	1.0657	2.8938	47
14	1.0658	2.8915	46
15	1.0659	2.8892	**45**
16	1.0660	2.8869	44
17	1.0661	2.8846	43
18	1.0662	2.8824	42
19	1.0663	2.8801	41
20	1.0665	2.8779	**40**
21	1.0666	2.8756	39
22	1.0667	2.8733	38
23	1.0668	2.8711	37
24	1.0669	2.8688	36
25	1.0670	2.8666	**35**
26	1.0671	2.8644	34
27	1.0673	2.8621	33
28	1.0674	2.8599	32
29	1.0675	2.8577	31
30	1.0676	2.8555	**30**
31	1.0677	2.8532	29
32	1.0678	2.8510	28
33	1.0680	2.8488	27
34	1.0681	2.8466	26
35	1.0682	2.8444	**25**
36	1.0683	2.8422	24
37	1.0684	2.8400	23
38	1.0685	2.8378	22
39	1.0687	2.8356	21
40	1.0688	2.8334	**20**
41	1.0689	2.8312	19
42	1.0690	2.8291	18
43	1.0691	2.8269	17
44	1.0692	2.8247	16
45	1.0694	2.8225	**15**
46	1.0695	2.8204	14
47	1.0696	2.8182	13
48	1.0697	2.8161	12
49	1.0698	2.8139	11
50	1.0700	2.8117	**10**
51	1.0701	2.8096	9
52	1.0702	2.8075	8
53	1.0703	2.8053	7
54	1.0704	2.8032	6
55	1.0705	2.8010	**5**
56	1.0707	2.7989	4
57	1.0708	2.7968	3
58	1.0709	2.7947	2
59	1.0710	2.7925	1
60	1.0711	2.7904	**0**
′	Csc	Sec	′

110° (290°) (249°) **69°**

21° (201°) (338°) **158°**

′	Sec	Csc	′
0	1.0711	2.7904	**60**
1	1.0712	2.7883	59
2	1.0714	2.7862	58
3	1.0715	2.7841	57
4	1.0716	2.7820	56
5	1.0717	2.7799	**55**
6	1.0719	2.7778	54
7	1.0720	2.7757	53
8	1.0721	2.7736	52
9	1.0722	2.7715	51
10	1.0723	2.7695	**50**
11	1.0725	2.7674	49
12	1.0726	2.7653	48
13	1.0727	2.7632	47
14	1.0728	2.7612	46
15	1.0730	2.7591	**45**
16	1.0731	2.7570	44
17	1.0732	2.7550	43
18	1.0733	2.7529	42
19	1.0734	2.7509	41
20	1.0736	2.7488	**40**
21	1.0737	2.7468	39
22	1.0738	2.7447	38
23	1.0739	2.7427	37
24	1.0740	2.7407	36
25	1.0742	2.7386	**35**
26	1.0743	2.7366	34
27	1.0744	2.7346	33
28	1.0745	2.7325	32
29	1.0747	2.7305	31
30	1.0748	2.7285	**30**
31	1.0749	2.7265	29
32	1.0750	2.7245	28
33	1.0752	2.7225	27
34	1.0753	2.7205	26
35	1.0754	2.7185	**25**
36	1.0756	2.7165	24
37	1.0757	2.7145	23
38	1.0758	2.7125	22
39	1.0759	2.7105	21
40	1.0760	2.7085	**20**
41	1.0761	2.7065	19
42	1.0763	2.7046	18
43	1.0764	2.7026	17
44	1.0765	2.7006	16
45	1.0766	2.6986	**15**
46	1.0768	2.6967	14
47	1.0769	2.6947	13
48	1.0770	2.6927	12
49	1.0771	2.6908	11
50	1.0773	2.6888	**10**
51	1.0774	2.6869	9
52	1.0775	2.6849	8
53	1.0777	2.6830	7
54	1.0778	2.6811	6
55	1.0779	2.6791	**5**
56	1.0780	2.6772	4
57	1.0782	2.6752	3
58	1.0783	2.6733	2
59	1.0784	2.6714	1
60	1.0785	2.6695	**0**
′	Csc	Sec	′

111° (291°) (248°) **68°**

22° (202°) (337°) **157°**

′	Sec	Csc	′
0	1.0785	2.6695	**60**
1	1.0787	2.6675	59
2	1.0788	2.6656	58
3	1.0789	2.6637	57
4	1.0790	2.6618	56
5	1.0792	2.6599	**55**
6	1.0793	2.6580	54
7	1.0794	2.6561	53
8	1.0796	2.6542	52
9	1.0797	2.6523	51
10	1.0798	2.6504	**50**
11	1.0799	2.6485	49
12	1.0801	2.6466	48
13	1.0802	2.6447	47
14	1.0803	2.6429	46
15	1.0804	2.6410	**45**
16	1.0806	2.6391	44
17	1.0807	2.6372	43
18	1.0808	2.6354	42
19	1.0810	2.6335	41
20	1.0811	2.6316	**40**
21	1.0812	2.6298	39
22	1.0814	2.6279	38
23	1.0815	2.6260	37
24	1.0816	2.6242	36
25	1.0817	2.6223	**35**
26	1.0819	2.6205	34
27	1.0820	2.6186	33
28	1.0821	2.6168	32
29	1.0823	2.6150	31
30	1.0824	2.6131	**30**
31	1.0825	2.6113	29
32	1.0827	2.6095	28
33	1.0828	2.6076	27
34	1.0829	2.6058	26
35	1.0830	2.6040	**25**
36	1.0832	2.6022	24
37	1.0833	2.6003	23
38	1.0834	2.5985	22
39	1.0836	2.5967	21
40	1.0837	2.5949	**20**
41	1.0838	2.5931	19
42	1.0840	2.5913	18
43	1.0841	2.5895	17
44	1.0842	2.5877	16
45	1.0844	2.5859	**15**
46	1.0845	2.5841	14
47	1.0846	2.5823	13
48	1.0848	2.5805	12
49	1.0849	2.5788	11
50	1.0850	2.5770	**10**
51	1.0852	2.5752	9
52	1.0853	2.5734	8
53	1.0854	2.5716	7
54	1.0856	2.5699	6
55	1.0857	2.5681	**5**
56	1.0858	2.5663	4
57	1.0860	2.5646	3
58	1.0861	2.5628	2
59	1.0862	2.5611	1
60	1.0864	2.5593	**0**
′	Csc	Sec	′

112° (292°) (247°) **67°**

23° (203°) (336°) **156°**

′	Sec	Csc	′
0	1.0864	2.5593	**60**
1	1.0865	2.5576	59
2	1.0866	2.5558	58
3	1.0868	2.5541	57
4	1.0869	2.5523	56
5	1.0870	2.5506	**55**
6	1.0872	2.5488	54
7	1.0873	2.5471	53
8	1.0874	2.5454	52
9	1.0876	2.5436	51
10	1.0877	2.5419	**50**
11	1.0878	2.5402	49
12	1.0880	2.5384	48
13	1.0881	2.5367	47
14	1.0883	2.5350	46
15	1.0884	2.5333	**45**
16	1.0885	2.5316	44
17	1.0887	2.5299	43
18	1.0888	2.5282	42
19	1.0889	2.5264	41
20	1.0891	2.5247	**40**
21	1.0892	2.5230	39
22	1.0893	2.5213	38
23	1.0895	2.5196	37
24	1.0896	2.5180	36
25	1.0898	2.5163	**35**
26	1.0899	2.5146	34
27	1.0900	2.5129	33
28	1.0902	2.5112	32
29	1.0903	2.5095	31
30	1.0904	2.5078	**30**
31	1.0906	2.5062	29
32	1.0907	2.5045	28
33	1.0909	2.5028	27
34	1.0910	2.5012	26
35	1.0911	2.4995	**25**
36	1.0913	2.4978	24
37	1.0914	2.4962	23
38	1.0915	2.4945	22
39	1.0917	2.4928	21
40	1.0918	2.4912	**20**
41	1.0920	2.4895	19
42	1.0921	2.4879	18
43	1.0922	2.4862	17
44	1.0924	2.4846	16
45	1.0925	2.4830	**15**
46	1.0927	2.4813	14
47	1.0928	2.4797	13
48	1.0929	2.4780	12
49	1.0931	2.4764	11
50	1.0932	2.4748	**10**
51	1.0934	2.4731	9
52	1.0935	2.4715	8
53	1.0936	2.4699	7
54	1.0938	2.4683	6
55	1.0939	2.4667	**5**
56	1.0941	2.4650	4
57	1.0942	2.4634	3
58	1.0944	2.4618	2
59	1.0945	2.4602	1
60	1.0946	2.4586	**0**
′	Csc	Sec	′

113° (293°) (246°) **66°**

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

24° (204°) (335°) **155°**

′	Sec	Csc	′
0	1.0946	2.4586	**60**
1	1.0948	2.4570	59
2	1.0949	2.4554	58
3	1.0951	2.4538	57
4	1.0952	2.4522	56
5	1.0953	2.4506	**55**
6	1.0955	2.4490	54
7	1.0956	2.4474	53
8	1.0958	2.4458	52
9	1.0959	2.4442	51
10	1.0961	2.4426	**50**
11	1.0962	2.4411	49
12	1.0963	2.4395	48
13	1.0965	2.4379	47
14	1.0966	2.4363	46
15	1.0968	2.4348	**45**
16	1.0969	2.4332	44
17	1.0971	2.4316	43
18	1.0972	2.4300	42
19	1.0974	2.4285	41
20	1.0975	2.4269	**40**
21	1.0976	2.4254	39
22	1.0978	2.4238	38
23	1.0979	2.4222	37
24	1.0981	2.4207	36
25	1.0982	2.4191	**35**
26	1.0984	2.4176	34
27	1.0985	2.4160	33
28	1.0987	2.4145	32
29	1.0988	2.4130	31
30	1.0989	2.4114	**30**
31	1.0991	2.4099	29
32	1.0992	2.4083	28
33	1.0994	2.4068	27
34	1.0995	2.4053	26
35	1.0997	2.4038	**25**
36	1.0998	2.4022	24
37	1.1000	2.4007	23
38	1.1001	2.3992	22
39	1.1003	2.3977	21
40	1.1004	2.3961	**20**
41	1.1006	2.3946	19
42	1.1007	2.3931	18
43	1.1009	2.3916	17
44	1.1010	2.3901	16
45	1.1011	2.3886	**15**
46	1.1013	2.3871	14
47	1.1014	2.3856	13
48	1.1016	2.3841	12
49	1.1017	2.3826	11
50	1.1019	2.3811	**10**
51	1.1020	2.3796	9
52	1.1022	2.3781	8
53	1.1023	2.3766	7
54	1.1025	2.3751	6
55	1.1026	2.3736	**5**
56	1.1028	2.3721	4
57	1.1029	2.3706	3
58	1.1031	2.3692	2
59	1.1032	2.3677	1
60	1.1034	2.3662	**0**
′	Csc	Sec	′

114° (294°) (245°) **65°**

25° (205°) (334°) **154°**

′	Sec	Csc	′
0	1.1034	2.3662	**60**
1	1.1035	2.3647	59
2	1.1037	2.3633	58
3	1.1038	2.3618	57
4	1.1040	2.3603	56
5	1.1041	2.3588	**55**
6	1.1043	2.3574	54
7	1.1044	2.3559	53
8	1.1046	2.3545	52
9	1.1047	2.3530	51
10	1.1049	2.3515	**50**
11	1.1050	2.3501	49
12	1.1052	2.3486	48
13	1.1053	2.3472	47
14	1.1055	2.3457	46
15	1.1056	2.3443	**45**
16	1.1058	2.3428	44
17	1.1059	2.3414	43
18	1.1061	2.3400	42
19	1.1062	2.3385	41
20	1.1064	2.3371	**40**
21	1.1066	2.3356	39
22	1.1067	2.3342	38
23	1.1069	2.3328	37
24	1.1070	2.3314	36
25	1.1072	2.3299	**35**
26	1.1073	2.3285	34
27	1.1075	2.3271	33
28	1.1076	2.3257	32
29	1.1078	2.3242	31
30	1.1079	2.3228	**30**
31	1.1081	2.3214	29
32	1.1082	2.3200	28
33	1.1084	2.3186	27
34	1.1085	2.3172	26
35	1.1087	2.3158	**25**
36	1.1089	2.3144	24
37	1.1090	2.3130	23
38	1.1092	2.3115	22
39	1.1093	2.3101	21
40	1.1095	2.3088	**20**
41	1.1096	2.3074	19
42	1.1098	2.3060	18
43	1.1099	2.3046	17
44	1.1101	2.3032	16
45	1.1102	2.3018	**15**
46	1.1104	2.3004	14
47	1.1106	2.2990	13
48	1.1107	2.2976	12
49	1.1109	2.2962	11
50	1.1110	2.2949	**10**
51	1.1112	2.2935	9
52	1.1113	2.2921	8
53	1.1115	2.2907	7
54	1.1117	2.2894	6
55	1.1118	2.2880	**5**
56	1.1120	2.2866	4
57	1.1121	2.2853	3
58	1.1123	2.2839	2
59	1.1124	2.2825	1
60	1.1126	2.2812	**0**
′	Csc	Sec	′

115° (295°) (244°) **64°**

26° (206°) (333°) **153°**

′	Sec	Csc	′
0	1.1126	2.2812	**60**
1	1.1128	2.2798	59
2	1.1129	2.2785	58
3	1.1131	2.2771	57
4	1.1132	2.2757	56
5	1.1134	2.2744	**55**
6	1.1136	2.2730	54
7	1.1137	2.2717	53
8	1.1139	2.2703	52
9	1.1140	2.2690	51
10	1.1142	2.2677	**50**
11	1.1143	2.2663	49
12	1.1145	2.2650	48
13	1.1147	2.2636	47
14	1.1148	2.2623	46
15	1.1150	2.2610	**45**
16	1.1151	2.2596	44
17	1.1153	2.2583	43
18	1.1155	2.2570	42
19	1.1156	2.2556	41
20	1.1158	2.2543	**40**
21	1.1159	2.2530	39
22	1.1161	2.2517	38
23	1.1163	2.2504	37
24	1.1164	2.2490	36
25	1.1166	2.2477	**35**
26	1.1168	2.2464	34
27	1.1169	2.2451	33
28	1.1171	2.2438	32
29	1.1172	2.2425	31
30	1.1174	2.2412	**30**
31	1.1176	2.2399	29
32	1.1177	2.2385	28
33	1.1179	2.2372	27
34	1.1180	2.2359	26
35	1.1182	2.2346	**25**
36	1.1184	2.2333	24
37	1.1185	2.2320	23
38	1.1187	2.2308	22
39	1.1189	2.2295	21
40	1.1190	2.2282	**20**
41	1.1192	2.2269	19
42	1.1194	2.2256	18
43	1.1195	2.2243	17
44	1.1197	2.2230	16
45	1.1198	2.2217	**15**
46	1.1200	2.2205	14
47	1.1202	2.2192	13
48	1.1203	2.2179	12
49	1.1205	2.2166	11
50	1.1207	2.2153	**10**
51	1.1208	2.2141	9
52	1.1210	2.2128	8
53	1.1212	2.2115	7
54	1.1213	2.2103	6
55	1.1215	2.2090	**5**
56	1.1217	2.2077	4
57	1.1218	2.2065	3
58	1.1220	2.2052	2
59	1.1222	2.2039	1
60	1.1223	2.2027	**0**
′	Csc	Sec	′

116° (296°) (243°) **63°**

27° (207°) (332°) **152°**

′	Sec	Csc	′
0	1.1223	2.2027	**60**
1	1.1225	2.2014	59
2	1.1227	2.2002	58
3	1.1228	2.1989	57
4	1.1230	2.1977	56
5	1.1232	2.1964	**55**
6	1.1233	2.1952	54
7	1.1235	2.1939	53
8	1.1237	2.1927	52
9	1.1238	2.1914	51
10	1.1240	2.1902	**50**
11	1.1242	2.1890	49
12	1.1243	2.1877	48
13	1.1245	2.1865	47
14	1.1247	2.1852	46
15	1.1248	2.1840	**45**
16	1.1250	2.1828	44
17	1.1252	2.1815	43
18	1.1253	2.1803	42
19	1.1255	2.1791	41
20	1.1257	2.1779	**40**
21	1.1259	2.1766	39
22	1.1260	2.1754	38
23	1.1262	2.1742	37
24	1.1264	2.1730	36
25	1.1265	2.1718	**35**
26	1.1267	2.1705	34
27	1.1269	2.1693	33
28	1.1270	2.1681	32
29	1.1272	2.1669	31
30	1.1274	2.1657	**30**
31	1.1276	2.1645	29
32	1.1277	2.1633	28
33	1.1279	2.1621	27
34	1.1281	2.1609	26
35	1.1282	2.1596	**25**
36	1.1284	2.1584	24
37	1.1286	2.1572	23
38	1.1288	2.1560	22
39	1.1289	2.1549	21
40	1.1291	2.1537	**20**
41	1.1293	2.1525	19
42	1.1294	2.1513	18
43	1.1296	2.1501	17
44	1.1298	2.1489	16
45	1.1300	2.1477	**15**
46	1.1301	2.1465	14
47	1.1303	2.1453	13
48	1.1305	2.1441	12
49	1.1307	2.1430	11
50	1.1308	2.1418	**10**
51	1.1310	2.1406	9
52	1.1312	2.1394	8
53	1.1313	2.1382	7
54	1.1315	2.1371	6
55	1.1317	2.1359	**5**
56	1.1319	2.1347	4
57	1.1320	2.1336	3
58	1.1322	2.1324	2
59	1.1324	2.1312	1
60	1.1326	2.1301	**0**
′	Csc	Sec	′

117° (297°) (242°) **62°**

28° (208°) (331°) **151°**

′	Sec	Csc	′
0	1.1326	2.1301	**60**
1	1.1327	2.1289	59
2	1.1329	2.1277	58
3	1.1331	2.1266	57
4	1.1333	2.1254	56
5	1.1334	2.1242	**55**
6	1.1336	2.1231	54
7	1.1338	2.1219	53
8	1.1340	2.1208	52
9	1.1342	2.1196	51
10	1.1343	2.1185	**50**
11	1.1345	2.1173	49
12	1.1347	2.1162	48
13	1.1349	2.1150	47
14	1.1350	2.1139	46
15	1.1352	2.1127	**45**
16	1.1354	2.1116	44
17	1.1356	2.1105	43
18	1.1357	2.1093	42
19	1.1359	2.1082	41
20	1.1361	2.1070	**40**
21	1.1363	2.1059	39
22	1.1365	2.1048	38
23	1.1366	2.1036	37
24	1.1368	2.1025	36
25	1.1370	2.1014	**35**
26	1.1372	2.1002	34
27	1.1374	2.0991	33
28	1.1375	2.0980	32
29	1.1377	2.0969	31
30	1.1379	2.0957	**30**
31	1.1381	2.0946	29
32	1.1383	2.0935	28
33	1.1384	2.0924	27
34	1.1386	2.0913	26
35	1.1388	2.0901	**25**
36	1.1390	2.0890	24
37	1.1392	2.0879	23
38	1.1393	2.0868	22
39	1.1395	2.0857	21
40	1.1397	2.0846	**20**
41	1.1399	2.0835	19
42	1.1401	2.0824	18
43	1.1402	2.0813	17
44	1.1404	2.0802	16
45	1.1406	2.0791	**15**
46	1.1408	2.0779	14
47	1.1410	2.0768	13
48	1.1412	2.0757	12
49	1.1413	2.0747	11
50	1.1415	2.0736	**10**
51	1.1417	2.0725	9
52	1.1419	2.0714	8
53	1.1421	2.0703	7
54	1.1423	2.0692	6
55	1.1424	2.0681	**5**
56	1.1426	2.0670	4
57	1.1428	2.0659	3
58	1.1430	2.0648	2
59	1.1432	2.0637	1
60	1.1434	2.0627	**0**
′	Csc	Sec	′

118° (298°) (241°) **61°**

29° (209°) (330°) **150°**

′	Sec	Csc	′
0	1.1434	2.0627	**60**
1	1.1435	2.0616	59
2	1.1437	2.0605	58
3	1.1439	2.0594	57
4	1.1441	2.0583	56
5	1.1443	2.0573	**55**
6	1.1445	2.0562	54
7	1.1446	2.0551	53
8	1.1448	2.0540	52
9	1.1450	2.0530	51
10	1.1452	2.0519	**50**
11	1.1454	2.0508	49
12	1.1456	2.0498	48
13	1.1458	2.0487	47
14	1.1460	2.0476	46
15	1.1461	2.0466	**45**
16	1.1463	2.0455	44
17	1.1465	2.0445	43
18	1.1467	2.0434	42
19	1.1469	2.0423	41
20	1.1471	2.0413	**40**
21	1.1473	2.0402	39
22	1.1474	2.0392	38
23	1.1476	2.0381	37
24	1.1478	2.0371	36
25	1.1480	2.0360	**35**
26	1.1482	2.0350	34
27	1.1484	2.0339	33
28	1.1486	2.0329	32
29	1.1488	2.0318	31
30	1.1490	2.0308	**30**
31	1.1491	2.0297	29
32	1.1493	2.0287	28
33	1.1495	2.0276	27
34	1.1497	2.0266	26
35	1.1499	2.0256	**25**
36	1.1501	2.0245	24
37	1.1503	2.0235	23
38	1.1505	2.0225	22
39	1.1507	2.0214	21
40	1.1509	2.0204	**20**
41	1.1510	2.0194	19
42	1.1512	2.0183	18
43	1.1514	2.0173	17
44	1.1516	2.0163	16
45	1.1518	2.0152	**15**
46	1.1520	2.0142	14
47	1.1522	2.0132	13
48	1.1524	2.0122	12
49	1.1526	2.0112	11
50	1.1528	2.0101	**10**
51	1.1530	2.0091	9
52	1.1532	2.0081	8
53	1.1533	2.0071	7
54	1.1535	2.0061	6
55	1.1537	2.0051	**5**
56	1.1539	2.0040	4
57	1.1541	2.0030	3
58	1.1543	2.0020	2
59	1.1545	2.0010	1
60	1.1547	2.0000	**0**
′	Csc	Sec	′

119° (299°) (240°) **60°**

30° (210°) (329°) **149°**

′	Sec	Csc	′
0	1.1547	2.0000	**60**
1	1.1549	1.9990	59
2	1.1551	1.9980	58
3	1.1553	1.9970	57
4	1.1555	1.9960	56
5	1.1557	1.9950	**55**
6	1.1559	1.9940	54
7	1.1561	1.9930	53
8	1.1563	1.9920	52
9	1.1565	1.9910	51
10	1.1566	1.9900	**50**
11	1.1568	1.9890	49
12	1.1570	1.9880	48
13	1.1572	1.9870	47
14	1.1574	1.9860	46
15	1.1576	1.9850	**45**
16	1.1578	1.9840	44
17	1.1580	1.9830	43
18	1.1582	1.9821	42
19	1.1584	1.9811	41
20	1.1586	1.9801	**40**
21	1.1588	1.9791	39
22	1.1590	1.9781	38
23	1.1592	1.9771	37
24	1.1594	1.9762	36
25	1.1596	1.9752	**35**
26	1.1598	1.9742	34
27	1.1600	1.9732	33
28	1.1602	1.9722	32
29	1.1604	1.9713	31
30	1.1606	1.9703	**30**
31	1.1608	1.9693	29
32	1.1610	1.9684	28
33	1.1612	1.9674	27
34	1.1614	1.9664	26
35	1.1616	1.9654	**25**
36	1.1618	1.9645	24
37	1.1620	1.9635	23
38	1.1622	1.9625	22
39	1.1624	1.9616	21
40	1.1626	1.9606	**20**
41	1.1628	1.9597	19
42	1.1630	1.9587	18
43	1.1632	1.9577	17
44	1.1634	1.9568	16
45	1.1636	1.9558	**15**
46	1.1638	1.9549	14
47	1.1640	1.9539	13
48	1.1642	1.9530	12
49	1.1644	1.9520	11
50	1.1646	1.9511	**10**
51	1.1648	1.9501	9
52	1.1650	1.9492	8
53	1.1652	1.9482	7
54	1.1654	1.9473	6
55	1.1656	1.9463	**5**
56	1.1658	1.9454	4
57	1.1660	1.9444	3
58	1.1662	1.9435	2
59	1.1664	1.9425	1
60	1.1666	1.9416	**0**
′	Csc	Sec	′

120° (300°) (239°) **59°**

31° (211°) (328°) **148°**

′	Sec	Csc	′
0	1.1666	1.9416	**60**
1	1.1668	1.9407	59
2	1.1670	1.9397	58
3	1.1672	1.9388	57
4	1.1675	1.9379	56
5	1.1677	1.9369	**55**
6	1.1679	1.9360	54
7	1.1681	1.9351	53
8	1.1683	1.9341	52
9	1.1685	1.9332	51
10	1.1687	1.9323	**50**
11	1.1689	1.9313	49
12	1.1691	1.9304	48
13	1.1693	1.9295	47
14	1.1695	1.9285	46
15	1.1697	1.9276	**45**
16	1.1699	1.9267	44
17	1.1701	1.9258	43
18	1.1703	1.9249	42
19	1.1705	1.9239	41
20	1.1707	1.9230	**40**
21	1.1710	1.9221	39
22	1.1712	1.9212	38
23	1.1714	1.9203	37
24	1.1716	1.9194	36
25	1.1718	1.9184	**35**
26	1.1720	1.9175	34
27	1.1722	1.9166	33
28	1.1724	1.9157	32
29	1.1726	1.9148	31
30	1.1728	1.9139	**30**
31	1.1730	1.9130	29
32	1.1732	1.9121	28
33	1.1735	1.9112	27
34	1.1737	1.9103	26
35	1.1739	1.9094	**25**
36	1.1741	1.9084	24
37	1.1743	1.9075	23
38	1.1745	1.9066	22
39	1.1747	1.9057	21
40	1.1749	1.9048	**20**
41	1.1751	1.9039	19
42	1.1753	1.9031	18
43	1.1756	1.9022	17
44	1.1758	1.9013	16
45	1.1760	1.9004	**15**
46	1.1762	1.8905	14
47	1.1764	1.8986	13
48	1.1766	1.8977	12
49	1.1768	1.8968	11
50	1.1770	1.8959	**10**
51	1.1773	1.8950	9
52	1.1775	1.8941	8
53	1.1777	1.8933	7
54	1.1779	1.8924	6
55	1.1781	1.8915	**5**
56	1.1783	1.8906	4
57	1.1785	1.8897	3
58	1.1788	1.8888	2
59	1.1790	1.8880	1
60	1.1792	1.8871	**0**
′	Csc	Sec	′

121° (301°) (238°) **58°**

32° (212°) (327°) **147°**

′	Sec	Csc	′
0	1.1792	1.8871	**60**
1	1.1794	1.8862	59
2	1.1796	1.8853	58
3	1.1798	1.8844	57
4	1.1800	1.8836	56
5	1.1803	1.8827	**55**
6	1.1805	1.8818	54
7	1.1807	1.8810	53
8	1.1809	1.8801	52
9	1.1811	1.8792	51
10	1.1813	1.8783	**50**
11	1.1815	1.8775	49
12	1.1818	1.8766	48
13	1.1820	1.8757	47
14	1.1822	1.8749	46
15	1.1824	1.8740	**45**
16	1.1826	1.8731	44
17	1.1828	1.8723	43
18	1.1831	1.8714	42
19	1.1833	1.8706	41
20	1.1835	1.8697	**40**
21	1.1837	1.8688	39
22	1.1839	1.8680	38
23	1.1842	1.8671	37
24	1.1844	1.8663	36
25	1.1846	1.8654	**35**
26	1.1848	1.8646	34
27	1.1850	1.8637	33
28	1.1852	1.8629	32
29	1.1855	1.8620	31
30	1.1857	1.8612	**30**
31	1.1859	1.8603	29
32	1.1861	1.8595	28
33	1.1863	1.8586	27
34	1.1866	1.8578	26
35	1.1868	1.8569	**25**
36	1.1870	1.8561	24
37	1.1872	1.8552	23
38	1.1875	1.8544	22
39	1.1877	1.8535	21
40	1.1879	1.8527	**20**
41	1.1881	1.8519	19
42	1.1883	1.8510	18
43	1.1886	1.8502	17
44	1.1888	1.8494	16
45	1.1890	1.8485	**15**
46	1.1892	1.8477	14
47	1.1895	1.8468	13
48	1.1897	1.8460	12
49	1.1899	1.8452	11
50	1.1901	1.8443	**10**
51	1.1903	1.8435	9
52	1.1906	1.8427	8
53	1.1908	1.8419	7
54	1.1910	1.8410	6
55	1.1912	1.8402	**5**
56	1.1915	1.8394	4
57	1.1917	1.8385	3
58	1.1919	1.8377	2
59	1.1921	1.8369	1
60	1.1924	1.8361	**0**
′	Csc	Sec	′

122° (302°) (237°) **57°**

33° (213°) (326°) **146°**

′	Sec	Csc	′
0	1.1924	1.8361	**60**
1	1.1926	1.8353	59
2	1.1928	1.8344	58
3	1.1930	1.8336	57
4	1.1933	1.8328	56
5	1.1935	1.8320	**55**
6	1.1937	1.8312	54
7	1.1939	1.8303	53
8	1.1942	1.8295	52
9	1.1944	1.8287	51
10	1.1946	1.8279	**50**
11	1.1949	1.8271	49
12	1.1951	1.8263	48
13	1.1953	1.8255	47
14	1.1955	1.8247	46
15	1.1958	1.8238	**45**
16	1.1960	1.8230	44
17	1.1962	1.8222	43
18	1.1964	1.8214	42
19	1.1967	1.8206	41
20	1.1969	1.8198	**40**
21	1.1971	1.8190	39
22	1.1974	1.8182	38
23	1.1976	1.8174	37
24	1.1978	1.8166	36
25	1.1981	1.8158	**35**
26	1.1983	1.8150	34
27	1.1985	1.8142	33
28	1.1987	1.8134	32
29	1.1990	1.8126	31
30	1.1992	1.8118	**30**
31	1.1994	1.8110	29
32	1.1997	1.8102	28
33	1.1999	1.8094	27
34	1.2001	1.8086	26
35	1.2004	1.8078	**25**
36	1.2006	1.8070	24
37	1.2008	1.8062	23
38	1.2011	1.8055	22
39	1.2013	1.8047	21
40	1.2015	1.8039	**20**
41	1.2018	1.8031	19
42	1.2020	1.8023	18
43	1.2022	1.8015	17
44	1.2025	1.8007	16
45	1.2027	1.8000	**15**
46	1.2029	1.7992	14
47	1.2032	1.7984	13
48	1.2034	1.7976	12
49	1.2036	1.7968	11
50	1.2039	1.7960	**10**
51	1.2041	1.7953	9
52	1.2043	1.7945	8
53	1.2046	1.7937	7
54	1.2048	1.7929	6
55	1.2050	1.7922	**5**
56	1.2053	1.7914	4
57	1.2055	1.7906	3
58	1.2057	1.7898	2
59	1.2060	1.7891	1
60	1.2062	1.7883	**0**
′	Csc	Sec	′

123° (303°) (236°) **56°**

34° (214°) (325°) **145°**

′	Sec	Csc	′
0	1.2062	1.7883	**60**
1	1.2065	1.7875	59
2	1.2067	1.7868	58
3	1.2069	1.7860	57
4	1.2072	1.7852	56
5	1.2074	1.7844	**55**
6	1.2076	1.7837	54
7	1.2079	1.7829	53
8	1.2081	1.7821	52
9	1.2084	1.7814	51
10	1.2086	1.7806	**50**
11	1.2088	1.7799	49
12	1.2091	1.7791	48
13	1.2093	1.7783	47
14	1.2096	1.7776	46
15	1.2098	1.7768	**45**
16	1.2100	1.7761	44
17	1.2103	1.7753	43
18	1.2105	1.7745	42
19	1.2108	1.7738	41
20	1.2110	1.7730	**40**
21	1.2112	1.7723	39
22	1.2115	1.7715	38
23	1.2117	1.7708	37
24	1.2120	1.7700	36
25	1.2122	1.7693	**35**
26	1.2124	1.7685	34
27	1.2127	1.7678	33
28	1.2129	1.7670	32
29	1.2132	1.7663	31
30	1.2134	1.7655	**30**
31	1.2136	1.7648	29
32	1.2139	1.7640	28
33	1.2141	1.7633	27
34	1.2144	1.7625	26
35	1.2146	1.7618	**25**
36	1.2149	1.7610	24
37	1.2151	1.7603	23
38	1.2154	1.7596	22
39	1.2156	1.7588	21
40	1.2158	1.7581	**20**
41	1.2161	1.7573	19
42	1.2163	1.7566	18
43	1.2166	1.7559	17
44	1.2168	1.7551	16
45	1.2171	1.7544	**15**
46	1.2173	1.7537	14
47	1.2176	1.7529	13
48	1.2178	1.7522	12
49	1.2181	1.7515	11
50	1.2183	1.7507	**10**
51	1.2185	1.7500	9
52	1.2188	1.7493	8
53	1.2190	1.7485	7
54	1.2193	1.7478	6
55	1.2195	1.7471	**5**
56	1.2198	1.7463	4
57	1.2200	1.7456	3
58	1.2203	1.7449	2
59	1.2205	1.7442	1
60	1.2208	1.7434	**0**
′	Csc	Sec	′

124° (304°) (235°) **55°**

35° (215°) (324°) **144°**

′	Sec	Csc	′
0	1.2208	1.7434	**60**
1	1.2210	1.7427	59
2	1.2213	1.7420	58
3	1.2215	1.7413	57
4	1.2218	1.7406	56
5	1.2220	1.7398	**55**
6	1.2223	1.7391	54
7	1.2225	1.7384	53
8	1.2228	1.7377	52
9	1.2230	1.7370	51
10	1.2233	1.7362	**50**
11	1.2235	1.7355	49
12	1.2238	1.7348	48
13	1.2240	1.7341	47
14	1.2243	1.7334	46
15	1.2245	1.7327	**45**
16	1.2248	1.7320	44
17	1.2250	1.7312	43
18	1.2253	1.7305	42
19	1.2255	1.7298	41
20	1.2258	1.7291	**40**
21	1.2260	1.7284	39
22	1.2263	1.7277	38
23	1.2265	1.7270	37
24	1.2268	1.7263	36
25	1.2271	1.7256	**35**
26	1.2273	1.7249	34
27	1.2276	1.7242	33
28	1.2278	1.7235	32
29	1.2281	1.7228	31
30	1.2283	1.7221	**30**
31	1.2286	1.7213	29
32	1.2288	1.7206	28
33	1.2291	1.7199	27
34	1.2293	1.7192	26
35	1.2296	1.7185	**25**
36	1.2299	1.7179	24
37	1.2301	1.7172	23
38	1.2304	1.7165	22
39	1.2306	1.7158	21
40	1.2309	1.7151	**20**
41	1.2311	1.7144	19
42	1.2314	1.7137	18
43	1.2317	1.7130	17
44	1.2319	1.7123	16
45	1.2322	1.7116	**15**
46	1.2324	1.7109	14
47	1.2327	1.7102	13
48	1.2329	1.7095	12
49	1.2332	1.7088	11
50	1.2335	1.7081	**10**
51	1.2337	1.7075	9
52	1.2340	1.7068	8
53	1.2342	1.7061	7
54	1.2345	1.7054	6
55	1.2348	1.7047	**5**
56	1.2350	1.7040	4
57	1.2353	1.7033	3
58	1.2355	1.7027	2
59	1.2358	1.7020	1
60	1.2361	1.7013	**0**
′	Csc	Sec	′

125° (305°) (234°) **54°**

36° (216°) (323°) **143°**

′	Sec	Csc	′
0	1.2361	1.7013	**60**
1	1.2363	1.7006	59
2	1.2366	1.6999	58
3	1.2369	1.6993	57
4	1.2371	1.6986	56
5	1.2374	1.6979	**55**
6	1.2376	1.6972	54
7	1.2379	1.6966	53
8	1.2382	1.6959	52
9	1.2384	1.6952	51
10	1.2387	1.6945	**50**
11	1.2390	1.6939	49
12	1.2392	1.6932	48
13	1.2395	1.6925	47
14	1.2397	1.6918	46
15	1.2400	1.6912	**45**
16	1.2403	1.6905	44
17	1.2405	1.6898	43
18	1.2408	1.6892	42
19	1.2411	1.6885	41
20	1.2413	1.6878	**40**
21	1.2416	1.6871	39
22	1.2419	1.6865	38
23	1.2421	1.6858	37
24	1.2424	1.6852	36
25	1.2427	1.6845	**35**
26	1.2429	1.6838	34
27	1.2432	1.6832	33
28	1.2435	1.6825	32
29	1.2437	1.6818	31
30	1.2440	1.6812	**30**
31	1.2443	1.6805	29
32	1.2445	1.6799	28
33	1.2448	1.6792	27
34	1.2451	1.6785	26
35	1.2453	1.6779	**25**
36	1.2456	1.6772	24
37	1.2459	1.6766	23
38	1.2462	1.6759	22
39	1.2464	1.6753	21
40	1.2467	1.6746	**20**
41	1.2470	1.6739	19
42	1.2472	1.6733	18
43	1.2475	1.6726	17
44	1.2478	1.6720	16
45	1.2480	1.6713	**15**
46	1.2483	1.6707	14
47	1.2486	1.6700	13
48	1.2489	1.6694	12
49	1.2491	1.6687	11
50	1.2494	1.6681	**10**
51	1.2497	1.6674	9
52	1.2499	1.6668	8
53	1.2502	1.6661	7
54	1.2505	1.6655	6
55	1.2508	1.6649	**5**
56	1.2510	1.6642	4
57	1.2513	1.6636	3
58	1.2516	1.6629	2
59	1.2519	1.6623	1
60	1.2521	1.6616	**0**
′	Csc	Sec	′

126° (306°) (233°) **53°**

37° (217°) (322°) **142°**

′	Sec	Csc	′
0	1.2521	1.6616	**60**
1	1.2524	1.6610	59
2	1.2527	1.6604	58
3	1.2530	1.6597	57
4	1.2532	1.6591	56
5	1.2535	1.6584	**55**
6	1.2538	1.6578	54
7	1.2541	1.6572	53
8	1.2543	1.6565	52
9	1.2546	1.6559	51
10	1.2549	1.6553	**50**
11	1.2552	1.6546	49
12	1.2554	1.6540	48
13	1.2557	1.6534	47
14	1.2560	1.6527	46
15	1.2563	1.6521	**45**
16	1.2566	1.6515	44
17	1.2568	1.6508	43
18	1.2571	1.6502	42
19	1.2574	1.6496	41
20	1.2577	1.6489	**40**
21	1.2579	1.6483	39
22	1.2582	1.6477	38
23	1.2585	1.6471	37
24	1.2588	1.6464	36
25	1.2591	1.6458	**35**
26	1.2593	1.6452	34
27	1.2596	1.6446	33
28	1.2599	1.6439	32
29	1.2602	1.6433	31
30	1.2605	1.6427	**30**
31	1.2608	1.6421	29
32	1.2610	1.6414	28
33	1.2613	1.6408	27
34	1.2616	1.6402	26
35	1.2619	1.6396	**25**
36	1.2622	1.6390	24
37	1.2624	1.6383	23
38	1.2627	1.6377	22
39	1.2630	1.6371	21
40	1.2633	1.6365	**20**
41	1.2636	1.6359	19
42	1.2639	1.6353	18
43	1.2641	1.6346	17
44	1.2644	1.6340	16
45	1.2647	1.6334	**15**
46	1.2650	1.6328	14
47	1.2653	1.6322	13
48	1.2656	1.6316	12
49	1.2659	1.6310	11
50	1.2661	1.6303	**10**
51	1.2664	1.6297	9
52	1.2667	1.6291	8
53	1.2670	1.6285	7
54	1.2673	1.6279	6
55	1.2676	1.6273	**5**
56	1.2679	1.6267	4
57	1.2682	1.6261	3
58	1.2684	1.6255	2
59	1.2687	1.6249	1
60	1.2690	1.6243	**0**
′	Csc	Sec	′

127° (307°) (232°) **52°**

38° (218°) (321°) **141°**

′	Sec	Csc	′
0	1.2690	1.6243	**60**
1	1.2693	1.6237	59
2	1.2696	1.6231	58
3	1.2699	1.6225	57
4	1.2702	1.6219	56
5	1.2705	1.6213	**55**
6	1.2708	1.6207	54
7	1.2710	1.6201	53
8	1.2713	1.6195	52
9	1.2716	1.6189	51
10	1.2719	1.6183	**50**
11	1.2722	1.6177	49
12	1.2725	1.6171	48
13	1.2728	1.6165	47
14	1.2731	1.6159	46
15	1.2734	1.6153	**45**
16	1.2737	1.6147	44
17	1.2740	1.6141	43
18	1.2742	1.6135	42
19	1.2745	1.6129	41
20	1.2748	1.6123	**40**
21	1.2751	1.6117	39
22	1.2754	1.6111	38
23	1.2757	1.6105	37
24	1.2760	1.6099	36
25	1.2763	1.6093	**35**
26	1.2766	1.6087	34
27	1.2769	1.6082	33
28	1.2772	1.6076	32
29	1.2775	1.6070	31
30	1.2778	1.6064	**30**
31	1.2781	1.6058	29
32	1.2784	1.6052	28
33	1.2787	1.6046	27
34	1.2790	1.6040	26
35	1.2793	1.6035	**25**
36	1.2796	1.6029	24
37	1.2799	1.6023	23
38	1.2802	1.6017	22
39	1.2804	1.6011	21
40	1.2807	1.6005	**20**
41	1.2810	1.6000	19
42	1.2813	1.5994	18
43	1.2816	1.5988	17
44	1.2819	1.5982	16
45	1.2822	1.5976	**15**
46	1.2825	1.5971	14
47	1.2828	1.5965	13
48	1.2831	1.5959	12
49	1.2834	1.5953	11
50	1.2837	1.5948	**10**
51	1.2840	1.5942	9
52	1.2843	1.5936	8
53	1.2846	1.5930	7
54	1.2849	1.5925	6
55	1.2852	1.5919	**5**
56	1.2855	1.5913	4
57	1.2859	1.5907	3
58	1.2862	1.5902	2
59	1.2865	1.5896	1
60	1.2868	1.5890	**0**
′	Csc	Sec	′

128° (308°) (231°) **51°**

39° (219°) (320°) **140°**

′	Sec	Csc	′
0	1.2868	1.5890	60
1	1.2871	1.5884	59
2	1.2874	1.5879	58
3	1.2877	1.5873	57
4	1.2880	1.5867	56
5	1.2883	1.5862	55
6	1.2886	1.5856	54
7	1.2889	1.5850	53
8	1.2892	1.5845	52
9	1.2895	1.5839	51
10	1.2898	1.5833	50
11	1.2901	1.5828	49
12	1.2904	1.5822	48
13	1.2907	1.5816	47
14	1.2910	1.5811	46
15	1.2913	1.5805	45
16	1.2916	1.5800	44
17	1.2919	1.5794	43
18	1.2923	1.5788	42
19	1.2926	1.5783	41
20	1.2929	1.5777	40
21	1.2932	1.5771	39
22	1.2935	1.5766	38
23	1.2938	1.5760	37
24	1.2941	1.5755	36
25	1.2944	1.5749	35
26	1.2947	1.5744	34
27	1.2950	1.5738	33
28	1.2953	1.5732	32
29	1.2957	1.5727	31
30	1.2960	1.5721	30
31	1.2963	1.5716	29
32	1.2966	1.5710	28
33	1.2969	1.5705	27
34	1.2972	1.5699	26
35	1.2975	1.5694	25
36	1.2978	1.5688	24
37	1.2981	1.5683	23
38	1.2985	1.5677	22
39	1.2988	1.5672	21
40	1.2991	1.5666	20
41	1.2994	1.5661	19
42	1.2997	1.5655	18
43	1.3000	1.5650	17
44	1.3003	1.5644	16
45	1.3007	1.5639	15
46	1.3010	1.5633	14
47	1.3013	1.5628	13
48	1.3016	1.5622	12
49	1.3019	1.5617	11
50	1.3022	1.5611	10
51	1.3026	1.5606	9
52	1.3029	1.5601	8
53	1.3032	1.5595	7
54	1.3035	1.5590	6
55	1.3038	1.5584	5
56	1.3041	1.5579	4
57	1.3045	1.5573	3
58	1.3048	1.5568	2
59	1.3051	1.5563	1
60	1.3054	1.5557	0
′	Csc	Sec	′

129° (309°) (230°) **50°**

40° (220°) (319°) **139°**

′	Sec	Csc	′
0	1.3054	1.5557	60
1	1.3057	1.5552	59
2	1.3060	1.5546	58
3	1.3064	1.5541	57
4	1.3067	1.5536	56
5	1.3070	1.5530	55
6	1.3076	1.5525	54
7	1.3076	1.5520	53
8	1.3080	1.5514	52
9	1.3083	1.5509	51
10	1.3086	1.5504	50
11	1.3089	1.5498	49
12	1.3093	1.5493	48
13	1.3096	1.5488	47
14	1.3099	1.5482	46
15	1.3102	1.5477	45
16	1.3105	1.5472	44
17	1.3109	1.5466	43
18	1.3112	1.5461	42
19	1.3115	1.5456	41
20	1.3118	1.5450	40
21	1.3122	1.5445	39
22	1.3125	1.5440	38
23	1.3128	1.5435	37
24	1.3131	1.5429	36
25	1.3135	1.5424	35
26	1.3138	1.5419	34
27	1.3141	1.5413	33
28	1.3144	1.5408	32
29	1.3148	1.5403	31
30	1.3151	1.5398	30
31	1.3154	1.5392	29
32	1.3157	1.5387	28
33	1.3161	1.5382	27
34	1.3164	1.5377	26
35	1.3167	1.5372	25
36	1.3171	1.5366	24
37	1.3174	1.5361	23
38	1.3177	1.5356	22
39	1.3180	1.5351	21
40	1.3184	1.5345	20
41	1.3187	1.5340	19
42	1.3190	1.5335	18
43	1.3194	1.5330	17
44	1.3197	1.5325	16
45	1.3200	1.5320	15
46	1.3203	1.5314	14
47	1.3207	1.5309	13
48	1.3210	1.5304	12
49	1.3213	1.5299	11
50	1.3217	1.5294	10
51	1.3220	1.5289	9
52	1.3223	1.5283	8
53	1.3227	1.5278	7
54	1.3230	1.5273	6
55	1.3233	1.5268	5
56	1.3237	1.5263	4
57	1.3240	1.5258	3
58	1.3243	1.5253	2
59	1.3247	1.5248	1
60	1.3250	1.5243	0
′	Csc	Sec	′

130° (310°) (229°) **49°**

41° (221°) (318°) **138°**

′	Sec	Csc	′
0	1.3250	1.5243	60
1	1.3253	1.5237	59
2	1.3257	1.5232	58
3	1.3260	1.5227	57
4	1.3264	1.5222	56
5	1.3267	1.5217	55
6	1.3270	1.5212	54
7	1.3274	1.5207	53
8	1.3277	1.5202	52
9	1.3280	1.5197	51
10	1.3284	1.5192	50
11	1.3287	1.5187	49
12	1.3291	1.5182	48
13	1.3294	1.5177	47
14	1.3297	1.5172	46
15	1.3301	1.5167	45
16	1.3304	1.5162	44
17	1.3307	1.5156	43
18	1.3311	1.5151	42
19	1.3314	1.5146	41
20	1.3318	1.5141	40
21	1.3321	1.5136	39
22	1.3325	1.5131	38
23	1.3328	1.5126	37
24	1.3331	1.5121	36
25	1.3335	1.5116	35
26	1.3338	1.5111	34
27	1.3342	1.5107	33
28	1.3345	1.5102	32
29	1.3348	1.5097	31
30	1.3352	1.5092	30
31	1.3355	1.5087	29
32	1.3359	1.5082	28
33	1.3362	1.5077	27
34	1.3366	1.5072	26
35	1.3369	1.5067	25
36	1.3373	1.5062	24
37	1.3376	1.5057	23
38	1.3380	1.5052	22
39	1.3383	1.5047	21
40	1.3386	1.5042	20
41	1.3390	1.5037	19
42	1.3393	1.5032	18
43	1.3397	1.5027	17
44	1.3400	1.5023	16
45	1.3404	1.5018	15
46	1.3407	1.5013	14
47	1.3411	1.5008	13
48	1.3414	1.5003	12
49	1.3418	1.4998	11
50	1.3421	1.4993	10
51	1.3425	1.4988	9
52	1.3428	1.4984	8
53	1.3432	1.4979	7
54	1.3435	1.4974	6
55	1.3439	1.4969	5
56	1.3442	1.4964	4
57	1.3446	1.4959	3
58	1.3449	1.4954	2
59	1.3453	1.4950	1
60	1.3456	1.4945	0
′	Csc	Sec	′

131° (311°) (228°) **48°**

NATURAL FUNCTIONS—SECANTS AND COSECANTS (Continued)

42° (222°) (317°) **137°**

′	Sec	Csc	′
0	1.3456	1.4945	**60**
1	1.3460	1.4940	59
2	1.3463	1.4935	58
3	1.3467	1.4930	57
4	1.3470	1.4925	56
5	1.3474	1.4921	**55**
6	1.3478	1.4916	54
7	1.3481	1.4911	53
8	1.3485	1.4906	52
9	1.3488	1.4901	51
10	1.3492	1.4897	**50**
11	1.3495	1.4892	49
12	1.3499	1.4887	48
13	1.3502	1.4882	47
14	1.3506	1.4878	46
15	1.3510	1.4873	**45**
16	1.3513	1.4868	44
17	1.3517	1.4863	43
18	1.3520	1.4859	42
19	1.3524	1.4854	41
20	1.3527	1.4849	**40**
21	1.3531	1.4844	39
22	1.3535	1.4840	38
23	1.3538	1.4835	37
24	1.3542	1.4830	36
25	1.3545	1.4825	**35**
26	1.3549	1.4821	34
27	1.3553	1.4816	33
28	1.3556	1.4811	32
29	1.3560	1.4807	31
30	1.3563	1.4802	**30**
31	1.3567	1.4797	29
32	1.3571	1.4792	28
33	1.3574	1.4788	27
34	1.3578	1.4783	26
35	1.3582	1.4778	**25**
36	1.3585	1.4774	24
37	1.3589	1.4769	23
38	1.3592	1.4764	22
39	1.3596	1.4760	21
40	1.3600	1.4755	**20**
41	1.3603	1.4750	19
42	1.3607	1.4746	18
43	1.3611	1.4741	17
44	1.3614	1.4737	16
45	1.3618	1.4732	**15**
46	1.3622	1.4727	14
47	1.3625	1.4723	13
48	1.3629	1.4718	12
49	1.3633	1.4713	11
50	1.3636	1.4709	**10**
51	1.3640	1.4704	9
52	1.3644	1.4700	8
53	1.3647	1.4695	7
54	1.3651	1.4690	6
55	1.3655	1.4686	**5**
56	1.3658	1.4681	4
57	1.3662	1.4677	3
58	1.3666	1.4672	2
59	1.3670	1.4667	1
60	1.3673	1.4663	**0**
′	Csc	Sec	′

132° (312°) (227°) **47°**

43° (223°) (316°) **136°**

′	Sec	Csc	′
0	1.3673	1.4663	**60**
1	1.3677	1.4658	59
2	1.3681	1.4654	58
3	1.3684	1.4649	57
4	1.3688	1.4645	56
5	1.3692	1.4640	**55**
6	1.3696	1.4635	54
7	1.3699	1.4631	53
8	1.3703	1.4626	52
9	1.3707	1.4622	51
10	1.3711	1.4617	**50**
11	1.3714	1.4613	49
12	1.3718	1.4608	48
13	1.3722	1.4604	47
14	1.3726	1.4599	46
15	1.3729	1.4595	**45**
16	1.3733	1.4590	44
17	1.3737	1.4586	43
18	1.3741	1.4581	42
19	1.3744	1.4577	41
20	1.3748	1.4572	**40**
21	1.3752	1.4568	39
22	1.3756	1.4563	38
23	1.3759	1.4559	37
24	1.3763	1.4554	36
25	1.3767	1.4550	**35**
26	1.3771	1.4545	34
27	1.3775	1.4541	33
28	1.3778	1.4536	32
29	1.3782	1.4532	31
30	1.3786	1.4527	**30**
31	1.3790	1.4523	29
32	1.3794	1.4518	28
33	1.3797	1.4514	27
34	1.3801	1.4510	26
35	1.3805	1.4505	**25**
36	1.3809	1.4501	24
37	1.3813	1.4496	23
38	1.3817	1.4492	22
39	1.3820	1.4487	21
40	1.3824	1.4483	**20**
41	1.3828	1.4479	19
42	1.3832	1.4474	18
43	1.3836	1.4470	17
44	1.3840	1.4465	16
45	1.3843	1.4461	**15**
46	1.3847	1.4457	14
47	1.3851	1.4452	13
48	1.3855	1.4448	12
49	1.3859	1.4443	11
50	1.3863	1.4439	**10**
51	1.3867	1.4435	9
52	1.3871	1.4430	8
53	1.3874	1.4426	7
54	1.3878	1.4422	6
55	1.3882	1.4417	**5**
56	1.3886	1.4413	4
57	1.3890	1.4409	3
58	1.3894	1.4404	2
59	1.3898	1.4400	1
60	1.3902	1.4396	**0**
′	Csc	Sec	

133° (313°) (226°) **46°**

44° (224°) (315°) **135°**

′	Sec	Csc	′
0	1.3902	1.4396	**60**
1	1.3906	1.4391	59
2	1.3909	1.4387	58
3	1.3913	1.4383	57
4	1.3917	1.4378	56
5	1.3921	1.4374	**55**
6	1.3925	1.4370	54
7	1.3929	1.4365	53
8	1.3933	1.4361	52
9	1.3937	1.4357	51
10	1.3941	1.4352	**50**
11	1.3945	1.4348	49
12	1.3949	1.4344	48
13	1.3953	1.4340	47
14	1.3957	1.4335	46
15	1.3961	1.4331	**45**
16	1.3965	1.4327	44
17	1.3969	1.4322	43
18	1.3972	1.4318	42
19	1.3976	1.4314	41
20	1.3980	1.4310	**40**
21	1.3984	1.4305	39
22	1.3988	1.4301	38
23	1.3992	1.4297	37
24	1.3996	1.4293	36
25	1.4000	1.4288	**35**
26	1.4004	1.4284	34
27	1.4008	1.4280	33
28	1.4012	1.4276	32
29	1.4016	1.4271	31
30	1.4020	1.4267	**30**
31	1.4024	1.4263	29
32	1.4028	1.4259	28
33	1.4032	1.4255	27
34	1.4036	1.4250	26
35	1.4040	1.4246	**25**
36	1.4044	1.4242	24
37	1.4048	1.4238	23
38	1.4052	1.4234	22
39	1.4057	1.4229	21
40	1.4061	1.4225	**20**
41	1.4065	1.4221	19
42	1.4069	1.4217	18
43	1.4073	1.4213	17
44	1.4077	1.4208	16
45	1.4081	1.4204	**15**
46	1.4085	1.4200	14
47	1.4089	1.4196	13
48	1.4093	1.4192	12
49	1.4097	1.4188	11
50	1.4101	1.4183	**10**
51	1.4105	1.4179	9
52	1.4109	1.4175	8
53	1.4113	1.4171	7
54	1.4118	1.4167	6
55	1.4122	1.4163	**5**
56	1.4126	1.4159	4
57	1.4130	1.4154	3
58	1.4134	1.4150	2
59	1.4138	1.4146	1
60	1.4142	1.4142	**0**
	Csc	Sec	′

134° (314°) (225°) **45°**

NATURAL TRIGONOMETRIC FUNCTIONS FOR ANGLES IN DEGREES AND DECIMALS

Deg.	Sin	Tan	Cot	Cos	Deg.
0.0	.00000	.00000	∞	1.0000	**90.0**
.1	.00175	.00175	573.0	1.0000	89.9
.2	.00349	.00349	286.5	1.0000	.8
.3	.00524	.00524	191.0	1.0000	.7
.4	.00698	.00698	143.24	1.0000	.6
.5	.00873	.00873	114.59	1.0000	.5
.6	.01047	.01047	95.49	0.9999	.4
.7	.01222	.01222	81.85	.9999	.3
.8	.01396	.01396	71.62	.9999	.2
.9	.01571	.01571	63.66	.9999	89.1
1.0	.01745	.01746	57.29	0.9998	**89.0**
.1	.01920	.01920	52.08	.9998	88.9
.2	.02094	.02095	47.74	.9998	.8
.3	.02269	.02269	44.07	.9997	.7
.4	.02443	.02444	40.92	.9997	.6
.5	.02618	.02619	38.19	.9997	.5
.6	.02792	.02793	35.80	.9996	.4
.7	.02967	.02968	33.69	.9996	.3
.8	.03141	.03143	31.82	.9995	.2
.9	.03316	.03317	30.14	.9995	88.1
2.0	.03490	.03492	28.64	0.9994	**88.0**
.1	.03664	.03667	27.27	.9993	87.9
.2	.03839	.03842	26.03	.9993	.8
.3	.04013	.04016	24.90	.9992	.7
.4	.04188	.04191	23.86	.9991	.6
.5	.04362	.04366	22.90	.9990	.5
.6	.04536	.04541	22.02	.9990	.4
.7	.04711	.04716	21.20	.9989	.3
.8	.04885	.04891	20.45	.9988	.2
.9	.05059	.05066	19.74	.9987	87.1
3.0	.05234	.05241	19.081	0.9986	**87.0**
.1	.05408	.05416	18.464	.9985	86.9
.2	.05582	.05591	17.886	.9984	.8
.3	.05756	.05766	17.343	.9983	.7
.4	.05931	.05941	16.832	.9982	.6
.5	.06105	.06116	16.350	.9981	.5
.6	.06279	.06291	15.895	.9980	.4
.7	.06453	.06467	15.464	.9979	.3
.8	.06627	.06642	15.056	.9978	.2
.9	.06802	.06817	14.669	.9977	86.1
4.0	.06976	.06993	14.301	0.9976	**86.0**
.1	.07150	.07168	13.951	.9974	85.9
.2	.07324	.07344	13.617	.9973	.8
.3	.07498	.07519	13.300	.9972	.7
.4	.07672	.07695	12.996	.9971	.6
.5	.07846	.07870	12.706	.9969	.5
.6	.08020	.08046	12.429	.9968	.4
.7	.08194	.08221	12.163	.9966	.3
.8	.08368	.08397	11.909	.9965	.2
.9	.08542	.08573	11.664	.9963	85.1
5.0	.08716	.08749	11.430	0.9962	**85.0**
.1	.08889	.08925	11.205	.9960	84.9
.2	.09063	.09101	10.988	.9959	.8
.3	.09237	.09277	10.780	.9957	.7
.4	.09411	.09453	10.579	.9956	.6
.5	.09585	.09629	10.385	.9954	.5
.6	.09758	.09805	10.199	.9952	.4
.7	.09932	.09981	10.019	.9951	.3
.8	.10106	.10158	9.845	.9949	.2
.9	.10279	.10334	9.677	.9947	84.1
6.0	.10453	.10510	9.514	0.9945	**84.0**
Deg.	**Cos**	**Cot**	**Tan**	**Sin**	**Deg.**

Deg.	Sin	Tan	Cot	Cos	Deg.
6.0	.10453	.10510	9.514	0.9945	**84.0**
.1	.10626	.10687	9.357	.9943	83.9
.2	.1080	.10863	9.205	.9942	.8
.3	.10973	.11040	9.058	.9940	.7
.4	.11147	.11217	8.915	.9938	.6
.5	.11320	.11394	8.777	.9936	.5
.6	.11494	.11570	8.643	.9934	.4
.7	.11667	.11747	8.513	.9932	.3
.8	.11840	.11924	8.386	.9930	.2
.9	.12014	.12101	8.264	.9928	83.1
7.0	.12187	.12278	8.144	0.9925	**83.0**
.1	.12360	.12456	8.028	.9923	82.9
.2	.12533	.12633	7.916	.9921	.8
.3	.12706	.12810	7.806	.9919	.7
.4	.12880	.12988	7.700	.9917	.6
.5	.13053	.13165	7.596	.9914	.5
.6	.13226	.13343	7.495	.9912	.4
.7	.13399	.13521	7.396	.9910	.3
.8	.13572	.13698	7.300	.9907	.2
.9	.13744	.13876	7.207	.9905	82.1
8.0	.13917	.14054	7.115	0.9903	**82.0**
.1	.14090	.14232	7.026	.9900	81.9
.2	.14263	.14410	6.940	.9898	.8
.3	.14436	.14588	6.855	.9895	.7
.4	.14608	.14767	6.772	.9893	.6
.5	.14781	.14945	6.691	.9890	.5
.6	.14954	.15124	6.612	.9888	.4
.7	.15126	.15302	6.535	.9885	.3
.8	.15299	.15481	6.460	.9882	.2
.9	.15471	.15660	6.386	.9880	81.1
9.0	.15643	.15838	6.314	0.9877	**81.0**
.1	.15816	.16017	6.243	.9874	80.9
.2	.15988	.16196	6.174	.9871	.8
.3	.16160	.16376	6.107	.9869	.7
.4	.16333	.16555	6.041	.9866	.6
.5	.16505	.16734	5.976	.9863	.5
.6	.16677	.16914	5.912	.9860	.4
.7	.16849	.17093	5.850	.9857	.3
.8	.17021	.17273	5.789	.9854	.2
.9	.17193	.17453	5.730	.9851	80.1
10.0	.1736	.1763	5.671	0.9848	**80.0**
.1	.1754	.1781	5.614	.9845	79.9
.2	.1771	.1799	5.558	.9842	.8
.3	.1788	.1817	5.503	.9839	.7
.4	.1805	.1835	5.449	.9836	.6
.5	.1822	.1853	5.396	.9833	.5
.6	.1840	.1871	5.343	.9829	.4
.7	.1857	.1890	5.292	.9826	.3
.8	.1874	.1908	5.242	.9823	.2
.9	.1891	.1926	5.193	.9820	79.1
11.0	.1908	.1944	5.145	0.9816	**79.0**
.1	.1925	.1962	5.097	.9813	78.9
.2	.1942	.1980	5.050	.9810	.8
.3	.1959	.1998	5.005	.9806	.7
.4	.1977	.2016	4.959	.9803	.6
.5	.1994	.2035	4.915	.9799	.5
.6	.2011	.2053	4.872	.9796	.4
.7	.2028	.2071	4.829	.9792	.3
.8	.2045	.2089	4.787	.9789	.2
.9	.2062	.2107	4.745	.9785	78.1
12.0	.2079	.2126	4.705	0.9781	**78.0**
Deg.	**Cos**	**Cot**	**Tan**	**Sin**	**Deg.**

NATURAL FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg	Sin	Tan	Cot	Cos	Deg
12.0	0.2079	0.2126	4.705	0.9781	**78.0**
.1	.2096	.2144	4.665	.9778	77.9
.2	.2113	.2162	4.625	.9774	.8
.3	.2130	.2180	4.586	.9770	.7
.4	.2147	.2199	4.548	.9767	.6
.5	.2164	.2217	4.511	.9763	.5
.6	.2181	.2235	4.474	.9759	.4
.7	.2198	.2254	4.437	.9755	.3
.8	.2215	.2272	4.402	.9751	.2
.9	.2233	.2290	4.366	.9748	77.1
13.0	0.2250	0.2309	4.331	0.9744	**77.0**
.1	.2267	.2327	4.297	.9740	76.9
.2	.2284	.2345	4.264	.9736	.8
.3	.2300	.2364	4.230	.9732	.7
.4	.2317	.2382	4.198	.9728	.6
.5	.2334	.2401	4.165	.9724	.5
.6	.2351	.2419	4.134	.9720	.4
.7	.2368	.2438	4.102	.9715	.3
.8	.2385	.2456	4.071	.9711	.2
.9	.2402	.2475	4.041	.9707	76.1
14.0	0.2419	0.2493	4.011	0.9703	**76.0**
.1	.2436	.2512	3.981	.9699	75.9
.2	.2453	.2530	3.952	.9694	.8
.3	.2470	.2549	3.923	.9690	.7
.4	.2487	.2568	3.895	.9686	.6
.5	.2504	.2586	3.867	.9681	.5
.6	.2521	.2605	3.839	.9677	.4
.7	.2538	.2623	3.812	.9673	.3
.8	.2554	.2642	3.785	.9668	.2
.9	.2571	.2661	3.758	.9664	75.1
15.0	0.2588	0.2679	3.732	0.9659	**75.0**
.1	.2605	.2698	3.706	.9655	74.9
.2	.2622	.2717	3.681	.9650	.8
.3	.2639	.2736	3.655	.9646	.7
.4	.2656	.2754	3.630	.9641	.6
.5	.2672	.2773	3.606	.9636	.5
.6	.2689	.2792	3.582	.9632	.4
.7	.2706	.2811	3.558	.9627	.3
.8	.2723	.2830	3.534	.9622	.2
.9	.2740	.2849	3.511	.9617	74.1
16.0	0.2756	0.2867	3.487	0.9613	**74.0**
.1	.2773	.2886	3.465	.9608	73.9
.2	.2790	.2905	3.442	.9603	.8
.3	.2807	.2924	3.420	.9598	.7
.4	.2823	.2943	3.398	.9593	.6
.5	.2840	.2962	3.376	.9588	.5
.6	.2857	.2981	3.354	.9583	.4
.7	.2874	.3000	3.333	.9578	.3
.8	.2890	.3019	3.312	.9573	.2
.9	.2907	.3038	3.291	.9568	73.1
17.0	0.2924	0.3057	3.271	0.9563	**73.0**
.1	.2940	.3076	3.251	.9558	72.9
.2	.2957	.3096	3.230	.9553	.8
.3	.2974	.3115	3.211	.9548	.7
.4	.2990	.3134	3.191	.9542	.6
.5	.3007	.3153	3.172	.9537	.5
.6	.3024	.3172	3.152	.9532	.4
.7	.3040	.3191	3.133	.9527	.3
.8	.3057	.3211	3.115	.9521	.2
.9	.3074	.3230	3.096	.9516	72.1
18.0	0.3090	0.3249	3.078	0.9511	**72.0**
Deg.	Cos	Cot	Tan	Sin	Deg.

Deg.	Sin	Tan	Cot	Cos	Deg.
18.0	0.3090	0.3249	3.078	0.9511	**72.0**
.1	.3107	.3269	3.060	.9505	71.9
.2	.3123	.3288	3.042	.9500	.8
.3	.3140	.3307	3.024	.9494	.7
.4	.3156	.3327	3.006	.9489	.6
.5	.3173	.3346	2.989	.9483	.5
.6	.3190	.3365	2.971	.9478	.4
.7	.3206	.3385	2.954	.9472	.3
.8	.3223	.3404	2.937	.9466	.2
.9	.3239	.3424	2.921	.9461	71.1
19.0	0.3256	0.3443	2.904	0.9455	**71.0**
.1	.3272	.3463	2.888	.9449	70.9
.2	.3289	.3482	2.872	.9444	.8
.3	.3305	.3502	2.856	.9438	.7
.4	.3322	.3522	2.840	.9432	.6
.5	.3338	.3541	2.824	.9426	.5
.6	.3355	.3561	2.808	.9421	.4
.7	.3371	.3581	2.793	.9415	.3
.8	.3387	.3600	2.778	.9409	.2
.9	.3404	.3620	2.762	.9403	70.1
20.0	0.3420	0.3640	2.747	0.9397	**70.0**
.1	.3437	.3659	2.733	.9391	69.9
.2	.3453	.3679	2.718	.9385	.8
.3	.3469	.3699	2.703	.9379	.7
.4	.3486	.3719	2.689	.9373	.6
.5	.3502	.3739	2.675	.9367	.5
.6	.3518	.3759	2.660	.9361	.4
.7	.3535	.3779	2.646	.9354	.3
.8	.3551	.3799	2.633	.9348	.2
.9	.3567	.3819	2.619	.9342	69.1
21.0	0.3584	0.3839	2.605	0.9336	**69.0**
.1	.3600	.3859	2.592	.9330	68.9
.2	.3616	.3879	2.578	.9323	.8
.3	.3633	.3899	2.565	.9317	.7
.4	.3649	.3919	2.552	.9311	.6
.5	.3665	.3939	2.539	.9304	.5
.6	.3681	.3959	2.526	.9298	.4
.7	.3697	.3979	2.513	.9291	.3
.8	.3714	.4000	2.500	.9285	.2
.9	.3730	.4020	2.488	.9278	68.1
22.0	0.3746	0.4040	2.475	0.9272	**68.0**
.1	.3762	.4061	2.463	.9265	67.9
.2	.3778	.4081	2.450	.9259	.8
.3	.3795	.4101	2.438	.9252	.7
.4	.3811	.4122	2.426	.9245	.6
.5	.3827	.4142	2.414	.9239	.5
.6	.3843	.4163	2.402	.9232	.4
.7	.3859	.4183	2.391	.9225	.3
.8	.3875	.4204	2.379	.9219	.2
.9	.3891	.4224	2.367	.9212	67.1
23.0	0.3907	0.4245	2.356	0.9205	**67.0**
.1	.3923	.4265	2.344	.9198	66.9
.2	.3939	.4286	2.333	.9191	.8
.3	.3955	.4307	2.322	.9184	.7
.4	.3971	.4327	2.311	.9178	.6
.5	.3987	.4348	2.300	.9171	.5
.6	.4003	.4369	2.289	.9164	.4
.7	.4019	.4390	2.278	.9157	.3
.8	.4035	.4411	2.267	.9150	.2
.9	.4051	.4431	2.257	.9143	66.1
24.0	0.4067	0.4452	2.246	0.9135	**66.0**
Deg.	Cos	Cot	Tan	Sin	Deg.

NATURAL FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg.	Sin	Tan	Cot	Cos	Deg.
24.0	0.4067	0.4452	2.246	0.9135	**66.0**
.1	.4083	.4473	2.236	.9128	65.9
.2	.4099	.4494	2.225	.9121	.8
.3	.4115	.4515	2.215	.9114	.7
.4	.4131	.4536	2.204	.9107	.6
.5	.4147	.4557	2.194	.9100	.5
.6	.4163	.4578	2.184	.9092	.4
.7	.4179	.4599	2.174	.9085	.3
.8	.4195	.4621	2.164	.9078	.2
.9	.4210	.4642	2.154	.9070	65.1
25.0	0.4226	0.4663	2.145	0.9063	**65.0**
.1	.4242	.4684	2.135	.9056	64.9
.2	.4258	.4706	2.125	.9048	.8
.3	.4274	.4727	2.116	.9041	.7
.4	.4289	.4748	2.106	.9033	.6
.5	.4305	.4770	2.097	.9026	.5
.6	.4321	.4791	2 087	.9018	.4
.7	.4337	.4813	2.078	.9011	.3
.8	.4352	.4834	2.069	.9003	.2
.9	.4368	.4856	2.059	.8996	64.1
26.0	0.4384	0.4877	2.050	0.8988	**64.0**
.1	.4399	.4899	2.041	.8980	63 9
.2	.4415	.4921	2.032	.8973	.8
.3	.4431	.4942	2.023	.8965	.7
.4	.4446	.4964	2.014	.8957	.6
.5	.4462	.4986	2.006	.8949	.5
.6	.4478	.5008	1.997	.8942	.4
.7	.4493	.5029	1 988	.8934	.3
.8	.4509	.5051	1.980	.8926	.2
.9	.4524	.5073	1.971	.8918	63.1
27.0	0.4540	0.5095	1.963	0.8910	**63.0**
.1	.4555	.5117	1.954	.8902	62.9
.2	.4571	.5139	1.946	.8894	.8
.3	.4586	.5161	1.937	.8886	.7
.4	.4602	.5184	1.929	.8878	.6
.5	.4617	.5206	1.921	.8870	.5
.6	.4633	.5228	1.913	.8862	.4
.7	.4648	.5250	1.905	.8854	.3
.8	.4664	.5272	1.897	.8846	.2
.9	.4679	.5295	1.889	.8838	62.1
28.0	0.4695	0.5317	1.881	0.8829	**62.0**
.1	.4710	.5340	1.873	.8821	61.9
.2	.4726	.5362	1.865	.8813	.8
.3	.4741	.5384	1.857	.8805	.7
.4	.4756	.5407	1.849	.8796	.6
.5	.4772	.5430	1.842	.8788	.5
.6	.4787	.5452	1.834	.8780	.4
.7	.4802	.5475	1.827	.8771	.3
.8	.4818	.5498	1.819	.8763	.2
.9	.4833	.5520	1.811	.8755	61.1
29.0	0.4848	0.5543	1.804	0 8746	**61.0**
.1	.4863	.5566	1.797	.8738	60.9
.2	.4879	.5589	1.789	.8729	.8
.3	.4894	.5612	1.782	.8721	.7
.4	.4909	.5635	1.775	.8712	.6
.5	.4924	.5658	1.767	.8704	.5
.6	.4939	.5681	1.760	.8695	.4
.7	.4955	.5704	1.753	.8686	.3
.8	.4970	.5727	1.746	.8678	.2
.9	.4985	.5750	1.739	.8669	60.1
30.0	0.5000	0.5774	1.732	0.8660	**60.0**
Deg.	Cos	Cot	Tan	Sin	Deg.

Deg.	Sin	Tan	Cot	Cos	Deg.
30.0	0.5000	0.5774	1.7321	0.8660	**60.0**
.1	.5015	.5797	1.7251	.8652	59.9
.2	.5030	.5820	1.7182	.8643	.8
.3	.5045	.5844	1.7113	.8634	.7
.4	.5060	.5867	1.7045	.8625	.6
.5	.5075	.5890	1.6977	.8616	.5
.6	.5090	.5914	1.6909	.8607	.4
.7	.5105	.5938	1.6842	.8599	.3
.8	.5120	.5961	1.6775	.8590	.2
.9	.5135	.5985	1.6709	.8581	59.1
31.0	0.5150	0.6009	1.6643	0.8572	**59.0**
.1	.5165	.6032	1.6577	.8563	58.9
.2	.5180	.6056	1 6512	.8554	.8
.3	.5195	.6080	1.6447	.8545	.7
.4	.5210	.6104	1.6383	.8536	.6
.5	.5225	.6128	1.6319	.8526	.5
.6	.5240	.6152	1.6255	.8517	.4
.7	.5255	.6176	1.6191	.8508	.3
.8	.5270	.6200	1.6128	.8499	.2
.9	.5284	.6224	1.6066	.8490	58 1
32.0	0.5299	0.6249	1.6003	0.8480	**58.0**
.1	.5314	.6273	1.5941	.8471	57.9
.2	.5329	.6297	1.5880	.8462	.8
.3	.5344	.6322	1.5818	.8453	.7
.4	.5358	.6346	1.5757	8443	.6
.5	.5373	.6371	1.5697	.8434	.5
.6	.5388	.6395	1 5637	.8425	.4
.7	.5402	.6420	1.5577	.8415	.3
.8	.5417	.6445	1.5517	.8406	.2
.9	.5432	.6469	1.5458	.8396	57.1
33.0	0.5446	0.6494	1.5399	0.8387	**57.0**
.1	.5461	.6519	1.5340	.8377	56.9
.2	.5476	.6544	1.5282	.8368	.8
.3	.5490	.6569	1.5224	.8358	.7
.4	.5505	.6594	1.5166	.8348	.6
.5	.5519	.6619	1.5108	.8339	.5
.6	.5534	.6644	1.5051	.8329	.4
.7	.5548	.6669	1.4994	.8320	.3
.8	.5563	.6694	1.4938	.8310	.2
.9	.5577	.6720	1.4882	.8300	56.1
34.0	0 5592	0.6745	1.4826	0.8290	**56.0**
.1	.5606	.6771	1.4770	.8281	55.9
.2	.5621	.6796	1.4715	.8271	.8
.3	.5635	.6822	1.4659	.8261	.7
.4	.5650	.6847	1.4605	.8251	.6
.5	.5664	.6873	1.4550	.8241	.5
.6	.5678	.6899	1.4496	.8231	.4
.7	.5693	.6924	1.4442	.8221	.3
.8	.5707	.6950	1.4388	.8211	.2
.9	.5721	.6976	1.4335	.8202	55.1
35.0	0.5736	0.7002	1.4281	0.8192	**55.0**
.1	.5750	.7028	1.4229	.8181	54.9
.2	.5764	.7054	1.4176	.8171	.8
.3	.5779	.7080	1.4124	.8161	.7
.4	.5793	.7107	1.4071	.8151	.6
.5	.5807	.7133	1.4019	.8141	.5
.6	.5821	.7159	1.3968	.8131	.4
.7	.5835	.7186	1.3916	.8121	.3
.8	.5850	.7212	1.3865	.8111	.2
.9	.5864	.7239	1.3814	.8100	54.1
36.0	0.5878	0.7265	1.3764	0.8090	**54.0**
Deg.	Cos	Cot	Tan	Sin	Deg.

NATURAL FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg.	Sin	Tan	Cot	Cos	Deg
36.0	0.5878	0.7265	1.3764	0.8090	**54.0**
.1	.5892	.7292	1.3713	.8080	53.9
.2	.5906	.7319	1.3663	.8070	.8
.3	.5920	.7346	1.3613	.8059	.7
.4	.5934	.7373	1.3564	.8049	.6
.5	.5948	.7400	1.3514	.8039	.5
.6	.5962	.7427	1.3465	.8028	.4
.7	.5976	.7454	1.3416	.8018	.3
.8	.5990	.7481	1.3367	.8007	.2
.9	.6004	.7508	1.3319	.7997	53.1
37.0	0.6018	0.7536	1.3270	0.7986	**53.0**
.1	.6032	.7563	1.3222	.7976	52.9
.2	.6046	.7590	1.3175	.7965	.8
.3	.6060	.7618	1.3127	.7955	.7
.4	.6074	.7646	1.3079	.7944	.6
.5	.6088	.7673	1.3032	.7934	.5
.6	.6101	.7701	1.2985	.7923	.4
.7	.6115	.7729	1.2938	.7912	.3
.8	.6129	.7757	1.2892	.7902	.2
.9	.6143	.7785	1.2846	.7891	52.1
38.0	0.6157	0.7813	1.2799	0.7880	**52.0**
.1	.6170	.7841	1.2753	.7869	51.9
.2	.6184	.7869	1.2708	.7859	.8
.3	.6198	.7898	1.2662	.7848	.7
.4	.6211	.7926	1.2617	.7837	.6
.5	.6225	.7954	1.2572	.7826	.5
.6	.6239	.7983	1.2527	.7815	.4
.7	.6252	.8012	1.2482	.7804	.3
.8	.6266	.8040	1.2437	.7793	.2
.9	.6280	.8069	1.2393	.7782	51.1
39.0	0.6293	0.8098	1.2349	0.7771	**51.0**
.1	.6307	.8127	1.2305	.7760	50.9
.2	.6320	.8156	1.2261	.7749	.8
.3	.6334	.8185	1.2218	.7738	.7
.4	.6347	.8214	1.2174	.7727	.6
.5	.6361	.8243	1.2131	.7716	.5
.6	.6374	.8273	1.2088	.7705	.4
.7	.6388	.8302	1.2045	.7694	.3
.8	.6401	.8332	1.2002	.7683	.2
.9	.6414	.8361	1.1960	.7672	50.1
40.0	0.6428	0.8391	1.1918	0.7660	**50.0**
.1	.6441	.8421	1.1875	.7649	49.9
.2	.6455	.8451	1.1833	.7638	.8
.3	.6468	.8481	1.1792	.7627	.7
.4	.6481	.8511	1.1750	.7615	.6
40.5	0.6494	0.8541	1.1708	0.7604	**49.5**
Deg.	Cos	Cot	Tan	Sin	Deg

Deg	Sin	Tan	Cot	Cos	Deg.
40.5	0.6494	0.8541	1.1708	0.7604	**49.5**
.6	.6508	.8571	1.1667	.7593	.4
.7	.6521	.8601	1.1626	.7581	.3
.8	.6534	.8632	1.1585	.7570	.2
.9	.6547	.8662	1.1544	.7559	49.1
41.0	0.6561	0.8693	1.1504	0.7547	**49.0**
.1	.6574	.8724	1.1463	.7536	48.9
.2	.6587	.8754	1.1423	.7524	.8
.3	.6600	.8785	1.1383	.7513	.7
.4	.6613	.8816	1.1343	.7501	.6
.5	.6626	.8847	1.1303	.7490	.5
.6	.6639	.8878	1.1263	.7478	.4
.7	.6652	.8910	1.1224	.7466	.3
.8	.6665	.8941	1.1184	.7455	.2
.9	.6678	.8972	1.1145	.7443	48.1
42.0	0.6691	0.9004	1.1106	0.7431	**48.0**
.1	.6704	.9036	1.1067	.7420	47.9
.2	.6717	.9067	1.1028	.7408	.8
.3	.6730	.9099	1.0990	.7396	.7
.4	.6743	.9131	1.0951	.7385	.6
.5	.6756	.9163	1.0913	.7373	.5
.6	.6769	.9195	1.0875	.7361	.4
.7	.6782	.9228	1.0837	.7349	.3
.8	.6794	.9260	1.0799	.7337	.2
.9	.6807	.9293	1.0761	.7325	47.1
43.0	0.6820	0.9325	1.0724	0.7314	**47.0**
.1	.6833	.9358	1.0686	.7302	46.9
.2	.6845	.9391	1.0649	.7290	.8
.3	.6858	.9424	1.0612	.7278	.7
.4	.6871	.9457	1.0575	.7266	.6
.5	.6884	.9490	1.0538	.7254	.5
.6	.6896	.9523	1.0501	.7242	.4
.7	.6909	.9556	1.0464	.7230	.3
.8	.6921	.9590	1.0428	.7218	.2
.9	.6934	.9623	1.0392	.7206	46.1
44.0	0.6947	0.9657	1.0355	0.7193	**46.0**
.1	.6959	.9691	1.0319	.7181	45.9
.2	.6972	.9725	1.0283	.7169	.8
.3	.6984	.9759	1.0247	.7157	.7
.4	.6997	.9793	1.0212	.7145	.6
.5	.7009	.9827	1.0176	.7133	.5
.6	.7022	.9861	1.0141	.7120	.4
.7	.7034	.9896	1.0105	.7108	.3
.8	.7046	.9930	1.0070	.7096	.2
.9	.7059	.9965	1.0035	.7083	45.1
45.0	0.7071	1.0000	1.0000	0.7071	**45.0**
Deg.	Cos	Cot	Tan	Sin	Deg

LOGARITHMS OF TRIGONOMETRIC FUNCTIONS FOR ANGLES IN DEGREES AND DECIMALS

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
0.0	— ∞	— ∞	∞	0.0000	**90.0**
.1	7.2419	7.2419	2.7581	0.0000	89.9
.2	7.5429	7.5429	2.4571	0.0000	.8
.3	7.7190	7.7190	2.2810	0.0000	.7
.4	7.8439	7.8439	2.1561	0.0000	.6
.5	7.9408	7.9409	2.0591	0.0000	.5
.6	8.0200	8.0200	1.9800	0.0000	.4
.7	8.0870	8.0870	1.9130	0.0000	.3
.8	8.1450	8.1450	1.8550	0.0000	.2
.9	8.1961	8.1962	1.8038	9.9999	89.1
1.0	8.2419	8.2419	1.7581	9.9999	**89.0**
.1	8.2832	8.2833	1.7167	9.9999	88.9
.2	8.3210	8.3211	1.6789	9.9999	.8
.3	8.3558	8.3559	1.6441	9.9999	.7
.4	8.3880	8.3881	1.6119	9.9999	.6
.5	8.4179	8.4181	1.5819	9.9999	.5
.6	8.4459	8.4461	1.5539	9.9998	.4
.7	8.4723	8.4725	1.5275	9.9998	.3
.8	8.4971	8.4973	1.5027	9.9998	.2
.9	8.5206	8.5208	1.4792	9.9998	88.1
2.0	8.5428	8.5431	1.4569	9.9997	**88.0**
.1	8.5640	8.5643	1.4357	9.9997	87.9
.2	8.5842	8.5845	1.4155	9.9997	.8
.3	8.6035	8.6038	1.3962	9.9996	.7
.4	8.6220	8.6223	1.3777	9.9996	.6
.5	8.6397	8.6401	1.3599	9.9996	.5
.6	8.6567	8.6571	1.3429	9.9996	.4
.7	8.6731	8.6736	1.3264	9.9995	.3
.8	8.6889	8.6894	1.3106	9.9995	.2
.9	8.7041	8.7046	1.2954	9.9994	87.1
3.0	8.7188	8.7194	1.2806	9.9994	**87.0**
.1	8.7330	8.7337	1.2663	9.9994	86.9
.2	8.7468	8.7475	1.2525	9.9993	.8
.3	8.7602	8.7609	1.2391	9.9993	.7
.4	8.7731	8.7739	1.2261	9.9992	.6
.5	8.7857	8.7865	1.2135	9.9992	.5
.6	8.7979	8.7988	1.2012	9.9991	.4
.7	8.8098	8.8107	1.1893	9.9991	.3
.8	8.8213	8.8223	1.1777	9.9990	.2
.9	8.8326	8.8336	1.1664	9.9990	86.1
4.0	8.8436	8.8446	1.1554	9.9989	**86.0**
.1	8.8543	8.8554	1.1446	9.9989	85.9
.2	8.8647	8.8659	1.1341	9.9988	.8
.3	8.8749	8.8762	1.1238	9.9988	.7
.4	8.8849	8.8862	1.1138	9.9987	.6
.5	8.8946	8.8960	1.1040	9.9987	.5
.6	8.9042	8.9056	1.0944	9.9986	.4
.7	8.9135	8.9150	1.0850	9.9985	.3
.8	8.9226	8.9241	1.0759	9.9985	.2
.9	8.9315	8.9331	1.0669	9.9984	85.1
5.0	8.9403	8.9420	1.0580	9.9983	**85.0**
.1	8.9489	8.9506	1.0494	9.9983	84.9
.2	8.9573	8.9591	1.0409	9.9982	.8
.3	8.9655	8.9674	1.0326	9.9981	.7
.4	8.9736	8.9756	1.0244	9.9981	.6
.5	8.9816	8.9836	1.0164	9.9980	.5
.6	8.9894	8.9915	1.0085	9.9979	.4
.7	8.9970	8.9992	1.0008	9.9978	.3
.8	9.0046	9.0068	0.9932	9.9978	.2
.9	9.0120	9.0143	0.9857	9.9977	84.1
6.0	9.0192	9.0216	0.9784	9.9976	**84.0**
Deg.	L. Cos	L. Cot	L. Tan	L. Sin	Deg.

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
6.0	9.0192	9.0216	0.9784	9.9976	**84.0**
.1	9.0264	9.0289	0.9711	9.9975	83.9
.2	9.0334	9.0360	0.9640	9.9975	.8
.3	9.0403	8.0430	0.9570	9.9974	.7
.4	9.0472	9.0499	0.9501	9.9973	.6
.5	9.0539	9.0567	0.9433	9.9972	.5
.6	9.0605	9.0633	0.9367	9.9971	.4
.7	9.0670	9.0699	0.9301	9.9970	.3
.8	9.0734	9.0764	0.9236	9.9969	.2
.9	9.0797	9.0828	0.9172	9.9968	83.1
7.0	9.0859	9.0891	0.9109	9.9968	**83.0**
.1	9.0920	9.0954	0.9046	9.9967	82.9
.2	9.0981	9.1015	0.8985	9.9966	.8
.3	9.1040	9.1076	0.8924	9.9965	.7
.4	9.1099	9.1135	0.8865	9.9964	.6
.5	9.1157	9.1194	0.8806	9.9963	.5
.6	9.1214	9.1252	0.8748	9.9962	.4
.7	9.1271	9.1310	0.8690	9.9961	.3
.8	9.1326	9.1367	0.8633	9.9960	.2
.9	9.1381	9.1423	0.8577	9.9959	82.1
8.0	9.1436	9.1478	0.8522	9.9958	**82.0**
.1	9.1489	9.1533	0.8467	9.9956	81.9
.2	9.1542	9.1587	0.8413	9.9955	.8
.3	9.1591	9.1640	0.8360	9.9954	.7
.4	9.1646	9.1693	0.8307	9.9953	.6
.5	9.1697	9.1745	0.8255	9.9952	.5
.6	9.1747	9.1797	0.8203	9.9951	.4
.7	9.1797	9.1848	0.8152	9.9950	.3
.8	9.1847	9.1898	0.8102	9.9949	.2
.9	9.1895	9.1948	0.8052	9.9947	81.1
9.0	9.1943	9.1997	0.8003	9.9946	**81.0**
.1	9.1991	9.2046	0.7954	9.9945	80.9
.2	9.2038	9.2094	0.7906	9.9944	.8
.3	9.2085	9.2142	0.7858	9.9943	.7
.4	9.2131	9.2189	0.7811	9.9941	.6
.5	9.2176	9.2236	0.7764	9.9940	.5
.6	9.2221	9.2282	0.7718	9.9939	.4
.7	9.2266	9.2328	0.7672	9.9937	.3
.8	9.2310	9.2374	0.7626	9.9936	.2
.9	9.2353	9.2419	0.7581	9.9935	80.1
10.0	9.2397	9.2463	0.7537	9.9934	**80.0**
.1	9.2439	9.2507	0.7493	9.9932	79.9
.2	9.2482	9.2551	0.7449	9.9931	.8
.3	9.2524	9.2594	0.7406	9.9929	.7
.4	9.2565	9.2637	0.7363	9.9928	.6
.5	9.2606	9.2680	0.7320	9.9927	.5
.6	9.2647	9.2722	0.7278	9.9925	.4
.7	9.2687	9.2764	0.7236	9.9924	.3
.8	9.2727	9.2805	0.7195	9.9922	.2
.9	9.2767	9.2846	0.7154	9.9921	79.1
11.0	9.2806	9.2887	0.7113	9.9919	**79.0**
.1	9.2845	9.2927	0.7073	9.9918	78.9
.2	9.2883	9.2967	0.7033	9.9916	.8
.3	9.2921	9.3006	0.6994	9.9915	.7
.4	9.2959	9.3046	0.6954	9.9913	.6
.5	9.2997	9.3085	0.6915	9.9912	.5
.6	9.3034	9.3123	0.6877	9.9910	.4
.7	9.3070	9.3162	0.6838	9.9909	.3
.8	9.3107	9.3200	0.6800	9.9907	.2
.9	9.3143	9.3237	0.6763	9.9906	78.1
12.0	9.3179	9.3275	0.6725	9.9904	**78.0**
Deg.	L. Cos	L. Cot	L. Tan	L. Sin	Deg.

LOGARITHMS OF FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg	L. Sin	L. Tan	L. Cot	L. Cos	Deg
12.0	9.3179	9.3275	0.6725	9.9904	**78.0**
.1	9.3214	9.3312	0.6688	9.9902	77.9
.2	9.3250	9.3349	0.6651	9.9901	.8
.3	9.3284	9.3385	0.6615	9.9899	.7
.4	9.3319	9.3422	0.6578	9.9897	.6
.5	9.3353	9.3458	0.6542	9.9896	.5
.6	9.3387	9.3493	0.6507	9.9894	.4
.7	9.3421	9.3529	0.6471	9.9892	.3
.8	9.3455	9.3564	0.6436	9.9891	.2
.9	9.3488	9.3599	0.6401	9.9889	77.1
13.0	9.3521	9.3634	0.6366	9.9887	**77.0**
.1	9.3554	9.3668	0.6332	9.9885	76.9
.2	9.3586	9.3702	0.6298	9.9884	.8
.3	9.3618	9.3736	0.6264	9.9882	.7
.4	9.3650	9.3770	0.6230	9.9880	.6
.5	9.3682	9.3804	0.6196	9.9878	.5
.6	9.3713	9.3837	0.6163	9.9876	.4
.7	9.3745	9.3870	0.6130	9.9875	.3
.8	9.3775	9.3903	0.6097	9.9873	.2
.9	9.3806	9.3935	0.6065	9.9871	76.1
14.0	9.3837	9.3968	0.6032	9.9869	**76.0**
.1	9.3867	9.4000	0.6000	9.9867	75.9
.2	9.3897	9.4032	0.5968	9.9865	.8
.3	9.3927	9.4064	0.5936	9.9863	.7
.4	9.3957	9.4095	0.5905	9.9861	.6
.5	9.3986	9.4127	0.5873	9.9859	.5
.6	9.4015	9.4158	0.5842	9.9857	.4
.7	9.4044	9.4189	0.5811	9.9855	.3
.8	9.4073	9.4220	0.5780	9.9853	.2
.9	9.4102	9.4250	0.5750	9.9851	75.1
15.0	9.4130	9.4281	0.5719	9.9849	**75.0**
.1	9.4158	9.4311	0.5689	9.9847	74.9
.2	9.4186	9.4341	0.5659	9.9845	.8
.3	9.4214	9.4371	0.5629	9.9843	.7
.4	9.4242	9.4400	0.5600	9.9841	.6
.5	9.4269	9.4430	0.5570	9.9839	.5
.6	9.4296	9.4459	0.5541	9.9837	.4
.7	9.4323	9.4488	0.5512	9.9835	.3
.8	9.4350	9.4517	0.5483	9.9833	.2
.9	9.4377	9.4546	0.5454	9.9831	74.1
16.0	9.4403	9.4575	0.5425	9.9828	**74.0**
.1	9.4430	9.4603	0.5397	9.9826	73.9
.2	9.4456	9.4632	0.5368	9.9824	.8
.3	9.4482	9.4660	0.5340	9.9822	.7
.4	9.4508	9.4688	0.5312	9.9820	.6
.5	9.4533	9.4716	0.5284	9.9817	.5
.6	9.4559	9.4744	0.5256	9.9815	.4
.7	9.4584	9.4771	0.5229	9.9813	.3
.8	9.4609	9.4799	0.5201	9.9811	.2
.9	9.4634	9.4826	0.5174	9.9808	73.1
17.0	9.4659	9.4853	0.5147	9.9806	**73.0**
.1	9.4684	9.4880	0.5120	9.9804	72.9
.2	9.4709	9.4907	0.5093	9.9801	.8
.3	9.4733	9.4934	0.5066	9.9799	.7
.4	9.4757	9.4961	0.5039	9.9797	.6
.5	9.4781	9.4987	0.5013	9.9794	.5
.6	9.4805	9.5014	0.4986	9.9792	.4
.7	9.4829	9.5040	0.4960	9.9789	.3
.8	9.4853	9.5066	0.4934	9.9787	.2
.9	9.4876	9.5092	0.4908	9.9785	72.1
18.0	9.4900	9.5118	0.4882	9.9782	**72.0**
Deg.	L. Cos	L. Cot	L. Tan	L. Sin	Deg

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg
18.0	9.4900	9.5118	0.4882	9.9782	**72.0**
.1	9.4923	9.5143	0.4857	9.9780	71.9
.2	9.4946	9.5169	0.4831	9.9777	.8
.3	9.4969	9.5195	0.4805	9.9775	.7
.4	9.4992	9.5220	0.4780	9.9772	.6
.5	9.5015	9.5245	0.4755	9.9770	.5
.6	9.5037	9.5270	0.4730	9.9767	.4
.7	9.5060	9.5295	0.4705	9.9764	.3
.8	9.5082	9.5320	0.4680	9.9762	.2
.9	9.5104	9.5345	0.4655	9.9759	71.1
19.0	9.5126	9.5370	0.4630	9.9757	**71.0**
.1	9.5148	9.5394	0.4606	9.9754	70.9
.2	9.5170	9.5419	0.4581	9.9751	.8
.3	9.5192	9.5443	0.4557	9.9749	.7
.4	9.5213	9.5467	0.4533	9.9746	.6
.5	9.5235	9.5491	0.4509	9.9743	.5
.6	9.5256	9.5516	0.4484	9.9741	.4
.7	9.5278	9.5539	0.4461	9.9738	.3
.8	9.5299	9.5563	0.4437	9.9735	.2
.9	9.5320	9.5587	0.4413	9.9733	70.1
20.0	9.5341	9.5611	0.4389	9.9730	**70.0**
.1	9.5361	9.5634	0.4366	9.9727	69.9
.2	9.5382	9.5658	0.4342	9.9724	.8
.3	9.5402	9.5681	0.4319	9.9722	.7
.4	9.5423	9.5704	0.4296	9.9719	.6
.5	9.5443	9.5727	0.4273	9.9716	.5
.6	9.5463	9.5750	0.4250	9.9713	.4
.7	9.5484	9.5773	0.4227	9.9710	.3
.8	9.5504	9.5796	0.4204	9.9707	.2
.9	9.5523	9.5819	0.4181	9.9704	69.1
21.0	9.5543	9.5842	0.4158	9.9702	**69.0**
.1	9.5563	9.5864	0.4136	9.9699	68.9
.2	9.5583	9.5887	0.4113	9.9696	.8
.3	9.5602	9.5909	0.4091	9.9693	.7
.4	9.5621	9.5932	0.4068	9.9690	.6
.5	9.5641	9.5954	0.4046	9.9687	.5
.6	9.5660	9.5976	0.4024	9.9684	.4
.7	9.5679	9.5998	0.4002	9.9681	.3
.8	9.5698	9.6020	0.3980	9.9678	.2
.9	9.5717	9.6042	0.3958	9.9675	68.1
22.0	9.5736	9.6064	0.3936	9.9672	**68.0**
.1	9.5754	9.6086	0.3914	9.9669	67.9
.2	9.5773	9.6108	0.3892	9.9666	.8
.3	9.5792	9.6129	0.3871	9.9662	.7
.4	9.5810	9.6151	0.3849	9.9659	.6
.5	9.5828	9.6172	0.3828	9.9656	.5
.6	9.5847	9.6194	0.3806	9.9653	.4
.7	9.5865	9.6215	0.3785	9.9650	.3
.8	9.5883	9.6236	0.3764	9.9647	.2
.9	9.5901	9.6257	0.3743	9.9643	67.1
23.0	9.5919	9.6279	0.3721	9.9640	**67.0**
.1	9.5937	9.6300	0.3700	9.9637	66.9
.2	9.5954	9.6321	0.3679	9.9634	.8
.3	9.5972	9.6341	0.3659	9.9631	.7
.4	9.5990	9.6362	0.3638	9.9627	.6
.5	9.6007	9.6383	0.3617	9.9624	.5
.6	9.6024	9.6404	0.3596	9.9621	.4
.7	9.6042	9.6424	0.3576	9.9617	.3
.8	9.6059	9.6445	0.3555	9.9614	.2
.9	9.6076	9.6465	0.3535	9.9611	66.1
24.0	9.6093	9.6486	0.3514	9.9607	**66.0**
Deg.	L. Cos	L. Cot	L. Tan	L. Sin	Deg.

LOGARITHMS OF FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg	L. Sin	L. Tan	L. Cot	L. Cos	Deg
24.0	9.6093	9.6486	0.3514	9.9607	**66.0**
1	9.6110	9.6506	0.3494	9.9604	65 9
.2	9.6127	9.6527	0.3473	9.9601	.8
.3	9.6144	9.6547	0.3453	9.9597	.7
.4	9.6161	9.6567	0.3433	9.9594	.6
.5	9 6177	9.6587	0.3413	9 9590	.5
.6	9 6194	9.6607	0.3393	9.9587	.4
.7	9 6210	9.6627	0.3373	9.9583	.3
.8	9.6227	9.6647	0.3353	9.9580	.2
.9	9.6243	9.6667	0.3333	9.9576	65.1
25.0	9.6259	9.6687	0.3313	9.9573	**65.0**
.1	9.6276	9.6706	0.3294	9.9560	64 9
2	9.6292	9.6726	0 3274	9 9566	8
.3	9.6308	9.6746	0.3254	9.9562	.7
.4	9.6324	9.6765	0.3235	9.9558	.6
.5	9.6340	9.6785	0.3215	9.9555	.5
.6	9.6356	9.6804	0.3196	9.9551	.4
.7	9.6371	9.6824	0.3176	9.9548	.3
.8	9.6387	9.6843	0.3157	9.9544	.2
.9	9 6403	9.6863	0.3137	9 9540	64 1
26.0	9.6418	9.6882	0 3118	9 9537	**64.0**
.1	9.6434	9.6901	0.3099	9.9533	63.9
.2	9.6449	9.6920	0.3080	9.9529	.8
.3	9 6465	9 6939	0.3061	9 9525	7
.4	9.6480	9.6958	0.3042	9.9522	.6
.5	9.6495	9.6977	0.3023	9.9518	.5
.6	9.6510	9.6996	0 3004	9.9514	.4
.7	9.6526	9.7015	0 2985	9.9510	3
.8	9.6541	9.7034	0.2966	9.9506	.2
.9	9.6556	9.7053	0.2947	9.9503	63.1
27.0	9.6570	9.7072	0.2928	9.9499	**63.0**
.1	9.6585	9.7090	0.2910	9 9495	62 9
.2	9.6600	9.7109	0.2891	9.9491	.8
.3	9.6615	9.7128	0 2872	9.9487	.7
.4	9.6629	9.7146	0.2854	9.9483	.6
.5	9.6644	9.7165	0.2835	9.9479	.5
.6	9.6659	9.7183	0.2817	9.9475	.4
.7	9.6673	9.7202	0 2798	9 9471	3
.8	9.6687	9.7220	0.2780	9.9467	.2
.9	9.6702	9.7238	0.2762	9.9463	62.1
28.0	9 6716	9.7257	0.2743	0 9459	**62.0**
.1	9.6730	9.7275	0.2725	9.9455	61 9
.2	9.6744	9.7293	0.2707	9.9451	.8
.3	9.6759	9.7311	0.2689	9.9447	.7
.4	9.6773	9.7330	0.2670	9.9443	.6
.5	9.6787	9.7348	0.2652	9.9439	.5
.6	9.6801	9.7366	0.2634	9.9435	.4
.7	9.6814	9.7384	0.2616	9.9431	.3
.8	9.6828	9.7402	0.2598	9.9427	.2
.9	9.6842	9.7420	0.2580	9.9422	61 1
29.0	9.6856	9.7438	0.2562	9.9418	**61.0**
.1	9.6869	9.7455	0.2545	9.9414	60 9
.2	9.6883	9.7473	0.2527	9.9410	.8
.3	9.6896	9.7491	0.2509	9.9406	.7
.4	9.6910	9.7509	0.2491	9.9401	.6
.5	9.6923	9.7526	0.2474	9.9397	.5
.6	9.6937	9.7544	0.2456	9.9393	.4
.7	9.6950	9.7562	0.2438	9.9388	.3
.8	9.6963	9.7579	0.2421	9.9384	.2
.9	9.6977	9.7597	0.2403	9.9380	60.1
30.0	9.6990	9 7614	0.2386	9.9375	**60.0**
Deg	L. Cos	L. Cot	L. Tan	L. Sin	Deg

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
30.0	9.6990	9.7614	0.2386	9.9375	**60.0**
.1	9.7003	9.7632	0.2368	9.9371	59.9
.2	9.7016	9.7649	0.2351	9 9367	.8
3	9.7029	9.7667	0.2333	9 9362	.7
.4	9.7042	9.7684	0.2316	9.9358	.6
.5	9.7055	9.7701	0.2299	9.9353	.5
.6	9.7068	9.7719	0.2281	9.9349	.4
.7	9.7080	9.7736	0.2264	9.9344	.3
.8	9.7093	9.7753	0.2247	9.9340	.2
.9	9.7106	9.7771	0.2229	9.9335	59.1
31.0	9.7118	9.7788	0.2212	9.9331	**59.0**
.1	9.7131	9.7805	0.2195	9.9326	58.9
.2	9.7144	9.7822	0 2178	9.9322	.8
.3	9.7156	9.7839	0.2161	9.9317	.7
.4	9.7168	9.7856	0.2144	9.9312	.6
.5	9.7181	9.7873	0.2127	9.9308	.5
,6	9 7193	9.7890	0.2110	9.9303	.4
.7	9.7205	9.7907	0.2093	9.9298	.3
.8	9.7218	9.7924	0.2076	9.9294	.2
.9	9.7230	9.7941	0 2059	9.9289	58 1
32.0	9 7242	9.7958	0.2042	9.9284	**58.0**
.1	9.7254	9.7975	0.2025	9.9279	57.9
.2	9.7266	9.7992	0.2008	9.9275	.8
.3	9 7278	9.8008	0.1992	9.9270	.7
.4	9.7290	9.8025	0.1975	9.9265	.6
.5	9 7302	9.8042	0.1958	9.9260	.5
.6	9.7314	9 8059	0.1941	9 9255	.4
.7	9.7326	9.8075	0.1925	9.9251	.3
.8	9.7338	9.8092	0.1908	9.9246	.2
.9	9.7349	9.8109	0.1891	9.9241	57 1
33.0	9.7361	9.8125	0.1875	9.9236	**57.0**
.1	9.7373	9.8142	0.1858	9.9231	56 9
.2	9.7384	9.8158	0.1842	9.9226	.8
.3	9.7396	9 8175	0.1825	9.9221	.7
.4	9.7407	9.8191	0.1809	9.9216	.6
.5	9.7419	9.8208	0.1792	9.9211	.5
.6	9.7430	9.8224	0.1776	9.9206	.4
.7	9 7442	9 8241	0.1759	9 9201	3
.8	9.7453	9.8257	0.1743	9 9196	.2
.9	9.7464	9.8274	0.1726	9.9191	56 1
34.0	9 7476	9.8290	0.1710	9.9186	**56.0**
.1	9.7487	9.8306	0.1694	9.9181	55 9
.2	9.7498	9.8323	0.1677	9.9175	.8
.3	9.7509	9.8339	0.1661	9.9170	.7
4	9 7520	9.8355	0.1645	9 9165	6
.5	9.7531	9.8371	0.1629	9.9160	.5
.6	9.7542	9.8388	0.1612	9.9155	4
.7	9.7553	9.8404	0.1596	9.9149	.3
.8	9 7564	9.8420	0.1580	9.9144	2
.9	9.7575	9.8436	0.1564	9.9139	55.1
35.0	9.7586	9.8452	0.1548	9.9134	**55.0**
.1	9.7597	9.8468	0.1532	9.9128	54.9
.2	9.7607	9.8484	0.1516	9.9123	.8
.3	9 7618	9.8501	0.1499	9.9118	.7
.4	9.7629	9.8517	0.1483	9 9112	.6
.5	9.7640	9.8533	0.1467	9.9107	.5
.6	9.7650	9.8549	0.1451	9.9101	.4
.7	9.7661	9.8565	0.1435	9 9096	.3
.8	9.7671	9 8581	0.1419	9.9091	.2
.9	9.7682	9.8597	0.1403	9.9085	54.1
36.0	9.7692	9.8613	0 1387	9 9080	**54.0**
Deg.	L. Cos	L Cot	L. Tan	L. Sin	Deg

LOGARITHMS OF FUNCTIONS FOR DEGREES AND DECIMALS (Continued)

Deg.	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
36.0	9.7692	9.8613	0.1387	9.9080	**54.0**
.1	9.7703	9.8629	0.1371	9.9074	53.9
.2	9.7713	9.8644	0.1356	9.9069	.8
.3	9.7723	9 8660	0.1340	9.9063	.7
.4	9.7734	9.8676	0.1324	9.9057	.6
.5	9.7744	9.8692	0.1308	9.9052	.5
.6	9 7754	9.8708	0.1292	9.9046	.4
.7	9 7764	9 8724	0.1276	9.9041	.3
.8	9.7774	9 8740	0.1260	9.9035	.2
.9	9.7785	9.8755	0.1245	9.9029	53.1
37.0	9 7795	9.8771	0.1229	9.9023	**53.0**
.1	9 7805	9 8787	0.1213	9 9018	52.9
.2	9 7815	9 8803	0.1197	9.9012	.8
.3	9.7825	9.8818	0.1182	9 9006	.7
.4	9 7835	9.8834	0.1166	9.9000	.6
.5	9 7844	9.8850	0.1150	9.8995	5
.6	9 7854	9 8865	0.1135	9.8989	.4
.7	9.7864	9 8881	0.1119	9 8983	.3
.8	9.7874	9.8897	0.1103	9.8977	.2
.9	9.7884	9.8912	0.1088	9.8971	52.1
38.0	9 7893	9.8928	0.1072	9.8965	**52.0**
1	9 7903	9.8944	0.1056	9.8959	51.9
.2	9 7913	9.8959	0.1041	9.8953	.8
.3	9.7922	9 8975	0.1025	9.8947	.7
.4	9 7932	9.8990	0.1010	9.8941	.6
.5	9.7941	9 9006	0.0994	9.8935	.5
.6	9 7951	9.9022	0.0978	9 8929	.4
.7	9.7960	9.9037	0.0963	9.8923	.3
.8	9 7970	9.9053	0 0947	9 8917	.2
.9	9.7979	9.9068	0.0932	9.8911	51.1
39.0	9.7989	9.9084	0.0916	9.8905	**51.0**
.1	9 7998	9.9099	0 0901	9.8899	50.9
.2	9.8007	9.9115	0.0885	9.8893	.8
.3	9 8017	9.9130	0.0870	9.8887	.7
.4	9.8026	9.9146	0.0854	9 8880	.6
.5	9.8035	9.9161	0.0839	9.8874	.5
.6	9.8044	9.9176	0 0824	9 8868	.4
.7	9.8053	9.9192	0.0808	9.8862	.3
.8	9.8063	9 9207	0 0793	9 8855	.2
.9	9.8072	9.9223	0.0777	9 8849	50 1
40.0	9 8081	9.9238	0.0762	9 8843	**50.0**
.1	9.8090	9.9254	0.0746	9.8836	49 9
.2	9.8099	9.9269	0.0731	9.8830	.8
.3	9.8101	9.9284	0.0716	9.8823	.7
.4	9.8117	9.9300	0.0700	9.8817	.6
.5	9.8125	9.9315	0.0685	9.8810	.5
.6	9.8134	9.9330	0.0670	9.8804	.4
.7	9.8143	9.9346	0.0654	9.8797	.3
.8	9.8152	9.9361	0 0639	9.8791	2
.9	9 8161	9.9376	0.0624	9.8784	49.1
41.0	9.8169	9.9392	0.0608	9.8778	**49.0**
Deg.	L. Cos	L. Cot	L. Tan	L. Sin	Deg.

Deg	L. Sin	L. Tan	L. Cot	L. Cos	Deg.
41.0	9 8169	9.9392	0.0608	9.8778	**49.0**
.1	9.8178	9.9407	0.0593	9.8771	48.9
.2	9.8187	9.9422	0.0578	9.8765	.8
.3	9.8195	9.9438	0.0562	9.8758	.7
.4	9.8204	9.9453	0.0547	9.8751	.6
.5	9.8213	9.9468	0.0532	9.8745	.5
.6	9.8221	9.9483	0.0517	9.8738	.4
.7	9.8230	9 9499	0.0501	9.8731	.3
.8	9.8238	9.9514	0.0486	9.8724	.2
.9	9.8247	9.9529	0.0471	9.8718	48.1
42.0	9.8255	9.9544	0.0456	9.8711	**48.0**
.1	9 8264	9.9560	0.0440	9.8704	47.9
.2	9.8272	9.9575	0.0425	9.8697	.8
.3	9.8280	9.9590	0.0410	9.8690	.7
.4	9.8289	9.9605	0.0395	9.8683	6
.5	9.8297	9.9621	0.0379	9 8676	.5
.6	9.8305	9.9636	0.0364	9.8669	.4
.7	9.8313	9.9651	0.0349	9.8662	.3
.8	9 8322	9.9666	0.0334	9.8655	.2
9	9.8330	9.9681	0.0319	9.8648	47.1
43.0	9.8338	9.9697	0.0303	9.8641	**47.0**
.1	9.8346	9.9712	0.0288	9.8634	46.9
.2	9.8354	9.9727	0.0273	9.8627	.8
.3	9.8362	9.9742	0.0258	9.8620	.7
.4	9.8370	9.9757	0.0243	9.8613	.6
.5	9.8378	9.9772	0.0228	9.8606	.5
.6	9.8386	9.9788	0.0212	9.8598	.4
.7	9.8394	9 9803	0.0197	9.8591	.3
.8	9.8402	9.9818	0 0182	9.8584	.2
.9	9.8410	9.9833	0.0167	9.8577	46.1
44.0	9.8418	9.9848	0.0152	9.8569	**46.0**
.1	9.8426	9.9864	0.0136	9 8562	45.9
.2	9.8433	9.9879	0 0121	9.8555	.8
.3	9.8441	9.9894	0.0106	9.8547	.7
.4	9.8449	9.9909	0.0091	9.8540	.6
.5	9.8457	9.9924	0.0076	9.8532	.5
.6	9.8464	9 9939	0 0061	9 8525	.4
.7	9.8472	9.9955	0.0045	9.8517	.3
.8	9.8480	9.9970	0.0030	9 8510	.2
.9	9.8487	9.9985	0.0015	9.8502	45.1
45.0	9.8495	0.0000	0.0000	9.8495	**45.0**
Deg	L. Cos	L. Cot	L. Tan	L. Sin	Deg.

NATURAL FUNCTIONS FOR ANGLES IN RADIANS

Rad.	Sin	Tan	Cot	Cos
.00	.00000	.00000	∞	1.0000
.01	.01000	.01000	99.997	.99995
.02	.02000	.02000	49.993	.99980
.03	.03000	.03001	33.323	.99955
.04	.03999	.04002	24.987	.99920
.05	.04998	.05004	19.983	.99875
.06	.05996	.06007	16.647	.99820
.07	.06994	.07011	14.262	.99755
.08	.07991	.08017	12.473	.99680
.09	.08988	.09024	11.081	.99595
.10	.09983	.10033	9.9666	.99500
.11	.10978	.11045	9.0542	.99396
.12	.11971	.12058	8.2933	.99281
.13	.12963	.13074	7 6489	.99156
.14	.13954	.14092	7.0961	.99022
.15	.14944	.15114	6.6166	.98877
.16	.15932	.16138	6.1966	.98723
.17	.16918	.17166	5.8256	.98558
.18	.17903	.18197	5.4954	.98384
.19	.18886	.19232	5.1997	.98200
.20	.19867	.20271	4.9332	.98007
.21	.20846	.21314	4.6917	.97803
.22	.21823	.22362	4.4719	.97590
.23	.22798	.23414	4.2709	.97367
.24	.23770	.24472	4.0864	.97134
.25	.24740	.25534	3.9163	.96891
.26	.25708	.26602	3.7591	.96639
.27	.26673	.27676	3.6133	.96377
.28	.27636	.28755	3.4776	.96106
.29	.28595	.29841	3.3511	.95824
.30	.29552	.30934	3.2327	.95534
.31	.30506	.32033	3.1218	.95233
.32	31457	.33139	3.0176	.94924
.33	.32404	.34252	2.9195	.94604
.34	.33349	.35374	2.8270	.94275
.35	.34290	.36503	2.7395	.93937
.36	.35227	.37640	2.6567	.93590
.37	.36162	.38786	2.5782	.93233
.38	.37092	.39941	2.5037	.92866
.39	.38019	.41105	2.4328	.92491
.40	38942	.42279	2 3652	.92106
.41	.39861	.43463	2 3008	.91712
.42	.40776	.44657	2.2393	.91309
.43	.41687	.45862	2.1804	.90897
.44	.42594	.47078	2.1241	.90475
.45	.43497	.48306	2.0702	.90045
.46	.44395	.49545	2 0184	.89605
.47	.45289	.50797	1.9686	.89157
.48	.46178	.52061	1.9208	.88699
.49	.47063	.53339	1.8748	.88233
.50	.47943	.54630	1.8305	.87758
Rad	Sin	Tan	Cot	Cos

Rad.	Sin	Tan	Cot	Cos
.50	.47943	.54630	1.8305	.87758
.51	.48818	.55936	1.7878	.87274
.52	.49688	.57256	1.7465	.86782
.53	.50553	.58592	1.7067	.86281
.54	.51414	.59943	1.6683	.85771
.55	.52269	.61311	1.6310	.85252
.56	.53119	.62695	1.5950	.84726
.57	.53963	.64097	1.5601	.84190
.58	.54802	.65517	1.5263	.83646
.59	.55636	.66956	1.4935	.83094
.60	.56464	.68414	1.4617	.82534
.61	.57287	.69892	1.4308	.81965
.62	.58104	.71391	1.4007	.81388
.63	.58914	.72911	1.3715	.80803
.64	.59720	.74454	1.3431	.80210
.65	.60519	.76020	1.3154	.79608
.66	.61312	.77610	1.2885	.78999
.67	.62099	.79225	1.2622	.78382
.68	.62879	.80866	1.2366	.77757
.69	.63654	.82534	1.2116	.77125
.70	.64422	.84229	1.1872	.76484
.71	.65183	.85953	1.1634	.75836
.72	.65938	.87707	1.1402	.75181
.73	.66687	.89492	1.1174	.74517
.74	.67429	.91309	1.0952	.73847
.75	.68164	.93160	1.0734	.73169
.76	.68892	.95045	1.0521	.72484
.77	.69614	.96967	1.0313	.71791
.78	.70328	.98926	1 0109	.71091
.79	.71035	1.0092	.99084	.70385
.80	.71736	1.0296	.97121	.69671
.81	.72429	1.0505	.95197	.68950
.82	.73115	1.0717	.93309	.68222
.83	.73793	1.0934	.91455	.67488
.84	.74464	1.1156	.89635	.66746
.85	.75128	1.1383	.87848	.65998
.86	.75784	1.1616	.86091	.65244
.87	.76433	1.1853	.84365	.64483
.88	.77074	1.2097	.82668	.63715
.89	.77707	1.2346	.80998	.62941
.90	.78333	1.2602	.79355	.62161
.91	.78950	1.2864	.77738	.61375
.92	.79560	1.3133	.76146	.60582
.93	.80162	1.3409	.74578	.59783
.94	.80756	1.3692	.73034	.58979
.95	.81342	1.3984	.71511	.58168
.96	.81919	1.4284	.70010	.57352
.97	.82489	1.4592	.68531	.56530
.98	.83050	1.4910	.67071	.55702
.99	.83603	1.5237	.65631	.54869
1.00	84147	1.5574	.64209	.54030
Rad.	Sin	Tan	Cot	Cos

FUNCTIONS FOR ANGLES IN RADIANS (Continued)

Rad.	Sin	Tan	Cot	Cos
1.00	.84147	1.5574	.64209	.54030
1.01	.84683	1.5922	.62806	.53186
1.02	.85211	1.6281	.61420	.52337
1.03	.85730	1.6652	.60051	.51482
1.04	.86240	1.7036	.58699	.50622
1.05	.86742	1.7433	.57362	.49757
1.06	.87236	1.7844	.56040	.48887
1.07	.87720	1.8270	.54734	.48012
1.08	.88196	1 8712	.53441	.47133
1.09	.88663	1.9171	.52162	.46249
1.10	.89121	1 9648	.50897	.45360
1 11	89570	2.0143	.49644	.44466
1 12	.90010	2 0660	.48404	.43568
1.13	.90441	2.1198	.47175	.42666
1.14	.90863	2.1759	.45959	.41759
1 15	.91276	2 2345	.44753	.40849
1 16	91680	2.2958	.43558	.39934
1 17	.92075	2.3600	.42373	.39015
1 18	.92461	2 4273	.41199	.38092
1.19	.92837	2.4979	.40034	.37166
1.20	.93204	2 5722	.38878	.36236
1 21	.93562	2.6503	.37731	.35302
1 22	.93910	2 7328	.36593	34365
1.23	.94249	2.8198	.35463	.33424
1.24	94578	2.9119	.34341	.32480
1 25	94898	3 0096	.33227	.31532
1.26	.95209	3.1133	.32121	.30582
1.27	95510	3 2236	.31021	.29628
1.28	.95802	3 3413	.29928	.28672
1.29	.96084	3.4672	.28842	.27712
1.30	96356	3.6021	.27762	.26750
1 31	.96618	3.7471	.26687	.25785
1.32	.96872	3.9033	.25619	.24818
1 33	97115	4.0723	.24556	.23848
1 34	.97348	4.2556	.23498	.22875
1 35	.97572	4 4552	.22446	.21901
1 36	97786	4.6734	.21398	20924
1 37	97991	4.9131	.20354	.19945
1.38	.98185	5.1774	.19315	.18964
1.39	.98370	5.4707	.18279	.17981
1.40	98545	5 7979	.17248	.16997
1.41	.98710	6.1654	.16220	.16010
1 42	98865	6.5811	.15195	.15023
1.43	.99010	7.0555	.14173	.14033
1.44	.99146	7.6018	.13155	.13042
1.45	99271	8.2381	.12139	.12050
1.46	99387	8 9886	.11125	.11057
1 47	.99492	9.8874	.10114	.10063
1 48	.99588	10.983	.09105	.09067
1.49	.99674	12.350	.08097	.08071
1.50	.99749	14.101	.07091	.07074
Rad.	Sin	Tan	Cot	Cos

Rad	Sin	Tan	Cot	Cos
1.50	99749	14.101	.07091	.07074
1.51	.99815	16.428	.06087	.06076
1.52	.99871	19.670	.05084	.05077
1.53	99917	24.498	.04082	.04079
1.54	.99953	32.461	.03081	.03079
1.55	.99978	48 078	.02080	.02079
1.56	.99994	92.621	.01080	.01080
1.57	1 0000	1255 8	.00080	.00080
1.58	.99996	−108 65	−.00920	−.00920
1.59	99982	−52.067	−.01921	−.01920
1.60	.99957	−34.233	−.02921	−.02920
1.61	99923	−25.495	−.03922	−.03919
1.62	.99879	−20.307	−.04924	−.04918
1.63	99825	−16.871	−.05927	−.05917
1.64	99761	−14.427	−.06931	−.06915
1.65	99687	−12.599	−.07937	−.07912
1.66	99602	−11 181	−.08944	−.08909
1.67	99508	−10 047	−.09953	−.09904
1.68	.99404	−9.1208	−.10964	−.10899
1.69	99290	−8.3492	−.11977	−.11892
1.70	.99166	−7.6966	−.12993	−.12884
1.71	99033	−7.1373	−.14011	−.13875
1.72	98889	−6.6524	−.15032	−.14865
1.73	98735	−6 2281	−.16056	−.15853
1.74	98572	−5.8535	−.17084	−.16840
1 75	98399	−5.5204	−.18115	−.17825
1.76	.98215	−5.2221	−.19149	−.18808
1.77	.98022	−4.9534	−.20188	−.19789
1.78	97820	−4.7101	−.21231	−.20768
1.79	.97607	−4.4887	−.22278	−.21745
1.80	.97385	−4.2863	−.23330	−.22720
1.81	.97153	−4.1005	−.24387	−.23693
1.82	96911	−3 9294	−.25449	−.24663
1.83	96659	−3.7712	−.26517	−.25631
1.84	.96398	−3.6245	−.27590	−.26596
1.85	.96128	−3 4881	−.28669	−.27559
1.86	95847	−3.3608	−.29755	−.28519
1.87	95557	−3.2419	−.30846	−.29476
1.88	95258	−3.1304	−.31945	−.30430
1.89	.94949	−3.0257	−.33051	−.31381
1.90	.94630	−2.9271	−.34164	−.32329
1.91	.94302	−2 8341	−.35284	−.33274
1.92	93965	−2.7463	−.36413	−.34215
1.93	93618	−2.6632	−.37549	−.35153
1.94	.93262	−2.5843	−.38695	−.36087
1.95	92896	−2 5095	−.39849	−.37018
1.96	.92521	−2 4383	−.41012	−.37945
1.97	.92137	−2.3705	−.42185	−.38868
1.98	91744	−2 3058	−.43368	−.39788
1.99	.91341	−2.2441	−.44562	−.40703
2.00	90930	−2.1850	−.45766	−.41615
Rad.	Sin	Tan	Cot	Cos

LOGARITHMS OF THE FUNCTIONS FOR ANGLES IN RADIANS

Rad.	L. Sin	L. Tan	L. Cot	L. Cos
.00	− ∞	− ∞	∞	0.00000
.01	7.99999	8.00001	1.99999	9.99998
.02	8.30100	8.30109	1.69891	9.99991
.03	8.47706	8.47725	1.52275	9.99980
.04	8.60194	8.60229	1.39771	9.99965
.05	8.69879	8.69933	1.30067	9.99946
.06	8.77789	8.77867	1.22133	9.99922
.07	8.84474	8.84581	1.15419	9.99894
.08	8.90263	8.90402	1.09598	9.99861
.09	8.95366	8.95542	1.04458	9.99824
.10	8.99928	9.00145	0.99855	9.99782
.11	9.04052	9.04315	0.95685	9.99737
.12	9.07814	9.08127	0.91873	9.99687
.13	9.11272	9.11640	0.88360	9.99632
.14	9.14471	9.14898	0.85102	9.99573
.15	9.17446	9.17937	0.82063	9.99510
.16	9.20227	9.20785	0.79215	9.99442
.17	9.22836	9.23466	0.76534	9.99369
.18	9.25292	9.26000	0.74000	9.99293
.19	9.27614	9.28402	0.71598	9.99211
.20	9.29813	9.30688	0.69312	9.99126
.21	9.31902	9.32867	0.67133	9.99035
.22	9.33891	9.34951	0.65049	9.98940
.23	9.35789	9.36948	0.63052	9.98841
.24	9.37603	9.38866	0.61134	9.98737
.25	9.39341	9.40712	0.59288	9.98628
.26	9.41007	9.42492	0.57508	9.98515
.27	9.42607	9.44210	0.55790	9.98397
.28	9.44147	9.45872	0.54128	9.98275
.29	9.45629	9.47482	0.52518	9.98148
.30	9.47059	9.49043	0.50957	9.98016
.31	9.48438	9.50559	0.49441	9.97879
.32	9.49771	9.52034	0.47966	9.97737
.33	9.51060	9.53469	0.46531	9.97591
.34	9.52308	9.54868	0.45132	9.97440
.35	9.53516	9.56233	0.43767	9.97284
.36	9.54688	9.57565	0.42435	9.97123
.37	9.55825	9.58868	0.41132	9.96957
.38	9.56928	9.60142	0.39858	9.96786
.39	9.58000	9.61390	0.38610	9.96610
.40	9.59042	9.62613	0.37387	9.96429
.41	9.60055	9.63812	0.36188	9.96243
.42	9.61041	9.64989	0.35011	9.96051
.43	9.62000	9.66145	0.33855	9.95855
.44	9.62935	9.67282	0.32718	9.95653
.45	9.63845	9.68400	0.31600	9.95446
.46	9.64733	9.69500	0.30500	9.95233
.47	9.65599	9.70583	0.29417	9.95015
.48	9.66443	9.71651	0.28349	9.94792
.49	9.67268	9.72704	0.27296	9.94563
.50	9.68072	9.73743	0.26257	9.94329
Rad	L. Sin	L. Tan	L. Cot	L. Cos

Rad.	L. Sin	L. Tan	L. Cot	L. Cos
.50	9.68072	9.73743	0.26257	9.94329
.51	9.68858	9.74769	0.25231	9.94089
.52	9.69625	9.75782	0.24218	9.93843
.53	9.70375	9.76784	0.23216	9.93591
.54	9.71108	9.77774	0.22226	9.93334
.55	9.71824	9.78754	0.21246	9.93071
.56	9.72525	9.79723	0.20277	9.92801
.57	9.73210	9.80684	0.19316	9.92526
.58	9.73880	9.81635	0.18365	9.92245
.59	9.74536	9.82579	0.17421	9.91957
.60	9.75177	9.83514	0.16486	9.91663
.61	9.75805	9.84443	0.15557	9.91363
.62	9.76420	9.85364	0.14636	9.91056
.63	9.77022	9.86280	0.13720	9.90743
.64	9.77612	9.87189	0.12811	9.90423
.65	9.78189	9.88093	0.11907	9.90096
.66	9.78754	9.88992	0.11008	9.89762
.67	9.79308	9.89886	0.10114	9.89422
.68	9.79851	9.90777	0.09223	9.89074
.69	9.80382	9.91663	0.08337	9.88719
.70	9.80903	9.92546	0.07454	9.88357
.71	9.81414	9.93426	0.06574	9.87988
.72	9.81914	9.94303	0.05697	9.87611
.73	9.82404	9.95178	0.04822	9.87226
.74	9.82885	9.96051	0.03949	9.86833
.75	9.83355	9.96923	0.03077	9.86433
.76	9.83817	9.97793	0.02207	9.86024
.77	9.84269	9.98662	0.01338	9.85607
.78	9.84713	9.99531	0.00469	9.85182
.79	9.85147	0.00400	9.99600	9.84748
.80	9.85573	0.01268	9.98732	9.84305
.81	9.85991	0.02138	9.97862	9.83853
.82	9.86400	0.03008	9.96992	9.83393
.83	9.86802	0.03879	9.96121	9.82922
.84	9.87195	0.04752	9.95248	9.82443
.85	9.87580	0.05627	9.94373	9.81953
.86	9.87958	0.06504	9.93496	9.81454
.87	9.88328	0.07384	9.92616	9.80944
.88	9.88691	0.08266	9.91734	9.80424
.89	9.89046	0.09153	9.90847	9.79894
.90	9.89394	0.10043	9.89957	9.79352
.91	9.89735	0.10937	9.89063	9.78799
.92	9.90070	0.11835	9.88165	9.78234
.93	9.90397	0.12739	9.87261	9.77658
.94	9.90717	0.13648	9.86352	9.77070
.95	9.91031	0.14563	9.85437	9.76469
.96	9.91339	0.15484	9.84516	9.75855
.97	9.91639	0.16412	9.83588	9.75228
.98	9.91934	0.17347	9.82653	9.74587
.99	9.92222	0.18289	9.81711	9.73933
1.00	9.92504	0.19240	9.80760	9.73264
Rad.	L. Sin	L. Tan	L. Cot	L. Cos

LOGARITHMS OF FUNCTIONS FOR ANGLES IN RADIANS (Continued)

Rad.	L Sin	L. Tan	L. Cot	L. Cos
1.00	9.92504	0.19240	9.80760	9 73264
1 01	9.92780	0.20200	9.79800	9.72580
1.02	9.93049	0.21169	9.78831	9.71881
1.03	9.93313	0.22148	9.77852	9.71165
1.04	9.93571	0.23137	9.76863	9.70434
1 05	9.93823	0.24138	9.75862	9 69686
1 06	9.94069	0.25150	9.74850	9.68920
1 07	9.94310	0.26175	9.73825	9.68135
1 08	9.94545	0.27212	9.72788	9.67332
1.09	9.94774	0.28264	9.71736	9.66510
1.10	9.94998	0.29331	9.70669	9.65667
1.11	9.95216	0.30413	9.69587	9.64803
1 12	9 95429	0.31512	9.68488	9.63917
1.13	9.95637	0.32628	9 67372	9 63008
1.14	9.95839	0.33763	9.66237	9.62075
1.15	9.96036	0 34918	9 65082	9 61118
1.16	9 96228	0.36093	9.63907	9.60134
1.17	9.96414	0.37291	9.62709	9 59123
1.18	9.96596	0 38512	9 61488	9.58084
1.19	9.96772	0 39757	9 60243	9.57015
1.20	9.96943	0.41030	9.58970	9.55914
1 21	9.97110	0.42330	9 57670	9 54780
1 22	9.97271	0.43660	9.56340	9 53611
1.23	9.97428	0.45022	9.54978	9.52406
1.24	9.97579	0.46418	9.53582	9.51161
1 25	9.97726	0.47850	9.52150	9 49875
1.26	9.97868	0.49322	9 50678	9 48546
1.27	9.98005	0.50835	9.49165	9 47170
1 28	9.98137	0 52392	9.47608	9 45745
1.29	9.98265	0 53998	9.46002	9.44267
1.30	9.98388	0 55656	9 44344	9.42732
1 31	9.98506	0.57369	9.42631	9 41137
1 32	9.98620	0.59144	9.40856	9 39476
1.33	9.98729	0.60984	9.39016	9 37744
1.34	9.98833	0.62896	9.37104	9 35937
1.35	9.98933	0.64887	9.35113	9.34046
1 36	9.99028	0 66964	9.33036	9.32064
1 37	9.99119	0.69135	9.30865	9 29983
1.38	9.99205	0 71411	9.28589	9 27793
1.39	9.99286	0.73804	9.26196	9.25482
1.40	9.99363	0 76327	9 23673	9.23036
1 41	9.99436	0.78996	9.21004	9 20440
1.42	9.99504	0.81830	9.18170	9.17674
1.43	9.99568	0.84853	9.15147	9.14716
1.44	9.99627	0.88092	9.11908	9.11536
1.45	9.99682	0.91583	9.08417	9.08100
1.46	9.99733	0.95369	9.04631	9.04364
1.47	9.99779	0.99508	9.00492	9 00271
1.48	9.99821	1.04074	8 95926	8 95747
1.49	9.99858	1.09166	8.90834	8.90692
1.50	9.99891	1.14926	8.85074	8.84965
Rad.	L. Sin	L. Tan	L. Cot	L. Cos

Rad	L. Sin	L. Tan	L Cot	L. Cos
1.50	9.99891	1.14926	8.85074	8 84965
1.51	9.99920	1.21559	8.78441	8.78361
1.52	9.99944	1 29379	8.70621	8 70565
1 53	9 99964	1.38914	8.61086	8.61050
1.54	9.99979	1.51136	8.48864	8 48843
1.55	9.99991	1.68195	8 31805	8.31796
1.56	9.99997	1.96671	8.03329	8.03327
1.57	0.00000	3.09891	6.90109	6 90109
1.58	9.99998	2.03603*	7 96397*	7 96396*
1.59	9.99992	1.71656	8 28344	8.28336
1.60	9.99981	1.53444	8.46556	8 46538
1.61	9.99967	1.40645	8 59355	8 59323
1 62	9 99947	1 30765	8.69235	8 69182
1.63	9.99924	1.22714	8 77286	8.77209
1.64	9.99896	1.15918	8.84082	8 83978
1.65	9 99864	1.10035	8 89965	8 89829
1 66	9.99827	1.04847	8 95154	8.94981
1.67	9.99786	1.00204	8.99796	8 99582
1 68	9.99741	0.96003	9 03997	9 03737
1 69	9.99691	0.92165	9.07835	9 07526
1.70	9.99636	0 88630	9.11370	9 11007
1 71	9.99578	0 85353	9.14647	9 14225
1 72	9.99515	0 82298	9.17702	9 17217
1 73	9.99447	0 79436	9 20564	9.20012
1.74	9.99375	0.76742	9.23258	9.22634
1 75	9.99299	0.74197	9 25803	9 25102
1 76	9.99218	0.71784	9 28216	9 27434
1.77	9.99133	0.69490	9 30510	9 29642
1 78	9.99043	0.67303	9.32697	9 31740
1 79	9 98948	0.65212	9 34788	9 33736
1.80	9.98849	0.63208	9 36792	9.35641
1 81	9.98745	0 61284	9 38716	9 37462
1 82	9.98637	0 59432	9 40568	9.39205
1 83	9.98524	0.57648	9.42352	9.40877
1.84	9.98407	0.55925	9.44075	9.42482
1.85	9.98285	0.54258	9.45742	9 44026
1 86	9 98158	0 52645	9.47355	9 45513
1.87	9.98026	0 51080	9.48920	9 46947
1 88	9.97890	0.49560	9.50440	9 48330
1 89	9.97749	0.48082	9.51918	9 49667
1.90	9.97603	0.46644	9.53356	9 50959
1.91	9.97452	0 45242	9 54758	9 52210
1.92	9.97296	0 43875	9.56125	9.53422
1.93	9 97136	0.42540	9.57460	9 54597
1.94	9.96970	0.41235	9.58765	9 55735
1.95	9.96800	0.39958	9 60042	9.56841
1.96	9.96624	0.38708	9.61292	9.57916
1.97	9.96443	0 37484	9.62516	9 58960
1 98	9.96258	0 36283	9 63717	9 59975
1.99	9.96067	0.35104	9.64896	9 60963
2.00	9.95871	0.33946	9.66054	9.61925
Rad.	L Sin	L Tan	L. Cot	L Cos

* Values of the cosine, tangent and cotangent for angles in the table, 1.58 radians and above, are negative.

HAVERSINES

The following table gives the values of the haversines and their logarithms for angles from 0 to 180° at 10 minute intervals. Characteristics of the logarithms are omitted.

°	0′ Value	0′ Log	10′ Value	10′ Log	20′ Value	20′ Log	30′ Value	30′ Log	40′ Value	40′ Log	50′ Value	50′ Log
0	.0000	—	.0000	$\bar{6}$.3254	.0000	$\bar{6}$.9275	.0000	$\bar{5}$.2796	.0000	$\bar{5}$.5295	.0001	$\bar{5}$.7233
1	.0001	$\bar{5}$.8817	.0001	.0156	.0001	.1316	.0002	.2339	.0002	.3254	.0003	.4081
2	.0003	.4837	.0004	.5532	.0004	.6176	.0005	.6775	.0005	.7336	0006	.7862
3	.0007	.8358	.0008	.8828	.0008	.9273	.0009	.9607	.0010	.0101	.0011	.0487
4	.0012	.0856	0013	.1211	.0014	.1551	.0015	.1879	.0017	.2195	.0018	.2499
5	.0019	.2794	0020	.3078	.0022	.3354	.0023	.3621	.0024	.3880	.0026	.4132
6	.0027	.4376	.0029	.4614	.0031	.4845	.0032	.5071	.0034	.5290	.0036	.5504
7	.0037	.5714	0039	.5918	.0041	.6117	.0043	.6312	.0045	.6503	.0047	.6689
8	.0049	.6872	.0051	.7051	.0053	.7226	.0055	.7397	.0057	.7566	.0059	.7731
9	.0062	.7893	.0064	.8052	.0066	.8208	.0069	.8361	.0071	.8512	.0073	.8660
10	.0076	.8806	.0079	.8949	.0081	.9090	.0084	.9229	.0086	.9365	.0089	.9499
11	.0092	.9631	.0095	.9762	.0097	.9890	0100	.0016	.0103	.0141	.0106	.0264
12	.0109	.0385	.0112	.0504	.0115	.0622	.0119	.0738	.0122	.0852	.0125	.0966
13	.0128	.1077	.0131	.1187	.0135	.1296	.0138	.1404	.0142	.1510	0145	.1614
14	.0149	.1718	0152	.1820	.0156	.1921	.0159	.2021	0163	.2120	0167	.2217
15	.0170	.2314	.0174	.2409	.0178	.2504	.0182	.2597	.0186	.2689	0190	.2781
16	0194	2871	0198	.2961	0202	.3049	.0206	.3137	.0210	.3223	0214	.3309
17	0218	.3394	0223	.3478	.0227	.3561	.0231	.3644	0236	.3726	0240	.3807
18	.0245	.3887	.0249	.3966	.0254	4045	.0258	.4123	0263	.4200	.0268	.4276
19	.0272	.4352	0277	.4427	0282	.4502	.0287	.4576	.0292	.4649	0297	.4721
20	.0302	.4793	0307	.4865	0312	.4935	.0317	.5006	0322	.5075	0327	.5144
21	.0332	.5213	0337	.5281	.0343	.5348	.0348	.5415	0353	.5481	.0359	.5547
22	.0364	.5612	.0370	.5677	.0375	.5741	.0381	.5805	0386	.5868	0392	.5931
23	0397	.5993	.0403	.6055	.0409	.6116	.0415	.6177	0421	.6238	0426	.6298
24	0432	.6358	.0438	.6417	.0444	.6476	.0450	.6534	0456	.6592	.0462	.6650
25	.0468	.6707	.0475	.6764	.0481	.6820	0487	.6876	.0493	.6932	.0500	.6987
26	.0506	.7042	0512	.7096	.0519	.7150	0525	.7204	.0532	.7258	.0538	.7311
27	.0545	.7364	0552	.7416	.0558	.7468	.0565	.7520	.0572	.7572	.0578	.7623
28	.0585	.7674	.0592	.7724	.0599	.7774	0606	.7824	.0613	.7874	0620	7923
29	.0627	.7972	0634	.8021	.0641	.8069	.0648	.8117	0655	.8165	0663	.8213
30	.0670	.8260	.0677	.8307	0684	.8354	0692	.8400	.0699	8446	.0707	.8492
31	.0714	.8538	0722	.8583	.0729	.8629	.0737	.8673	0744	8718	.0752	.8763
32	.0760	.8807	0767	.8851	.0775	.8894	.0783	.8938	.0791	.8981	.0799	.9024
33	.0807	.9067	.0815	.9109	.0823	.9152	0831	.9194	.0839	.9236	.0847	.9277
34	0855	.9319	.0863	.9360	0871	.9401	0879	.9442	0888	9482	0896	.9523
35	.0904	.9563	.0913	.9603	.0921	.9643	.0929	.9682	0938	9721	0946	.9761
36	.0955	.9800	.0963	.9838	.0972	.9877	.0981	.9915	.0989	.9954	0998	.9992
37	.1007	.0030	.1016	.0067	.1024	.0105	.1033	.0142	.1042	.0179	1051	.0216
38	.1060	.0253	.1069	.0289	.1078	.0326	.1087	.0362	.1096	.0398	1105	.0434
39	.1114	.0470	.1123	.0505	.1133	.0541	.1142	.0576	.1151	.0611	.1160	.0646
40	.1170	.0681	.1179	.0716	1189	.0750	.1198	.0784	1207	0819	1217	.0853
41	.1226	.0887	.1236	.0920	.1246	.0954	.1255	.0987	.1265	.1020	1275	.1054
42	.1284	.1087	.1294	.1119	.1304	.1152	.1314	.1185	1323	.1217	.1333	.1249
43	.1343	.1282	.1353	.1314	.1363	.1345	.1373	.1377	.1383	.1409	.1393	.1440
44	.1403	.1472	.1413	.1503	.1424	.1534	.1434	.1565	.1444	.1596	.1454	.1626
45	.1464	.1657	.1475	.1687	.1485	.1718	.1495	.1748	.1506	.1778	.1516	.1808
46	.1527	.1838	.1537	.1867	.1548	.1897	.1558	.1926	.1569	.1956	1579	.1985
47	.1590	.2014	1601	.2043	.1611	.2072	.1622	.2101	.1633	.2129	.1644	.2158
48	.1654	.2186	.1665	.2215	1676	.2243	1687	.2271	.1698	.2299	.1709	.2327
49	.1720	.2355	.1731	.2382	.1742	.2410	.1753	.2437	.1764	.2465	.1775	.2492
50	.1786	.2519	.1797	.2546	.1808	.2573	.1820	.2600	.1831	.2627	.1842	.2653
51	.1853	.2680	.1865	.2706	.1876	.2732	.1887	.2759	.1899	.2785	.1910	.2811
52	.1922	.2837	.1933	2863	1945	.2888	.1956	.2914	.1968	.2940	1979	.2965
53	.1991	.2991	2003	.3016	.2014	.3041	.2026	.3066	2038	.3091	.2049	.3116
54	.2061	.3141	.2073	.3166	.2085	.3190	2096	.3215	.2108	.3239	.2120	.3264
55	.2132	.3288	.2144	.3312	.2156	.3336	.2168	.3361	.2180	.3384	.2192	.3408
56	.2204	.3432	.2216	.3456	.2228	.3480	.2240	.3503	.2252	.3527	.2265	.3550
57	.2277	.3573	.2289	.3596	.2301	.3620	2314	.3643	.2326	.3666	.2338	.3689
58	.2350	.3711	.2363	.3734	.2375	.3757	.2388	.3779	.2400	.3802	2412	.3824
59	.2425	.3847	.2437	.3869	.2450	.3891	.2462	.3913	2475	.3935	.2487	.3957

HAVERSINES (Continued)

Characteristics of the logarithms are omitted.

°	0′ Value	0′ Log	10′ Value	10′ Log	20′ Value	20′ Log	30′ Value	30′ Log	40′ Value	40′ Log	50′ Value	50′ Log
60	2500	.3979	2513	.4001	2525	.4023	2538	.4045	2551	.4066	2563	.4088
61	2576	.4109	.2589	.4131	2601	.4152	2614	.4173	2627	.4195	.2640	4216
62	2653	.4237	.2665	.4258	.2678	.4279	.2691	.4300	2704	.4320	2717	.4341
63	2730	.4362	2743	.4382	.2756	.4403	2769	.4423	2782	.4444	2795	.4464
64	2808	.4484	2821	.4504	.2834	.4524	2847	.4545	2861	.4565	.2874	.4584
65	2887	.4604	.2900	.4624	2913	.4644	.2927	.4664	.2940	.4683	2953	.4703
66	.2966	.4722	.2980	.4742	.2993	.4761	.3006	.4780	3020	.4799	.3033	.4819
67	.3046	4838	3060	.4857	.3073	.4876	3087	.4895	3100	.4914	3113	4932
68	3127	.4951	3140	.4970	.3154	.4989	3167	.5007	3181	.5026	3195	5044
69	3208	.5063	.3222	.5081	3235	.5099	3249	.5117	3263	.5136	3276	.5154
70	.3290	.5172	3304	.5190	.3317	.5208	3331	.5226	3345	5244	3358	.5261
71	3372	.5279	3386	.5297	3400	.5314	3413	.5332	3427	.5349	3441	.5367
72	3455	.5384	3469	5402	.3483	.5419	3496	.5436	3510	.5454	3524	.5471
73	3538	.5488	.3552	.5505	3566	.5522	.3580	.5539	.3594	.5556	3608	.5572
74	.3622	5589	3636	.5606	3650	.5623	3664	.5639	.3678	.5656	3692	.5672
75	3706	.5689	.3720	.5705	3734	.5722	3748	.5738	3762	5754	3776	.5771
76	3790	.5787	3805	.5803	3819	.5819	3833	.5835	3847	.5851	3861	.5867
77	3875	.5883	3889	.5899	3904	.5915	3918	.5930	.3932	.5946	3946	.5962
78	3960	.5977	3975	.5993	3989	6009	4003	.6024	4017	6039	4032	.6055
79	4046	.6070	4060	.6086	4075	.6101	4089	.6116	.4103	6131	4117	.6146
80	4132	.6161	4146	.6176	4160	.6191	4175	6206	.4189	6221	4203	6236
81	.4218	.6251	4232	.6266	.4247	.6280	4261	.6295	.4275	.6310	4290	.6324
82	4304	.6339	.4319	.6353	4333	.6368	4347	.6382	4362	.6397	4376	.6411
83	4391	6425	4405	.6440	4420	.6454	.4434	.6468	4448	6482	4463	.6496
84	4477	.6510	.4492	.6524	4506	.6538	4521	.6552	.4535	.6566	4550	6580
85	.4564	.6594	.4579	.6607	4593	.6621	4608	.6635	4622	.6648	.4637	.6662
86	4651	6676	4666	.6689	4680	.6703	.4695	6716	4709	.6730	4724	.6743
87	.4738	.6756	4753	.6770	4767	.6783	4782	.6796	.4796	.6809	.4811	.6822
88	4826	.6835	.4840	.6848	4855	.6862	.4869	.6875	4884	.6887	.4898	.6900
89	4913	.6913	.4927	6926	4942	.6939	4956	.6952	4971	.6964	4985	.6977
90	5000	.6990	5015	.7002	5029	.7015	5044	7027	.5058	.7040	5073	.7052
91	5087	.7065	5102	.7077	.5116	.7090	5131	.7102	5145	7114	.5160	.7126
92	5174	.7139	.5189	7151	5204	7163	.5218	.7175	.5233	.7187	.5247	.7199
93	5232	.7211	5276	7223	5291	.7235	5305	.7247	5320	.7259	5334	.7271
94	5349	.7283	5363	.7294	5378	.7306	5392	.7318	5407	7329	5421	.7341
95	5436	7353	5450	.7364	5465	7376	5479	7387	5494	7399	5508	.7410
96	5523	.7421	.5537	.7433	5552	.7444	.5566	.7455	.5580	.7467	.5595	.7478
97	5609	7489	5624	7500	5638	.7511	5653	.7523	5667	7534	5681	.7545
98	5696	.7556	5710	.7567	5725	.7577	5739	.7588	5753	7599	5768	.7610
99	5782	.7621	5797	7632	5811	7642	5825	.7653	5840	.7664	5854	.7674
100	.5868	.7685	.5883	.7696	5897	.7706	.5911	.7717	5925	.7727	5940	.7738
101	5054	.7748	5968	.7759	5983	.7769	5997	.7779	6011	.7790	6025	.7800
102	6040	.7810	6054	7820	6068	.7830	6082	.7841	.6096	.7851	6111	.7861
103	6125	7871	6139	.7881	6153	.7891	6167	.7901	6181	.7911	6195	.7921
104	6210	.7931	6224	.7940	.6238	.7950	6252	.7960	6266	.7970	6280	.7980
105	6294	7989	6308	.7999	6322	.8009	6336	.8018	6350	.8028	6364	.8037
106	6378	.8047	6392	.8056	.6406	.8066	6420	.8075	.6434	.8085	6448	.8094
107	6462	.8104	.6476	.8113	.6490	.8122	6504	.8131	6517	.8141	6531	.8150
108	6545	.8159	6559	.8168	.6573	.8177	6587	.8187	.6600	.8196	6614	.8205
109	6628	.8214	.6642	.8223	6655	.8232	6669	8241	6683	.8250	6696	.8258
110	6710	.8267	6724	.8276	6737	.8285	6751	.8294	.6765	.8302	6778	.8311
111	.6792	.8320	6805	.8329	.6819	.8337	.6833	.8346	.6846	.8354	6860	.8363
112	6873	.8371	6887	.8380	.6900	.8388	6913	.8397	6927	.8405	6940	.8414
113	6954	.8422	.6967	.8430	6980	.8439	6994	.8447	.7007	.8455	7020	.8464
114	.7034	.8472	.7047	8480	.7060	.8488	.7073	8496	.7087	.8504	7100	.8513
115	.7113	.8521	7126	.8529	.7139	.8537	.7153	.8545	7166	8553	.7179	.8561
116	.7192	.8568	.7205	.8576	7218	.8584	7231	.8592	7244	8600	.7257	8608
117	.7270	.8615	.7283	.8623	7296	.8631	7309	.8638	.7322	8646	7335	8654
118	7347	.8661	7360	.8669	.7373	.8676	7386	8684	7399	.8691	.7411	.8699
119	.7424	.8706	.7437	.8714	7449	.8721	.7462	.8729	7475	.8736	7487	.8743

HAVERSINES (Continued)

Characteristics of the logarithms are omitted.

°	0′ Value	0′ Log	10′ Value	10′ Log	20′ Value	20′ Log	30′ Value	30′ Log	40′ Value	40′ Log	50′ Value	50′ Log
120	.7500	8751	.7513	.8758	.7525	.8765	7538	.8772	.7550	8780	7563	.8787
121	.7575	.8794	.7588	.8801	.7600	.8808	.7612	.8815	.7625	.8822	.7637	.8829
122	.7650	.8836	.7662	.8843	.7674	.8850	.7686	.8857	.7699	.8864	.7711	.8871
123	.7723	.8878	.7735	.8885	.7748	.8892	.7760	.8898	.7772	.8905	.7784	.8912
124	.7796	.8919	.7808	.8925	.7820	.8932	.7832	.8939	.7844	.8945	.7856	.8952
125	.7868	.8959	.7880	.8965	.7892	.8972	.7904	.8978	.7915	.8985	.7927	.8991
126	.7939	.8998	.7951	.9004	.7962	.9010	.7974	.9017	.7986	.9023	7997	9030
127	.8009	.9036	.8021	.9042	.8032	.9048	.8044	.9055	.8055	.9061	.8067	.9067
128	.8078	9073	.8090	.9079	.8101	.9085	.8113	.9092	.8124	.9098	.8135	.9104
129	.8147	.9110	.8158	.9116	.8169	.9122	.8180	.9128	.8192	.9134	.8203	.9140
130	.8214	.9146	.8225	.9151	.8236	.9157	.8247	.9163	.8258	.9169	.8269	.9175
131	.8280	.9180	.8291	.9186	.8302	.9192	.8313	.9198	.8324	.9203	.8335	.9209
132	.8346	.9215	.8356	.9220	.8367	.9226	.8378	.9231	.8389	.9237	.8399	.9242
133	.8410	9248	.8421	.9253	.8431	.9259	.8442	.9264	.8452	.9270	.8463	.9275
134	.8473	.9281	.8484	.9286	.8494	.9291	.8505	.9297	.8515	.9302	.8525	.9307
135	.8536	.9312	.8546	.9318	.8556	.9323	.8566	.9328	.8576	.9333	.8587	.9338
136	.8597	.9343	.8607	.9348	.8617	.9353	.8627	.9359	.8637	.9364	.8647	.9369
137	.8657	.9374	.8667	.9379	.8677	.9383	.8686	.9388	.8696	.9393	.8706	.9398
138	8716	9403	.8725	.9408	.8735	.9413	.8745	.9417	.8754	.9422	.8764	.9427
139	.8774	9432	.8783	.9436	.8793	.9441	.8802	.9446	.8811	.9450	.8821	.9455
140	.8830	9460	8840	.9464	.8849	.9469	.8858	.9473	.8867	.9478	.8877	.9482
141	.8886	.9487	.8895	.9491	.8904	.9496	.8913	.9500	.8922	.9505	.8931	.9509
142	.8940	.9513	.8949	.9518	.8958	.9522	.8967	.9526	.8976	.9531	.8984	.9535
143	.8993	.9539	.9002	.9543	.9011	.9548	.9019	.9552	9028	.9556	.9037	.9560
144	.9045	.9564	.9054	.9568	.9062	.9572	.9071	.9576	.9079	.9580	.9087	.9584
145	.9096	9588	.9104	.9592	.9112	.9596	.9121	.9600	.9129	.9604	.9137	.9608
146	.9145	.9612	.9153	.9616	.9161	.9620	.9169	.9623	.9177	.9627	.9185	.9631
147	.9193	.9635	.9201	.9638	.9209	.9642	.9217	.9646	9225	.9650	.9233	.9653
148	.9240	.9657	.9248	.9660	.9256	.9664	.9263	.9668	.9271	.9671	.9278	.9675
149	.9286	.9678	.9293	.9682	.9301	.9685	.9308	.9689	9316	.9692	.9323	.9695
150	.9330	.9699	.9337	.9702	.9345	.9706	9352	.9709	.9359	.9712	.9366	.9716
151	9373	.9719	.9380	.9722	.9387	.9725	.9394	.9729	.9401	.9732	.9408	.9735
152	.9415	.9738	.9422	.9741	.9428	.9744	.9435	.9747	.9442	.9751	.9448	.9754
153	.9455	.9757	.9462	.9760	.9468	.9763	.9475	.9766	.9481	.9769	.9488	.9772
154	.9494	.9774	.9500	.9777	.9507	.9780	.9513	.9783	.9519	.9786	.9525	.9789
155	.9532	.9792	.9538	.9794	.9544	.9797	.9550	.9800	.9556	.9803	.9562	.9805
156	.9568	.9808	.9574	.9811	.9579	.9813	.9585	.9816	.9591	.9819	.9597	.9821
157	.9603	.9824	.9608	.9826	.9614	.9829	.9619	9831	.9625	.9834	.9630	.9836
158	.9636	9839	.9641	.9841	.9647	.9844	.9652	.9846	.9657	.9849	.9663	.9851
159	.9668	.9853	.9673	.9856	.9678	.9858	.9683	.9860	.9688	.9863	.9693	.9865
160	.9698	9867	.9703	.9869	.9708	.9871	.9713	.9874	.9718	.9876	.9723	.9878
161	.9728	.9880	.9732	.9882	.9737	.9884	.9742	.9886	.9746	.9888	.9751	.9890
162	.9755	.9892	.9760	.9894	.9764	.9896	.9769	.9898	.9773	.9900	.9777	.9902
163	.9782	.9904	.9786	.9906	.9790	.9908	.9794	.9910	9798	.9911	.9802	.9913
164	.9806	9915	.9810	.9917	.9814	.9919	.9818	.9920	.9822	.9922	.9826	.9924
165	.9830	.9925	.9833	.9927	.9837	.9929	.9841	.9930	.9844	9932	.9848	.9933
166	.9851	.9935	.9855	.9937	.9858	.9938	.9862	.9940	.9865	.9941	.9869	.9943
167	.9872	.9944	.9875	.9945	.9878	.9947	.9881	.9948	.9885	.9950	.9888	.9951
168	.9891	.9952	.9894	.9954	.9897	.9955	.9900	.9956	.9903	.9957	.9905	.9959
169	.9908	.9960	.9911	.9961	.9914	.9962	.9916	.9963	.9919	.9965	.9921	.9966
170	.9924	.9967	.9927	.9968	.9929	.9969	.9931	.9970	.9934	.9971	.9936	.9972
171	.9938	.9973	.9941	.9974	.9943	.9975	.9945	.9976	.9947	.9977	.9949	.9978
172	.9951	.9979	.9953	.9980	.9955	.9981	.9957	.9981	.9959	.9982	.9961	.9983
173	.9963	.9984	.9964	.9985	.9966	.9985	.9968	.9986	.9969	.9987	.9971	.9987
174	.9973	.9988	.9974	.9989	.9976	.9989	.9977	.9990	.9978	.9991	.9980	.9991
175	.9981	.9992	.9982	.9992	.9983	.9993	.9985	.9993	.9986	.9994	.9987	.9994
176	.9988	.9995	.9989	.9995	.9990	.9996	.9991	.9996	.9992	.9996	.9992	.9997
177	.9993	.9997	.9994	.9997	.9995	.9998	.9995	.9998	.9996	.9998	.9996	9998
178	.9997	.9999	.9997	.9999	.9998	.9999	.9998	.9999	.9999	.9999	.9999	9999
179	.9999	.9999	.9999	.9999	1.0000	.0000	1.0000	.0000	1.0000	.0000	1.0000	.0000
180	1.0000	0000										

NATURAL OR NAPERIAN LOGARITHMS

0.000–0.499

N	0	1	2	3	4	5	6	7	8	9
0.00	−∞	−6† .90776	−6 .21461	−5 .80914	−5 .52146	−5 .29832	−5 .11600	−4 .96185	−4 82831	−4 71053
.01	−4 60517	.50986	.42285	.34281	.26870	.19971	.13517	.07454	01738	* 96332
.02	−3.91202	.86323	.81671	.77226	.72970	.68888	.64966	.61192	.57555	.54046
.03	.50656	.47377	.44202	.41125	.38139	35241	32424	29684	.27017	.24419
.04	.21888	.19418	.17009	.14656	.12357	.10109	.07911	.05761	.03655	.01593
.05	−2.99573	.97593	.95651	.93746	.91877	.90042	.88240	.86470	.84731	.83022
.06	.81341	.79688	.78062	.76462	.74887	.73337	.71810	.70306	.68825	67365
.07	.65926	.64508	.63109	.61730	.60369	.59027	.57702	.56395	55105	53831
.08	.52573	.51331	50104	48891	47694	.46510	.45341	.44185	43042	41912
.09	.40795	.39690	.38597	.37516	.36446	.35388	.34341	.33304	.32279	.31264
0.10	−2.30259	.29263	.28278	27303	.26336	.25379	.24432	.23493	.22562	.21641
.11	.20727	.19823	.18926	.18037	17156	.16282	.15417	.14558	.13707	.12863
.12	.12026	.11196	.10373	.09557	.08747	.07944	.07147	.06357	05573	04794
.13	.04022	.03256	.02495	01741	.00992	00248	*.99510	* 98777	* 98050	* 97328
.14	−1 96611	.95900	.95193	.94491	.93794	.93102	.92415	.91732	.91054	.90381
.15	.89712	.89048	.88387	.87732	.87080	.86433	.85790	.85151	84516	.83885
.16	.83258	.82635	.82016	.81401	.80789	.80181	.79577	.78976	.78379	77786
.17	.77196	.76609	.76026	.75446	.74870	.74297	.73727	.73161	.72597	72037
.18	.71480	.70926	.70375	69827	.69282	68740	.68201	.67665	.67131	66601
.19	.66073	.65548	.65026	.64507	.63990	.63476	.62964	.62455	.61949	61445
0.20	−1 60944	.60445	.59949	.59455	.58964	.58475	.57988	.57504	.57022	.56542
.21	.56065	.55590	.55117	.54646	.54178	.53712	.53248	52786	52326	.51868
.22	.51413	.50959	.50508	50058	49611	.49165	.48722	.48281	47841	.47403
.23	.46968	.46534	.46102	.45672	.45243	.44817	.44392	.43970	43548	.43129
.24	.42712	.42296	.41882	.41469	.41059	.40650	.40242	.39837	.39433	39030
.25	.38629	.38230	.37833	.37437	.37042	.36649	.36258	.35868	.35480	35093
.26	.34707	.34323	.33941	33560	.33181	.32803	.32426	.32051	.31677	31304
.27	.30933	.30564	30195	.29828	.29463	.29098	.28735	.28374	.28013	27654
.28	.27297	.26940	.26585	26231	.25878	.25527	25176	.24827	.24479	24133
.29	.23787	.23443	.23100	.22758	.22418	.22078	.21740	.21402	21066	.20731
0.30	−1.20397	.20065	.19733	.19402	.19073	.18744	.18417	.18091	.17766	.17441
.31	.17118	.16796	.16475	.16155	.15836	.15518	.15201	.14885	.14570	.14256
.32	.13943	13631	.13320	.13010	.12701	.12393	.12086	.11780	.11474	.11170
.33	.10866	.10564	.10262	.09961	.09661	.09362	09064	.08767	08471	.08176
.34	.07881	.07587	.07294	.07002	.06711	.06421	.06132	05843	.05555	.05268
.35	−1.04982	.04697	.04412	.04129	.03846	.03564	.03282	.03002	.02722	.02443
.36	02165	.01888	.01611	.01335	.01060	.00786	.00512	.00239	*.99967	*.99696
.37	−0 99425	.99155	.98886	.98618	.98350	.98083	.97817	.97551	.97286	.97022
.38	.96758	.96496	96233	.95972	.95711	.95451	.95192	.94933	.94675	.94418
.39	.94161	.93905	.93649	.93395	.93140	.92887	.92634	.92382	.92130	.91879
0.40	−0 91629	.91379	.91130	.90882	.90634	.90387	.90140	.89894	.89649	.89404
.41	.89160	.88916	.88673	.88431	.88189	.87948	.87707	.87467	.87227	86988
.42	.86750	.86512	.86275	.86038	.85802	.85567	.85332	.85097	.84863	.84630
.43	.84397	.84165	.83933	.83702	.83471	.83241	.83011	.82782	.82554	82326
.44	.82098	.81871	.81645	.81419	.81193	.80968	.80744	.80520	.80296	.80073
.45	.79851	.79629	.79407	.79186	.78966	.78746	.78526	.78307	.78089	.77871
.46	.77653	.77436	.77219	.77003	.76787	.76572	.76357	.76143	.75929	.75715
.47	.75502	.75290	.75078	.74866	.74655	.74444	.74234	.74024	.73814	.73605
.48	.73397	.73189	.72981	.72774	.72567	.72361	.72155	71949	71744	71539
.49	.71335	.71131	.70928	.70725	.70522	70320	70118	69917	.69716	.69515

† Note that the characteristics are given *above* the mantissa for the first line. In the second and following lines they are given at the left.

NATURAL OR NAPERIAN LOGARITHMS (Continued)

0.500–0.999

N	0	1	2	3	4	5	6	7	8	9
0.50	−0.69315	.69115	.68916	.68717	.68518	.68320	.68122	.67924	.67727	.67531
.51	.67334	.67139	.66943	.66748	.66553	.66359	.66165	.65971	.65778	.65585
.52	.65393	.65201	.65009	.64817	.64626	64436	.64245	.64055	.63866	.63677
.53	.63488	.63299	.63111	.62923	.62736	.62549	.62362	.62176	.61990	.61804
.54	.61619	.61434	.61249	.61065	.60881	.60697	.60514	.60331	.60148	.59966
.55	.59784	.59602	.59421	.59240	.59059	.58879	.58699	.58519	.58340	.58161
.56	.57982	.57803	.57625	.57448	.57270	.57093	.56916	.56740	.56563	.56387
.57	.56212	.56037	.55862	.55687	.55513	.55339	.55165	.54991	.54818	.54645
.58	.54473	.54300	.54128	.53957	.53785	.53614	.53444	.53273	.53103	.52933
.59	.52763	.52594	.52425	.52256	.52088	.51919	.51751	.51584	.51416	.51249
0.60	−0 51083	.50916	.50750	.50584	.50418	.50253	.50088	.49923	.49758	.49594
.61	.49430	.49266	.49102	.48939	.48776	.48613	.48451	.48289	48127	.47965
.62	.47804	.47642	.47482	.47321	.47160	.47000	.46840	.46681	.46522	.46362
.63	46204	.46045	.45887	.45728	.45571	.45413	.45256	.45099	.44942	.44785
.64	.44629	.44473	.44317	.44161	.44006	.43850	.43696	.43541	.43386	.43232
.65	.43078	.42925	.42771	.42618	.42465	.42312	.42159	.42007	.41855	.41703
.66	.41552	.41400	.41249	.41098	.40947	40797	.40647	.40497	40347	.40197
.67	.40048	.39899	.39750	.39601	.39453	.39304	.39156	.39008	.38861	.38713
.68	.38566	38419	.38273	.38126	.37980	.37834	.37688	.37542	.37397	.37251
.69	.37106	.36962	.36817	.36673	.36528	.36384	.36241	.36097	.35954	.35810
0.70	−0.35667	.35525	.35382	.35240	.35098	.34956	.34814	.34672	.34531	.34390
.71	.34249	.34108	.33968	.33827	.33687	.33547	.33408	.33268	.33129	.32989
.72	.32850	.32712	.32573	.32435	.32296	.32158	.32021	.31883	.31745	.31608
.73	.31471	.31334	.31197	.31061	.30925	.30788	.30653	.30517	.30381	.30246
.74	.30111	.29975	.29841	.29706	.29571	.29437	.29303	.29169	.29035	.28902
.75	.28768	.28635	.28502	.28369	.28236	.28104	.27971	.27839	.27707	.27575
.76	.27444	.27312	.27181	.27050	.26919	.26788	.26657	.26527	.26397	.26266
.77	.26136	.26007	.25877	.25748	.25618	.25489	.25360	.25231	.25103	.24974
.78	.24846	.24718	.24590	.24462	.24335	.24207	.24080	.23953	.23826	.23699
.79	.23572	.23446	.23319	.23193	.23067	.22941	.22816	.22690	.22565	.22439
0.80	−0.22314	.22189	.22065	.21940	.21816	.21691	.21567	.21443	.21319	.21196
.81	.21072	.20949	.20825	.20702	.20579	.20457	.20334	.20212	.20089	.19967
.82	.19845	.19723	.19601	.19480	.19358	.19237	.19116	.18995	.18874	.18754
.83	.18633	.18513	.18392	.18272	.18152	.18032	.17913	.17793	.17674	.17554
.84	.17435	.17316	.17198	.17079	.16960	.16842	.16724	.16605	.16487	.16370
.85	−0.16252	.16134	.16017	.15900	.15782	.15665	.15548	.15432	.15315	.15199
.86	.15032	.14966	.14850	.14734	.14618	.14503	.14387	.14272	.14156	.14041
.87	.13926	.13811	.13697	.13582	.13467	.13353	.13239	.13125	.13011	.12897
.88	.12783	.12670	.12556	.12443	.12330	.12217	.12104	.11991	.11878	.11766
.89	.11653	.11541	.11429	.11317	.11205	.11093	.10981	.10870	.10759	.10647
0.90	−0.10536	.10425	.10314	.10203	.10093	.09982	.09872	.09761	.09651	.09541
.91	.09431	.09321	.09212	.09102	.08992	.08883	08774	.08665	.08556	.08447
.92	.08338	.08230	.08121	.08013	.07904	.07796	.07688	.07580	.07472	.07365
.93	.07257	.07150	.07042	.06935	.06828	.06721	.06614	.06507	.06401	.06294
.94	.06188	.06081	.05975	.05869	.05763	.05657	.05551	.05446	.05340	.05235
.95	.05129	.05024	.04919	.04814	.04709	.04604	.04500	.04395	.04291	.04186
.96	.04082	.03978	.03874	.03770	.03666	.03563	.03459	.03356	03252	.03149
.97	.03046	.02943	.02840	.02737	.02634	.02532	.02429	.02327	.02225	.02122
.98	.02020	.01918	.01816	.01715	.01613	.01511	.01410	.01309	.01207	.01106
.99	.01005	.00904	.00803	.00702	.00602	.00501	.00401	.00300	.00200	.00100

NATURAL OR NAPERIAN LOGARITHMS (Continued)

To find the natural logarithm of a number which is $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, etc of a number whose logarithm is given, subtract from the given logarithm $\log_e 10$, $2 \log_e 10$, $3 \log_e 10$, etc.

To find the natural logarithm of a number which is 10, 100, 1000, etc times a number whose logarithm is given, add to the given logarithm $\log_e 10$, $2 \log_e 10$, $3 \log_e 10$, etc.

$\log_e 10 =$	2 30258 50930	$6 \log_e 10 =$	13 81551 05580
$2 \log_e 10 =$	4 60517 01860	$7 \log_e 10 =$	16 11809 56510
$3 \log_e 10 =$	6 90775 52790	$8 \log_e 10 =$	18 42068 07440
$4 \log_e 10 =$	9 21034 03720	$9 \log_e 10 =$	20 72326 58369
$5 \log_e 10 =$	11 51292 54650	$10 \log_e 10 =$	23 02585 09299

See preceding table for logarithms for numbers between 0 000 and 0 999

1.00–4.99

N	0	1	2	3	4	5	6	7	8	9
1.0	0 00000	00995	.01980	.02956	.03922	.04879	.05827	.06766	07696	08618
.1	.09531	10436	.11333	12222	.13103	.13976	.14842	.15700	.16551	17395
.2	.18232	19062	.19885	.20701	.21511	22314	.23111	.23902	.24686	.25464
.3	26236	27003	.27763	.28518	.29267	.30010	.30748	.31481	.32208	32930
.4	.33647	.34359	.35066	.35767	.36464	.37156	.37844	.38526	.39204	.39878
.5	.40547	41211	.41871	.42527	.43178	43825	.44469	.45108	.45742	46373
.6	47000	47623	.48243	.48858	49470	50078	.50682	.51282	.51879	52473
.7	53063	53649	.54232	54812	.55389	.55962	.56531	.57098	.57661	58222
.8	.58779	59333	.59884	.60432	.60977	.61519	62058	.62594	.63127	63658
.9	.64185	.64710	.65233	.65752	.66269	.66783	.67294	.67803	.68310	.68813
2.0	0 69315	69813	.70310	70804	.71295	.71784	.72271	.72755	.73237	.73716
.1	74194	74669	.75142	.75612	.76081	76547	77011	.77473	.77932	.78390
.2	78846	79299	.79751	80200	80648	81093	.81536	.81978	.82418	.82855
.3	.83291	83725	84157	.84587	.85015	85442	.85866	.86289	.86710	.87129
.4	.87547	87963	.88377	.88789	.89200	.89609	.90016	.90422	.90826	.91228
.5	.91629	.92028	.92426	.92822	.93216	.93609	94001	.94391	.94779	.95166
.6	95551	95935	96317	96698	.97078	97456	97833	98208	98582	98954
.7	99325	99695	* 00063	* 00430	* 00796	* 01160	* 01523	*.01885	*.02245	*.02604
.8	1 02962	03318	.03674	.04028	.04380	.04732	05082	.05431	05779	06126
.9	06471	06815	.07158	.07500	.07841	.08181	.08519	.08856	.09192	.09527
3.0	1 09861	10194	.10526	.10856	.11186	.11514	.11841	.12168	.12493	.12817
.1	13140	.13462	.13783	.14103	.14422	.14740	15057	.15373	.15688	.16002
.2	16315	.16627	16938	.17248	.17557	17865	.18173	.18479	.18784	19089
.3	19392	.19695	.19996	.20297	.20597	.20896	21194	.21491	.21788	22083
.4	22378	.22671	.22964	.23256	.23547	.23837	24127	24415	.24703	.24990
.5	25276	25562	.25846	26130	26413	.26695	.26976	.27257	.27536	27815
.6	.28093	28371	.28647	.28923	.29198	29473	.29746	.30019	.30291	.30563
.7	30833	31103	.31372	.31641	31909	.32176	.32442	32708	.32972	.33237
.8	33500	33763	.34025	.34286	.34547	.34807	.35067	.35325	.35584	.35841
.9	.36098	.36354	.36609	.36864	.37118	.37372	.37624	.37877	.38128	.38379
4.0	1 38629	.38879	.39128	.39377	.39624	.39872	.40118	.40364	.40610	.40854
.1	41099	.41342	.41585	.41828	.42070	.42311	.42552	.42792	.43031	.43270
.2	43508	.43746	.43984	.44220	.44456	.44692	.44927	.45161	.45395	.45629
.3	45862	46094	.46326	.46557	.46787	.47018	.47247	.47476	.47705	.47933
.4	48160	.48387	.48614	.48840	.49065	49290	.49515	.49739	.49962	.50185
.5	50408	50630	.50851	.51072	.51293	.51513	.51732	.51951	.52170	.52388
.6	.52606	52823	.53039	.53256	53471	.53687	.53902	.54116	.54330	54543
.7	.54756	54969	.55181	55393	55604	.55814	56025	.56235	.56444	.56653
8	.56862	57070	.57277	57485	.57691	57898	58104	58309	58515	58719
.9	.58924	.59127	59331	.59534	59737	.59939	60141	60342	60543	60744

NATURAL OR NAPERIAN LOGARITHMS (Continued)

5.00–9.99

N	0	1	2	3	4	5	6	7	8	9
5.0	1 60944	.61144	.61343	.61542	.61741	.61939	62137	62334	62531	62728
.1	.62924	63120	63315	.63511	.63705	.63900	.64094	.64287	.64481	.64673
.2	.64866	.65058	65250	.65441	.65632	65823	.66013	66203	.66393	.66582
.3	.66771	66959	.67147	.67335	.67523	.67710	67896	.68083	.68269	.68455
.4	.68640	.68825	.69010	.69194	.69378	.69562	.69745	.69928	.70111	.70293
.5	.70475	.70656	.70838	.71019	.71199	.71380	.71560	.71740	71919	.72098
.6	.72277	72455	72633	.72811	72988	.73166	73342	.73519	.73695	.73871
.7	.74047	.74222	74397	.74572	.74746	74920	.75094	75267	.75440	.75613
.8	.75786	.75958	76130	.76302	.76473	.76644	.76815	.76985	.77156	.77326
.9	.77495	.77665	.77834	.78002	.78171	.78339	.78507	.78675	.78842	.79009
6.0	1.79176	79342	.79509	.79675	.79840	.80006	.80171	.80336	80500	.80665
.1	.80829	.80993	.81156	.81319	.81482	.81645	.81808	.81970	.82132	.82294
.2	.82455	.82616	.82777	.82938	.83098	.83258	.83418	.83578	.83737	.83896
.3	.84055	.84214	.84372	.84530	.84688	.84845	.85003	.85160	.85317	.85473
.4	.85630	.85786	.85942	.86097	.86253	.86408	.86563	.86718	.86872	87026
.5	.87180	.87334	.87487	.87641	.87794	.87947	.88099	.88251	.88403	.88555
.6	.88707	.88858	.89010	.89160	.89311	.89462	.89612	.89762	.89912	.90061
.7	.90211	.90360	.90509	.90658	.90806	.90954	.91102	.91250	.91398	.91545
.8	.91692	.91839	.91986	.92132	.92279	.92425	.92571	.92716	.92862	.93007
.9	93152	.93297	.93442	.93586	.93730	.93874	.94018	.94162	.94305	.94448
7.0	1 94591	.94734	.94876	.95019	.95161	.95303	.95445	.95586	.95727	.95869
.1	96009	.96150	.96291	.96431	.96571	.96711	.96851	.96991	.97130	.97269
.2	.97408	.97547	.97685	.97824	.97962	.98100	.98238	.98376	.98513	98650
.3	.98787	.98924	.99061	.99198	.99334	.99470	.99606	.99742	.99877	*.00013
.4	2 00148	.00283	.00418	.00553	.00687	.00821	.00956	.01089	.01223	01357
.5	01490	.01624	.01757	.01890	.02022	.02155	.02287	.02419	.02551	.02683
.6	.02815	.02946	.03078	.03209	.03340	.03471	.03601	.03732	.03862	.03992
.7	04122	04252	.04381	.04511	.04640	.04769	.04898	.05027	.05156	.05284
.8	05412	.05540	.05668	.05796	.05924	.06051	.06179	.06306	.06433	.06560
.9	06686	.06813	.06939	.07065	.07191	.07317	.07443	.07568	.07694	.07819
8.0	2 07944	.08069	.08194	.08318	.08443	.08567	.08691	.08815	.08939	.09063
.1	.09186	.09310	.09433	.09556	.09679	.09802	.09924	.10047	.10169	.10291
.2	10413	.10535	.10657	.10779	.10900	.11021	.11142	.11263	.11384	.11505
.3	11626	11746	.11866	.11986	.12106	.12226	.12346	.12465	.12585	.12704
.4	12823	.12942	.13061	.13180	.13298	.13417	.13535	.13653	.13771	.13889
.5	.14007	.14124	.14242	.14359	.14476	.14593	.14710	.14827	.14943	.15060
.6	15176	15292	.15409	.15524	.15640	.15756	.15871	.15987	.16102	.16217
.7	16332	.16447	.16562	.16677	.16791	.16905	.17020	.17134	.17248	.17361
.8	17475	.17589	.17702	.17816	.17929	.18042	.18155	.18267	.18380	.18493
.9	18605	.18717	.18830	.18942	.19054	19165	.19277	.19389	.19500	19611
9.0	2 19722	.19834	.19944	.20055	.20166	.20276	.20387	.20497	.20607	.20717
.1	.20827	.20937	.21047	.21157	.21266	.21375	.21485	.21594	21703	.21812
.2	.21920	.22029	.22138	.22246	.22354	.22462	.22570	.22678	.22786	.22894
.3	.23001	.23109	.23216	.23324	.23431	.23538	.23645	.23751	.23858	.23965
.4	.24071	.24177	.24284	.24390	.24496	.24601	.24707	.24813	.24918	.25024
.5	.25129	.25234	.25339	.25444	.25549	.25654	.25759	.25863	.25968	.26072
.6	.26176	.26280	.26384	.26488	.26592	.26696	.26799	.26903	.27006	.27109
.7	.27213	.27316	.27419	.27521	.27624	.27727	.27829	.27932	.28034	.28136
.8	.28238	.28340	.28442	.28544	.28646	.28747	.28849	.28950	.29051	.29152
.9	.29253	.29354	.29455	.29556	.29657	.29757	.29858	.29958	.30058	.30158

NATURAL OR NAPERIAN LOGARITHMS (Continued)

Constants

$\log_e 10 = 2.30258\ 50930$	$6 \log_e 10 = 13.81551\ 05580$
$2 \log_e 10 = 4.60517\ 01860$	$7 \log_e 10 = 16.11809\ 56510$
$3 \log_e 10 = 6.90775\ 52790$	$8 \log_e 10 = 18.42068\ 07440$
$4 \log_e 10 = 9.21034\ 03720$	$9 \log_e 10 = 20.72326\ 58369$
$5 \log_e 10 = 11.51292\ 54650$	$10 \log_e 10 = 23.02585\ 09299$

10.0 49.9

N	0	1	2	3	4	5	6	7	8	9
10.	2 30259	31254	.32239	.33214	.34181	35138	36085	37024	37955	38876
11.	39790	40695	41591	42480	43361	44235	45191	45959	46810	47654
12.	48491	49321	.50144	.50960	.51770	52573	53370	.54160	54945	55723
13.	56495	.57261	.58022	.58776	59525	.60269	61007	.61740	62467	63189
14.	.63906	.64617	65324	.66026	66723	67415	.68102	.68785	.69463	.70136
15.	.70805	.71469	72130	.72785	.73437	74084	74727	.75366	.76001	76632
16	.77259	.77882	.78501	.79117	.79728	80336	80940	.81541	.82138	82731
17.	.83321	83908	.84491	85071	85647	.86220	.86790	.87356	.87920	88480
18.	.89037	89591	90142	90690	.91235	91777	.92316	.92852	.93386	93916
19.	.94444	.94969	.95491	.96011	96527	97041	.97553	.98062	.98568	.99072
20.	2 99573	* 00072	*.00568	* 01062	* 01553	* 02042	*.02529	* 03013	*.03495	* 03975
21.	3 04452	04927	.05400	.05871	.06339	.06805	07269	.07731	.08191	.08649
22.	.09104	09558	10009	.10459	.10906	11352	.11795	12236	.12676	13114
23.	.13549	.13983	.14415	.14845	.15274	.15700	.16125	.16548	.16969	17388
24.	.17805	.18221	.18635	.19048	19458	.19867	.20275	.20680	.21084	21487
25.	.21888	.22287	.22684	.23080	.23475	23868	24259	.24649	.25037	.25424
26.	.25810	.26194	.26576	.26957	.27336	.27714	28091	.28466	28840	29213
27.	.29584	29953	30322	.30689	31054	.31419	.31782	.32143	32504	32863
28.	.33220	33577	.33932	.34286	34639	.34990	35341	35690	36038	36384
29.	.36730	37074	.37417	37759	.38099	.38439	.38777	.39115	.39451	.39786
30.	3 40120	40453	40784	.41115	41444	.41773	.42100	.42426	42751	43076
31.	.43399	.43721	.44042	44362	44681	44999	.45316	.45632	.45947	46261
32.	.46574	.46886	.47197	.47507	47816	.48124	48431	.48738	.49043	49347
33.	.49651	49953	.50255	.50556	50856	.51155	51453	.51750	.52046	.52342
34.	.52636	.52930	53223	.53515	.53806	.54096	.54385	.54674	.54962	55249
35.	.55535	55820	56105	.56388	.56671	.56953	.57235	.57515	.57795	58074
36.	.58352	58629	58906	59182	59457	59731	.60005	60278	.60550	60821
37.	.61092	.61362	.61631	.61899	62167	62434	62700	.62966	63231	63495
38.	.63759	.64021	.64284	.64545	64806	.65066	65325	65584	.65842	66099
39.	.66356	66612	66868	67122	67377	67630	.67883	.68135	.68387	68638
40.	3.68888	.69138	.69387	.69635	69883	.70130	70377	.70623	.70868	.71113
41.	.71357	71601	.71844	72086	.72328	.72569	.72810	.73050	.73290	73529
42.	.73767	.74005	.74242	.74479	.74715	74950	75185	.75420	75654	75887
43.	.76120	.76352	.76584	.76815	.77046	77276	.77506	.77735	.77963	.78191
44.	.78419	.78646	.78872	79098	79324	.79549	.79773	.79997	.80221	.80444
45.	.80666	.80888	81110	81331	81551	81771	.81991	.82210	.82428	.82647
46.	.82864	83081	.83298	83514	83730	83945	84160	.84374	84588	84802
47.	.85015	.85227	85439	85651	.85862	.86073	.86283	.86493	.86703	86912
48.	.87120	87328	87536	87743	87950	88156	.88362	.88568	.88773	88978
49	89182	89386	89589	89792	89995	90197	90399	90600	90801	91002

NATURAL OR NAPERIAN LOGARITHMS (Continued)

50.0–99.9

N	0	1	2	3	4	5	6	7	8	9
50.	3.91202	.91402	.91602	.91801	.91999	92197	92395	.92593	.92790	.92986
51.	.93183	.93378	.93574	.93769	.93964	.94158	.94352	.94546	.94739	.94932
52.	.95124	.95316	95508	.95700	.95891	.96081	.96272	.96462	.96651	.96840
53.	.97029	.97218	.97406	.97594	.97781	.97968	.98155	.98341	.98527	.98713
54.	.98898	.99083	.99268	.99452	.99636	.99820	*.00003	*.00186	*.00369	*.00551
55.	4.00733	.00915	.01096	.01277	.01458	.01638	.01818	.01998	.02177	.02356
56.	.02535	.02714	.02892	.03069	.03247	.03424	.03601	.03777	.03954	.04130
57.	.04305	.04480	.04655	.04830	.05004	.05178	.05352	.05526	.05699	.05872
58.	.06044	.06217	.06389	.06560	.06732	.06903	.07073	.07244	.07414	.07584
59.	.07754	.07923	.08092	.08261	.08429	.08598	.08766	.08933	.09101	.09268
60.	4 09434	.09601	.09767	.09933	.10099	.10264	.10429	.10594	.10759	.10923
61.	.11087	.11251	.11415	.11578	.11741	.11904	.12066	.12228	.12390	12552
62.	.12713	.12875	.13036	.13196	.13357	.13517	.13677	.13836	.13996	.14155
63.	.14313	.14472	.14630	.14789	.14946	.15104	.15261	.15418	.15575	.15732
64.	.15888	.16044	.16200	.16356	.16511	.16667	.16821	.16976	.17131	.17285
65.	.17439	.17592	.17746	.17899	.18052	.18205	.18358	18510	.18662	.18814
66.	.18965	.19117	.19268	.19419	.19570	.19720	.19870	.20020	.20170	.20320
67.	.20469	.20618	.20767	.20916	.21065	.21213	.21361	.21509	.21656	21804
68.	.21951	.22098	.22244	.22391	.22537	.22683	.22829	.22975	.23120	.23266
69.	.23411	.23555	.23700	.23844	.23989	.24133	.24276	.24420	.24563	.24707
70.	4 24850	.24992	.25135	.25277	.25419	.25561	.25703	.25845	.25986	.26127
71.	.26268	.26409	.26549	.26690	.26830	.26970	.27110	.27249	.27388	.27527
72.	.27667	.27805	.27944	.28082	.28221	.28359	.28496	.28634	.28772	.28909
73.	.29046	.29183	.29320	.29456	.29592	.29729	.29865	30000	.30136	.30271
74.	.30407	.30542	.30676	.30811	.30946	.31080	.31214	.31348	.31482	.31615
75.	.31749	.31882	.32015	.32149	.32281	.32413	.32546	.32678	.32810	.32942
76.	.33073	.33205	.33336	.33467	.33598	.33729	.33860	.33990	.34120	.34251
77.	.34381	.34510	.34640	.34769	.34899	.35028	.35157	.35286	.35414	.35543
78.	.35671	.35800	.35927	.36055	.36182	.36310	.36437	.36564	.36691	.36818
79.	.36945	.37071	.37198	.37324	.37450	.37576	.37701	.37827	.37952	.38078
80.	4.38203	.38328	.38452	.38577	.38701	.38826	.38950	.39074	.39198	.39321
81.	.39445	.39568	.39692	.39815	.39938	.40060	.40183	.40305	.40428	.40550
82.	.40672	40794	.40916	.41037	.41159	.41280	.41401	.41522	.41643	41764
83.	.41884	.42004	.42125	.42245	.42365	.42485	.42604	.42724	.42843	.42963
84	.43082	.43201	.43319	.43438	.43557	.43675	.43793	.43912	.44030	.44147
85.	.44265	44383	.44500	.44617	.44735	.44852	.44969	.45085	.45202	.45318
86.	.45435	.45551	.45667	.45783	.45899	.46014	.46130	.46245	.46361	.46476
87.	.46591	.46706	.46820	.46935	.47050	.47164	.47278	.47392	.47506	.47620
88.	.47734	.47847	.47961	.48074	.48187	.48300	.48413	.48526	.48639	.48751
89.	.48864	.48976	.49088	.49200	.49312	.49424	.49536	.49647	.49758	.49870
90.	4 49981	.50092	.50203	.50314	.50424	.50535	.50645	.50756	.50866	.50976
91.	.51086	.51196	.51305	.51415	.51525	.51634	.51743	.51852	.51961	.52070
92.	.52179	.52287	.52396	.52504	.52613	.52721	.52829	.52937	.53045	.53152
93.	.53260	.53367	.53475	.53582	.53689	.53796	.53903	54010	.54116	.54223
94.	.54329	.54436	.54542	.54648	.54754	.54860	.54966	.55071	.55177	.55282
95.	.55388	.55493	.55598	.55703	.55808	.55913	.56017	.56122	.56226	.56331
96.	.56435	.56539	.56643	.56747	.56851	.56954	.57058	.57161	.57265	.57368
97.	.57471	.57574	.57677	.57780	.57883	.57985	.58088	.58190	.58292	.58395
98.	.58497	.58599	.58701	.58802	.58904	.59006	59107	.59208	.59310	.59411
99.	.59512	.59613	59714	.59815	.59915	.60016	.60116	.60217	.60317	.60417

NATURAL OR NAPERIAN LOGARITHMS (Continued)

100–499

N	0	1	2	3	4	5	6	7	8	9
0	∞	0 00000	0.69315	1 09861	38629	.60944	79176	94591	* 07944	* 19722
1	2 30259	39790	48491	56495	63906	70805	77259	83321	89037	94444
2	99573	* 04452	*.09104	* 13549	*.17805	*.21888	* 25810	* 29584	* 33220	* 36730
3	3 40120	43399	.46574	49651	52636	.55535	58352	61092	.63759	66356
4	68888	71357	.73767	.76120	.78419	.80666	.82864	85015	.87120	.89182
5	91202	93183	.95124	97029	.98898	*.00733	*.02535	* 04305	* 06044	* 07754
6	4 09434	11087	.12713	.14313	.15888	.17439	18965	.20469	.21951	23411
7	24850	26268	.27667	29046	.30407	.31749	33073	34381	.35671	36945
8	38203	.39445	.40672	41884	43082	.44265	.45435	46591	.47734	48864
9	49981	51086	.52179	.53260	.54329	.55388	.56435	.57471	.58497	.59512
10	4 60517	61512	.62497	63473	.64439	.65396	66344	67283	.68213	.69135
11	70048	70953	.71850	72739	73620	.74493	75359	.76217	.77068	77912
12	78749	79579	.80402	81218	82028	82831	83628	.84419	.85203	85981
13	86753	87520	.88280	89035	89784	.90527	91265	91998	.92725	93447
14	94164	94876	.95583	96284	96981	.97673	98361	.99043	.99721	* 00395
15	5 01064	01728	.02388	03044	03695	.04343	04986	.05625	.06260	06890
16	07517	08140	.08760	09375	.09987	.10595	11199	.11799	.12396	.12990
17	13580	14166	14749	15329	15906	.16479	.17048	.17615	18178	18739
18	19296	19850	.20401	.20949	21494	.22036	22575	23111	23644	24175
19	24702	25227	.25750	.26269	.26786	.27300	.27811	.28320	.28827	29330
20	5 29832	30330	30827	31321	31812	.32301	.32788	.33272	33754	.34233
21	34711	35186	.35659	36129	.36598	.37064	.37528	.37990	.38450	38907
22	39363	39816	.40268	40717	41165	.41610	.42053	.42495	.42935	.43372
23	43808	44242	44674	.45104	45532	45959	46383	.46806	.47227	47646
24	48064	48480	.48894	49306	49717	.50126	.50533	.50939	.51343	51745
25	52146	52545	.52943	53339	53733	54126	54518	.54908	.55296	.55683
26	56068	56452	.56834	57215	57595	.57973	58350	58725	.59099	.59471
27	59842	60212	60580	60947	61313	61677	62040	.62402	.62762	.63121
28	63479	63835	.64191	64545	64897	65249	65599	.65948	.66296	66643
29	66988	67332	.67675	.68017	.68358	.68698	69036	.69373	.69709	70044
30	5 70378	70711	.71043	.71373	71703	.72031	72359	72685	.73010	.73334
31	73657	73979	.74300	74620	74939	75257	75574	.75890	.76205	76519
32	76832	77144	.77455	.77765	78074	78383	78690	.78996	.79301	.79606
33	79909	80212	.80513	.80814	81114	81413	81711	.82008	.82305	82600
34	82895	83188	.83481	.83773	84064	.84354	84644	.84932	.85220	85507
35	85793	86079	.86363	.86647	86930	87212	87493	.87774	88053	88332
36	88610	88888	.89164	.89440	89715	89990	90263	90536	.90808	91080
37	91350	91620	.91889	92158	.92426	92693	92959	93225	.93489	.93754
38	94017	94280	.94542	94803	95064	95324	.95584	95842	.96101	96358
39	96615	96871	.97126	.97381	97635	97889	98141	98394	.98645	.98896
40	5 99146	.99396	.99645	.99894	* 00141	* 00389	* 00635	* 00881	* 01127	* 01372
41	6 01616	01859	.02102	.02345	.02587	.02828	.03069	03309	.03548	03787
42	04025	.04263	.04501	04737	04973	05209	.05444	.05678	.05912	.06146
43	06379	.06611	.06843	07074	07304	07535	.07764	.07993	.08222	08450
44	08677	.08904	.09131	09357	09582	.09807	.10032	.10256	.10479	10702
45	10925	11147	.11368	.11589	.11810	.12030	.12249	.12468	.12687	12905
46	13123	.13340	.13556	.13773	.13988	14204	.14419	.14633	.14847	15060
47	15273	15486	.15698	.15910	16121	16331	16542	.16752	.16961	17170
48	17379	.17587	.17794	18002	.18208	18415	.18621	.18826	.19032	19236
49	19441	19644	.19848	.20051	.20254	20456	20658	.20859	.21060	.21261

NATURAL OR NAPERIAN LOGARITHMS (Continued)

500-999

N	0	1	2	3	4	5	6	7	8	9
50	6.21461	.21661	.21860	.22059	.22258	.22456	.22654	.22851	23048	23245
51	.23441	.23637	.23832	.24028	.24222	.24417	.24611	.24804	.24998	25190
52	.25383	.25575	.25767	25958	.26149	26340	.26530	.26720	.26910	.27099
53	.27288	.27476	.27664	.27852	.28040	.28227	.28413	.28600	.28786	28972
54	.29157	.29342	.29527	.29711	.29895	.30079	.30262	.30445	.30628	.30810
55	.30992	.31173	.31355	.31536	.31716	31897	.32077	.32257	32436	.32615
56	.32794	.32972	33150	.33328	.33505	.33683	33859	.34036	34212	34388
57	.34564	.34739	.34914	.35089	.35263	.35437	.35611	.35784	35957	36130
58	.36303	.36475	.36647	.36819	.36990	37161	.37332	37502	.37673	37843
59	.38012	.38182	.38351	.38519	.38688	.38856	.39024	.39192	.39359	.39526
60	6.39693	.39859	.40026	.40192	.40357	.40523	40688	.40853	41017	41182
61	.41346	.41510	41673	.41836	.41999	42162	.42325	.42487	42649	.42811
62	42972	43133	.43294	.43455	.43615	43775	.43935	.44095	.44254	14413
63	.44572	44731	44889	45047	45205	.45362	.45520	.45677	45834	.45990
64	.46147	.46303	.46459	46614	.46770	.46925	.47080	.47235	47389	47543
65	47697	.47851	.48004	.48158	.48311	.48464	48616	.48768	48920	49072
66	.49224	.49375	.49527	.49677	49828	.49979	.50129	.50279	.50429	50578
67	.50728	50877	.51026	.51175	.51323	.51471	.51619	.51767	.51915	52062
68	52209	.52356	52503	.52649	52796	.52942	.53088	.53233	.53379	53524
69	.53669	.53814	.53959	.54103	.54247	54391	.54535	.54679	.54822	.54965
70	6.55108	.55251	.55393	.55536	.55678	.55820	.55962	.56103	.56244	.56386
71	.56526	.56667	.56808	56948	.57088	57228	.57368	.57508	.57647	.57786
72	.57925	.58064	.58203	.58341	.58479	.58617	.58755	.58893	.59030	59167
73	.59304	.59441	.59578	.59715	.59851	.59987	.60123	.60259	60394	60530
74	.60665	.60800	.60935	.61070	.61204	61338	.61473	.61607	.61740	.61874
75	.62007	.62141	.62274	62407	.62539	62672	.62804	.62936	.63068	63200
76	.63332	.63463	.63595	.63726	.63857	.63988	64118	.64249	64379	64509
77	.64639	.64769	.64898	65028	.65157	65286	.65415	.65544	.65673	.65801
78	.65929	.66058	.66185	.66313	.66441	.66568	.66696	.66823	.66950	67077
79	.67203	.67330	.67456	.67582	.67708	.67834	.67960	.68085	.68211	68336
80	6.68461	.68586	.68711	.68835	.68960	.69084	.69208	.69332	.69456	.69580
81	.69703	.69827	.69950	.70073	.70196	.70319	.70441	.70564	70686	70808
82	.70930	.71052	.71174	.71296	.71417	.71538	.71659	.71780	.71901	72022
83	.72143	.72263	.72383	.72503	.72623	.72743	.72863	.72982	.73102	73221
84	.73340	.73459	.73578	.73697	.73815	.73934	.74052	.74170	74288	.74406
85	.74524	74641	.74759	.74876	.74993	.75110	.75227	.75344	.75460	.75577
86	75693	.75809	.75926	76041	.76157	.76273	.76388	.76504	.76619	76734
87	.76849	.76964	77079	.77194	.77308	.77422	.77537	.77651	.77765	77878
88	.77992	.78106	.78219	.78333	.78446	.78559	.78672	.78784	.78897	79010
89	.79122	.79234	.79347	.79459	.79571	.79682	.79794	.79906	.80017	.80128
90	6.80239	80351	.80461	.80572	.80683	.80793	.80904	.81014	.81124	.81235
91	.81344	.81454	.81564	.81674	.81783	.81892	.82002	.82111	.82220	.82329
92	.82437	.82546	82655	.82763	.82871	.82979	.83087	.83195	.83303	83411
93	.83518	.83626	.83733	.83841	.83948	.84055	.84162	.84268	.84375	.84482
94	.84588	.84694	.84801	.84907	.85013	.85118	.85224	.85330	.85435	.85541
95	.85646	.85751	.85857	.85961	.86066	86171	.86276	.86380	86485	86589
96	.86693	.86797	.86901	.87005	.87109	87213	87316	.87420	.87523	87626
97	.87730	.87833	.87936	.88038	.88141	.88244	.88346	.88449	.88551	.88653
98	88755	.88857	.88959	.89061	.89163	.89264	89366	.89467	.89568	89669
99	.89770	**.89871**	.89972	.90073	.90174	.90274	.90375	.90475	.90575	90675

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
0.00	1 0000	0 00000	1 000000	**0.50**	1 6487	0 21715	0 606531
0.01	1 0101	.00434	0 990050	0.51	1 6653	.22149	.600496
0.02	1 0202	.00869	980199	0.52	1 6820	22583	.594521
0.03	1 0305	.01303	970446	0.53	1.6989	.23018	.588605
0.04	1.0408	.01737	.960789	0.54	1.7160	.23452	.582748
0.05	1 0513	0.02171	0 951229	**0.55**	1 7333	0.23886	0.576950
0.06	1.0618	.02606	.941765	0.56	1.7507	.24320	.571209
0.07	1 0725	.03040	.932394	0.57	1 7683	.24755	.565525
0.08	1 0833	.03474	.923116	0.58	1 7860	.25189	.559898
0.09	1.0942	.03909	.913931	0.59	1.8040	.25623	.554327
0.10	1 1052	0.04343	0 904837	**0.60**	1.8221	0.26058	0.548812
0.11	1 1163	.04777	.895834	0.61	1 8404	.26492	.543351
0.12	1 1275	05212	.886920	0.62	1 8589	.26926	.537944
0.13	1 1388	.05646	.878095	0 63	1 8776	.27361	.532592
0.14	1 1503	.06080	.869358	0.64	1.8965	.27795	.527292
0.15	1.1618	0.06514	0.860708	**0.65**	1.9155	0 28229	0.522046
0.16	1 1735	.06949	852144	0 66	1 9348	.28663	.516851
0.17	1 1853	07383	843665	0 67	1.9542	.29098	.511709
0.18	1 1972	.07817	.835270	0 68	1.9739	.29532	.506617
0.19	1 2092	.08252	.826959	0.69	1.9937	.29966	.501576
0.20	1 2214	0 08686	0 818731	**0.70**	2 0138	0.30401	0.496585
0.21	1 2337	.09120	.810584	0.71	2.0340	.30835	.491644
0.22	1 2461	.09554	.802519	0.72	2.0544	.31269	.486752
0.23	1 2586	.09989	794534	0 73	2.0751	31703	.481909
0.24	1 2712	10423	.786628	0.74	2.0959	.32138	.477114
0.25	1.2840	0.10857	0.778801	**0.75**	2 1170	0.32572	0.472367
0.26	1 2969	.11292	.771052	0 76	2 1383	.33006	.467666
0.27	1 3100	.11726	.763379	0.77	2 1598	.33441	.463013
0.28	1 3231	.12160	.755784	0 78	2.1815	.33875	.458406
0.29	1.3364	.12595	748264	0.79	2.2034	.34309	.453845
0.30	1 3499	0 13029	0.740818	**0.80**	2.2255	0 34744	0.449329
0.31	1 3634	.13463	.733447	0.81	2 2479	35178	.444858
0.32	1 3771	.13897	.726149	0.82	2 2705	.35612	.440432
0.33	1 3910	.14332	.718924	0.83	2 2933	.36046	.436049
0.34	1.4049	.14766	.711770	0.84	2.3164	.36481	.431711
0.35	1.4191	0 15200	0.704688	**0.85**	2 3396	0 36915	0.427415
0 36	1 4333	.15635	.697676	0.86	2 3632	.37349	.423162
0.37	1 4477	.16069	.690734	0.87	2 3869	.37784	.418952
0.38	1 4623	.16503	.683861	0.88	2.4109	.38218	.414783
0.39	1.4770	.16937	.677057	0.89	2.4351	.38652	.410656
0.40	1.4918	0.17372	0 670320	**0.90**	2 4596	0.39087	0.406570
0.41	1.5068	.17806	.663650	0.91	2 4843	.39521	.402524
0.42	1 5220	.18240	.657047	0.92	2 5093	.39955	.398519
0.43	1 5373	.18675	.650509	0.93	2 5345	.40389	.394554
0.44	1.5527	.19109	.644036	0.94	2.5600	.40824	.390628
0.45	1 5683	0 19543	0.637628	**0.95**	2 5857	0.41258	0.386741
0.46	1.5841	.19978	631284	0.96	2 6117	.41692	.382893
0.47	1 6000	.20412	.625002	0.97	2 6379	.42127	.379083
0.48	1 6161	.20846	.618783	0.98	2 6645	.42561	.375311
0.49	1.6323	.21280	.612626	0 99	2.6912	.42995	.371577
0.50	1.6487	0.21715	0.606531	**1.00**	2 7183	0.43429	0.367879

EXPONENTIAL FUNCTIONS (Continued)

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
1.00	2 7183	0.43429	0.367879	**1.50**	4 4817	0 65144	0 223130
1.01	2 7456	.43864	.364219	1.51	4 5267	.65578	220910
1.02	2 7732	44298	.360595	1.52	4 5722	.66013	218712
1.03	2 8011	.44732	357007	1.53	4 6182	.66447	216536
1.04	2.8292	.45167	.353455	1.54	4 6646	.66881	.214381
1.05	2.8577	0 45601	0 349938	**1.55**	4 7115	0.67316	0 212248
1.06	2 8864	.46035	346456	1.56	4 7588	67750	210136
1.07	2 9154	46470	.343009	1.57	4 8066	.68184	.208045
1.08	2 9447	.46904	.339596	1.58	4 8550	.68619	.205975
1.09	2 9743	.47338	336216	1.59	4 9037	69053	203926
1.10	3 0042	0 47772	0 332871	**1.60**	4 9530	0.69487	0 201897
1.11	3 0344	48207	329559	1.61	5 0028	.69921	.199888
1.12	3 0649	48641	.326280	1.62	5 0531	.70356	197899
1.13	3 0957	49075	323033	1.63	5 1039	.70790	195930
1.14	3 1268	49510	319819	1 64	5 1552	.71224	.193980
1.15	3 1582	0 49944	0 316637	**1.65**	5 2070	0 71659	0 192050
1.16	3 1899	50378	313486	1.66	5 2593	.72093	190139
1.17	3 2220	50812	310367	1.67	5 3122	.72527	.188247
1.18	3 2544	.51247	.307279	1.68	5 3656	.72961	186374
1.19	3.2871	51681	.304221	1.69	5 4195	.73396	.184520
1.20	3 3201	0 52115	0 301194	**1.70**	5 4739	0.73830	0 182684
1.21	3 3535	52550	.298197	1 71	5 5290	.74264	180866
1.22	3 3872	52984	.295230	1 72	5 5845	.74699	.179066
1.23	3 4212	53418	292293	1 73	5 6407	.75133	.177284
1.24	3 4556	53853	289384	1.74	5 6973	.75567	.175520
1.25	3 4903	0 54287	0 286505	**1.75**	5 7546	0 76002	0 173774
1.26	3 5254	54721	283654	1.76	5 8124	.76436	.172045
1.27	3 5609	55155	.280832	1.77	5 8709	.76870	.170333
1.28	3 5966	55590	.278037	1.78	5 9299	77304	168638
1.29	3 6328	.56024	.275271	1.79	5 9895	77739	.166960
1.30	3 6693	0.56458	0 272532	**1.80**	6 0496	0 78173	0 165299
1.31	3 7062	56893	269820	1.81	6 1104	78607	.163654
1.32	3 7434	.57327	.267135	1.82	6 1719	79042	.162026
1.33	3 7810	.57761	.264477	1.83	6 2339	79476	.160414
1.34	3 8190	.58195	.261846	1.84	6 2965	79910	.158817
1.35	3 8574	0 58630	0 259240	**1.85**	6 3598	0 80344	0 157237
1.36	3 8962	59064	256661	1.86	6 4237	80779	.155673
1.37	3 9354	.59498	.254107	1.87	6 4883	81213	.154124
1.38	3 9749	59933	.251579	1.88	6 5535	.81647	.152590
1.39	4 0149	60367	.249075	1.89	6 6194	82082	.151072
1.40	4 0552	0 60801	0 246597	**1.90**	6 6859	0 82516	0.149569
1.41	4 0960	61236	244143	1 91	6 7531	82950	148080
1.42	4 1371	61670	.241714	1.92	6 8210	.83385	.146607
1.43	4 1787	.62104	239309	1 93	6 8895	.83819	.145148
1.44	4 2207	.62538	.236928	1.94	6 9588	84253	.143704
1.45	4 2631	0 62973	0 234570	**1.95**	7 0287	0 84687	0 142274
1.46	4 3060	.63407	232236	1.96	7 0993	85122	.140858
1.47	4 3492	.63841	229925	1 97	7 1707	.85556	.139457
1.48	4 3929	.64276	227638	1.98	7 2427	.85990	138069
1.49	4.4371	.64710	225373	1.99	7 3155	.86425	.136695
1.50	4.4817	0 65144	0 223130	**2.00**	7 3891	0 86859	0 135335

EXPONENTIAL FUNCTIONS (Continued)

x	e^x	$\operatorname{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\operatorname{Log}_{10}(e^x)$	e^{-x}
2.00	7.3891	0 86859	0 135335	**2.50**	12.182	1 08574	0.082085
2.01	7 4633	.87293	.133989	2.51	12 305	1 09008	.081268
2.02	7 5383	87727	.132655	2 52	12 429	1 09442	.080460
2.03	7 6141	88162	.131336	2.53	12 554	1 09877	079659
2.04	7.6906	.88596	130029	2.54	12 680	1.10311	.078866
2.05	7 7679	0 89030	0.128735	**2.55**	12 807	1.10745	0 078082
2.06	7 8460	89465	.127454	2.56	12 936	1.11179	.077305
2.07	7 9248	.89899	.126186	2.57	13 066	1 11614	.076536
2.08	8 0045	.90333	.124930	2.58	13 197	1.12048	.075774
2.09	8 0849	.90768	.123687	2.59	13 330	1 12482	.075020
2.10	8 1662	0 91202	0 122456	**2.60**	13 464	1.12917	0 074274
2.11	8 2482	.91636	.121238	2.61	13 599	1.13351	.073535
2.12	8 3311	92070	.120032	2 62	13 736	1 13785	.072803
2.13	8 4149	92505	.118837	2.63	13 874	1 14219	.072078
2.14	8 4994	.92939	.117655	2.64	14 013	1.14654	.071361
2.15	8 5849	0.93373	0.116484	**2.65**	14 154	1 15088	0.070651
2.16	8 6711	93808	115325	2.66	14 296	1 15522	.069948
2.17	8 7583	94242	.114178	2.67	14 440	1.15957	.069252
2.18	8 8463	94676	.113042	2.68	14 585	1.16391	.068563
2.19	8 9352	95110	111917	2 69	14 732	1 16825	.067881
2.20	9 0250	0 95545	0 110803	**2.70**	14 880	1.17260	0.067206
2.21	9 1157	.95979	109701	2.71	15 029	1 17694	.066537
2.22	9 2073	96413	.108609	2.72	15 180	1.18128	.065875
2.23	9 2999	96848	.107528	2.73	15 333	1 18562	.065219
2.24	9 3933	.97282	.106459	2.74	15 487	1.18997	.064570
2.25	9 4877	0.97716	0 105399	**2.75**	15 643	1 19431	0 063928
2.26	9 5831	98151	.104350	2.76	15 800	1 19865	063292
2.27	9 6794	98585	103312	2.77	15 959	1 20300	062662
2.28	9 7767	99019	102284	2 78	16 119	1 20734	.062039
2.29	9 8749	99453	.101266	2.79	16 281	1 21168	.061421
2.30	9 9742	0 99888	0 100259	**2.80**	16 445	1 21602	0.060810
2.31	10 074	1 00322	099261	2.81	16 610	1 22037	.060205
2.32	10 176	1 00756	098274	2.82	16 777	1 22471	059606
2.33	10 278	1 01191	.097296	2 83	16 945	1 22905	.059013
2.34	10 381	1 01625	.096328	2.84	17 116	1 23340	.058426
2.35	10.486	1 02059	0.095369	**2.85**	17.288	1.23774	0.057844
2.36	10 591	1 02493	.094420	2.86	17 462	1 24208	.057269
2.37	10 697	1.02928	.093481	2.87	17 637	1 24643	.056699
2.38	10 805	1 03362	.092551	2.88	17.814	1.25077	.056135
2.39	10.913	1 03796	.091630	2.89	17.993	1.25511	.055576
2.40	11.023	1.04231	0 090718	**2.90**	18.174	1 25945	0.055023
2.41	11 134	1.04665	.089815	2.91	18 357	1.26380	.054476
2.42	11 246	1.05099	.088922	2.92	18 541	1 26814	.053934
2.43	11.359	1.05534	.088037	2.93	18 728	1.27248	.053397
2.44	11.473	1.05968	.087161	2.94	18.916	1.27683	.052866
2.45	11 588	1.06402	0.086294	**2.95**	19 106	1.28117	0.052340
2.46	11.705	1.06836	.085435	2.96	19 298	1.28551	.051819
2.47	11.822	1.07271	.084585	2.97	19 492	1 28985	.051303
2.48	11 941	1 07705	083743	2.98	19 688	1 29420	.050793
2.49	12.061	1 08139	.082910	2.99	19 886	1 29854	.050287
2.50	12.182	1 08574	0 082085	**3.00**	20 086	1 30288	0 049787

EXPONENTIAL FUNCTIONS (Continued)

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
3.00	20.086	1.30288	0.049787	**3.50**	33.115	1.52003	0.030197
3.01	20.287	1.30723	.049292	3.51	33.448	1.52437	.029897
3.02	20.491	1.31157	.048801	3.52	33.784	1.52872	.029599
3.03	20.697	1.31591	.048316	3.53	34.124	1.53306	.029305
3.04	20.905	1.32026	.047835	3.54	34.467	1.53740	.029013
3.05	21.115	1.32460	0.047359	**3.55**	34.813	1.54175	0.028725
3.06	21.328	1.32894	.046888	3.56	35.163	1.54609	.028439
3.07	21.542	1.33328	.046421	3.57	35.517	1.55043	.028156
3.08	21.758	1.33763	.045959	3.58	35.874	1.55477	.027876
3.09	21.977	1.34197	.045502	3.59	36.234	1.55912	.027598
3.10	22.198	1.34631	0.045049	**3.60**	36.598	1.56346	0.027324
3.11	22.421	1.35066	.044601	3.61	36.966	1.56780	.027052
3.12	22.646	1.35500	.044157	3.62	37.338	1.57215	.026783
3.13	22.874	1.35934	.043718	3.63	37.713	1.57649	.026516
3.14	23.104	1.36368	.043283	3.64	38.092	1.58083	.026252
3.15	23.336	1.36803	0.042852	**3.65**	38.475	1.58517	0.025991
3.16	23.571	1.37237	.042426	3.66	38.861	1.58952	.025733
3.17	23.807	1.37671	.042004	3.67	39.252	1.59386	.025476
3.18	24.047	1.38106	.041586	3.68	39.646	1.59820	.025223
3.19	24.288	1.38540	.041172	3.69	40.045	1.60255	.024972
3.20	24.533	1.38974	0.040762	**3.70**	40.447	1.60689	0.024724
3.21	24.779	1.39409	.040357	3.71	40.854	1.61123	.024478
3.22	25.028	1.39843	.039955	3.72	41.264	1.61558	.024234
3.23	25.280	1.40277	.039557	3.73	41.679	1.61992	.023993
3.24	25.534	1.40711	.039164	3.74	42.098	1.62426	.023754
3.25	25.790	1.41146	0.038774	**3.75**	42.521	1.62860	0.023518
3.26	26.050	1.41580	.038388	3.76	42.948	1.63295	.023284
3.27	26.311	1.42014	.038006	3.77	43.380	1.63729	.023052
3.28	26.576	1.42449	.037628	3.78	43.816	1.64163	.022823
3.29	26.843	1.42883	.037254	3.79	44.256	1.64598	.022596
3.30	27.113	1.43317	0.036883	**3.80**	44.701	1.65032	0.022371
3.31	27.385	1.43751	.036516	3.81	45.150	1.65466	.022148
3.32	27.660	1.44186	.036153	3.82	45.604	1.65900	.021928
3.33	27.938	1.44620	.035793	3.83	46.063	1.66335	.021710
3.34	28.219	1.45054	.035437	3.84	46.525	1.66769	.021494
3.35	28.503	1.45489	0.035084	**3.85**	46.993	1.67203	0.021280
3.36	28.789	1.45923	.034735	3.86	47.465	1.67638	.021068
3.37	29.079	1.46357	.034390	3.87	47.942	1.68072	.020858
3.38	29.371	1.46792	.034047	3.88	48.424	1.68506	.020651
3.39	29.666	1.47226	.033709	3.89	48.911	1.68941	.020445
3.40	29.964	1.47660	0.033373	**3.90**	49.402	1.69375	0.020242
3.41	30.265	1.48094	.033041	3.91	49.899	1.69809	.020041
3.42	30.569	1.48529	.032712	3.92	50.400	1.70243	.019841
3.43	30.877	1.48963	.032387	3.93	50.907	1.70678	.019644
3.44	31.187	1.49397	.032065	3.94	51.419	1.71112	.019448
3.45	31.500	1.49832	0.031746	**3.95**	51.935	1.71546	0.019255
3.46	31.817	1.50266	.031430	3.96	52.457	1.71981	.019063
3.47	32.137	1.50700	.031117	3.97	52.985	1.72415	.018873
3.48	32.460	1.51134	.030807	3.98	53.517	1.72849	.018686
3.49	32.786	1.51569	.030501	3.99	54.055	1.73283	.018500
3.50	33.115	1.52003	0.030197	**4.00**	54.598	1.73718	0.018316

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
4.00	54.598	1.73718	0.018316	**4.50**	90.017	1.95433	0.011109
4.01	55.147	1.74152	.018133	4.51	90.922	1.95867	.010998
4.02	55.701	1.74586	.017953	4.52	91.836	1.96301	.010889
4.03	56.261	1.75021	.017774	4.53	92.759	1.96735	.010781
4.04	56.826	1.75455	.017597	4.54	93.691	1.97170	.010673
4.05	57.397	1.75889	0.017422	**4.55**	94.632	1.97604	0.010567
4.06	57.974	1.76324	.017249	4.56	95.583	1.98038	.010462
4.07	58.557	1.76758	.017077	4.57	96.544	1.98473	.010358
4.08	59.145	1.77192	.016907	4.58	97.514	1.98907	.010255
4.09	59.740	1.77626	.016739	4.59	98.494	1.99341	.010153
4.10	60.340	1.78061	0.016573	**4.60**	99.484	1.99775	0.010052
4.11	60.947	1.78495	.016408	4.61	100.48	2.00210	.009952
4.12	61.559	1.78929	.016245	4.62	101.49	2.00644	.009853
4.13	62.178	1.79364	.016083	4.63	102.51	2.01078	.009755
4.14	62.803	1.79798	.015923	4.64	103.54	2.01513	.009658
4.15	63.434	1.80232	0.015764	**4.65**	104.58	2.01947	0.009562
4.16	64.072	1.80667	.015608	4.66	105.64	2.02381	.009466
4.17	64.715	1.81101	.015452	4.67	106.70	2.02816	.009372
4.18	65.366	1.81535	.015299	4.68	107.77	2.03250	.009279
4.19	66.023	1.81969	.015146	4.69	108.85	2.03684	.009187
4.20	66.686	1.82404	0.014996	**4.70**	109.95	2.04118	0.009095
4.21	67.357	1.82838	.014846	4.71	111.05	2.04553	.009005
4.22	68.033	1.83272	.014699	4.72	112.17	2.04987	.008915
4.23	68.717	1.83707	.014552	4.73	113.30	2.05421	.008826
4.24	69.408	1.84141	.014408	4.74	114.43	2.05856	.008739
4.25	70.105	1.84575	0.014264	**4.75**	115.58	2.06290	0.008652
4.26	70.810	1.85009	.014122	4.76	116.75	2.06724	.008566
4.27	71.522	1.85444	.013982	4.77	117.92	2.07158	.008480
4.28	72.240	1.85878	.013843	4.78	119.10	2.07593	.008396
4.29	72.966	1.86312	.013705	4.79	120.30	2.08027	.008312
4.30	73.700	1.86747	0.013569	**4.80**	121.51	2.08461	0.008230
4.31	74.440	1.87181	.013434	4.81	122.73	2.08896	.008148
4.32	75.189	1.87615	.013300	4.82	123.97	2.09330	.008067
4.33	75.944	1.88050	.013168	4.83	125.21	2.09764	.007987
4.34	76.708	1.88484	.013037	4.84	126.47	2.10199	.007907
4.35	77.478	1.88918	0.012907	**4.85**	127.74	2.10633	0.007828
4.36	78.257	1.89352	.012778	4.86	129.02	2.11067	.007750
4.37	79.044	1.89787	.012651	4.87	130.32	2.11501	.007673
4.38	79.838	1.90221	.012525	4.88	131.63	2.11936	.007597
4.39	80.640	1.90655	.012401	4.89	132.95	2.12370	.007521
4.40	81.451	1.91090	0.012277	**4.90**	134.29	2.12804	0.007447
4.41	82.269	1.91524	.012155	4.91	135.64	2.13239	.007372
4.42	83.096	1.91958	.012034	4.92	137.00	2.13673	.007299
4.43	83.931	1.92392	.011914	4.93	138.38	2.14107	.007227
4.44	84.775	1.92827	.011796	4.94	139.77	2.14541	.007155
4.45	85.627	1.93261	0.011679	**4.95**	141.17	2.14976	0.007083
4.46	86.488	1.93695	.011562	4.96	142.59	2.15410	.007013
4.47	87.357	1.94130	.011447	4.97	144.03	2.15844	.006943
4.48	88.235	1.94564	.011333	4.98	145.47	2.16279	.006874
4.49	89.121	1.94998	.011221	4.99	146.94	2.16713	.006806
4.50	90.017	1.95433	0.011109	**5.00**	148.41	2.17147	0.006738

EXPONENTIAL FUNCTIONS (Continued)

x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}	x	e^x	$\text{Log}_{10}(e^x)$	e^{-x}
5.00	148.41	2.17147	0.006738	**5.0**	148.41	2.17147	0.006738
5.01	149.90	2.17582	.006671	5.1	164.02	2.21490	.006097
5.02	151.41	2.18016	.006605	5.2	181.27	2.25833	.005517
5.03	152.93	2.18450	.006539	5.3	200.34	2.30176	.004992
5.04	154.47	2.18884	.006474	5.4	221.41	2.34519	.004517
5.05	156.02	2.19319	0.006409	**5.5**	244.69	2.38862	0.004087
5.06	157.59	2.19753	.006346	5.6	270.43	2.43205	.003698
5.07	159.17	2.20187	.006282	5.7	298.87	2.47548	.003346
5.08	160.77	2.20622	.006220	5.8	330.30	2.51891	.003028
5.09	162.39	2.21056	.006158	5.9	365.04	2.56234	.002739
5.10	164.02	2.21490	0.006097	**6.0**	403.43	2.60577	0.002479
5.11	165.67	2.21924	.006036	6.1	445.86	2.64920	.002243
5.12	167.34	2.22359	.005976	6.2	492.75	2.69263	.002029
5.13	169.02	2.22793	.005917	6.3	544.57	2.73606	.001836
5.14	170.72	2.23227	.005858	6.4	601.85	2.77948	.001662
5.15	172.43	2.23662	0.005799	**6.5**	665.14	2.82291	0.001503
5.16	174.16	2.24096	.005742	6.6	735.10	2.86634	.001360
5.17	175.91	2.24530	.005685	6.7	812.41	2.90977	.001231
5.18	177.68	2.24965	.005628	6.8	897.85	2.95320	.001114
5.19	179.47	2.25399	.005572	6.9	992.27	2.99663	.001008
5.20	181.27	2.25833	0.005517	**7.0**	1096.6	3.04006	0.000912
5.21	183.09	2.26267	.005462	7.1	1212.0	3.08349	.000825
5.22	184.93	2.26702	.005407	7.2	1339.4	3.12692	.000747
5.23	186.79	2.27136	.005354	7.3	1480.3	3.17035	.000676
5.24	188.67	2.27570	.005300	7.4	1636.0	3.21378	.000611
5.25	190.57	2.28005	0.005248	**7.5**	1808.0	3.25721	0.000553
5.26	192.48	2.28439	.005195	7.6	1998.2	3.30064	.000500
5.27	194.42	2.28873	.005144	7.7	2208.3	3.34407	.000453
5.28	196.37	2.29307	.005092	7.8	2440.6	3.38750	.000410
5.29	198.34	2.29742	.005042	7.9	2697.3	3.43093	.000371
5.30	200.34	2.30176	0.004992	**8.0**	2981.0	3.47436	0.000335
5.31	202.35	2.30610	.004942	8.1	3294.5	3.51779	.000304
5.32	204.38	2.31045	.004893	8.2	3641.0	3.56121	.000275
5.33	206.44	2.31479	.004844	8.3	4023.9	3.60464	.000249
5.34	208.51	2.31913	.004796	8.4	4447.1	3.64807	.000225
5.35	210.61	2.32348	0.004748	**8.5**	4914.8	3.69150	0.000203
5.36	212.72	2.32782	.004701	8.6	5431.7	3.73493	.000184
5.37	214.86	2.33216	.004654	8.7	6002.9	3.77836	.000167
5.38	217.02	2.33650	.004608	8.8	6634.2	3.82179	.000151
5.39	219.20	2.34085	.004562	8.9	7332.0	3.86522	.000136
5.40	221.41	2.34519	0.004517	**9.0**	8103.1	3.90865	0.000123
5.41	223.63	2.34953	.004472	9.1	8955.3	3.95208	.000112
5.42	225.88	2.35388	.004427	9.2	9897.1	3.99551	.000101
5.43	228.15	2.35822	.004383	9.3	10938	4.03894	.000091
5.44	230.44	2.36256	.004339	9.4	12088	4.08237	.000083
5.45	232.76	2.36690	0.004296	**9.5**	13360	4.12580	0.000075
5.46	235.10	2.37125	.004254	9.6	14765	4.16923	.000068
5.47	237.46	2.37559	.004211	9.7	16318	4.21266	.000061
5.48	239.85	2.37993	.004169	9.8	18034	4.25609	.000055
5.49	242.26	2.38428	.004128	9.9	19930	4.29952	.000050
5.50	244.69	2.38862	0.004087	**10.0**	22026	4.34294	0.000045

HYPERBOLIC FUNCTIONS

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	$\log_{10}$	Value	$\log_{10}$	Value	$\log_{10}$	Value	$\log_{10}$
0.00	0.00000	$-\infty$	1 00000	.00000	0.00000	$-\infty$	∞	∞
0.01	.01000	.00001	1 00005	.00002	.01000	.99999	100 003	.00001
0.02	.02000	.30106	1 00020	.00009	.02000	.30097	50 007	.69903
0.03	.03000	.47719	1 00045	.00020	.02999	.47699	33 343	52301
0.04	.04001	.60218	1.00080	.00035	.03998	.60183	25.013	.39817
0.05	0.05002	.69915	1 00125	.00054	0.04996	.69861	20 017	30139
0.06	.06004	.77841	1 00180	00078	.05993	.77763	16 687	22237
0.07	.07006	.84545	1.00245	.00106	06989	.84439	14 309	15561
0.08	.08009	.90355	1 00320	.00139	.07983	.90216	12.527	.09784
0.09	.09012	.95483	1.00405	.00176	.08976	.95307	11.141	.04693
0.10	0.10017	.00072	1.00500	.00217	0 09967	.99856	10 0333	.00144
0.11	.11022	04227	1 00606	.00262	.10956	.03965	9 1275	96035
0.12	.12029	08022	1 00721	.00312	.11943	07710	8 3733	.92290
0.13	.13037	.11517	1 00846	00366	.12927	.11151	7 7356	88849
0.14	.14046	.14755	1.00982	.00424	.13909	.14330	7.1895	85670
0.15	0 15056	.17772	1 01127	.00487	0 14889	.17285	6 7166	.82715
0.16	16068	.20597	1 01283	00554	.15865	.20044	6 3032	79956
0.17	.17082	.23254	1 01448	00625	.16838	.22629	5 9389	77371
0.18	.18097	.25762	1 01624	.00700	.17808	25062	5 6154	.74938
0 19	.19115	.28136	1.01810	.00779	.18775	.27357	5 3263	.72643
0.20	0 20134	30392	1 02007	.00863	0.19738	.29529	5 0665	.70471
0.21	21155	32541	1.02213	.00951	.20697	.31590	4 8317	.68410
0.22	.22178	34592	1 02430	.01043	.21652	.33549	4.6186	66451
0.23	23203	36555	1 02657	01139	.22603	35416	4 4242	64584
0.24	24231	.38437	1.02894	01239	.23550	.37198	4.2464	62802
0.25	0 25261	40245	1 03141	.01343	0 24492	.38902	4 0830	61098
0.26	26294	41986	1 03399	.01452	25430	.40534	3 9324	59466
0.27	.27329	43663	1 03667	.01564	.26362	.42099	3 7933	.57901
0.28	28367	45282	1.03946	.01681	.27291	43601	3 6643	.56399
0.29	29408	.46847	1.04235	.01801	.28213	.45046	3 5444	54954
0.30	0 30452	48362	1 04534	.01926	0 29131	.46436	3 4327	53564
0.31	31499	49830	1 04844	.02054	.30044	.47775	3 3285	.52225
0.32	.32549	51254	1.05164	.02187	30951	.49067	3 2309	50933
0.33	33602	.52637	1.05495	.02323	.31852	.50314	3 1395	49686
0.34	.34659	.53981	1.05836	.02463	.32748	.51518	3.0536	.48482
0.35	0 35719	.55290	1.06188	.02607	0.33638	52682	2 9729	47318
0.36	.36783	.56564	1.06550	.02755	.34521	.53809	2 8968	.46191
0.37	.37850	.57807	1.06923	.02907	.35399	54899	2 8249	45101
0.38	.38921	.59019	1.07307	.03063	.36271	.55956	2 7570	44044
0.39	.39996	.60202	1.07702	.03222	.37136	.56980	2.6928	43020
0.40	0.41075	.61358	1.08107	.03385	0.37995	.57973	2 6319	.42027
0.41	42158	.62488	1.08523	.03552	.38847	.58936	2 5742	.41064
0.42	.43246	.63594	1.08950	.03723	.39693	59871	2.5193	40129
0.43	.44337	.64677	1.09388	.03897	.40532	60780	2 4672	.39220
0.44	.45434	.65738	1.09837	.04075	.41364	.61663	2 4175	.38337
0.45	0.46534	.66777	1.10297	.04256	0.42190	.62521	2 3702	.37479
0.46	.47640	67797	1.10768	.04441	.43008	.63355	2 3251	.36645
0.47	.48750	.68797	1 11250	.04630	.43820	.64167	2.2821	35833
0.48	49865	.69779	1.11743	.04822	.44624	64957	2 2409	.35043
0.49	.50984	70744	1 12247	.05018	.45422	.65726	2 2016	34274

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x Value	Sinh x $\log_{10}$	Cosh x Value	Cosh x $\log_{10}$	Tanh x Value	Tanh x $\log_{10}$	Coth x Value	Coth x $\log_{10}$
0.50	0 52110	.71692	1 12763	.05217	0 46212	.66475	2.1640	33525
0.51	53240	72624	1 13289	.05419	46995	.67205	2 1279	.32795
0.52	54375	73540	1 13827	05625	47770	67916	2 0934	32084
0.53	.55516	.74442	1.14377	.05834	48538	.68608	2 0602	31392
0.54	.56663	75330	1.14938	.06046	.49299	.69284	2.0284	.30716
0.55	0 57815	.76204	1 15510	.06262	0.50052	.69942	1.9979	30058
0.56	.58973	.77065	1.16094	.06481	50798	.70584	1 9686	29416
0 57	.60137	77914	1.16690	.06703	.51536	.71211	1 9404	.28789
0.58	.61307	78751	1 17297	06929	.52267	71822	1 9133	28178
0.59	.62483	.79576	1.17916	.07157	.52990	72419	1 8872	.27581
0.60	0 63665	80390	1 18547	.07389	0 53705	.73001	1 8620	26999
0.61	.64854	.81194	1.19189	.07624	54413	.73570	1 8378	26430
0.62	.66049	.81987	1.19844	07861	55113	74125	1 8145	25875
0.63	.67251	.82770	1 20510	.08102	55805	74667	1 7919	25333
0 64	.68459	83543	1 21189	.08346	56490	.75197	1 7702	.24803
0.65	0 69675	84308	1 21879	08593	0 57167	75715	1 7493	.24285
0.66	.70897	.85063	1 22582	08843	57836	76220	1.7290	.23780
0.67	.72126	.85809	1 23297	09095	58498	.76714	1 7095	23286
0.68	.73363	.86548	1 24025	09351	.59152	77197	1 6906	22803
0.69	74607	.87278	1 24765	.09609	.59798	.77669	1.6723	22331
0.70	0.75858	.88000	1 25517	.09870	0.60437	.78130	1.6546	21870
0 71	.77117	.88715	1 26282	10134	.61068	.78581	1 6375	21419
0.72	.78384	.89423	1 27059	10401	61691	.79022	1 6210	20978
0.73	.79659	.90123	1 27849	10670	62307	.79453	1 6050	20547
0.74	.80941	.90817	1 28652	.10942	.62915	.79875	1.5895	.20125
0.75	0.82232	.91504	1 29468	11216	0 63515	80288	1 5744	19712
0.76	.83530	.92185	1 30297	.11493	.64108	80691	1 5599	19309
0.77	.84838	.92859	1 31139	11773	64693	.81086	1 5458	18914
0.78	86153	.93527	1 31994	.12055	.65271	81472	1 5321	18528
0.79	.87478	.94190	1 32862	.12340	.65841	81850	1.5188	18150
0.80	0.88811	94846	1 33743	.12627	0.66404	82219	1 5059	.17781
0.81	.90152	.95498	1.34638	.12917	66959	.82581	1.4935	17419
0.82	.91503	96144	1 35547	13209	67507	.82935	1 4813	17065
0.83	.92863	96784	1 36468	.13503	.68048	83281	1 4696	.16719
0.84	.94233	.97420	1 37404	.13800	68581	.83620	1.4581	.16380
0.85	0.95612	98051	1 38353	.14099	0.69107	83952	1.4470	16048
0.86	.97000	98677	1.39316	.14400	.69626	84277	1 4362	.15723
0.87	.98398	99299	1 40293	.14704	70137	84595	1 4258	15405
0.88	.99806	99916	1.41284	.15009	.70642	.84906	1.4156	.15094
0.89	1.01224	00528	1 42289	.15317	.71139	.85211	1.4057	14789
0.90	1.02652	.01137	1.43309	.15627	0.71630	.85509	1 3961	.14491
0 91	1.04090	.01741	1 44342	15939	.72113	85801	1 3867	.14199
0.92	1.05539	.02341	1 45390	.16254	.72590	86088	1 3776	.13912
0.93	1.06998	.02937	1.46453	.16570	.73059	.86368	1 3687	13632
0.94	1.08468	.03530	1.47530	.16888	.73522	.86642	1.3601	.13358
0.95	1.09948	.04119	1.48623	17208	0 73978	86910	1 3517	.13090
0.96	1.11440	.04704	1.49729	17531	.74428	87173	1 3436	12827
0.97	1.12943	.05286	1.50851	.17855	74870	87431	1 3356	.12569
0 98	1 14457	.05864	1 51988	.18181	75307	87683	1 3279	12317
0.99	1.15983	06439	1.53141	18509	75736	87930	1 3204	.12070

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x Value	Sinh x $\log_{10}$	Cosh x Value	Cosh x $\log_{10}$	Tanh x Value	Tanh x $\log_{10}$	Coth x Value	Coth x $\log_{10}$
1.00	1.17520	.07011	1.54308	.18839	0 76159	88172	1 3130	.11828
1.01	1 19069	07580	1.55491	.19171	.76576	.88409	1 3059	.11591
1.02	1.20630	08146	1 56689	.19504	.76987	.88642	1 2989	11358
1.03	1 22203	.08708	1 57904	.19839	77391	.88869	1 2921	11131
1.04	1.23788	.09268	1.59134	.20176	.77789	.89092	1 2855	.10908
1.05	1 25386	.09825	1 60379	.20515	0.78181	.89310	1 2791	.10690
1.06	1 26996	.10379	1 61641	20855	78566	89524	1 2728	.10476
1.07	1 28619	.10930	1.62919	.21197	.78946	.89733	1 2667	.10267
1.08	1 30254	.11479	1 64214	.21541	.79320	.89938	1 2607	.10062
1.09	1.31903	.12025	1 65525	.21886	.79688	.90139	1 2549	.09861
1.10	1 33565	.12569	1.66852	.22233	0.80050	.90336	1.2492	.09664
1.11	1 35240	.13111	1 68196	.22582	.80406	90529	1.2437	.09471
1.12	1 36929	.13649	1 69557	.22931	.80757	.90718	1 2383	.09282
1.13	1 38631	.14186	1 70934	23283	.81102	.90903	1.2330	.09097
1.14	1 40347	.14720	1.72329	.23636	.81441	.91085	1.2279	.08915
1.15	1.42078	.15253	1.73741	.23990	0 81775	.91262	1 2229	.08738
1.16	1.43822	.15783	1 75171	24346	82104	91436	1.2180	.08564
1.17	1 45581	.16311	1 76618	.24703	.82427	.91607	1.2132	08393
1.18	1 47355	.16836	1 78083	25062	.82745	.91774	1.2085	08226
1.19	1 49143	.17360	1 79565	.25422	.83058	.91938	1.2040	.08062
1.20	1 50946	.17882	1 81066	.25784	0 83365	.92099	1.1995	.07901
1.21	1 52764	.18402	1 82584	.26146	.83668	.92256	1.1952	.07744
1.22	1 54598	.18920	1 84121	.26510	.83965	.92410	1.1910	07590
1 23	1 56447	.19437	1 85676	.26876	.84258	92561	1.1868	07439
1.24	1 58311	.19951	1 87250	.27242	.84546	.92709	1.1828	.07291
1.25	1 60192	.20464	1 88842	.27610	0.84828	.92854	1 1789	07146
1.26	1 62088	.20975	1 90454	.27979	.85106	92996	1 1750	.07004
1 27	1 64001	.21485	1 92084	28349	.85380	93135	1.1712	.06865
1.28	1 65930	.21993	1 93734	.28721	85648	93272	1 1676	06728
1.29	1.67876	22499	1 95403	.29093	.85913	.93406	1.1640	.06594
1.30	1 69838	.23004	1.97091	.29467	0 86172	.93537	1.1605	.06463
1.31	1.71818	.23507	1 98800	.29842	.86428	.93665	1.1570	.06335
1.32	1 73814	.24009	2 00528	.30217	.86678	.93791	1.1537	.06209
1.33	1.75828	.24509	2 02276	.30594	.86925	.93914	1.1504	.06086
1.34	1 77860	.25008	2 04044	.30972	.87167	.94035	1.1472	.05965
1.35	1.79909	.25505	2 05833	.31352	0.87405	.94154	1.1441	05846
1.36	1.81977	.26002	2 07643	31732	.87639	.94270	1.1410	.05730
1.37	1.84062	.26496	2 09473	.32113	.87869	.94384	1 1381	.05616
1.38	1 86166	.26990	2 11324	.32495	.88095	.94495	1.1351	.05505
1.39	1 88289	.27482	2.13196	.32878	.88317	.94604	1.1323	.05396
1.40	1 90430	.27974	2 15090	.33262	0.88535	.94712	1.1295	.05288
1.41	1 92591	.28464	2 17005	.33647	.88749	.94817	1.1268	.05183
1.42	1 94770	.28952	2.18942	.34033	.88960	.94919	1 1241	.05081
1.43	1 96970	.29440	2 20900	.34420	.89167	.95020	1.1215	04980
1.44	1 99188	.29926	2 22881	.34807	.89370	.95119	1.1189	.04881
1.45	2.01427	.30412	2 24884	.35196	0.89569	.95216	1.1165	04784
1.46	2 03686	.30896	2.26910	.35585	.89765	95311	1 1140	.04689
1.47	2 05965	.31379	2 28958	35976	.89958	95404	1 1116	04596
1.48	2 08265	31862	2 31029	.36367	.90147	.95495	1.1093	04505
1.49	2 10586	.32343	2.33123	.36759	.90332	.95584	1.1070	.04416

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x Value	Sinh x $\log_{10}$	Cosh x Value	Cosh x $\log_{10}$	Tanh x Value	Tanh x $\log_{10}$	Coth x Value	Coth x $\log_{10}$
1.50	2 12928	.32823	2 35241	37151	0 90515	95672	1 1048	04328
1.51	2.15291	33303	2 37382	37545	.90694	95758	1.1026	04242
1.52	2.17676	.33781	2 39547	37939	.90870	95842	1.1005	04158
1.53	2 20082	.34258	2.41736	38334	.91042	.95924	1 0984	04076
1.54	2.22510	.34735	2.43949	.38730	.91212	96005	1 0963	03995
1.55	2 24961	.35211	2 46186	39126	0 91379	96084	1 0943	03916
1.56	2.27434	.35686	2.48448	.39524	.91542	.96162	1 0924	03838
1.57	2 29930	.36160	2 50735	39921	.91703	96238	1 0905	03762
1.58	2.32449	36633	2 53047	.40320	.91860	.96313	1 0886	03687
1.59	2.34991	.37105	2 55384	.40719	.92015	96386	1.0868	03614
1.60	2 37557	37577	2 57746	.41119	0.92167	96457	1 0850	03543
1.61	2 40146	.38048	2.60135	.41520	.92316	.96528	1 0832	03472
1.62	2 42760	.38518	2.62549	.41921	.92462	96597	1 0815	03403
1 63	2 45397	38987	2 64990	.42323	.92606	96664	1 0798	03336
1.64	2 48059	.39456	2 67457	.42725	.92747	96730	1.0782	03270
1.65	2 50746	.39923	2 69951	.43129	0.92886	96795	1 0766	03205
1.66	2.53459	.40391	2 72472	.43532	93022	96858	1 0750	03142
1.67	2 56196	.40857	2 75021	.43937	.93155	96921	1.0735	03079
1.68	2 58959	.41323	2.77596	.44341	.93286	96982	1 0720	03018
1.69	2 61748	.41788	2.80200	.44747	.93415	97042	1 0705	02958
1.70	2 64563	42253	2 82832	.45153	93541	97100	1 0691	02900
1.71	2 67405	.42717	2 85491	.45559	.93665	97158	1.0676	02842
1.72	2 70273	43180	2 88180	.45966	93786	97214	1 0663	02786
1.73	2 73168	.43643	2 90897	46374	93906	97269	1 0649	02731
1.74	2 76091	.44105	2 93643	.46782	94023	.97323	1 0636	02677
1.75	2 79041	.44567	2 96419	47191	0 94138	.97376	1 0623	02624
1.76	2 82020	45028	2 99224	.47600	94250	97428	1.0610	02572
1.77	2 85026	.45488	3.02059	.48009	.94361	97479	1.0598	.02521
1 78	2.88061	.45948	3 04925	.48419	.94470	97529	1.0585	02471
1.79	2 91125	.46408	3 07821	48830	.94576	.97578	1.0574	02422
1.80	2 94217	46867	3 10747	.49241	0.94681	97626	1.0562	02374
1.81	2 97340	.47325	3 13705	49652	.94783	.97673	1 0550	02327
1.82	3 00492	.47783	3 16694	.50064	.94884	97719	1.0539	.02281
1.83	3 03674	48241	3.19715	50476	.94983	97764	1.0528	02236
1.84	3.06886	48698	3 22768	.50889	.95080	97809	1 0518	.02191
1.85	3 10129	.49154	3 25853	51302	0 95175	97852	1 0507	.02148
1.86	3 13403	49610	3.28970	51716	95268	97895	1 0497	.02105
1.87	3 16709	50066	3 32121	.52130	95359	97936	1 0487	02064
1.88	3 20046	.50521	3 35305	52544	.95449	97977	1 0477	02023
1.89	3 23415	.50976	3 38522	52959	.95537	98017	1.0467	.01983
1.90	3 26816	.51430	3 41773	53374	0 95624	98057	1 0458	01943
1.91	3 30250	.51884	3.45058	53789	.95709	98095	1.0448	01905
1.92	3 33718	52338	3.48378	54205	.95792	98133	1 0439	01867
1.93	3 37218	.52791	3 51733	54621	.95873	.98170	1 0430	01830
1.94	3.40752	.53244	3.55123	.55038	.95953	.98206	1.0422	.01794
1.95	3 44321	.53696	3 58548	.55455	0.96032	.98242	1 0413	.01758
1.96	3 47923	.54148	3.62009	.55872	.96109	.98276	1 0405	01724
1.97	3 51561	.54606	3 65507	.56290	.96185	98311	1 0397	01689
1.98	3 55234	.55051	3 69041	56707	.96259	.98344	1 0389	.01656
1.99	3.58942	.55502	3.72611	57126	.96331	98377	1.0381	.01623

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	$\log_{10}$	Value	$\log_{10}$	Value	$\log_{10}$	Value	$\log_{10}$
2.00	3 62686	.55953	3.76220	.57544	0.96403	98409	1 0373	.01591
2.01	3.66466	.56403	3.79865	.57963	96473	98440	1 0366	.01560
2.02	3.70283	.56853	3 83549	.58382	.96541	.98471	1 0358	.01529
2.03	3.74138	.57303	3.87271	.58802	.96609	98502	1 0351	.01498
2.04	3.78029	.57753	3.91032	.59221	96675	98531	1 0344	.01469
2.05	3.81958	58202	3 94832	.59641	0 96740	98560	1 0337	.01440
2.06	3.85926	58650	3 98671	.60061	96803	98589	1 0330	.01411
2.07	3.89932	.59099	4 02550	.60482	.96865	98617	1 0324	.01383
2.08	3.93977	.59547	4 06470	.60903	.96926	98644	1 0317	.01356
2.09	3.98061	.59995	4 10430	61324	.96986	.98671	1.0311	.01329
2.10	4.02186	.60443	4.14431	.61745	0 97045	.98697	1 0304	.01303
2.11	4.06350	.60890	4 18474	.62167	.97103	98723	1 0298	.01277
2.12	4.10555	.61337	4.22558	.62589	.97159	.98748	1 0292	.01252
2.13	4.14801	.61784	4 26685	.63011	.97215	98773	1.0286	.01227
2.14	4.19089	.62231	4 30855	.63433	.97269	.98798	1 0281	.01202
2.15	4.23419	.62677	4.35067	.63856	0.97323	.98821	1 0275	.01179
2.16	4.27791	.63123	4 39323	.64278	.97375	.98845	1.0270	.01155
2.17	4.32205	.63569	4.43623	.64701	97426	.98868	1 0264	.01132
2.18	4.36663	.64015	4 47967	.65125	.97477	.98890	1 0259	.01110
2.19	4.41165	.64460	4.52356	.65548	.97526	.98912	1.0254	.01088
2.20	4 45711	.64905	4.56791	.65972	0.97574	.98934	1.0249	.01066
2.21	4 50301	.65350	4.61271	.66396	.97622	.98955	1.0244	.01045
2.22	4.54936	.65795	4.65797	.66820	.97668	.98975	1 0239	.01025
2.23	4 59617	.66240	4 70370	.67244	.97714	.98996	1.0234	.01004
2.24	4 64344	.66684	4.74989	.67668	.97759	.99016	1 0229	.00984
2.25	4.69117	.67128	4.79657	.68093	0.97803	.99035	1.0225	.00965
2.26	4.73937	.67572	4.84372	.68518	.97846	.99054	1.0220	.00946
2.27	4.78804	68016	4 89136	.68943	.97888	.99073	1.0216	.00927
2.28	4 83720	68459	4 93948	.69368	.97929	99091	1.0211	.00909
2.29	4.88684	68903	4 98810	.69794	.97970	.99109	1.0207	.00891
2.30	4 93696	.69346	5 03722	.70219	0.98010	.99127	1 0203	.00873
2.31	4.98758	.69789	5 08684	.70645	.98049	.99144	1.0199	.00856
2.32	5.03870	70232	5.13697	.71071	.98087	.99161	1.0195	.00839
2.33	5.09032	.70675	5.18762	.71497	.98124	.99178	1 0191	.00822
2.34	5.14245	.71117	5.23878	.71923	.98161	.99194	1 0187	.00806
2.35	5 19510	.71559	5.29047	.72349	0.98197	.99210	1.0184	.00790
2.36	5 24827	.72002	5 34269	.72776	.98233	.99226	1.0180	.00774
2.37	5 30196	.72444	5.39544	.73203	.98267	.99241	1.0176	.00759
2 38	5 35618	.72885	5.44873	.73630	.98301	.99256	1.0173	.00744
2.39	5 41093	.73327	5.50256	.74056	.98335	.99271	1 0169	.00729
2.40	5 46623	.73769	5.55695	.74484	0.98367	.99285	1.0166	.00715
2.41	5 52207	.74210	5.61189	.74911	.98400	.99299	1.0163	.00701
2.42	5 57847	.74652	5.66739	.75338	98431	.99313	1.0159	.00687
2.43	5 63542	.75093	5 72346	.75766	.98462	.99327	1.0156	.00673
2.44	5 69294	.75534	5.78010	.76194	.98492	.99340	1.0153	.00660
2.45	5 75103	.75975	5 83732	.76621	0.98522	.99353	1 0150	.00647
2.46	5 80969	.76415	5.89512	.77049	.98551	.99366	1.0147	.00634
2.47	5 86893	.76856	5 95352	.77477	.98579	.99379	1 0144	.00621
2.48	5 92876	.77296	6.01250	.77906	.98607	.99391	1.0141	.00609
2.49	5 98918	.77737	6.07209	.78334	.98635	.99403	1.0138	.00597

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x		Cosh x		Tanh x		Coth x	
	Value	$\log_{10}$	Value	$\log_{10}$	Value	$\log_{10}$	Value	$\log_{10}$
2.50	6.05020	.78177	6.13229	.78762	0.98661	.99415	1.0136	.00585
2.51	6.11183	.78617	6.19310	.79191	.98688	.99426	1.0133	.00574
2.52	6.17407	.79057	6.25453	.79619	.98714	.99438	1.0130	.00562
2.53	6.23692	.79497	6.31658	.80048	.98739	.99449	1.0128	.00551
2.54	6.30040	.79937	6.37927	.80477	.98764	.99460	1.0125	.00540
2.55	6.36451	.80377	6.44259	.80906	0.98788	.99470	1.0123	.00530
2.56	6.42926	.80816	6.50656	.81335	.98812	.99481	1.0120	.00519
2.57	6.49464	.81256	6.57118	.81764	.98835	.99491	1.0118	.00509
2.58	6.56068	.81695	6.63646	.82194	.98858	.99501	1.0115	.00499
2.59	6.62738	.82134	6.70240	.82623	.98881	.99511	1.0113	.00489
2.60	6.69473	.82573	6.76901	.83052	0.98903	.99521	1.0111	.00479
2.61	6.76276	.83012	6.83629	.83482	.98924	.99530	1.0109	.00470
2.62	6.83146	.83451	6.90426	.83912	.98946	.99540	1.0107	.00460
2.63	6.90085	.83890	6.97292	.84341	.98966	.99549	1.0104	.00451
2.64	6.97092	.84329	7.04228	.84771	.98987	.99558	1.0102	.00442
2.65	7.04169	.84768	7.11234	.85201	0.99007	.99566	1.0100	.00434
2.66	7.11317	.85206	7.18312	.85631	.99026	.99575	1.0098	.00425
2.67	7.18536	.85645	7.25461	.86061	.99045	.99583	1.0096	.00417
2.68	7.25827	.86083	7.32683	.86492	.99064	.99592	1.0094	.00408
2.69	7.33190	.86522	7.39978	.86922	.99083	.99600	1.0093	.00400
2.70	7.40626	.86960	7.47347	.87352	0.99101	.99608	1.0091	.00392
2.71	7.48137	.87398	7.54791	.87783	.99118	.99615	1.0089	.00385
2.72	7.55722	.87836	7.62310	.88213	.99136	.99623	1.0087	.00377
2.73	7.63383	.88274	7.69905	.88644	.99153	.99631	1.0085	.00369
2.74	7.71121	.88712	7.77578	.89074	.99170	.99638	1.0084	.00362
2.75	7.78935	.89150	7.85328	.89505	0.99186	.99645	1.0082	.00355
2.76	7.86828	.89588	7.93157	.89936	.99202	.99652	1.0080	.00348
2.77	7.94799	.90026	8.01065	.90367	.99218	.99659	1.0079	.00341
2.78	8.02849	.90463	8.09053	.90798	.99233	.99666	1.0077	.00334
2.79	8.10980	.90901	8.17122	.91229	.99248	.99672	1.0076	.00328
2.80	8.19192	.91339	8.25273	.91660	0.99263	.99679	1.0074	.00321
2.81	8.27486	.91776	8.33506	.92091	.99278	.99685	1.0073	.00315
2.82	8.35862	.92213	8.41823	.92522	.99292	.99691	1.0071	.00309
2.83	8.44322	.92651	8.50224	.92953	.99306	.99698	1.0070	.00302
2.84	8.52867	.93088	8.58710	.93385	.99320	.99704	1.0069	.00296
2.85	8.61497	.93525	8.67281	.93816	0.99333	.99709	1.0067	.00291
2.86	8.70213	.93963	8.75940	.94247	.99346	.99715	1.0066	.00285
2.87	8.79016	.94400	8.84686	.94679	.99359	.99721	1.0065	.00279
2.88	8.87907	.94837	8.93520	.95110	.99372	.99726	1.0063	.00274
2.89	8.96887	.95274	9.02444	.95542	.99384	.99732	1.0062	.00268
2.90	9.05956	.95711	9.11458	.95974	0.99396	.99737	1.0061	.00263
2.91	9.15116	.96148	9.20564	.96405	.99408	.99742	1.0060	.00258
2.92	9.24368	.96584	9.29761	.96837	.99420	.99747	1.0058	.00253
2.93	9.33712	.97021	9.39051	.97269	.99431	.99752	1.0057	.00248
2.94	9.43149	.97458	9.48436	.97701	.99443	.99757	1.0056	.00243
2.95	9.52681	.97895	9.57915	.98133	0.99454	.99762	1.0055	.00238
2.96	9.62308	.98331	9.67490	.98565	.99464	.99767	1.0054	.00233
2.97	9.72031	.98768	9.77161	.98997	.99475	.99771	1.0053	.00229
2.98	9.81851	.99205	9.86930	.99429	.99485	.99776	1.0052	.00224
2.99	9.91770	.99641	9.96798	.99861	.99496	.99780	1.0051	.00220
3.00	10.01787	.00078	10.06766	.00293	0.99505	.99785	1.0050	.00215

HYPERBOLIC FUNCTIONS (Continued)

The logarithms given below show the mantissa only. The proper characteristic must be added.

x	Sinh x Value	Sinh x $\log_{10}$	Cosh x Value	Cosh x $\log_{10}$	Tanh x Value	Tanh x $\log_{10}$	Coth x Value	Coth x $\log_{10}$
3.0	10.0179	.00078	10.0677	.00293	0.99505	.99785	1.0050	.00215
3.1	11.0765	.04440	11.1215	.04616	.99595	.99824	1.0041	.00176
3.2	12.2459	.08799	12.2866	.08943	.99668	.99856	1.0033	.00144
3.3	13.5379	.13155	13.5748	.13273	.99728	.99882	1.0027	.00118
3.4	14.9654	.17509	14.9987	.17605	.99777	.99903	1.0022	.00097
3.5	16.5426	.21860	16.5728	.21940	0.99818	.99921	1.0018	.00079
3.6	18.2855	.26211	18.3128	.26275	.99851	.99935	1.0015	.00065
3.7	20.2113	.30559	20.2360	.30612	.99878	.99947	1.0012	.00053
3.8	22.3394	.34907	22.3618	.34951	.99900	.99957	1.0010	.00043
3.9	24.6911	.39254	24.7113	.39290	.99918	.99964	1.0008	.00036
4.0	27.2899	.43600	27.3082	.43629	0.99933	.99971	1.0007	.00029
4.1	30.1619	.47946	30.1784	.47970	.99945	.99976	1.0005	.00024
4.2	33.3357	.52291	33.3507	.52310	.99955	.99980	1.0004	.00020
4.3	36.8431	.56636	36.8567	.56652	.99963	.99984	1.0004	.00016
4.4	40.7193	.60980	40.7316	.60993	.99970	.99987	1.0003	.00013
4.5	45.0030	.65324	45.0141	.65335	0.99975	.99989	1.0002	.00011
4.6	49.7371	.69668	49.7472	.69677	.99980	.99991	1.0002	.00009
4.7	54.9690	.74012	54.9781	.74019	.99983	.99993	1.0002	.00007
4.8	60.7511	.78355	60.7593	.78361	.99986	.99994	1.0001	.00006
4.9	67.1412	.82699	67.1486	.82704	.99989	.99995	1.0001	.00005
5.0	74.2032	.87042	74.2099	.87046	0.99991	.99996	1.0001	.00004

FACTORIALS, EXACT VALUES AND RECIPROCALS

n	$n!$	n	$n!$	n	$1/n!$	n	$1/n!$
1	1	11	39916800	1	1.	11	$.25052 \times 10^{-7}$
2	2	12	479001600	2	0.5	12	$.20877 \times 10^{-8}$
3	6	13	6227020800	3	.16667	13	$.16059 \times 10^{-9}$
4	24	14	87178291200	4	$.41667 \times 10^{-1}$	14	$.11471 \times 10^{-10}$
5	120	15	1307674368000	5	$.83333 \times 10^{-2}$	15	$.76472 \times 10^{-12}$
6	720	16	20922789888000	6	$.13889 \times 10^{-2}$	16	$.47795 \times 10^{-13}$
7	5040	17	355687428096000	7	$.19841 \times 10^{-3}$	17	$.28115 \times 10^{-14}$
8	40320	18	6402373705728000	8	$.24802 \times 10^{-4}$	18	$.15619 \times 10^{-15}$
9	362880	19	121645100408832000	9	$.27557 \times 10^{-5}$	19	$.82206 \times 10^{-17}$
10	3628800	20	2432902008176640000	10	$.27557 \times 10^{-6}$	20	$.41103 \times 10^{-18}$

DEGREES—RADIANS

1 radian = 57° 17′ 44″.80625

	log
1 radian = 57.29577 95131 degrees	1.75812 26324
1 radian = 3437.74677 07849 minutes	3.53627 38828
1 radian = 206264.80625 seconds	5.31442 51332
1 degree = 0.01745 32925 19943 radians	8.24187 73676–10
1 minute = 0.00029 08882 08666 radians	6.46372 61172–10
1 second = 0.00000 48481 36811 radians	4.68557 48668–10

DEGREES—RADIANS

The table gives in radians the angle which is expressed in degrees and minutes at the side and top. Angles expressed to the nearest minute and second can readily be converted to radians by adding to the equivalent of the whole number of degrees the equivalents of the minutes and seconds found on the third page of this table.

°	00′	10	20	30	40	50
0	0 00000	0 00291	0 00582	0 00873	0 01164	0.01454
1	0 01745	0 02036	0 02327	0 02618	0 02909	0 03200
2	0 03491	0 03782	0 04072	0 04363	0 04654	0 04945
3	0 05236	0.05527	0 05818	0 06109	0 06400	0 06690
4	0 06981	0 07272	0 07563	0 07854	0 08145	0 08436
5	0 08727	0 09018	0 09308	0 09599	0 09890	0 10181
6	0 10472	0 10763	0 11054	0 11345	0 11636	0 11926
7	0 12217	0 12508	0 12799	0 13090	0 13381	0.13672
8	0 13963	0 14254	0 14544	0 14835	0 15126	0 15417
9	0 15708	0 15999	0 16290	0 16581	0 16872	0.17162
10	0.17453	0 17744	0 18035	0 18326	0 18617	0 18908
11	0 19199	0 19490	0 19780	0 20071	0 20362	0 20653
12	0 20944	0 21235	0 21526	0.21817	0 22108	0 22398
13	0 22689	0 22980	0 23271	0.23562	0 23853	0 24144
14	0 24435	0 24725	0 25016	0 25307	0 25598	0 25889
15	0 26180	0 26471	0 26762	0 27053	0 27343	0 27634
16	0 27925	0 28216	0 28507	0 28798	0 29089	0 29380
17	0 29671	0 29961	0 30252	0.30543	0 30834	0 31125
18	0 31416	0 31707	0 31998	0 32289	0 32579	0 32870
19	0 33161	0 33452	0 33743	0 34034	0.34325	0 34616
20	0.34907	0 35197	0 35488	0 35779	0 36070	0 36361
21	0 36652	0 36943	0 37234	0 37525	0 37815	0 38106
22	0 38397	0 38688	0 38979	0 39270	0 39561	0 39852
23	0 40143	0 40433	0 40724	0 41015	0 41306	0 41597
24	0 41888	0 42179	0 42470	0 42761	0 43051	0 43342
25	0 43633	0 43924	0 44215	0 44506	0 44797	0 45088
26	0 45379	0 45669	0 45960	0 46251	0 46542	0 46833
27	0.47124	0 47415	0 47706	0 47997	0 48287	0 48578
28	0 48869	0 49160	0.49451	0 49742	0 50033	0 50324
29	0.50615	0 50905	0 51196	0 51487	0 51778	0 52069
30	0.52360	0 52651	0 52942	0 53233	0 53523	0 53814
31	0.54105	0 54396	0.54687	0 54978	0 55269	0 55560
32	0 55851	0 56141	0.56432	0 56723	0 57014	0.57305
33	0 57596	0 57887	0.58178	0 58469	0 58759	0 59050
34	0 59341	0 59632	0 59923	0 60214	0 60505	0 60796
35	0 61087	0.61377	0 61668	0 61959	0 62250	0 62541
36	0 62832	0.63123	0 63414	0 63705	0 63995	0 64286
37	0 64577	0 64868	0 65159	0 65450	0 65741	0 66032
38	0 66323	0 66613	0 66904	0 67195	0.67486	0 67777
39	0.68068	0 68359	0 68650	0 68941	0.69231	0 69522
40	0 69813	0 70104	0 70395	0 70686	0 70977	0 71268
41	0 71558	0 71849	0 72140	0 72431	0 72722	0 73013
42	0 73304	0 73595	0 73886	0 74176	0 74467	0 74758
43	0 75049	0.75340	0.75631	0 75922	0.76213	0 76504
44	0 76794	0 77085	0 77376	0 77667	0.77958	0 78249
45	0 78540	0 78831	0 79122	0 79412	0.79703	0 79994
46	0.80285	0 80576	0 80867	0 81158	0 81449	0 81740
47	0 82030	0 82321	0.82612	0 82903	0 83194	0 83485
48	0.83776	0 84067	0 84358	0 84648	0 84939	0 85230
49	0.85521	0 85812	0 86103	0 86394	0.86685	0.86976
50	0.87266	0 87557	0 87848	0 88139	0 88430	0 88721

DEGREES—RADIANS (Continued)

°	00′	10	20	30	40	50
50	0.87266	0.87557	0 87848	0 88139	0 88430	0 88721
51	0.89012	0 89303	0 89594	0.89884	0 90175	0 90466
52	0.90757	0.91048	0 91339	0 91630	0 91921	0.92212
53	0.92502	0.92793	0 93084	0 93375	0 93666	0 93957
54	0.94248	0 94539	0 94830	0 95120	0 95411	0 95702
55	0 95993	0 96284	0 96575	0 96866	0 97157	0 97448
56	0 97738	0 98029	0 98320	0 98611	0 98902	0 99193
57	0 99484	0 99775	1 00066	1 00356	1 00647	1 00938
58	1 01229	1 01520	1 01811	1 02102	1 02393	1 02684
59	1 02974	1.03265	1 03556	1 03847	1 04138	1.04429
60	1.04720	1.05011	1 05302	1 05592	1 05883	1 06174
61	1 06465	1.06756	1 07047	1 07338	1.07629	1 07920
62	1.08210	1.08501	1.08792	1.09083	1.09374	1 09665
63	1 09956	1.10247	1 10538	1 10828	1.11119	1 11410
64	1.11701	1.11992	1 12283	1 12574	1.12865	1 13156
65	1 13446	1 13737	1 14028	1.14319	1.14610	1 14901
66	1 15192	1.15483	1 15774	1 16064	1 16355	1 16646
67	1 16937	1 17228	1 17519	1 17810	1 18101	1 18392
68	1 18682	1 18973	1 19264	1 19555	1 19846	1 20137
69	1 20428	1 20719	1 21009	1 21300	1 21591	1 21882
70	1 22173	1 22464	1 22755	1 23046	1 23337	1 23627
71	1.23918	1 24209	1 24500	1 24791	1 25082	1 25373
72	1 25664	1 25955	1 26245	1 26536	1 26827	1 27118
73	1 27409	1 27700	1 27991	1 28282	1 28573	1 28863
74	1 29154	1.29445	1.29736	1 30027	1 30318	1 30609
75	1 30900	1 31191	1 31481	1.31772	1 32063	1 32354
76	1 32645	1 32936	1 33227	1 33518	1 33809	1 34099
77	1 34390	1 34681	1 34972	1 35263	1 35554	1 35845
78	1 36136	1 36427	1 36717	1 37008	1 37299	1 37590
79	1 37881	1 38172	1 38463	1 38754	1 39045	1 39335
80	1 39626	1 39917	1 40208	1 40499	1 40790	1 41081
81	1 41372	1 41663	1 41953	1 42244	1.42535	1 42826
82	1 43117	1 43408	1 43699	1 43990	1 44281	1 44571
83	1 44862	1 45153	1 45444	1.45735	1.46026	1 46317
84	1 46608	1.46899	1 47189	1 47480	1 47771	1 48062
85	1 48353	1 48644	1 48935	1 49226	1 49517	1 49807
86	1 50098	1 50389	1 50680	1.50971	1 51262	1 51553
87	1 51844	1 52135	1 52425	1 52716	1 53007	1 53298
88	1 53589	1.53880	1 54171	1 54462	1 54753	1 55043
89	1 55334	1.55625	1 55916	1 56207	1 56498	1 56789
90	1 57080	1.57371	1 57661	1 57952	1 58243	1 58534
91	1 58825	1 59116	1.59407	1 59698	1 59989	1 60279
92	1 60570	1.60861	1 61152	1 61443	1 61734	1 62025
93	1 62316	1 62607	1 62897	1.63188	1 63479	1 63770
94	1 64061	1 64352	1 64643	1 64934	1 65225	1 65515
95	1 65806	1.66097	1 66388	1 66679	1 66970	1 67261
96	1.67552	1 67842	1 68133	1 68424	1 68715	1 69006
97	1 69297	1 69588	1 69879	1 70170	1 70460	1 70751
98	1 71042	1 71333	1 71624	1 71915	1 72206	1 72497
99	1 72788	1 73078	1 73369	1 73660	1 73951	1 74242
100	1 74533	1 74824	1 75115	1 75406	1 75696	1 75987
101	1 76278	1 76569	1 76860	1 77151	1 77442	1 77733
102	1 78024	1.78314	1 78605	1 78896	1 79187	1 79478
103	1 79769	1.80060	1 80351	1 80642	1 80932	1 81223
104	1 81514	1.81805	1 82096	1 82387	1 82678	1 82969
105	1 83260	1.83550	1 83841	1 84132	1 84423	1 84714
106	1 85004	1.85296	1 85587	1 85878	1 86168	1 86459
107	1 86750	1 87041	1 87332	1 87623	1 87914	1 88205
108	1 88496	1 88786	1 89077	1 89368	1 89659	1 89950
109	1 90241	1 90532	1 90823	1 91114	1 91404	1 91695
110	1 91986	1 92277	1 92568	1 92859	1 93150	1 93441

DEGREES—RADIANS (Concluded)

Deg.	Radians	Deg.	Radians	Min.	Radians	Sec.	Radians
90	1 57080	**150**	2 61799	**0**	0 00000	**0**	0 00000
91	1 58825	151	2.63545	1	0 00029	1	0.00000
92	1 60570	152	2 65290	2	0 00058	2	0 00001
93	1 62316	153	2 67035	3	0 00087	3	0 00001
94	1.64061	154	2 68781	4	0 00116	4	0 00002
95	1 65806	**155**	2 70526	**5**	0 00145	**5**	0 00002
96	1.67552	156	2 72271	6	0 00175	6	0 00003
97	1 69297	157	2.74017	7	0 00204	7	0.00003
98	1 71042	158	2 75762	8	0.00233	8	0.00004
99	1 72788	159	2 77507	9	0 00262	9	0 00004
100	1.74533	**160**	2 79253	**10**	0.00291	**10**	0 00005
101	1 76278	161	2 80998	11	0 00320	11	0 00005
102	1 78024	162	2 82743	12	0 00349	12	0 00006
103	1 79769	163	2 84489	13	0.00378	13	0 00006
104	1 81514	164	2 86234	14	0 00407	14	0 00007
105	1 83260	**165**	2 87979	**15**	0 00436	**15**	0 00007
106	1 85005	166	2 89725	16	0.00465	16	0 00008
107	1 86750	167	2.91470	17	0.00495	17	0 00008
108	1.88496	168	2.93215	18	0 00524	18	0 00009
109	1 90241	169	2.94961	19	0 00553	19	0 00009
110	1 91986	**170**	2.96706	**20**	0 00582	**20**	0 00010
111	1 93732	171	2 98451	21	0 00611	21	0 00010
112	1.95477	172	3.00197	22	0 00640	22	0 00011
113	1 97222	173	3 01942	23	0.00669	23	0 00011
114	1 98968	174	3 03687	24	0 00698	24	0 00012
115	2.00713	**175**	3 05433	**25**	0 00727	**25**	0 00012
116	2 02458	176	3.07178	26	0 00756	26	0 00013
117	2 04204	177	3.08923	27	0 00785	27	0 00013
118	2 05949	178	3.10669	28	0.00814	28	0 00014
119	2.07694	179	3.12414	29	0 00844	29	0.00014
120	2 09440	**180**	3 14159	**30**	0 00873	**30**	0 00015
121	2.11185	190	3 31613	31	0 00902	31	0 00015
122	2 12930	200	3.49066	32	0 00931	32	0 00016
123	2 14676	210	3 66519	33	0 00960	33	0 00016
124	2 16421	220	3 83972	34	0 00989	34	0 00016
125	2.18166	**230**	4.01426	**35**	0.01018	**35**	0 00017
126	2.19911	240	4 18879	36	0 01047	36	0 00017
127	2 21657	250	4 36332	37	0 01076	37	0 00018
128	2 23402	260	4 53786	38	0 01105	38	0 00018
129	2.25147	270	4 71239	39	0.01134	39	0.00019
130	2 26893	**280**	4 88692	**40**	0 01164	**40**	0.00019
131	2 28638	290	5.06145	41	0.01193	41	0 00020
132	2 30383	300	5 23599	42	0 01222	42	0 00020
133	2 32129	310	5.41052	43	0 01251	43	0 00021
134	2.33874	320	5 58505	44	0 01280	44	0 00021
135	2 35619	**330**	5 75959	**45**	0 01309	**45**	0 00022
136	2.37365	340	5 93412	46	0.01338	46	0 00022
137	2 39110	350	6 10865	47	0 01367	47	0 00023
138	2 40855	360	6 28319	48	0 01396	48	0 00023
139	2 42601	370	6 45772	49	0 01425	49	0 00024
140	2 44346	**380**	6.63225	**50**	0 01454	**50**	0 00024
141	2 46091	390	6 80678	51	0.01484	51	0 00025
142	2.47837	400	6 98132	52	0.01513	52	0.00025
143	2 49582	410	7.15585	53	0.01542	53	0 00026
144	2.51327	420	7 33038	54	0 01571	54	0 00026
145	2.53073	**430**	7 50492	**55**	0 01600	**55**	0 00027
146	2.54818	440	7 67945	56	0.01629	56	0 00027
147	2.56563	450	7 85398	57	0.01658	57	0 00028
148	2.58309	460	8 02851	58	0 01687	58	0 00028
149	2.60054	470	8 20305	59	0 01716	59	0 00029
150	2.61799	**480**	8.37758	**60**	0 01745	**60**	0 00029

DEGREES AND DECIMAL FRACTIONS TO RADIANS

The table below facilitates conversion of an angle expressed in degrees and decimal fractions into radians. To convert 25.78 into radians, find the equivalents, successively, of 20°, 5°, 0°.7, 0°.08 and add.

Deg.	Radians	Deg.	Radians	Deg.	Radians	Deg.	Radians	Deg.	Radians
10	0.174533	1	0.017453	0.1	0.001745	0 01	0.000175	0.001	0.000017
20	0.349066	2	.034907	.2	.003491	.02	.000349	.002	.000035
30	0 523599	3	.052360	.3	.005236	.03	.000524	.003	.000052
40	0 698132	4	.069813	.4	.006981	.04	.000698	.004	.000070
50	0.872665	5	.087266	.5	.008727	.05	.000873	.005	.000087
60	1.047198	6	.104720	.6	.010472	.06	.001047	.006	.000105
70	1.221730	7	.122173	.7	.012217	.07	.001222	.007	.000122
80	1.396263	8	.139626	.8	.013963	.08	.001396	.008	.000140
90	1.570796	9	.157080	.9	.015708	.09	.001571	.009	.000157

RADIANS—DEGREES

Radians	Degrees	Radians	Degrees	Radians	Degrees	Radians	Degrees
1	57 2958	0 1	5 7296	0 01	0 5730	0 001	0.0573
2	114 5916	.2	11 4592	.02	1 1459	.002	.1146
3	171 8873	3	17.1887	03	1 7189	003	1719
4	229 1831	4	22 9183	.04	2 2918	004	2292
5	286 4789	5	28 6479	.05	2 8648	005	2865
6	343 7747	6	34 3775	.06	3 4377	.006	3438
7	401 0705	7	40 1070	07	4 0107	.007	4011
8	458 3662	.8	45 8366	08	4 5837	008	4584
9	515 6620	.9	51 5662	09	5 1566	009	.5157
10	572 9578	1 0	57 2958	10	5 7296	010	5730

RADIANS—DEGREES

Multiples and Fractions of π Radians

Radians	Radians	Deg.	Radians	Radians	Deg.	Radians	Radians	Deg.
π	3 1416	180	$\pi/2$	1 5708	90	$2\pi/3$	2 0944	120
2π	6 2832	360	$\pi/3$	1 0472	60	$3\pi/4$	2 3562	135
3π	9 4248	540	$\pi/4$	0 7854	45	$5\pi/6$	2 6180	150
4π	12 5664	720	$\pi/5$	0 6283	36	$7\pi/6$	3 6652	210
5π	15 7080	900	$\pi/6$	0 5236	30	$5\pi/4$	3 9270	225
6π	18 8496	1080	$\pi/7$	0 4488	25 714	$4\pi/3$	4 1888	240
7π	21 9911	1260	$\pi/8$	0 3927	22 5	$3\pi/2$	4 7124	270
8π	25 1327	1440	$\pi/9$	0 3491	20	$5\pi/3$	5 2360	300
9π	28 2743	1620	$\pi/10$	0 3142	18	$7\pi/4$	5 4978	315
10π	31 4159	1800	$\pi/12$	0 2618	15	$11\pi/6$	5 7596	330

CONVERSION OF ANGLES FROM ARC TO TIME

Arc	Time	Arc	Time	Arc	Time	Arc	Time
°	h m	°	h m	″	s	″	s
′	m s	′	m s				
0	0 00	20	1 20	0	0 00	8	0 53
1	0 04	30	2 00	1	0 07	9	0 60
2	0 08	40	2 40	2	0 13	10	0 67
3	0 12	50	3 20	3	0 20	20	1 33
4	0 16	60	4 00	4	0 27	30	2 00
5	0 20	70	4 40	5	0 33	40	2 67
6	0 24	80	5 20	6	0.40	50	3 33
7	0 28	90	6 00	7	0 47	60	4.00
8	0 32	100	6 40				
9	0 36	200	13 20				
10	0 40	300	20 00				

MINUTES AND SECONDS TO DECIMAL PARTS OF A DEGREE

MINUTES AND SECONDS TO DECIMAL PARTS OF A DEG.

Min.	Degrees	Sec.	Degrees
0	0.00000	**0**	0.00000
1	.01667	1	.00028
2	.03333	2	.00056
3	.05	3	.00083
4	.06667	4	.00111
5	.08333	5	.00139
6	.10	6	.00167
7	.11667	7	.00194
8	.13333	8	.00222
9	.15	9	.0025
10	0.16667	**10**	0.00278
11	.18333	11	.00306
12	.20	12	.00333
13	.21667	13	.00361
14	.23333	14	.00389
15	.25	15	.00417
16	.26667	16	.00444
17	.28333	17	.00472
18	.30	18	.005
19	.31667	19	.00528
20	0.33333	**20**	0.00556
21	.35	21	.00583
22	.36667	22	.00611
23	.38333	23	.00639
24	.40	24	.00667
25	.41667	25	.00694
26	.43333	26	00722
27	.45	27	.0075
28	.46667	28	.00778
29	.48333	29	.00806
30	0.50	**30**	0.00833
31	.51667	31	.00861
32	.53333	32	.00889
33	.55	33	.00917
34	.56667	34	.00944
35	.58333	35	.00972
36	.60	36	.01
37	.61667	37	.01028
38	.63333	38	.01056
39	.65	39	.01083
40	0.66667	**40**	0.01111
41	.68333	41	.01139
42	.70	42	.01167
43	.71667	43	.01194
44	.73333	44	.01222
45	.75	45	.0125
46	.76667	46	.01278
47	.78333	47	.01306
48	.80	48	.01333
49	.81667	49	.01361
50	0.83333	**50**	0.01389
51	.85	51	.01417
52	.86667	52	.01444
53	.88333	53	.01472
54	.90	54	.015
55	.91667	55	.01528
56	.93333	56	.01556
57	.95	57	.01583
58	.96667	58	.01611
59	.98333	59	.01639
60	1.00	**60**	0.01667

DECIMAL PARTS OF A DEGREE TO MINUTES AND SECONDS

Deg.	′	″	Deg.	′	″
0.00	0	00	**0.60**	36	
.01	0	36	.61	36	36
.02	1	12	.62	37	12
.03	1	48	.63	37	48
.04	2	24	.64	38	24
.05	3		.65	39	
.06	3	36	.66	39	36
.07	4	12	.67	40	12
.08	4	48	.68	40	48
.09	5	24	.69	41	24
0.10	6		**0.70**	42	
.11	6	36	.71	42	36
.12	7	12	.72	43	12
.13	7	48	.73	43	48
.14	8	24	.74	44	24
.15	9		.75	45	
.16	9	36	.76	45	36
.17	10	12	.77	46	12
.18	10	48	.78	46	48
.19	11	24	.79	47	24
0.20	12		**0.80**	48	
.21	12	36	.81	48	36
.22	13	12	.82	49	12
.23	13	48	.83	49	48
.24	14	24	.84	50	24
.25	15		.85	51	
.26	15	36	.86	51	36
.27	16	12	.87	52	12
.28	16	48	.88	52	48
.29	17	24	89	53	24
0.30	18		**0.90**	54	
.31	18	36	.91	54	36
.32	19	12	.92	55	12
.33	19	48	.93	55	48
.34	20	24	.94	56	24
.35	21		.95	57	
.36	21	36	.96	57	36
.37	22	12	.97	58	12
.38	22	48	.98	58	48
39	23	24	.99	59	24
0.40	24		**1.00**	60	
.41	24	36			
.42	25	12			
.43	25	48			
.44	26	24			
.45	27				
.46	27	36			
.47	28	12			
.48	28	48			
.49	29	24			
0.50	30				
.51	30	36			
.52	31	12			
.53	31	48			
.54	32	24			
.55	33				
.56	33	36			
.57	34	12			
.58	34	48			
.59	35	24			
0.60	36				

Deg.	Sec.
0.000	0.0
.001	3.6
.002	7.2
.003	10.8
.004	14.4
.005	18.
.006	21.6
.007	25.2
.008	28.8
.009	32.4
0.010	36.

NUMERICAL TABLES
Reciprocals, Circumference and Area of Circles

As a matter of convenience, the values of 1000 $\times$ $(1/n)$ are given in the table. To obtain the actual value of the reciprocal, shift the decimal point three places to the left.

Circumferences and areas of circles are given for the values of n as the diameter.

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
0	∞	0 000000	.0000000	**50**	20 00000	157 0796	1963 495
1	1000 000	3 141593	7853982	51	19 60784	160 2212	2042 821
2	500 0000	6 283185	3 141593	52	19 23077	163 3628	2123 717
3	333 3333	9 424778	7 068583	53	18 86792	166 5044	2206 183
4	250 0000	12.56637	12.56637	54	18.51852	169 6460	2290 221
5	200 0000	15.70796	19 63495	55	18 18182	172 7876	2375 829
6	166 6667	18.84956	28 27433	56	17.85714	175 9292	2463 009
7	142 8571	21.99115	38 48451	57	17 54386	179 0708	2551 759
8	125 0000	25 13274	50 26548	58	17.24138	182 2124	2642 079
9	111.1111	28 27433	63.61725	59	16.94915	185 3540	2733 971
10	100 0000	31 41593	78.53982	**60**	16 66667	188 4956	2827 433
11	90 90909	34 55752	95 03318	61	16 39344	191 6372	2922.467
12	83 33333	37 69911	113 0973	62	16 12903	194 7787	3019 071
13	76.92308	40 84070	132.7323	63	15.87302	197.9203	3117 245
14	71 42857	43.98230	153.9380	64	15.62500	201.0619	3216 991
15	66 66667	47.12389	176.7146	65	15 38462	204 2035	3318 307
16	62 50000	50 26548	201 0619	66	15 15152	207 3451	3421.194
17	58 82353	53 40708	226 9801	67	14 92537	210 4867	3525 652
18	55 55556	56 54867	254 4690	68	14 70588	213 6283	3631 681
19	52 63158	59 69026	283 5287	69	14 49275	216 7699	3739 281
20	50 00000	62 83185	314 1593	**70**	14 28571	219 9115	3848 451
21	47 61905	65 97345	346 3606	71	14 08451	223 0531	3959.192
22	45 45455	69 11504	380 1327	72	13 88889	226 1947	4071 504
23	43 47826	72 25663	415 4756	73	13 69863	229 3363	4185.387
24	41.66667	75 39822	452 3893	74	13 51351	232.4779	4300 840
25	40 00000	78 53982	490 8739	75	13 33333	235 6194	4417 865
26	38 46154	81 68141	530 9292	76	13.15789	238 7610	4536 460
27	37 03704	84 82300	572 5553	77	12.98701	241 9026	4656 626
28	35 71429	87 96459	615 7522	78	12 82051	245 0442	4778 362
29	34 48276	91 10619	660 5199	79	12.65823	248.1858	4901 670
30	33 33333	94 24778	706 8583	**80**	12.50000	251.3274	5026 548
31	32 25806	97 38937	754 7676	81	12.34568	254.4690	5152 997
32	31 25000	100 5310	804 2477	82	12 19512	257 6106	5281 017
33	30 30303	103.6726	855 2986	83	12 04819	260 7522	5410 608
34	29.41176	106.8142	907.9203	84	11.90476	263.8938	5541 769
35	28.57143	109.9557	962 1128	85	11.76471	267.0354	5674 502
36	27 77778	113 0973	1017 876	86	11 62791	270 1770	5808 805
37	27 02703	116 2389	1075 210	87	11 49425	273.3186	5944 679
38	26.31579	119 3805	1134 115	88	11.36364	276 4602	6082 123
39	25 64103	122.5221	1194 591	89	11.23596	279.6017	6221.139
40	25.00000	125.6637	1256 637	**90**	11.11111	282 7433	6361.725
41	24 39024	128.8053	1320 254	91	10.98901	285 8849	6503 882
42	23 80952	131.9469	1385 442	92	10.86957	289.0265	6647.610
43	23 25581	135.0885	1452 201	93	10 75269	292.1681	6792 909
44	22.72727	138.2301	1520 531	94	10.63830	295.3097	6939 778
45	22.22222	141.3717	1590 431	95	10.52632	298.4513	7088 218
46	21 73913	144.5133	1661 903	96	10 41667	301 5929	7238 229
47	21.27660	147.6549	1734 945	97	10 30928	304 7345	7389.811
48	20 83333	150 7964	1809 557	98	10 20408	307.8761	7542 964
49	20.40816	153.9380	1885.741	99	10.10101	311.0177	7697.687
50	20 00000	157 0796	1963 495	**100**	10 00000	314 1593	7853 982

RECIPROCALS, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circum-ference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circum-ference πn	Area $\frac{\pi n^2}{4}$
100	10.00000	314.1593	7853.982	**150**	6 666 667	471 2389	17671 46
101	9 900 990	317.3009	8011 847	151	6 622 517	474 3805	17907 86
102	9.803 922	320 4425	8171 282	152	6 578 947	477 5221	18145.84
103	9 708 738	323 5840	8332.289	153	6.535 948	480 6637	18385 39
104	9 615 385	326.7256	8494 867	154	6.493 506	483.8053	18626.50
105	9 523 810	329 8672	8659.015	155	6 451 613	486 9469	18869 19
106	9.433 962	333 0088	8824 734	156	6 410 256	490 0885	19113 45
107	9 345 794	336 1504	8992 024	157	6 369 427	493 2300	19359 28
108	9.259 259	339 2920	9160 884	158	6 329 114	496 3716	19606 68
109	9.174 312	342 4336	9331 316	159	6 289 308	499.5132	19855 65
110	9 090 909	345 5752	9503 318	**160**	6 250 000	502 6548	20106 19
111	9 009 009	348.7168	9676 891	161	6.211 180	505.7964	20358.31
112	8 928 571	351.8584	9852 035	162	6.172 840	508 9380	20611 99
113	8.849 558	355.0000	10028 75	163	6.134 969	512.0796	20867.24
114	8 771 930	358.1416	10207.03	164	6.097 561	515.2212	21124 07
115	8 695 652	361.2832	10386 89	165	6.060 606	518.3628	21382 46
116	8 620 690	364.4247	10568 32	166	6 024 096	521 5044	21642 43
117	8 547 009	367.5663	10751 32	167	5 988 024	524 6460	21903 97
118	8 474 576	370 7079	10935.88	168	5 952 381	527.7876	22167.08
119	8 403 361	373.8495	11122.02	169	5.917 160	530 9292	22431.76
120	8 333 333	376 9911	11309 73	**170**	5 882 353	534.0708	22698.01
121	8 264 463	380 1327	11499 01	171	5 847 953	537.2123	22965 83
122	8 196 721	383.2743	11689 87	172	5 813 953	540 3539	23235.22
123	8.130 081	386.4159	11882 29	173	5 780 347	543.4955	23506.18
124	8 064 516	389.5575	12076.28	174	5 747 126	546.6371	23778.71
125	8 000 000	392 6991	12271 85	175	5 714 286	549 7787	24052 82
126	7.936 508	395 8407	12468 98	176	5 681 818	552 9203	24328 49
127	7.874 016	398 9823	12667 69	177	5 649 718	556 0619	24605.74
128	7 812 500	402 1239	12867 96	178	5 617 978	559 2035	24884 56
129	7.751 938	405 2655	13069 81	179	5 586 592	562 3451	25164.94
130	7 692 308	408 4070	13273 23	**180**	5 555 556	565 4867	25446 90
131	7 633 588	411.5486	13478 22	181	5 524 862	568 6283	25730 43
132	7 575 758	414.6902	13684 78	182	5 494 505	571 7699	26015.53
133	7 518 797	417.8318	13892 91	183	5 464 481	574.9115	26302 20
134	7.462 687	420.9734	14102.61	184	5.434 783	578 0530	26590.44
135	7.407 407	424.1150	14313 88	185	5 405 405	581 1946	26880.25
136	7 352 941	427 2566	14526 72	186	5 376 344	584.3362	27171 63
137	7 299 270	430 3982	14741.14	187	5 347 594	587 4778	27464 59
138	7 246 377	433.5398	14957.12	188	5.319 149	590 6194	27759 11
139	7 194 245	436.6814	15174.68	189	5 291 005	593.7610	28055.21
140	7.142 857	439 8230	15393 80	**190**	5 263 158	596 9026	28352.87
141	7.092 199	442.9646	15614 50	191	5 235 602	600.0442	28652 11
142	7.042 254	446.1062	15836 77	192	5.208 333	603 1858	28952 92
143	6.993 007	449.2477	16060 61	193	5.181 347	606 3274	29255 30
144	6.944 444	452.3893	16286 02	194	5.154 639	609.4690	29559.25
145	6 896 552	455 5309	16513.00	195	5 128 205	612.6106	29864 77
146	6.849 315	458 6725	16741.55	196	5 102 041	615.7522	30171 86
147	6 802 721	461.8141	16971.67	197	5 076 142	618 8938	30480 52
148	6 756 757	464.9557	17203 36	198	5.050 505	622 0353	30790 75
149	6 711 409	468.0973	17436.62	199	5 025 126	625.1769	31102.55
150	6.666 667	471.2389	17671 46	**200**	5.000 000	628.3185	31415.93

RECIPROCALS, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
200	5 000 000	628 3185	31415 93	**250**	4.000 000	785 3982	49087.39
201	4 975 124	631 4601	31730.87	251	3 984 064	788 5398	49480.87
202	4 950 495	634 6017	32047 39	252	3 968 254	791 6813	49875.92
203	4 926 108	637 7433	32365 47	253	3.952 569	794 8229	50272 55
204	4.901 961	640 8849	32685.13	254	3.937 008	797.9645	50670 75
205	4 878 049	644 0265	33006 36	255	3 921 569	801.1061	51070 52
206	4 854 369	647.1681	33329.16	256	3 906 250	804 2477	51471 85
207	4.830 918	650 3097	33653.53	257	3 891 051	807.3893	51874 76
208	4 807 692	653 4513	33979 47	258	3 875 969	810 5309	52279 24
209	4.784 689	656 5929	34306.98	259	3.861 004	813.6725	52685 29
210	4 761 905	659 7345	34636.06	**260**	3.846 154	816 8141	53092 92
211	4 739 336	662 8760	34966 71	261	3 831 418	819.9557	53502 11
212	4 716 981	666 0176	35298 94	262	3 816 794	823.0973	53912 87
213	4 694 836	669.1592	35632 73	263	3.802 281	826 2389	54325 21
214	4.672 897	672 3008	35968.09	264	3.787 879	829.3805	54739.11
215	4 651 163	675.4424	36305 03	265	3 773 585	832 5221	55154 59
216	4.629 630	678.5840	36643 54	266	3 759 398	835.6636	55571.63
217	4 608 295	681 7256	36983 61	267	3 745 318	838 8052	55990 25
218	4 587 156	684.8672	37325 26	268	3.731 343	841 9468	56410 44
219	4 566 210	688 0088	37668 48	269	3 717 472	845 0884	56832.20
220	4.545 455	691.1504	38013 27	**270**	3 703 704	848.2300	57255 53
221	4 524 887	694.2920	38359 63	271	3.690 037	851.3716	57680 43
222	4 504 505	697.4336	38707 56	272	3 676 471	854 5132	58106 90
223	4 484 305	700 5752	39057 07	273	3 663 004	857.6548	58534 94
224	4 464 286	703 7168	39408.14	274	3 649 635	860.7964	58964.55
225	4 444 444	706.8583	39760 78	275	3.636 364	863 9380	59395.74
226	4 424 779	709.9999	40115 00	276	3 623 188	867 0796	59828 49
227	4 405 286	713.1415	40470 78	277	3 610 108	870 2212	60262.82
228	4 385 965	716.2831	40828 14	278	3 597 122	873 3628	60698.71
229	4.366 812	719.4247	41187.07	279	3.584 229	876 5044	61136.18
230	4.347 826	722.5663	41547 56	**280**	3 571 429	879 6459	61575 22
231	4.329 004	725 7079	41909 63	281	3 558 719	882.7875	62015 82
232	4 310 345	728 8495	42273 27	282	3 546 099	885 9291	62458.00
233	4 291 845	731.9911	42638 48	283	3 533 569	889 0707	62901 75
234	4.273 504	735.1327	43005 26	284	3 521 127	892.2123	63347.07
235	4 255 319	738.2743	43373 61	285	3 508 772	895.3539	63793.97
236	4.237 288	741.4159	43743 54	286	3 496 503	898.4955	64242.43
237	4 219 409	744.5575	44115 03	287	3.484 321	901 6371	64692.46
238	4 201 681	747 6991	44488 09	288	3 472 222	904 7787	65144.07
239	4.184 100	750 8406	44862 73	289	3.460 208	907.9203	65597.24
240	4.166 667	753 9822	45238 93	**290**	3 448 276	911.0619	66051.99
241	4.149 378	757.1238	45616 71	291	3 436 426	914.2035	66508.30
242	4.132 231	760 2654	45996 06	292	3 424 658	917.3451	66966.19
243	4.115 226	763 4070	46376 98	293	3 412 969	920 4866	67425 65
244	4.098 361	766.5486	46759.47	294	3.401 361	923.6282	67886.68
245	4.081 633	769.6902	47143 52	295	3.389 831	926 7698	68349.28
246	4.065 041	772.8318	47529.16	296	3.378 378	929.9114	68813 45
247	4.048 583	775.9734	47916 36	297	3 367 003	933.0530	69279.19
248	4.032 258	779.1150	48305 13	298	3 355 705	936 1946	69746 50
249	4.016 064	782.2566	48695.47	299	3.344 482	939.3362	70215.38
250	4.000 000	785.3982	49087.39	**300**	3.333 333	942.4778	70685.83

RECIPROCALS, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
300	3 333 333	942.4778	70685 83	**350**	2.857 143	1099 557	96211 28
301	3 322 259	945 6194	71157 86	351	2 849 003	1102 699	96761 84
302	3 311 258	948 7610	71631 45	352	2 840 909	1105 841	97313 97
303	3 300 330	951.9026	72106 62	353	2 832 861	1108.982	97867 68
304	3.289 474	955.0442	72583 36	354	2 824 859	1112 124	98422 96
305	3.278 689	958.1858	73061.66	355	2 816 901	1115 265	98979 80
306	3 267 974	961 3274	73541 54	356	2 808 989	1118 407	99538 22
307	3 257 329	964 4689	74022 99	357	2 801 120	1121 549	100 098 2
308	3 246 753	967 6105	74506 01	358	2 793 296	1124 690	100 659 8
309	3 236 246	970 7521	74990 60	359	2 785 515	1127 832	101 222 9
310	3 225 806	973 8937	75476 76	**360**	2 777 778	1130 973	101 787 6
311	3 215 434	977 0353	75964.50	361	2 770 083	1134 115	102 353 9
312	3 205 128	980 1769	76453 80	362	2 762 431	1137 257	102 921 7
313	3 194 888	983 3185	76944 67	363	2 754 821	1140 398	103 491 1
314	3 184 713	986 4601	77437 12	364	2.747 253	1143 540	104 062 1
315	3.174 603	989 6017	77931 13	365	2 739 726	1146 681	104 634 7
316	3.164 557	992 7433	78426 72	366	2 732 240	1149 823	105 208 8
317	3.154 574	995 8849	78923 88	367	2.724 796	1152 965	105 784 5
318	3 144 654	999 0265	79422 60	368	2 717 391	1156 106	106 361 8
319	3 134 796	1002 168	79922 90	369	2.710 027	1159 248	106 940 6
320	3 125 000	1005 310	80424 77	**370**	2 702 703	1162 389	107 521 0
321	3 115 265	1008 451	80928 21	371	2 695 418	1165 531	108 103 0
322	3 105 590	1011.593	81433 22	372	2 688 172	1168 672	108 686 5
323	3 095 975	1014 734	81939 80	373	2 680 965	1171 814	109 271 7
324	3 086 420	1017.876	82447 96	374	2 673 797	1174 956	109 858 4
325	3 076 923	1021 018	82957 68	375	2 666 667	1178 097	110 446 6
326	3 067 485	1024.159	83468 98	376	2 659 574	1181 239	111 036 5
327	3 058 104	1027 301	83981 84	377	2 652 520	1184 380	111 627.9
328	3 048 780	1030 442	84496 28	378	2 645 503	1187 522	112 220 8
329	3.039 514	1033 584	85012 28	379	2 638 522	1190 664	112 815 4
330	3.030 303	1036 726	85529 86	**380**	2 631 579	1193 805	113 411 5
331	3 021 148	1039 867	86049 01	381	2 624 672	1196 947	114 009 2
332	3 012 048	1043 009	86569 73	382	2 617 801	1200 088	114 608 4
333	3.003 003	1046 150	87092 02	383	2 610 966	1203 230	115 209 3
334	2 994 012	1049 292	87615 88	384	2 604 167	1206 372	115 811 7
335	2 985 075	1052 434	88141 31	385	2 597 403	1209 513	116 415 6
336	2 976 190	1055 575	88668 31	386	2 590 674	1212 655	117 021 2
337	2 967 359	1058 717	89196 88	387	2 583 979	1215 796	117 628 3
338	2 958 580	1061 858	89727 03	388	2 577 320	1218 938	118 237 0
339	2 949 853	1065 000	90258 74	389	2 570 694	1222 080	118 847 2
340	2 941 176	1068.142	90792 03	**390**	2 564 103	1225 221	119 459 1
341	2.932 551	1071 283	91326 88	391	2 557 545	1228 363	120 072 5
342	2 923 977	1074 425	91863 31	392	2 551 020	1231 504	120 687 4
343	2.915 452	1077 566	92401 31	393	2 544 529	1234 646	121 304 0
344	2 906 977	1080 708	92940 88	394	2 538 071	1237 788	121 922 1
345	2 898 551	1083 849	93482 02	395	2 531 646	1240.929	122 541 7
346	2 890 173	1086 991	94024 73	396	2 525 253	1244 071	123 163 0
347	2 881 844	1090 133	94569 01	397	2 518 892	1247 212	123 785.8
348	2 873 563	1093 274	95114 86	398	2 512 563	1250 354	124 410 2
349	2 865 330	1096 416	95662 28	399	2.506 266	1253 495	125 036 2
350	2.857 143	1099 557	96211.28	**400**	2.500 000	1256.637	125 663 7

RECIPROCALS, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$		$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
400	2 500 000	1256 637	125 663.7	**450**	2 222 222	1413.717	159 043.1
401	2.493 766	1259 779	126 292 8	451	2 217 295	1416.858	159 750.8
402	2.487 562	1262.920	126 923 5	452	2 212 389	1420 000	160 460.0
403	2 481 390	1266.062	127 555 7	453	2.207 506	1423.141	161 170.8
404	2.475 248	1269.203	128 189.5	454	2.202 643	1426.283	161 883.1
405	2.469 136	1272.345	128 824 9	455	2.197 802	1429 425	162 597.1
406	2 463 054	1275.487	129 461.9	456	2.192 982	1432.566	163 312.6
407	2.457 002	1278 628	130 100.4	457	2.188 184	1435 708	164 029.6
408	2 450 980	1281.770	130 740.5	458	2.183 406	1438.849	164 748.3
409	2.444 988	1284.911	131 382.2	459	2.178 649	1441 991	165 468.5
410	2 439 024	1288.053	132 025.4	**460**	2 173 913	1445 133	166 190.3
411	2 433 090	1291.195	132 670 2	461	2.169 197	1448 274	166 913.6
412	2 427 184	1294.336	133 316 6	462	2.164 502	1451.416	167 638.5
413	2 421 308	1297.478	133 964 6	463	2 159 827	1454 557	168 365.0
414	2.415 459	1300.619	134 614.1	464	2.155 172	1457.699	169 093.1
415	2.409 639	1303 761	135 265 2	465	2.150 538	1460.841	169 822 7
416	2.403 846	1306.903	135 917.9	466	2.145 923	1463.982	170 553 9
417	2.398 082	1310.044	136 572 1	467	2 141 328	1467.124	171 286.7
418	2 392 344	1313.186	137 227 9	468	2 136 752	1470.265	172 021.0
419	2 386 635	1316.327	137 885.3	469	2.132 196	1473.407	172 757.0
420	2.380 952	1319.469	138 544 2	**470**	2.127 660	1476 549	173 494.5
421	2.375 297	1322 611	139 204 8	471	2.123 142	1479.690	174 233.5
422	2.369 668	1325 752	139 866 8	472	2.118 644	1482.832	174 974.1
423	2.364 066	1328 894	140 530 5	473	2.114 165	1485 973	175 716.3
424	2.358 491	1332.035	141 195.7	474	2 109 705	1489.115	176 460.1
425	2.352 941	1335.177	141 862 5	475	2 105 263	1492.257	177 205.5
426	2 347 418	1338.318	142 530 9	476	2 100 840	1495 398	177 952.4
427	2 341 920	1341.460	143 200 9	477	2 096 436	1498 540	178 700.9
428	2.336 449	1344.602	143 872 4	478	2 092 050	1501.681	179 450.9
429	2.331 002	1347.743	144 545.5	479	2.087 683	1504.823	180 202.5
430	2 325 581	1350 885	145 220.1	**480**	2.083 333	1507 964	180 955.7
431	2 320 186	1354.026	145 896.3	481	2 079 002	1511 106	181 710.5
432	2 314 815	1357.168	146 574.1	482	2 074 689	1514.248	182 466.8
433	2 309 469	1360.310	147 253.5	483	2.070 393	1517.389	183 224.8
434	2 304 147	1363.451	147 934.5	484	2.066 116	1520.531	183 984.2
435	2 298 851	1366 593	148 617 0	485	2 061 856	1523 672	184 745.3
436	2.293 578	1369 734	149 301 0	486	2 057 613	1526.814	185 507.9
437	2 288 330	1372 876	149 986.7	487	2.053 388	1529.956	186 272.1
438	2.283 105	1376.018	150 673 9	488	2.049 180	1533.097	187 037.9
439	2.277 904	1379.159	151 362.7	489	2.044 990	1536.239	187 805.2
440	2.272 727	1382.301	152 053.1	**490**	2 040 816	1539.380	188 574.1
441	2.267 574	1385.442	152 745 0	491	2.036 660	1542.522	189 344.6
442	2.262 443	1388.584	153 438 5	492	2.032 520	1545.664	190 116.6
443	2.257 336	1391 726	154 133.6	493	2.028 398	1548.805	190 890.2
444	2.252 252	1394.867	154 830 3	494	2.024 291	1551.947	191 665.4
445	2 247 191	1398.009	155 528 5	495	2.020 202	1555.088	192 442.2
446	2.242 152	1401.150	156 228 3	496	2.016 129	1558.230	193 220.5
447	2.237 136	1404.292	156 929.6	497	2.012 072	1561 372	194 000.4
448	2.232 143	1407.434	157 632 6	498	2.008 032	1564.513	194 781.9
449	2 227 171	1410.575	158 337.1	499	2.004 008	1567.655	195 564.9
450	2.222 222	1413.717	159 043.1	**500**	2 000 000	1570.796	196 349.5

RECIPROCALS, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
500	2.000 000	1570.796	196 349.5	**550**	1.818 182	1727.876	237 582.9
501	1 996 008	1573.938	197 135.7	551	1 814 882	1731.018	238 447.7
502	1.992 032	1577.080	197 923 5	552	1.811 594	1734.159	239 314.0
503	1.988 072	1580.221	198 712.8	553	1.808 318	1737.301	240 181.8
504	1.984 127	1583.363	199 503.7	554	1.805 054	1740.442	241 051.3
505	1 980 198	1586.504	200 296 2	555	1.801 802	1743.584	241 922.3
506	1.976 285	1589.646	201 090.2	556	1.798 561	1746.726	242 794.8
507	1.972 387	1592.787	201 885.8	557	1.795 332	1749.867	243 669.0
508	1.968 504	1595.929	202 683.0	558	1.792 115	1753.009	244 544.7
509	1.964 637	1599.071	203 481.7	559	1.788 909	1756.150	245 422.0
510	1.960 784	1602.212	204 282.1	**560**	1.785 714	1759.292	246 300.9
511	1.956 947	1605.354	205 084.0	561	1.782 531	1762.433	247 181.3
512	1.953 125	1608.495	205 887.4	562	1.779 359	1765.575	248 063.3
513	1.949 318	1611 637	206 692 4	563	1.776 199	1768.717	248 946.9
514	1.945 525	1614.779	207 499.1	564	1.773 050	1771.858	249 832.0
515	1.941 748	1617.920	208 307.2	565	1.769 912	1775.000	250 718.7
516	1.937 984	1621.062	209 117.0	566	1.766 784	1778.141	251 607.0
517	1.934 236	1624.203	209 928.3	567	1.763 668	1781.283	252 496.9
518	1.930 502	1627.345	210 741.2	568	1.760 563	1784.425	253 388.3
519	1.926 782	1630.487	211 555.6	569	1.757 469	1787.566	254 281.3
520	1.923 077	1633.628	212 371.7	**570**	1.754 386	1790.708	255 175 9
521	1.919 386	1636.770	213 189.3	571	1.751 313	1793.849	256 072.0
522	1.915 709	1639.911	214 008.4	572	1.748 252	1796.991	256 969.7
523	1.912 046	1643.053	214 829.2	573	1.745 201	1800.133	257 869 0
524	1.908 397	1646.195	215 651.5	574	1.742 160	1803.274	258 769.8
525	1.904 762	1649.336	216 475.4	575	1 739 130	1806.416	259 672.3
526	1.901 141	1652.478	217 300.8	576	1.736 111	1809.557	260 576.3
527	1.897 533	1655.619	218 127.8	577	1.733 102	1812.699	261 481.8
528	1.893 939	1658.761	218 956.4	578	1.730 104	1815.841	262 389.0
529	1.890 359	1661.903	219 786.6	579	1.727 116	1818.982	263 297.7
530	1.886 792	1665.044	220 618.3	**580**	1.724 138	1822.124	264 207.9
531	1 883 239	1668.186	221 451.7	581	1.721 170	1825.265	265 119.8
532	1 879 699	1671.327	222 286 5	582	1.718 213	1828.407	266 033.2
533	1.876 173	1674.469	223 123 0	583	1.715 266	1831.549	266 948.2
534	1.872 659	1677.610	223 961.0	584	1.712 329	1834.690	267 864.8
535	1.869 159	1680.752	224 800.6	585	1.709 402	1837.832	268 782 9
536	1.865 672	1683.894	225 641.8	586	1.706 485	1840.973	269 702 6
537	1.862 197	1687.035	226 484.5	587	1.703 578	1844.115	270 623 9
538	1.858 736	1690.177	227 328.8	588	1.700 680	1847.256	271 546.7
539	1.855 288	1693.318	228 174.7	589	1.697 793	1850.398	272 471.1
540	1.851 852	1696.460	229 022.1	**590**	1 694 915	1853.540	273 397.1
541	1.848 429	1699.602	229 871.1	591	1.692 047	1856.681	274 324.7
542	1.845 018	1702.743	230 721.7	592	1.689 189	1859.823	275 253.8
543	1.841 621	1705.885	231 573.9	593	1.686 341	1862.964	276 184.5
544	1.838 235	1709.026	232 427.6	594	1.683 502	1866.106	277 116.7
545	1.834 862	1712.168	233 282.9	595	1.680 672	1869.248	278 050.6
546	1.831 502	1715.310	234 139.8	596	1.677 852	1872.389	278 986.0
547	1.828 154	1718.451	234 998.2	597	1.675 042	1875.531	279 923.0
548	1.824 818	1721.593	235.858.2	598	1 672 241	1878.672	280 861.5
549	1.821 494	1724.734	236 719.8	599	1.669 449	1881.814	281 801.6
550	1.818 182	1727.876	237.582.9	**600**	1.666 667	1884.956	282 743.3

RECIPROCALS, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
600	1.666 667	1884 956	282 743.3	**650**	1 538 462	2042 035	331 830.7
601	1.663 894	1888.097	283 686 6	651	1 536 098	2045.177	332 852.5
602	1 661 130	1891.239	284 631.4	652	1 533 742	2048.318	333 875.9
603	1 658 375	1894 380	285 577 8	653	1 531 394	2051.460	334 900 8
604	1 655 629	1897.522	286 525.8	654	1.529 052	2054.602	335 927.4
605	1 652 893	1900.664	287 475.4	655	1.526 718	2057.743	336 955.4
606	1 650 165	1903.805	288 426 5	656	1 524 390	2060 885	337 985.1
607	1.647 446	1906 947	289 379 2	657	1.522 070	2064 026	339 016.3
608	1.644 737	1910.088	290 333.4	658	1.519 757	2067.168	340 049.1
609	1.642 036	1913 230	291 289.3	659	1.517 451	2070.310	341 083.5
610	1.639 344	1916 372	292 246.7	**660**	1.515 152	2073.451	342 119.4
611	1.636 661	1919 513	293 205 6	661	1.512 859	2076.593	343 157.0
612	1.633 987	1922 655	294 166 2	662	1 510 574	2079 734	344 196.0
613	1.631 321	1925 796	295 128 3	663	1.508 296	2082 876	345 236.7
614	1.628 664	1928.938	296 092.0	664	1.506 024	2086.018	346 278.9
615	1.626 016	1932.079	297 057 2	665	1 503 759	2089.159	347 322.7
616	1.623 377	1935 221	298 024 0	666	1.501 502	2092 301	348 368.1
617	1.620 746	1938 363	298 992 4	667	1.499 250	2095.442	349 415.0
618	1 618 123	1941.504	299 962 4	668	1.497 006	2098 584	350 463.5
619	1.615 509	1944 646	300 933 9	669	1.494 768	2101.725	351 513.6
620	1.612 903	1947.787	301 907.1	**670**	1.492 537	2104.867	352 565.2
621	1.610 306	1950.929	302 881 7	671	1.490 313	2108.009	353 618.5
622	1.607 717	1954.071	303 858 0	672	1.488 095	2111.150	354 673.2
623	1.605 136	1957 212	304 835 8	673	1.485 884	2114 292	355 729.6
624	1 602 564	1960.354	305 815 2	674	1 483 680	2117.433	356 787.5
625	1 600 000	1963.495	306 796 2	675	1 481 481	2120 575	357 847.0
626	1 597 444	1966.637	307 778.7	676	1.479 290	2123 717	358 908.1
627	1.594 896	1969 779	308 762.8	677	1.477 105	2126 858	359 970 8
628	1.592 357	1972.920	309 748 5	678	1.474 926	2130 000	361 035 0
629	1.589 825	1976.062	310 735.7	679	1.472 754	2133.141	362 100.8
630	1 587 302	1979 203	311 724.5	**680**	1.470 588	2136.283	363 168.1
631	1 584 786	1982 345	312 714 9	681	1.468 429	2139.425	364 237.0
632	1.582 278	1985 437	313 706.9	682	1.466 276	2142 566	365 307.5
633	1.579 779	1988 628	314 700.4	683	1.464 129	2145.708	366 379.6
634	1.577 287	1991.770	315 695.5	684	1.461 988	2148.849	367 453.2
635	1.574 803	1994.911	316 692.2	685	1.459 854	2151.991	368 528.5
636	1.572 327	1998.053	317 690.4	686	1.457 726	2155.133	369 605.2
637	1.569 859	2001.195	318 690.2	687	1.455 604	2158.274	370 683.6
638	1 567 398	2004.336	319 691 6	688	1.453 488	2161.416	371 763 5
639	1.564 945	2007.478	320 694.6	689	1.451 379	2164.557	372 845.0
640	1.562 500	2010 619	321 699.1	**690**	1.449 275	2167.699	373 928.1
641	1.560 062	2013.761	322 705 2	691	1.447 178	2170.841	375 012.7
642	1.557 632	2016.902	323 712 8	692	1.445 087	2173.982	376 098.9
643	1 555 210	2020 044	324 722 1	693	1.443 001	2177.124	377 186.7
644	1.552 795	2023.186	325 732 9	694	1.440 922	2180.265	378 276.0
645	1.550 388	2026 327	326 745.3	695	1.438 849	2183.407	379 366.9
646	1.547 988	2029 469	327 759.2	696	1.436 782	2186.548	380 459.4
647	1.545 595	2032 610	328 774 7	697	1.434 720	2189 690	381 553.5
648	1.543 210	2035 752	329 791 8	698	1.432 665	2192.832	382 649.1
649	1.540 832	2038 894	330 810.5	699	1.430 615	2195.973	383 746.3
650	1.538 462	2042.035	331 830 7	**700**	1.428 571	2199.115	384 845.1

RECIPROCALS, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
700	1.428 571	2199.115	384 845.1	**750**	1.333 333	2356.194	441 786.5
701	1.426 534	2202.256	385 945.4	751	1.331 558	2359.336	442 965.3
702	1.424 501	2205.398	387 047.4	752	1.329 787	2362.478	444 145.8
703	1.422 475	2208.540	388 150.8	753	1.328 021	2365.619	445 327.8
704	1.420 455	2211.681	389 255.9	754	1.326 260	2368.761	446 511.4
705	1.418 440	2214.823	390 362.5	755	1.324 503	2371.902	447 696.6
706	1.416 431	2217.964	391 470.7	756	1.322 751	2375.044	448 883.3
707	1.414 427	2221.106	392 580.5	757	1.321 004	2378.186	450 071.6
708	1.412 429	2224.248	393 691.8	758	1.319 261	2381.327	451 261.5
709	1.410 437	2227.389	394 804.7	759	1.317 523	2384.469	452 453.0
710	1.408 451	2230.531	395 919.2	**760**	1.315 789	2387.610	453 646.0
711	1.406 470	2233.672	397 035.3	761	1.314 060	2390.752	454 840.6
712	1.404 494	2236.814	398 152.9	762	1.312 336	2393.894	456 036.7
713	1.402 525	2239.956	399 272.1	763	1.310 616	2397.035	457 234.5
714	1.400 560	2243.097	400 392.8	764	1.308 901	2400.177	458 433.8
715	1.398 601	2246.239	401 515.2	765	1.307 190	2403.318	459 634.6
716	1.396 648	2249.380	402 639.1	766	1.305 483	2406.460	460 837.1
717	1.394 700	2252.522	403 764.6	767	1.303 781	2409.602	462 041.1
718	1.392 758	2255.664	404 891.6	768	1.302 083	2412.743	463 246.7
719	1.390 821	2258.805	406 020.2	769	1.300 390	2415.885	464 453.8
720	1.388 889	2261.947	407 150.4	**770**	1.298 701	2419.026	465 662.6
721	1.386 963	2265.088	408 282.2	771	1.297 017	2422.168	466 872.9
722	1.385 042	2268.230	409 415.5	772	1.295 337	2425.310	468 084.4
723	1.383 126	2271.371	410 550.4	773	1.293 661	2428.451	469 298.2
724	1.381 215	2274.513	411 686.9	774	1.291 990	2431.593	470 513.2
725	1.379 310	2277.655	412 824.9	775	1.290 323	2434.734	471 729.8
726	1.377 410	2280.796	413 964.5	776	1.288 660	2437.876	472 947.9
727	1.375 516	2283.938	415 105.7	777	1.287 001	2441.017	474 167.6
728	1.373 626	2287.079	416 248.5	778	1.285 347	2444.159	475 388.9
729	1.371 742	2290.221	417 392.8	779	1.283 697	2447.301	476 611.8
730	1.369 863	2293.363	418 538.7	**780**	1.282 051	2450.442	477 836.2
731	1.367 989	2296.504	419 686.1	781	1.280 410	2453.584	479 062.2
732	1.366 120	2299.646	420 835.2	782	1.278 772	2456.725	480 289.8
733	1.364 256	2302.787	421 985.8	783	1.277 139	2459.867	481 519.0
734	1.362 398	2305.929	423 138.0	784	1.275 510	2463.009	482 749.7
735	1.360 544	2309.071	424 291.7	785	1.273 885	2466.150	483 982.0
736	1.358 696	2312.212	425 447.0	786	1.272 265	2469.292	485 215.8
737	1.356 852	2315.354	426 603.9	787	1.270 648	2472.433	486 451.3
738	1.355 014	2318.495	427 762.4	788	1.269 036	2475.575	487 688.3
739	1.353 180	2321.637	428 922.4	789	1.267 427	2478.717	488 926.9
740	1.351 351	2324.779	430 084.0	**790**	1.265 823	2481.858	490 167.0
741	1.349 528	2327.920	431 247.2	791	1.264 223	2485.000	491 408.7
742	1.347 709	2331.062	432 412.0	792	1.262 626	2488.141	492 652.0
743	1.345 895	2334.203	433 578.3	793	1.261 034	2491.283	493 896.8
744	1.344 086	2337.345	434 746.2	794	1.259 446	2494.425	495 143.3
745	1.342 282	2340.487	435 915.6	795	1.257 862	2497.566	496 391.3
746	1.340 483	2343.628	437 086.6	796	1.256 281	2500.708	497 640.8
747	1.338 688	2346.770	438 259.2	797	1.254 705	2503.849	498 892.0
748	1.336 898	2349.911	439 433.4	798	1.253 133	2506.991	500 144.7
749	1.335 113	2353.053	440 609.2	799	1.251 564	2510.133	501 399.0
750	1.333 333	2356.194	441 786.5	**800**	1.250 000	2513.274	502 654.8

RECIPROCALS, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
800	1.250 000	2513.274	502 654.8	850	1.176 471	2670.354	567 450.2
801	1.248 439	2516.416	503 912.2	851	1.175 088	2673.495	568 786.1
802	1.246 883	2519.557	505 171.2	852	1.173 709	2676.637	570 123.7
803	1.245 330	2522.699	506 431.8	853	1.172 333	2679.779	571 462.8
804	1.243 781	2525.840	507 693.9	854	1.170 960	2682.920	572 803.4
805	1.242 236	2528.982	508 957.6	855	1.169 591	2686.062	574 145.7
806	1 240 695	2532.124	510 222.9	856	1.168 224	2689.203	575 489.5
807	1.239 157	2535.265	511 489.8	857	1.166 861	2692.345	576 834.9
808	1.237 624	2538.407	512 758.2	858	1.165 501	2695.486	578 181.9
809	1.236 094	2541.548	514 028.2	859	1.164 144	2698.628	579 530.4
810	1.234 568	2544.690	515 299.7	860	1.162 791	2701.770	580 880.5
811	1.233 046	2547.832	516 572.9	861	1.161 440	2704.911	582 232.2
812	1.231 527	2550.973	517 847.6	862	1.160 093	2708.053	583 585.4
813	1.230 012	2554.115	519 123.8	863	1.158 749	2711.194	584 940.2
814	1 228 501	2557.256	520 401.7	864	1.157 407	2714.336	586 296.6
815	1.226 994	2560.398	521 681.1	865	1.156 069	2717.478	587 654.5
816	1 225 490	2563 540	522 962.1	866	1.154 734	2720.619	589 014.1
817	1.223 990	2566.681	524 244.6	867	1.153 403	2723.761	590 375.2
818	1.222 494	2569.823	525 528 8	868	1.152 074	2726.902	591 737.8
819	1 221 001	2572.964	526 814 5	869	1.150 748	2730.044	593 102.1
820	1.219 512	2576.106	528 101.7	870	1.149 425	2733.186	594 467.9
821	1.218 027	2579 248	529 390.6	871	1.148 106	2736.327	595 835.2
822	1.216 545	2582.389	530 681.0	872	1.146 789	2739.469	597 204.2
823	1.215 067	2585.531	531 973.0	873	1.145 475	2742.610	598 574.7
824	1.213 592	2588.672	533 266.5	874	1.144 165	2745.752	599 946.8
825	1.212 121	2591.814	534 561.6	875	1.142 857	2748.894	601 320.5
826	1.210 654	2594.956	535 858.3	876	1.141 553	2752 035	602 695.7
827	1.209 190	2598.097	537 156.6	877	1.140 251	2755.177	604 072.5
828	1.207 729	2601.239	538 456.4	878	1.138 952	2758.318	605 450.9
829	1.206 273	2604.380	539 757.8	879	1.137 656	2761.460	606 830.8
830	1 204 819	2607.522	541.060.8	880	1.136 364	2764.602	608 212.3
831	1.203 369	2610.663	542 365.3	881	1.135 074	2767.743	609 595.4
832	1 201 923	2613.805	543 671.5	882	1.133 787	2770.885	610 980.1
833	1.200 480	2616.947	544 979.1	883	1.132 503	2774.026	612 366.3
834	1.199 041	2620.088	546 288.4	884	1.131 222	2777.168	613 754.1
835	1.197 605	2623.230	547 599.2	885	1.129 944	2780.309	615 143.5
836	1.196 172	2626.371	548 911.6	886	1.128 668	2783.451	616 534.4
837	1.194 743	2629.513	550 225.6	887	1.127 396	2786.593	617 926.9
838	1.193 317	2632.655	551 541.1	888	1.126 126	2789.734	619 321.0
839	1.191 895	2635.796	552 858.3	889	1.124 859	2792.876	620 716.7
840	1.190 476	2638.938	554 176 9	890	1.123 596	2796.017	622 113.9
841	1.189 061	2642.079	555 497.2	891	1.122 334	2799.159	623 512.7
842	1.187 648	2645.221	556 819.0	892	1.121 076	2802.301	624 913.0
843	1 186 240	2648.363	558 142 4	893	1.119 821	2805.442	626 315.0
844	1.184 834	2651.504	559 467.4	894	1.118 568	2808.584	627 718.5
845	1.183 432	2654.646	560 793 9	895	1.117 318	2811.725	629 123.6
846	1.182 033	2657.787	562 122 0	896	1.116 071	2814.867	630 530.2
847	1.180 638	2660.929	563 451.7	897	1.114 827	2818.009	631 938.4
848	1.179 245	2664.071	564 783 0	898	1.113 586	2821.150	633 348.2
849	1.177 856	2667.212	566 115.8	899	1.112 347	2824.292	634 759.6
850	1.176 471	2670.354	567 450.2	900	1.111 111	2827.433	636 172.5

RECIPROCALS, CIRCUMFERENCE AND AREA OF CIRCLES (Continued)

n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$	n	$1000\frac{1}{n}$	Circumference πn	Area $\frac{\pi n^2}{4}$
900	1.111 111	2827.433	636 172.5	**950**	1.052 632	2984.513	708 821.8
901	1.109 878	2830.575	637 587.0	951	1.051 525	2987.655	710 314.9
902	1.108 647	2833.717	639 003.1	952	1.050 420	2990.796	711 809.5
903	1.107 420	2836.858	640 420.7	953	1.049 318	2993.938	713 305.7
904	1.106 195	2840.000	641 839.9	954	1.048 218	2997.079	714 803.4
905	1.104 972	2843.141	643 260.7	955	1.047 120	3000.221	716 302 8
906	1.103 753	2846.283	644 683.1	956	1 046 025	3003 363	717 803 7
907	1.102 536	2849.425	646 107.0	957	1.044 932	3006 504	719 306 1
908	1.101 322	2852.566	647 532.5	958	1.043 841	3009.646	720 810.2
909	1.100 110	2855.708	648 959.6	959	1.042 753	3012.787	722 315.8
910	1.098 901	2858.849	650 388.2	**960**	1.041 667	3015.929	723 822.9
911	1.097 695	2861.991	651 818.4	961	1.040 583	3019.071	725 331.7
912	1.096 491	2865.133	653 250.2	962	1.039 501	3022.212	726 842.0
913	1.095 290	2868.274	654 683.6	963	1.038 422	3025.354	728 353.9
914	1.094 092	2871.416	656 118.5	964	1.037 344	3028.495	729 867.4
915	1.092 896	2874.557	657 555.0	965	1.036 269	3031.637	731 382.4
916	1 091 703	2877.699	658 993.0	966	1.035 197	3034.779	732 899.0
917	1.090 513	2880.840	660 432.7	967	1.034 126	3037.920	734 417.2
918	1 089 325	2883.982	661 873.9	968	1.033 058	3041.062	735 936.9
919	1.088 139	2887.124	663 316.7	969	1.031 992	3044.203	737 458 2
920	1 086 957	2890.265	664 761.0	**970**	1.030 928	3047.345	738 981.1
921	1.085 776	2893.407	666 206.9	971	1.029 866	3050 486	740 505.6
922	1 084 599	2896 548	667 654.4	972	1.028 807	3053.628	742 031.6
923	1.083 424	2899.690	669 103.5	973	1 027 749	3056.770	743 559.2
924	1 082 251	2902.832	670 554.1	974	1.026 694	3059.911	745 088.4
925	1.081 081	2905.973	672 006.3	975	1.025 641	3063.053	746 619.1
926	1.079 914	2909.115	673 460.1	976	1.024 590	3066.194	748 151.4
927	1.078 749	2912.256	674 915.4	977	1.023 541	3069.336	749 685.3
928	1.077 586	2915.398	676 372.3	978	1.022 495	3072.478	751 220.8
929	1.076 426	2918.540	677 830.8	979	1.021 450	3075.619	752 757.8
930	1.075 269	2921.681	679 290.9	**980**	1.020 408	3078.761	754 296.4
931	1.074 114	2924.823	680 752.5	981	1.019 368	3081.902	755 836.6
932	1.072 961	2927.964	682 215.7	982	1.018 330	3085.044	757 378.3
933	1.071 811	2931.106	683 680.5	983	1.017 294	3088.186	758 921.6
934	1.070 664	2934.248	685 146.8	984	1.016 260	3091.327	760 466.5
935	1.069 519	2937.389	686 614.7	985	1.015 228	3094.469	762 012.9
936	1.068 376	2940.531	688 084.2	986	1.014 199	3097.610	763 561.0
937	1.067 236	2943.672	689 555.2	987	1.013 171	3100.752	765 110.5
938	1.066 098	2946.814	691 027.9	988	1.012 146	3103.894	766 661.7
939	1 064 963	2949.956	692 502.1	989	1.011 122	3107.035	768 214.4
940	1 063 830	2953.097	693 977.8	**990**	1.010 101	3110.177	769 768.7
941	1.062 699	2956.239	695 455.2	991	1.009 082	3113.318	771 324.6
942	1.061 571	2959.380	696 934.1	992	1.008 065	3116.460	772 882.1
943	1.060 445	2962.522	698 414 5	993	1.007 049	3119.602	774 441.1
944	1.059 322	2965.663	699 896.6	994	1.006 036	3122.743	776 001.7
945	1.058 201	2968.805	701 380.2	995	1.005 025	3125.885	777 563.8
946	1.057 082	2971.947	702 865.4	996	1.004 016	3129.026	779 127.5
947	1.055 966	2975.088	704 352.1	997	1.003 009	3132.168	780 692.8
948	1.054 852	2978.230	705 840.5	998	1.002 004	3135.309	782 259.7
949	1.053 741	2981.371	707 330.4	999	1.001 001	3138.451	783 828.2
950	1.052 632	2984.513	708 821.8	**1000**	1.000 000	3141.593	785 398.2

SQUARES, CUBES AND ROOTS

Squares, Cubes and Roots

Roots of numbers other than those given directly may be found by the following relations:

$$\sqrt{100n}=10\sqrt{n};\quad \sqrt{1000n}=10\sqrt{10n};\quad \sqrt{\frac{1}{10}n}=\frac{1}{10}\sqrt{10n};\quad \sqrt{\frac{1}{100}n}=\frac{1}{10}\sqrt{n},$$

$$\sqrt{\frac{1}{1000}n}=\frac{1}{100}\sqrt{10n};\quad \sqrt[3]{1000n}=10\sqrt[3]{n};\quad \sqrt[3]{10{,}000n}=10\sqrt[3]{10n};\quad \sqrt[3]{100{,}000n}=$$

$$10\sqrt[3]{100n};\quad \sqrt[3]{\frac{1}{10}n}=\frac{1}{10}\sqrt[3]{100n},\quad \sqrt[3]{\frac{1}{100}n}=\frac{1}{10}\sqrt[3]{10n};\quad \sqrt[3]{\frac{1}{1000}n}=\frac{1}{10}\sqrt[3]{n}.$$

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
1	1	1.000 000	3 162 278	1	1.000 000	2 154 435	4 641 589
2	4	1.414 214	4 472 136	8	1.259 921	2.714 418	5.848 035
3	9	1.732 051	5 477 226	27	1.442 250	3 107 233	6 694 330
4	16	2.000 000	6.324 555	64	1.587 401	3.419 952	7.368 063
5	25	2 236 068	7 071 068	125	1.709 976	3 684 031	7 937 005
6	36	2.449 490	7 745 967	216	1.817 121	3 914 868	8 434 327
7	49	2.645 751	8.366 600	343	1.912 931	4 121 285	8 879 040
8	64	2.828 427	8 944 272	512	2 000 000	4 308 869	9 283 178
9	81	3.000 000	9.486 833	729	2.080 084	4 481 405	9 654 894
10	100	3.162 278	10.00000	1 000	2 154 435	4.641 589	10 00000
11	121	3.316 625	10.48809	1 331	2 223 980	4 791 420	10 32280
12	144	3.464 102	10 95445	1 728	2 289 428	4 932 424	10 62659
13	169	3.605 551	11 40175	2 197	2.351 335	5 065 797	10 91393
14	196	3.741 657	11.83216	2 744	2.410 142	5 192 494	11 18689
15	225	3.872 983	12.24745	3 375	2 466 212	5 313 293	11 44714
16	256	4 000 000	12 64911	4 096	2.519 842	5 428 835	11 69607
17	289	4.123 106	13.03840	4 913	2 571 282	5 539 658	11 93483
18	324	4 242 641	13 41641	5 832	2 620 741	5 646 216	12 16440
19	361	4.358 899	13.78405	6 859	2 668 402	5.748 897	12.38562
20	400	4.472 136	14 14214	8 000	2 714 418	5 848 035	12 59921
21	441	4 582 576	14 49138	9 261	2 758 924	5 943 922	12 80579
22	484	4 690 416	14 83240	10 648	2 802 039	6 036 811	13 00591
23	529	4 795 832	15.16575	12 167	2 843 867	6 126 926	13 20006
24	576	4 898 979	15.49193	13 824	2 884 499	6.214 465	13 38866
25	625	5 000 000	15.81139	15 625	2 924 018	6.299 605	13 57209
26	676	5.099 020	16 12452	17 576	2.962 496	6 382 504	13 75069
27	729	5.196 152	16.43168	19 683	3 000 000	6 463 304	13 92477
28	784	5.291 503	16.73320	21 952	3 036 589	6 542 133	14.09460
29	841	5.385 165	17.02939	24 389	3 072 317	6 619 106	14.26043
30	900	5.477 226	17.32051	27 000	3 107 233	6 694 330	14.42250
31	961	5.567 764	17.60682	29 791	3 141 381	6 767 899	14 58100
32	1 024	5 656 854	17.88854	32 768	3 174 802	6 839 904	14 73613
33	1 089	5 744 563	18.16590	35 937	3 207 534	6.910 423	14 88806
34	1 156	5.830 952	18.43909	39 304	3 239 612	6.979 532	15 03695
35	1 225	5.916 080	18.70829	42 875	3 271 066	7 047 299	15 18294
36	1 296	6 000 000	18 97367	46 656	3 301 927	7.113 787	15 32619
37	1 369	6 082 763	19.23538	50 653	3 332 222	7 179 054	15 46680
38	1 444	6.164 414	19 49359	54 872	3.361 975	7 243 156	15 60491
39	1 521	6.244 998	19 74842	59 319	3 391 211	7 306 144	15 74061
40	1 600	6.324 555	20 00000	64 000	3.419 952	7.368 063	15 87401
41	1 681	6.403 124	20 24846	68 921	3 448 217	7 428 959	16 00521
42	1 764	6 480 741	20.49390	74 088	3 476 027	7 488 872	16 13429
43	1 849	6.557 439	20 73644	79 507	3 503 398	7 547 842	16 26133
44	1 936	6.633 250	20 97618	85 184	3 530 348	7 605 905	16 38643
45	2 025	6.708 204	21.21320	91 125	3 556 893	7 663 094	16 50964
46	2 116	6.782 330	21.44761	97 336	3 583 048	7 719 443	16 63103
47	2 209	6.855 655	21 67948	103 823	3 608 826	7.774 980	16.75069
48	2 304	6.928 203	21.90890	110 592	3 634 241	7.829 735	16.86865
49	2 401	7.000 000	22.13594	117 649	3 659 306	7.883 735	16.98499
50	2 500	7.071 068	22.36068	125 000	3 684 031	7.937 005	17.09976

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
50	2 500	7.071 068	22 36068	125 000	3.684 031	7.937 005	17.09976
51	2 601	7 141 428	22.58318	132 651	3.708 430	7.989 570	17.21301
52	2 704	7 211 103	22 80351	140 608	3.732 511	8.041 452	17.32478
53	2 809	7 280 110	23.02173	148 877	3.756 286	8.092 672	17.43513
54	2 916	7.348 469	23.23790	157 464	3.779 763	8.143 253	17.54411
55	3 025	7.416 198	23 45208	166 375	3.802 952	8 193 213	17.65174
56	3 136	7 483 315	23.66432	175 616	3.825 862	8 242 571	17.75808
57	3 249	7 549 834	23 87467	185 193	3 848 501	8 291 344	17 86316
58	3 364	7 615 773	24 08319	195 112	3.870 877	8 339 551	17 96702
59	3 481	7.681 146	24.28992	205 379	3.892 996	8.387 207	18.06969
60	3 600	7 745 967	24 49490	216 000	3.914 868	8 434 327	18 17121
61	3 721	7 810 250	24.69818	226 981	3.936 497	8.480 926	18 27160
62	3 844	7.874 008	24.89980	238 328	3.957 892	8.527 019	18.37091
63	3 969	7.937 254	25 09980	250 047	3.979 057	8 572 619	18 46915
64	4 096	8.000 000	25.29822	262 144	4.000 000	8.617 739	18 56636
65	4 225	8 062 258	25.49510	274 625	4.020 726	8.662 391	18.66256
66	4 356	8 124 038	25.69047	287 496	4.041 240	8.706 588	18 75777
67	4 489	8.185 353	25.88436	300 763	4.061 548	8.750 340	18 85204
68	4 624	8 246 211	26.07681	314 432	4.081 655	8.793 659	18 94536
69	4 761	8 306 624	26.26785	328 509	4.101 566	8 836 556	19 03778
70	4 900	8.366 600	26.45751	343 000	4.121 285	8 879 040	19 12931
71	5 041	8 426 150	26 64583	357 911	4.140 818	8 921 121	19 21997
72	5 184	8.485 281	26.83282	373 248	4.160 168	8.962 809	19 30979
73	5 329	8 544 004	27 01851	389 017	4.179 339	9.004 113	19 39877
74	5 476	8 602 325	27.20294	405 224	4 198 336	9 045 042	19 48695
75	5 625	8.660 254	27.38613	421 875	4.217 163	9 085 603	19 57434
76	5 776	8.717 798	27 56810	438 976	4.235 824	9 125 805	19 66095
77	5 929	8.774 964	27.74887	456 533	4 254 321	9 165 656	19 74681
78	6 084	8.831 761	27.92848	474 552	4.272 659	9 205 164	19 83192
79	6 241	8.888 194	28.10694	493 039	4.290 840	9.244 335	19 91632
80	6 400	8.944 272	28 28427	512 000	4 308 869	9.283 178	20 00000
81	6 561	9 000 000	28.46050	531 441	4 326 749	9.321 698	20 08299
82	6 724	9 055 385	28 63564	551 368	4 344 481	9.359 902	20 16530
83	6 889	9.110 434	28 80972	571 787	4.362 071	9 397 796	20 24694
84	7 056	9.165 151	28.98275	592 704	4.379 519	9.435 388	20 32793
85	7 225	9 219 544	29.15476	614 125	4 396 830	9.472 682	20 40828
86	7 396	9 273 618	29 32576	636 056	4 414 005	9.509 685	20 48800
87	7 569	9 327 379	29 49576	658 503	4 431 048	9.546 403	20 56710
88	7 744	9 380 832	29 66479	681 472	4.447 960	9.582 840	20 64560
89	7 921	9.433 981	29.83287	704 969	4.464 745	9.619 002	20.72351
90	8 100	9 486 833	30.00000	729 000	4.481 405	9.654 894	20 80084
91	8 281	9 539 392	30 16621	753 571	4 497 941	9.690 521	20 87759
92	8 464	9 591 663	30.33150	778 688	4.514 357	9.725 888	20 95379
93	8 649	9.643 651	30 49590	804 357	4.530 655	9.761 000	21.02944
94	8 836	9.695 360	30.65942	830 584	4.546 836	9.795 861	21 10454
95	9 025	9.746 794	30 82207	857 375	4 562 903	9.830 476	21 17912
96	9 216	9.797 959	30 98387	884 736	4.578 857	9.864 848	21 25317
97	9 409	9.848 858	31 14482	912 673	4 594 701	9.898 983	21.32671
98	9 604	9.899 495	31 30495	941 192	4.610 436	9.932 884	21 39975
99	9 801	9.949 874	31.46427	970 299	4.626 065	9.966 555	21.47229
100	10 000	10.00000	31.62278	1 000 000	4 641 589	10.00000	21 54435

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
100	10 000	10 00000	31 62278	1 000 000	4 641 589	10 00000	21 54435
101	10 201	10 04988	31.78050	1 030 301	4.657 010	10 03322	21 61592
102	10 404	10 09950	31 93744	1 061 208	4.672 329	10 06623	21 68703
103	10 609	10 14889	32 09361	1 092 727	4 687 548	10 09902	21 75767
104	10 816	10.19804	32 24903	1 124 864	4 702 669	10 13159	21 82786
105	11 025	10 24695	32 40370	1 157 625	4 717 694	10 16396	21 89760
106	11 236	10 29563	32 55764	1 191 016	4 732 623	10 19613	21 96689
107	11 449	10 34408	32 71085	1 225 043	4 747 459	10 22809	22 03575
108	11 664	10 39230	32 86335	1 259 712	4 762 203	10 25986	22.10419
109	11 881	10 44031	33.01515	1 295 029	4 776 856	10 29142	22 17220
110	12 100	10 48809	33 16625	1 331 000	4.791 420	10 32280	22 23980
111	12 321	10 53565	33 31666	1 367 631	4 805 896	10 35399	22 30699
112	12 544	10 58301	33 46640	1 404 928	4 820 285	10 38499	22 37378
113	12 769	10 63015	33 61547	1 442 897	4 834 588	10 41580	22 44017
114	12 996	10.67708	33.76389	1 481 544	4.848 808	10 44644	22.50617
115	13 225	10 72381	33 91165	1 520 875	4 862 944	10 47690	22 57179
116	13 456	10 77033	34 05877	1 560 896	4 876 999	10 50718	22 63702
117	13 689	10 81665	34 20526	1 601 613	4 890 973	10 53728	22 70189
118	13 924	10 86278	34.35113	1 643 032	4 904 868	10 56722	22 76638
119	14 161	10.90871	34.49638	1 685 159	4.918 685	10 59699	22 83051
120	14 400	10 95445	34.64102	1 728 000	4.932 424	10 62659	22 89428
121	14 641	11 00000	34.78505	1 771 561	4 946 087	10.65602	22 95770
122	14 884	11.04536	34 92850	1 815 848	4 959 676	10 68530	23 02078
123	15 129	11.09054	35 07136	1 860 867	4 973 190	10 71441	23 08350
124	15 376	11.13553	35.21363	1 906 624	4.986 631	10 74337	23 14589
125	15 625	11 18034	35 35534	1 953 125	5 000 000	10 77217	23 20794
126	15 876	11 22497	35 49648	2 000 376	5 013 298	10 80082	23 26967
127	16 129	11 26943	35.63706	2 048 383	5 026 526	10 82932	23 33107
128	16 384	11 31371	35 77709	2 097 152	5 039 684	10 85767	23 39214
129	16 641	11 35782	35 91657	2 146 689	5 052 774	10 88587	23 45290
130	16 900	11.40175	36 05551	2 197 000	5 065 797	10 91393	23 51335
131	17 161	11.44552	36 19392	2 248 091	5 078 753	10 94184	23 57348
132	17 424	11.48913	36.33180	2 299 968	5.091 643	10 96961	23 63332
133	17 689	11.53256	36.46917	2 352 637	5 104 469	10 99724	23 69285
134	17 956	11.57584	36 60601	2 406 104	5.117 230	11 02474	23 75208
135	18 225	11.61895	36 74235	2 460 375	5 129 928	11 05209	23 81102
136	18 496	11.66190	36 87818	2 515 456	5 142 563	11.07932	23 86966
137	18 769	11.70470	37 01351	2 571 353	5 155 137	11 10641	23 92803
138	19 044	11.74734	37 14835	2 628 072	5 167 649	11 13336	23 98610
139	19 321	11.78983	37 28270	2 685 619	5 180 101	11 16019	24 04390
140	19 600	11 83216	37 41657	2 744 000	5 192 494	11 18689	24 10142
141	19 881	11.87434	37 54997	2 803 221	5 204 828	11 21346	24 15867
142	20 164	11.91638	37 68289	2 863 288	5 217 103	11 23991	24 21565
143	20 449	11.95826	37.81534	2 924 207	5.229 322	11 26623	24 27236
144	20 736	12 00000	37.94733	2 985 984	5 241 483	11.29243	24 32881
145	21 025	12.04159	38.07887	3 048 625	5 253 588	11 31851	24 38499
146	21 316	12.08305	38 20995	3 112 136	5 265 637	11 34447	24 44092
147	21 609	12.12436	38 34058	3 176 523	5 277 632	11.37031	24 49660
148	21 904	12.16553	38.47077	3 241 792	5.289 572	11.39604	24 55202
149	22 201	12.20656	38.60052	3 307 949	5.301 459	11.42165	24 60719
150	22 500	12.24745	38.72983	3 375 000	5.313 293	11 44714	24 66212

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
150	22 500	12 24745	38.72983	3 375 000	5 313 293	11.44714	24.66212
151	22 801	12 28821	38.85872	3 442 951	5 325 074	11 47252	24 71680
152	23 104	12 32883	38.98718	3 511 808	5 336 803	11 49779	24.77125
153	23 409	12 36932	39.11521	3 581 577	5 348 481	11 52295	24.82545
154	23 716	12 40967	39.24283	3 652 264	5.360 108	11 54800	24.87942
155	24 025	12.44990	39.37004	3 723 875	5.371 685	11 57295	24 93315
156	24 336	12.49000	39 49684	3 796 416	5.383 213	11 59778	24 98666
157	24 649	12.52996	39.62323	3 869 893	5 394 691	11 62251	25 03994
158	24 964	12 56981	39 74921	3 944 312	5 406 120	11 64713	25 09299
159	25 281	12 60952	39.87480	4 019 679	5.417 502	11 67165	25.14581
160	25 600	12 64911	40.00000	4 096 000	5 428 835	11 69607	25 19842
161	25 921	12 68858	40 12481	4 173 281	5 440 122	11 72039	25 25081
162	26 244	12 72792	40.24922	4 251 528	5 451 362	11 74460	25 30298
163	26 569	12 76715	40.37326	4 330 747	5 462 556	11 76872	25 35494
164	26 896	12 80625	40.49691	4 410 944	5.473 704	11 79274	25 40668
165	27 225	12 84523	40 62019	4 492 125	5.484 807	11 81666	25 45822
166	27 556	12 88410	40 74310	4 574 296	5 495 865	11 84048	25 50954
167	27 889	12 92285	40 86563	4 657 463	5 506 878	11 86421	25 56067
168	28 224	12 96148	40.98780	4 741 632	5.517 848	11 88784	25 61158
169	28 561	13 00000	41.10961	4 826 809	5.528 775	11 91138	25.66230
170	28 900	13 03840	41.23106	4 913 000	5 539 658	11 93483	25 71282
171	29 241	13 07670	41.35215	5 000 211	5.550 499	11 95819	25 76313
172	29 584	13.11488	41.47288	5 088 448	5 561 298	11 98145	25 81326
173	29 929	13.15295	41.59327	5 177 717	5 572 055	12 00463	25 86319
174	30 276	13 19091	41.71331	5 268 024	5 582 770	12 02771	25 91292
175	30 625	13 22876	41 83300	5 359 375	5.593 445	12.05071	25 96247
176	30 976	13 26650	41 95235	5 451 776	5.604 079	12 07362	26 01183
177	31 329	13 30413	42 07137	5 545 233	5.614 672	12 09645	26 06100
178	31 684	13 34166	42.19005	5 639 752	5 625 226	12 11918	26.10999
179	32 041	13 37909	42.30839	5 735 339	5 635 741	12.14184	26 15879
180	32 400	13 41641	42.42641	5 832 000	5 646 216	12 16440	26 20741
181	32 761	13 45362	42 54409	5 929 741	5.656 653	12 18689	26 25586
182	33 124	13 49074	42 66146	6 028 568	5.667 051	12 20929	26 30412
183	33 489	13 52775	42 77850	6 128 487	5 677 411	12 23161	26 35221
184	33 856	13 56466	42.89522	6 229 504	5.687 734	12.25385	26 40012
185	34 225	13 60147	43.01163	6 331 625	5 698 019	12 27601	26.44786
186	34 596	13 63818	43 12772	6 434 856	5 708 267	12 29809	26 49543
187	34 969	13 67479	43.24350	6 539 203	5 718 479	12 32009	26.54283
188	35 344	13 71131	43.35897	6 644 672	5 728 654	12 34201	26.59006
189	35 721	13 74773	43.47413	6 751 269	5 738 794	12 36386	26.63712
190	36 100	13 78405	43 58899	6 859 000	5.748 897	12 38562	26 68402
191	36 481	13 82027	43 70355	6 967 871	5.758 965	12 40731	26 73075
192	36 864	13.85641	43 81780	7 077 888	5.768 998	12 42893	26 77732
193	37 249	13.89244	43.93177	7 189 057	5.778 997	12 45047	26.82373
194	37 636	13 92839	44.04543	7 301 384	5.788 960	12.47194	26.86997
195	38 025	13 96424	44 15880	7 414 875	5.798 890	12 49333	26.91606
196	38 416	14 00000	44.27189	7 529 536	5.808 786	12.51465	26 96199
197	38 809	14.03567	44 38468	7 645 373	5.818 648	12 53590	27.00777
198	39 204	14.07125	44.49719	7 762 392	5.828 477	12 55707	27.05339
199	39 601	14 10674	44.60942	7 880 599	5.838 272	12 57818	27.09886
200	40 000	14.14214	44.72136	8 000 000	5.848 035	12.59921	27.14418

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
200	40 000	14.14214	44.72136	8 000 000	5.848 035	12.59921	27.14418
201	40 401	14.17745	44.83302	8 120 601	5.857 766	12.62017	27.18934
202	40 804	14.21267	44.94441	8 242 408	5.867 464	12.64107	27.23436
203	41 209	14.24781	45.05552	8 365 427	5.877 131	12.66189	27.27922
204	41 616	14.28286	45.16636	8 489 664	5.886 765	12.68265	27.32394
205	42 025	14.31782	45.27693	8 615 125	5.896 369	12.70334	27.36852
206	42 436	14.35270	45.38722	8 741 816	5.905 941	12.72396	27.41295
207	42 849	14.38749	45.49725	8 869 743	5.915 482	12.74452	27.45723
208	43 264	14.42221	45.60702	8 998 912	5.924 992	12.76501	27.50138
209	43 681	14.45683	45.71652	9 129 329	5.934 472	12.78543	27.54538
210	44 100	14.49138	45.82576	9 261 000	5.943 922	12.80579	27.58924
211	44 521	14.52584	45.93474	9 393 931	5.953 342	12.82609	27.63296
212	44 944	14.56022	46.04346	9 528 128	5.962 732	12.84632	27.67655
213	45 369	14.59452	46.15192	9 663 597	5.972 093	12.86648	27.72000
214	45 796	14.62874	46.26013	9 800 344	5.981 424	12.88659	27.76331
215	46 225	14.66288	46.36809	9 938 375	5.990 726	12.90663	27.80648
216	46 656	14.69694	46.47580	10 077 696	6.000 000	12.92661	27.84953
217	47 089	14.73092	46.58326	10 218 313	6.009 245	12.94653	27.89244
218	47 524	14.76482	46.69047	10 360 232	6.018 462	12.96638	27.93522
219	47 961	14.79865	46.79744	10 503 459	6.027 650	12.98618	27.97787
220	48 400	14.83240	46.90416	10 648 000	6.036 811	13.00591	28.02039
221	48 841	14.86607	47.01064	10 793 861	6.045 944	13.02559	28.06278
222	49 284	14.89966	47.11688	10 941 048	6.055 049	13.04521	28.10505
223	49 729	14.93318	47.22288	11 089 567	6.064 127	13.06477	28.14718
224	50 176	14.96663	47.32864	11 239 424	6.073 178	13.08427	28.18919
225	50 625	15.00000	47.43416	11 390 625	6.082 202	13.10371	28.23108
226	51 076	15.03330	47.53946	11 543 176	6.091 199	13.12309	28.27284
227	51 529	15.06652	47.64452	11 697 083	6.100 170	13.14242	28.31448
228	51 984	15.09967	47.74935	11 852 352	6.109 115	13.16169	28.35600
229	52 441	15.13275	47.85394	12 008 989	6.118 033	13.18090	28.39739
230	52 900	15.16575	47.95832	12 167 000	6.126 926	13.20006	28.43867
231	53 361	15.19868	48.06246	12 326 391	6.135 792	13.21916	28.47983
232	53 824	15.23155	48.16638	12 487 168	6.144 634	13.23821	28.52086
233	54 289	15.26434	48.27007	12 649 337	6.153 449	13.25721	28.56178
234	54 756	15.29706	48.37355	12 812 904	6.162 240	13.27614	28.60259
235	55 225	15.32971	48.47680	12 977 875	6.171 006	13.29503	28.64327
236	55 696	15.36229	48.57983	13 144 256	6.179 747	13.31386	28.68384
237	56 169	15.39480	48.68265	13 312 053	6.188 463	13.33264	28.72430
238	56 644	15.42725	48.78524	13 481 272	6.197 154	13.35136	28.76464
239	57 121	15.45962	48.88763	13 651 919	6.205 822	13.37004	28.80487
240	57 600	15.49193	48.98979	13 824 000	6.214 465	13.38866	28.84499
241	58 081	15.52417	49.09175	13 997 521	6.223 084	13.40723	28.88500
242	58 564	15.55635	49.19350	14 172 488	6.231 680	13.42575	28.92489
243	59 049	15.58846	49.29503	14 348 907	6.240 251	13.44421	28.96468
244	59 536	15.62050	49.39636	14 526 784	6.248 800	13.46263	29.00436
245	60 025	15.65248	49.49747	14 706 125	6.257 325	13.48100	29.04393
246	60 516	15.68439	49.59839	14 886 936	6.265 827	13.49931	29.08339
247	61 009	15.71623	49.69909	15 069 223	6.274 305	13.51758	29.12275
248	61 504	15.74802	49.79960	15 252 992	6.282 761	13.53580	29.16199
249	62 001	15.77973	49.89990	15 438 249	6.291 195	13.55397	29.20114
250	62 500	15.81139	50.00000	15 625 000	6.299 605	13.57209	29.24018

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
250	62 500	15 81139	50 00000	15 625 000	6 299 605	13.57209	29 24018
251	63 001	15 84298	50.09990	15 813 251	6.307 994	13.59016	29 27911
252	63 504	15 87451	50.19960	16 003 008	6 316 360	13.60818	29 31794
253	64 009	15 90597	50.29911	16 194 277	6.324 704	13.62616	29 35667
254	64 516	15 93738	50 39841	16 387 064	6.333 026	13 64409	29.39530
255	65 025	15 96872	50 49752	16 581 375	6 341 326	13 66197	29 43383
256	65 536	16 00000	50 59644	16 777 216	6 349 604	13.67981	29 47225
257	66 049	16.03122	50.69517	16 974 593	6 357 861	13.69760	29 51058
258	66 564	16.06238	50.79370	17 173 512	6.366 097	13 71534	29 54880
259	67 081	16.09348	50.89204	17 373 979	6.374 311	13.73304	29 58693
260	67 600	16 12452	50.99020	17 576 000	6.382 504	13.75069	29 62496
261	68 121	16.15549	51.08816	17 779 581	6 390 677	13.76830	29 66289
262	68 644	16.18641	51.18594	17 984 728	6 398 828	13 78586	29 70073
263	69 169	16.21727	51.28353	18 191 447	6 406 959	13 80337	29 73847
264	69 696	16.24808	51.38093	18 399 744	6 415 069	13.82085	29.77611
265	70 225	16.27882	51 47815	18 609 625	6.423 158	13 83828	29 81366
266	70 756	16.30951	51.57519	18 821 096	6 431 228	13.85566	29 85111
267	71 289	16 34013	51 67204	19 034 163	6.439 277	13.87300	29 88847
268	71 824	16 37071	51.76872	19 248 832	6 447 306	13 89030	29 92574
269	72 361	16.40122	51.86521	19 465 109	6.455 315	13.90755	29.96292
270	72 900	16 43168	51 96152	19 683 000	6 463 304	13 92477	30 00000
271	73 441	16 46208	52 05766	19 902 511	6.471 274	13 94194	30 03699
272	73 984	16 49242	52 15362	20 123 648	6 479 224	13 95906	30 07389
273	74 529	16 52271	52 24940	20 346 417	6 487 154	13 97615	30 11070
274	75 076	16 55295	52 34501	20 570 824	6.495 065	13 99319	30.14742
275	75 625	16 58312	52 44044	20 796 875	6.502 957	14 01020	30 18405
276	76 176	16 61325	52 53570	21 024 576	6 510 830	14 02716	30 22060
277	76 729	16 64332	52 63079	21 253 933	6.518 684	14 04408	30 25705
278	77 284	16 67333	52 72571	21 484 952	6.526 519	14 06096	30.29342
279	77 841	16 70329	52.82045	21 717 639	6.534 335	14 07780	30.32970
280	78 400	16 73320	52 91503	21 952 000	6 542 133	14.09460	30 36589
281	78 961	16 76305	53 00943	22 188 041	6.549 912	14.11136	30 40200
282	79 524	16 79286	53.10367	22 425 768	6 557 672	14.12808	30.43802
283	80 089	16 82260	53 19774	22 665 187	6.565 414	14.14476	30 47395
284	80 656	16 85230	53 29165	22 906 304	6.573 138	14.16140	30.50981
285	81 225	16 88194	53 38539	23 149 125	6.580 844	14.17800	30.54557
286	81 796	16 91153	53.47897	23 393 656	6 588 532	14.19456	30 58126
287	82 369	16 94107	53 57238	23 639 903	6.596 202	14 21109	30 61686
288	82 944	16 97056	53 66563	23 887 872	6.603 854	14 22757	30 65238
289	83 521	17 00000	53 75872	24 137 569	6.611 489	14 24402	30 68781
290	84 100	17 02939	53 85165	24 389 000	6.619 106	14 26043	30.72317
291	84 681	17 05872	53 94442	24 642 171	6.626 705	14 27680	30.75844
292	85 264	17.08801	54.03702	24 897 088	6.634 287	14 29314	30.79363
293	85 849	17.11724	54 12947	25 153 757	6.641 852	14 30944	30 82875
294	86 436	17.14643	54.22177	25 412 184	6.649 400	14.32570	30.86378
295	87 025	17.17556	54 31390	25 672 375	6 656 930	14 34192	30 89873
296	87 616	17.20465	54.40588	25 934 336	6.664 444	14 35811	30.93361
297	88 209	17 23369	54 49771	26 198 073	6.671 940	14 37426	30.96840
298	88 804	17 26268	54 58938	26 463 592	6 679 420	14 39037	31.00312
299	89 401	17.29162	54 68089	26 730 899	6.686 883	14 40645	31 03776
300	90 000	17 32051	54 77226	27 000 000	6.694 330	14.42250	31.07233

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
300	90 000	17 32051	54.77226	27 000 000	6 694 330	14 42250	31.07233
301	90 601	17 34935	54 86347	27 270 901	6 701 759	14 43850	31 10681
302	91 204	17 37815	54 95453	27 543 608	6 709 173	14 45447	31 14122
303	91 809	17.40690	55 04544	27 818 127	6 716 570	14.47041	31 17556
304	92 416	17 43560	55 13620	28 094 464	6.723 951	14.48631	31.20982
305	93 025	17 46425	55 22681	28 372 625	6 731 315	14 50218	31 24400
306	93 636	17 49286	55 31727	28 652 616	6.738 664	14.51801	31 27811
307	94 249	17.52142	55 40758	28 934 443	6.745 997	14 53381	31 31214
308	94 864	17 54993	55 49775	29 218 112	6.753 313	14 54957	31 34610
309	95 481	17 57840	55 58777	29 503 629	6.760 614	14 56530	31 37999
310	96 100	17 60682	55 67764	29 791 000	6.767 899	14 58100	31 41381
311	96 721	17 63519	55 76737	30 080 231	6 775 169	14 59666	31 44755
312	97 344	17 66352	55 85696	30 371 328	6 782 423	14.61229	31 48122
313	97 969	17 69181	55 94640	30 664 297	6 789 661	14 62788	31 51482
314	98 596	17 72005	56 03570	30 959 144	6 796 884	14 64344	31 54834
315	99 225	17.74824	56 12486	31 255 875	6.804 092	14 65897	31.58180
316	99 856	17.77639	56 21388	31 554 496	6 811 285	14 67447	31 61518
317	100 489	17.80449	56 30275	31 855 013	6 818 462	14 68993	31 64850
318	101 124	17.83255	56 39149	32 157 432	6 825 624	14.70536	31 68174
319	101 761	17.86057	56.48008	32 461 759	6 832 771	14 72076	31 71492
320	102 400	17 88854	56 56854	32 768 000	6 839 904	14 73613	31.74802
321	103 041	17.91647	56 65686	33 076 161	6 847 021	14 75146	31 78106
322	103 684	17 94436	56.74504	33 386 248	6 854 124	14 76676	31 81403
323	104 329	17.97220	56 83309	33 698 267	6 861 212	14 78203	31 84693
324	104 976	18.00000	56 92100	34 012 224	6 868 285	14 79727	31 87976
325	105 625	18.02776	57 00877	34 328 125	6.875 344	14 81248	31 91252
326	106 276	18.05547	57 09641	34 645 976	6 882 389	14 82766	31 94522
327	106 929	18.08314	57 18391	34 965 783	6.889 419	14 84280	31 97785
328	107 584	18.11077	57 27128	35 287 552	6 896 434	14 85792	32 01041
329	108 241	18 13836	57 35852	35 611 289	6.903 436	14 87300	32.04291
330	108 900	18 16590	57 44563	35 937 000	6 910 423	14 88806	32 07534
331	109 561	18.19341	57 53260	36 264 691	6 917 396	14 90308	32 10771
332	110 224	18.22087	57 61944	36 594 368	6 924 356	14 91807	32 14001
333	110 889	18.24829	57 70615	36 926 037	6 931 301	14 93303	32 17225
334	111 556	18.27567	57 79273	37 259 704	6 938 232	14 94797	32 20442
335	112 225	18 30301	57 87918	37 595 375	6 945 150	14 96287	32 23653
336	112 896	18 33030	57 96551	37 933 056	6 952 053	14 97774	32 26857
337	113 569	18 35756	58 05170	38 272 753	6.958 943	14 99259	32 30055
338	114 244	18 38478	58.13777	38 614 472	6 965 820	15 00740	32 33247
339	114 921	18 41195	58 22371	38 958 219	6.972 683	15.02219	32 36433
340	115 600	18.43909	58 30952	39 304 000	6 979 532	15 03695	32 39612
341	116 281	18 46619	58 39521	39 651 821	6.986 368	15 05167	32 42785
342	116 964	18.49324	58 48077	40 001 688	6 993 191	15 06637	32 45952
343	117 649	18.52026	58 56620	40 353 607	7.000 000	15 08104	32 49112
344	118 336	18.54724	58 65151	40 707 584	7.006 796	15.09568	32 52267
345	119 025	18.57418	58 73670	41 063 625	7 013 579	15 11030	32 55415
346	119 716	18.60108	58 82176	41 421 736	7 020 349	15 12488	32.58557
347	120 409	18 62794	58 90671	41 781 923	7 027 106	15.13944	32 61694
348	121 104	18.65476	58 99152	42 144 192	7 033 850	15 15397	32 64824
349	121 801	18 68154	59 07622	42 508 549	7 040 581	15 16847	32 67948
350	122 500	18.70829	59 16080	42 875 000	7 047 299	15 18294	32.71066

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
350	122 500	18 70829	59.16080	42 875 000	7 047 299	15 18294	32 71066
351	123 201	18 73499	59 24525	43 243 551	7 054 004	15 19739	32 74179
352	123 904	18 76166	59.32959	43 614 208	7.060 697	15 21181	32.77285
353	124 609	18 78829	59 41380	43 986 977	7 067 377	15 22620	32 80386
354	125 316	18 81489	59 49790	44 361 864	7 074 044	15 24057	32.83480
355	126 025	18 84144	59.58188	44 738 875	7.080 699	15 25490	32 86569
356	126 736	18 86796	59 66574	45 118 016	7 087 341	15 26921	32.89652
357	127 449	18 89444	59 74948	45 499 293	7 093 971	15 28350	32.92730
358	128 164	18 92089	59 83310	45 882 712	7.100 588	15 29775	32 95801
359	128 881	18 94730	59 91661	46 268 279	7.107 194	15 31198	32 98867
360	129 600	18 97367	60 00000	46 656 000	7 113 787	15 32619	33 01927
361	130 321	19 00000	60 08328	47 045 881	7 120 367	15 34037	33 04982
362	131 044	19 02630	60 16644	47 437 928	7.126 936	15 35452	33 08031
363	131 769	19 05256	60 24948	47 832 147	7.133 492	15.36864	33 11074
364	132 496	19.07878	60 33241	48 228 544	7.140 037	15.38274	33 14112
365	133 225	19 10497	60 41523	48 627 125	7 146 569	15 39682	33 17144
366	133 956	19 13113	60 49793	49 027 896	7 153 090	15 41087	33 20170
367	134 689	19 15724	60 58052	49 430 863	7.159 599	15 42489	33 23191
368	135 424	19.18333	60 66300	49 836 032	7 166 096	15 43889	33 26207
369	136 161	19 20937	60 74537	50 243 409	7 172 581	15 45286	33 29217
370	136 900	19 23538	60 82763	50 653 000	7 179 054	15 46680	33 32222
371	137 641	19 26136	60 90977	51 064 811	7 185 516	15 48073	33.35221
372	138 384	19 28730	60 99180	51 478 848	7 191 966	15 49462	33 38215
373	139 129	19 31321	61 07373	51 895 117	7 198 405	15 50849	33 41204
374	139 876	19 33908	61.15554	52 313 624	7.204 832	15 52234	33 44187
375	140 625	19 36492	61 23724	52 734 375	7 211 248	15 53616	33 47165
376	141 376	19 39072	61 31884	53 157 376	7 217 652	15 54996	33 50137
377	142 129	19 41649	61 40033	53 582 633	7 224 045	15 56373	33 53105
378	142 884	19 44222	61 48170	54 010 152	7.230 427	15 57748	33 56067
379	143 641	19 46792	61 56298	54 439 939	7 236 797	15 59121	33 59024
380	144 400	19 49359	61.64414	54 872 000	7 243 156	15 60491	33 61975
381	145 161	19 51922	61.72520	55 306 341	7.249 505	15.61858	33 64922
382	145 924	19 54482	61 80615	55 742 968	7 255 842	15 63224	33 67863
383	146 689	19 57039	61 88699	56 181 887	7 262 167	15 64587	33 70800
384	147 456	19 59592	61.96773	56 623 104	7.268 482	15.65947	33.73731
385	148 225	19 62142	62 04837	57 066 625	7.274 786	15.67305	33 76657
386	148 996	19 64688	62 12890	57 512 456	7 281 079	15 68661	33.79578
387	149 769	19 67232	62 20932	57 960 603	7.287 362	15 70014	33.82494
388	150 544	19 69772	62 28965	58 411 072	7.293 633	15 71366	33.85405
389	151 321	19 72308	62.36986	58 863 869	7.299 894	15 72714	33.88310
390	152 100	19 74842	62 44998	59 319 000	7.306 144	15 74061	33 91211
391	152 881	19 77372	62 52999	59 776 471	7.312 383	15 75405	33 94107
392	153 664	19 79899	62 60990	60 236 288	7.318 611	15 76747	33.96999
393	154 449	19 82423	62 68971	60 698 457	7 324 829	15 78087	33.99885
394	155 236	19.84943	62.76942	61 162 984	7.331 037	15 79424	34.02766
395	156 025	19 87461	62 84903	61 629 875	7.337 234	15 80759	34.05642
396	156 816	19 89975	62 92853	62 099 136	7.343 420	15 82092	34.08514
397	157 609	19 92486	63 00794	62 570 773	7.349 597	15 83423	34 11381
398	158 404	19.94994	63 08724	63 044 792	7.355 762	15.84751	34 14242
399	159 201	19.97498	63.16645	63 521 199	7.361 918	15 86077	34.17100
400	160 000	20 00000	63 24555	64 000 000	7.368 063	15 87401	34 19952

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
400	160 000	20 00000	63 24555	64 000 000	7 368 063	15 87401	34 19952
401	160 801	20 02498	63 32456	64 481 201	7 374 198	15 88723	34 22799
402	161 604	20 04994	63 40347	64 964 808	7.380 323	15 90042	34 25642
403	162 409	20 07486	63 48228	65 450 827	7 386 437	15 91360	34 28480
404	163 216	20 09975	63 56099	65 939 264	7.392 542	15 92675	34 31314
405	164 025	20 12461	63 63961	66 430 125	7 398 636	15 93988	34 34143
406	164 836	20 14944	63 71813	66 923 416	7 404 721	15 95299	34 36967
407	165 649	20 17424	63 79655	67 419 143	7.410 795	15 96607	34 39786
408	166 464	20 19901	63 87488	67 917 312	7 416 860	15 97914	34 42601
409	167 281	20 22375	63 95311	68 417 929	7 422 914	15 99218	34 45412
410	168 100	20 24846	64 03124	68 921 000	7 428 959	16 00521	34 48217
411	168 921	20 27313	64 10928	69 426 531	7 434 994	16 01821	34 51018
412	169 744	20 29778	64 18723	69 934 528	7 441 019	16 03119	34 53815
413	170 569	20 32240	64 26508	70 444 997	7 447 034	16 04415	34 56607
414	171 396	20 34699	64 34283	70 957 944	7 453 040	16 05709	34 59395
415	172 225	20 37155	64 42049	71 473 375	7 459 036	16 07001	34 62178
416	173 056	20 39608	64 49806	71 991 296	7 465 022	16 08290	34 64956
417	173 889	20 42058	64 57554	72 511 713	7 470 999	16 09578	34 67731
418	174 724	20 44505	64 65292	73 034 632	7 476 966	16 10864	34 70500
419	175 561	20 46949	64 73021	73 560 059	7 482 924	16 12147	34 73266
420	176 400	20 49390	64 80741	74 088 000	7 488 872	16 13429	34 76027
421	177 241	20 51828	64 88451	74 618 461	7 494 811	16 14708	34 78783
422	178 084	20 54264	64 96153	75 151 448	7 500 741	16 15986	34 81535
423	178 929	20 56696	65 03845	75 686 967	7 506 661	16 17261	34 84283
424	179 776	20 59126	65 11528	76 225 024	7 512 572	16 18534	34 87027
425	180 625	20 61553	65 19202	76 765 625	7 518 473	16 19806	34 89766
426	181 476	20 63977	65 26868	77 308 776	7 524 365	16 21075	34 92501
427	182 329	20 66398	65 34524	77 854 483	7 530 248	16 22343	34 95232
428	183 184	20 68816	65 42171	78 402 752	7 536 122	16 23608	34 97958
429	184 041	20 71232	65 49809	78 953 589	7 541 987	16 24872	35 00680
430	184 900	20 73644	65 57439	79 507 000	7 547 842	16 26133	35 03398
431	185 761	20 76054	65 65059	80 062 991	7 553 689	16 27393	35 06112
432	186 624	20 78461	65 72671	80 621 568	7.559 526	16 28651	35 08821
433	187 489	20 80865	65 80274	81 182 737	7 565 355	16 29906	35 11527
434	188 356	20 83267	65 87868	81 746 504	7 571 174	16 31160	35 14228
435	189 225	20 85665	65 95453	82 312 875	7 576 985	16 32412	35 16925
436	190 096	20 88061	66 03030	82 881 856	7 582 787	16 33662	35 19618
437	190 969	20 90454	66 10598	83 453 453	7 588 579	16 34910	35 22307
438	191 844	20 92845	66 18157	84 027 672	7 594 363	16 36156	35 24991
439	192 721	20 95233	66 25708	84 604 519	7.600 139	16 37400	35 27672
440	193 600	20 97618	66 33250	85 184 000	7 605 905	16 38643	35 30348
441	194 481	21 00000	66 40783	85 766 121	7 611 663	16 39883	35 33021
442	195 364	21 02380	66 48308	86 350 888	7 617 412	16 41122	35 35689
443	196 249	21 04757	66 55825	86 938 307	7 623 152	16 42358	35 38354
444	197 136	21 07131	66 63332	87 528 384	7 628 884	16 43593	35 41014
445	198 025	21 09502	66 70832	88 121 125	7 634 607	16 44826	35 43671
446	198 916	21 11871	66 78323	88 716 536	7 640 321	16 46057	35 46323
447	199 809	21 14237	66 85806	89 314 623	7 646 027	16 47287	35 48971
448	200 704	21 16601	66 93280	89 915 392	7 651 725	16 48514	35 51616
449	201 601	21 18962	67 00746	90 518 849	7 657 414	16 49740	35 54257
450	202 500	21 21320	67 08204	91 125 000	7 663 094	16 50964	35 56893

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
450	202 500	21 21320	67 08204	91 125 000	7 663 094	16 50964	35 56893
451	203 401	21 23676	67 15653	91 733 851	7 668 766	16 52186	35 59526
452	204 304	21 26029	67 23095	92 345 408	7 674 430	16 53406	35 62155
453	205 209	21 28380	67 30527	92 959 677	7.680 086	16 54624	35 64780
454	206 116	21 30728	67 37952	93 576 664	7.685 733	16 55841	35 67401
455	207 025	21 33073	67 45369	94 196 375	7 691 372	16 57056	35 70018
456	207 936	21 35416	67.52777	94 818 816	7 697 002	16 58269	35 72632
457	208 849	21 37756	67 60178	95 443 993	7 702 625	16 59480	35 75242
458	209 764	21 40093	67 67570	96 071 912	7 708 239	16 60690	35 77848
459	210 681	21 42429	67 74954	96 702 579	7.713 845	16 61897	35 80450
460	211 600	21 44761	67 82330	97 336 000	7 719 443	16 63103	35 83048
461	212 521	21 47091	67 89698	97 972 181	7 725 032	16 64308	35 85642
462	213 444	21 49419	67 97058	98 611 128	7 730 614	16 65510	35 88233
463	214 369	21 51743	68 04410	99 252 847	7 736 188	16 66711	35 90820
464	215 296	21 54066	68 11755	99 897 344	7 741 753	16 67910	35 93404
465	216 225	21.56386	68 19091	100 544 625	7.747 311	16 69108	35 95983
466	217 156	21 58703	68 26419	101 194 696	7 752 861	16 70303	35 98559
467	218 089	21 61018	68 33740	101 847 563	7 758 402	16 71497	36 01131
468	219 024	21 63331	68 41053	102 503 232	7 763 936	16 72689	36 03700
469	219 961	21 65641	68 48357	103 161 709	7 769 462	16 73880	36 06265
470	220 900	21 67948	68 55655	103 823 000	7 774 980	16 75069	36 08826
471	221 841	21 70253	68 62944	104 487 111	7 780 490	16 76256	36 11384
472	222 784	21 72556	68 70226	105 154 048	7 785 993	16 77441	36 13938
473	223 729	21 74856	68 77500	105 823 817	7 791 488	16 78625	36 16488
474	224 676	21 77154	68 84766	106 496 424	7 796 975	16 79807	36 19035
475	225 625	21 79449	68 92024	107 171 875	7 802 454	16 80988	36 21578
476	226 576	21 81742	68 99275	107 850 176	7 807 925	16 82167	36 24118
477	227 529	21 84033	69 06519	108 531 333	7 813 389	16 83344	36 26654
478	228 484	21 86321	69 13754	109 215 352	7 818 846	16 84519	36 29187
479	229 441	21 88607	69 20983	109 902 239	7 824 294	16 85693	36 31716
480	230 400	21 90890	69 28203	110 592 000	7 829 735	16 86865	36 34241
481	231 361	21 93171	69 35416	111 284 641	7 835 169	16 88036	36 36763
482	232 324	21 95450	69 42622	111 980 168	7 840 595	16 89205	36 39282
483	233 289	21 97726	69 49820	112 678 587	7 846 013	16 90372	36 41797
484	234 256	22 00000	69 57011	113 379 904	7.851 424	16 91538	36 44308
485	235 225	22 02272	69 64194	114 084 125	7 856 828	16 92702	36 46817
486	236 196	22 04541	69 71370	114 791 256	7 862 224	16 93865	36 49321
487	237 169	22 06808	69 78539	115 501 303	7 867 613	16 95026	36 51822
488	238 144	22 09072	69 85700	116 214 272	7 872 994	16 96185	36 54320
489	239 121	22 11334	69 92853	116 930 169	7.878 368	16 97343	36 56815
490	240 100	22 13594	70 00000	117 649 000	7 883 735	16 98499	36 59306
491	241 081	22.15852	70 07139	118 370 771	7 889 095	16 99654	36 61793
492	242 064	22 18107	70 14271	119 095 488	7 894 447	17 00807	36 64278
493	243 049	22.20360	70 21396	119 823 157	7 899 792	17 01959	36 66758
494	244 036	22 22611	70 28513	120 553 784	7 905 129	17 03108	36 69236
495	245 025	22 24860	70 35624	121 287 375	7 910 460	17 04257	36 71710
496	246 016	22 27106	70 42727	122 023 936	7 915 783	17 05404	36 74181
497	247 009	22 29350	70 49823	122 763 473	7 921 099	17 06549	36 76649
498	248 004	22 31591	70 56912	123 505 992	7.926 408	17 07693	36 79113
499	249 001	22 33831	70.63993	124 251 499	7.931 710	17 08835	36 81574
500	250 000	22.36068	70 71068	125 000 000	7.937 005	17 09976	36 84031

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
500	250 000	22 36068	70 71068	125 000 000	7 937 005	17.09976	36 84031
501	251 001	22 38303	70 78135	125 751 501	7.942 293	17.11115	36 86486
502	252 004	22.40536	70.85196	126 506 008	7.947 574	17.12253	36 88937
503	253 009	22 42766	70.92249	127 263 527	7.952 848	17.13380	36 91385
504	254 016	22 44994	70.99296	128 024 064	7.958 114	17.14524	36.93830
505	255 025	22 47221	71.06335	128 787 625	7.963 374	17.15657	36 96271
506	256 036	22 49444	71.13368	129 554 216	7.968 627	17.16789	36 98709
507	257 049	22.51666	71.20393	130 323 843	7.973 873	17.17919	37 01144
508	258 064	22 53886	71.27412	131 096 512	7.979 112	17.19048	37 03576
509	259 081	22.56103	71.34424	131 872 229	7.984 344	17.20175	37 06004
510	260 100	22 58318	71.41428	132 651 000	7.989 570	17.21301	37 08430
511	261 121	22 60531	71.48426	133 432 831	7 994 788	17.22425	37 10852
512	262 144	22 62742	71.55418	134 217 728	8 000 000	17 23548	37 13271
513	263 169	22.64950	71.62402	135 005 697	8 005 205	17.24669	37.15687
514	264 196	22 67157	71 69379	135 796 744	8.010 403	17.25789	37.18100
515	265 225	22 69361	71.76350	136 590 875	8 015 595	17 26908	37 20509
516	266 256	22 71563	71.83314	137 388 096	8 020 779	17 28025	37 22916
517	267 289	22.73763	71 90271	138 188 413	8 025 957	17 29140	37 25319
518	268 324	22 75961	71 97222	138 991 832	8.031 129	17 30254	37 27720
519	269 361	22.78157	72.04165	139 798 359	8.036 293	17 31367	37.30117
520	270 400	22 80351	72.11103	140 608 000	8.041 452	17.32478	37 32511
521	271 441	22 82542	72.18033	141 420 761	8 046 603	17 33588	37 34902
522	272 484	22 84732	72 24957	142 236 648	8 051 748	17 34696	37 37290
523	273 529	22 86919	72 31874	143 055 667	8 056 886	17 35804	37 39675
524	274 576	22 89105	72 38784	143 877 824	8 062 018	17 36909	37.42057
525	275 625	22 91288	72 45688	144 703 125	8 067 143	17 38013	37.44436
526	276 676	22 93469	72 52586	145 531 576	8 072 262	17 39116	37 46812
527	277 729	22 95648	72 59477	146 363 183	8 077 374	17 40218	37 49185
528	278 784	22 97825	72 66361	147 197 952	8 082 480	17.41318	37 51555
529	279 841	23.00000	72.73239	148 035 889	8.087 579	17.42416	37 53922
530	280 900	23.02173	72.80110	148 877 000	8.092 672	17.43513	37 56286
531	281 961	23.04344	72 86975	149 721 291	8 097 759	17 44609	37 58647
532	283 024	23.06513	72 93833	150 568 768	8 102 839	17 45704	37 61005
533	284 089	23 08679	73 00685	151 419 437	8 107 913	17.46797	37 63360
534	285 156	23.10844	73 07530	152 273 304	8.112 980	17.47889	37 65712
535	286 225	23 13007	73.14369	153 130 375	8 118 041	17 48979	37 68061
536	287 296	23.15167	73.21202	153 990 656	8.123 096	17 50068	37.70407
537	288 369	23.17326	73.28028	154 854 153	8.128 145	17 51156	37.72751
538	289 444	23.19483	73 34848	155 720 872	8.133 187	17.52242	37.75091
539	290 521	23 21637	73.41662	156 590 819	8.138 223	17.53327	37 77429
540	291 600	23 23790	73 48469	157 464 000	8 143 253	17 54411	37 79763
541	292 681	23.25941	73.55270	158 340 421	8.148 276	17.55493	37 82095
542	293 764	23 28089	73.62065	159 220 088	8.153 294	17 56574	37 84424
543	294 849	23.30236	73.68853	160 103 007	8.158 305	17.57654	37 86750
544	295 936	23.32381	73.75636	160 989 184	8.163 310	17 58732	37 89073
545	297 025	23 34524	73.82412	161 878 625	8.168 309	17 59800	37.91393
546	298 116	23 36664	73.89181	162 771 336	8.173 302	17.60885	37.93711
547	299 209	23 38803	73.95945	163 667 323	8 178 289	17 61959	37 96025
548	300 304	23 40940	74 02702	164 566 592	8.183 269	17.63032	37.98337
549	301 401	23.43075	74.09453	165 469 149	8.188 244	17.64104	38.00646
550	302 500	23.45208	74.16198	166 375 000	8.193 213	17 65174	38.02952

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
550	302 500	23.45208	74.16198	166 375 000	8.193 213	17.65174	38.02952
551	303 601	23.47339	74.22937	167 284 151	8.198 175	17.66243	38.05256
552	304 704	23.49468	74.29670	168 196 608	8.203 132	17.67311	38.07557
553	305 809	23.51595	74.36397	169 112 377	8.208 082	17.68378	38.09854
554	306 916	23.53720	74.43118	170 031 464	8.213 027	17.69443	38.12149
555	308 025	23.55844	74.49832	170 953 875	8.217 966	17.70507	38.14442
556	309 136	23.57965	74.56541	171 879 616	8.222 899	17.71570	38.16731
557	310 249	23.60085	74.63243	172 808 693	8.227 825	17.72631	38.19018
558	311 364	23.62202	74.69940	173 741 112	8.232 746	17.73691	38.21302
559	312 481	23.64318	74.76630	174 676 879	8.237 661	17.74750	38.23584
560	313 600	23.66432	74.83315	175 616 000	8.242 571	17.75808	38.25862
561	314 721	23.68544	74.89993	176 558 481	8.247 474	17.76864	38.28138
562	315 844	23.70654	74.96666	177 504 328	8.252 372	17.77920	38.30412
563	316 969	23.72762	75.03333	178 453 547	8.257 263	17.78973	38.32682
564	318 096	23.74868	75.09993	179 406 144	8.262 149	17.80026	38.34950
565	319 225	23.76973	75.16648	180 362 125	8.267 029	17.81077	38.37215
566	320 356	23.79075	75.23297	181 321 496	8.271 904	17.82128	38.39478
567	321 489	23.81176	75.29940	182 284 263	8.276 773	17.83177	38.41737
568	322 624	23.83275	75.36577	183 250 432	8.281 635	17.84224	38.43995
569	323 761	23.85372	75.43209	184 220 009	8.286 493	17.85271	38.46249
570	324 900	23.87467	75.49834	185 193 000	8.291 344	17.86316	38.48501
571	326 041	23.89561	75.56454	186 169 411	8.296 190	17.87360	38.50750
572	327 184	23.91652	75.63068	187 149 248	8.301 031	17.88403	38.52997
573	328 329	23.93742	75.69676	188 132 517	8.305 865	17.89444	38.55241
574	329 476	23.95830	75.76279	189 119 224	8.310 694	17.90485	38.57482
575	330 625	23.97916	75.82875	190 109 375	8.315 517	17.91524	38.59721
576	331 776	24.00000	75.89466	191 102 976	8.320 335	17.92562	38.61958
577	332 929	24.02082	75.96052	192 100 033	8.325 148	17.93599	38.64191
578	334 084	24.04163	76.02631	193 100 552	8.329 954	17.94634	38.66422
579	335 241	24.06242	76.09205	194 104 539	8.334 755	17.95669	38.68651
580	336 400	24.08319	76.15773	195 112 000	8.339 551	17.96702	38.70877
581	337 561	24.10394	76.22336	196 122 941	8.344 341	17.97734	38.73100
582	338 724	24.12468	76.28892	197 137 368	8.349 126	17.98765	38.75321
583	339 889	24.14539	76.35444	198 155 287	8.353 905	17.99794	38.77539
584	341 056	24.16609	76.41989	199 176 704	8.358 678	18.00823	38.79755
585	342 225	24.18677	76.48529	200 201 625	8.363 447	18.01850	38.81968
586	343 396	24.20744	76.55064	201 230 056	8.368 209	18.02876	38.84179
587	344 569	24.22808	76.61593	202 262 003	8.372 967	18.03901	38.86387
588	345 744	24.24871	76.68116	203 297 472	8.377 719	18.04925	38.88593
589	346 921	24.26932	76.74634	204 336 469	8.382 465	18.05947	38.90796
590	348 100	24.28992	76.81146	205 379 000	8.387 207	18.06969	38.92996
591	349 281	24.31049	76.87652	206 425 071	8.391 942	18.07989	38.95195
592	350 464	24.33105	76.94154	207 474 688	8.396 673	18.09008	38.97390
593	351 649	24.35159	77.00649	208 527 857	8.401 398	18.10026	38.99584
594	352 836	24.37212	77.07140	209 584 584	8.406 118	18.11043	39.01774
595	354 025	24.39262	77.13624	210 644 875	8.410 833	18.12059	39.03963
596	355 216	24.41311	77.20104	211 708 736	8.415 542	18.13074	39.06149
597	356 409	24.43358	77.26578	212 776 173	8.420 246	18.14087	39.08332
598	357 604	24.45404	77.33046	213 847 192	8.424 945	18.15099	39.10513
599	358 801	24.47448	77.39509	214 921 799	8.429 638	18.16111	39.12692
600	360 000	24.49490	77.45967	216 000 000	8.434 327	18.17121	39.14868

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
600	360 000	24.49490	77.45967	216 000 000	8.434 327	18.17121	39.14868
601	361 201	24.51530	77.52419	217 081 801	8.439 010	18.18130	39.17041
602	362 404	24.53569	77.58866	218 167 208	8.443 688	18.19137	39.19213
603	363 609	24.55606	77.65307	219 256 227	8.448 361	18.20144	39.21382
604	364 816	24.57641	77.71744	220 348 864	8.453 028	18.21150	39.23548
605	366 025	24.59675	77.78175	221 445 125	8.457 691	18.22154	39.25712
606	367 236	24.61707	77.84600	222 545 016	8.462 348	18.23158	39.27874
607	368 449	24.63737	77.91020	223 648 543	8.467 000	18.24160	39.30033
608	369 664	24.65766	77.97435	224 755 712	8.471 647	18.25161	39.32190
609	370 881	24.67793	78.03845	225 866 529	8.476 289	18.26161	39.34345
610	372 100	24.69818	78.10250	226 981 000	8.480 926	18.27160	39.36497
611	373 321	24.71841	78.16649	228 099 131	8.485 558	18.28158	39.38647
612	374 544	24.73863	78.23043	229 220 928	8.490 185	18.29155	39.40795
613	375 769	24.75884	78.29432	230 346 397	8.494 807	18.30151	39.42940
614	376 996	24.77902	78.35815	231 475 544	8.499 423	18.31145	39.45083
615	378 225	24.79919	78.42194	232 608 375	8.504 035	18.32139	39.47223
616	379 456	24.81935	78.48567	233 744 896	8.508 642	18.33131	39.49362
617	380 689	24.83948	78.54935	234 885 113	8.513 243	18.34123	39.51498
618	381 924	24.85961	78.61298	236 029 032	8.517 840	18.35113	39.53631
619	383 161	24.87971	78.67655	237 176 659	8.522 432	18.36102	39.55763
620	384 400	24.89980	78.74008	238 328 000	8.527 019	18.37091	39.57892
621	385 641	24.91987	78.80355	239 483 061	8.531 601	18.38078	39.60018
622	386 884	24.93993	78.86698	240 641 848	8.536 178	18.39064	39.62143
623	388 129	24.95997	78.93035	241 804 367	8.540 750	18.40049	39.64265
624	389 376	24.97999	78.99367	242 970 624	8.545 317	18.41033	39.66385
625	390 625	25.00000	79.05694	244 140 625	8.549 880	18.42016	39.68503
626	391 876	25.01999	79.12016	245 314 376	8.554 437	18.42998	39.70618
627	393 129	25.03997	79.18333	246 491 883	8.558 990	18.43978	39.72731
628	394 384	25.05993	79.24645	247 673 152	8.563 538	18.44958	39.74842
629	395 641	25.07987	79.30952	248 858 189	8.568 081	18.45937	39.76951
630	396 900	25.09980	79.37254	250 047 000	8.572 619	18.46915	39.79057
631	398 161	25.11971	79.43551	251 239 591	8.577 152	18.47891	39.81161
632	399 424	25.13961	79.49843	252 435 968	8.581 681	18.48867	39.83263
633	400 689	25.15949	79.56130	253 636 137	8.586 205	18.49842	39.85363
634	401 956	25.17936	79.62412	254 840 104	8.590 724	18.50815	39.87461
635	403 225	25.19921	79.68689	256 047 875	8.595 238	18.51788	39.89556
636	404 496	25.21904	79.74961	257 259 456	8.599 748	18.52759	39.91649
637	405 769	25.23886	79.81228	258 474 853	8.604 252	18.53730	39.93740
638	407 044	25.25866	79.87490	259 694 072	8.608 753	18.54700	39.95829
639	408 321	25.27845	79.93748	260 917 119	8.613 248	18.55668	39.97916
640	409 600	25.29822	80.00000	262 144 000	8.617 739	18.56636	40.00000
641	410 881	25.31798	80.06248	263 374 721	8.622 225	18.57602	40.02082
642	412 164	25.33772	80.12490	264 609 288	8.626 706	18.58568	40.04162
643	413 449	25.35744	80.18728	265 847 707	8.631 183	18.59532	40.06240
644	414 736	25.37716	80.24961	267 089 984	8.635 655	18.60495	40.08316
645	416 025	25.39685	80.31189	268 336 125	8.640 123	18.61458	40.10390
646	417 316	25.41653	80.37413	269 586 136	8.644 585	18.62419	40.12461
647	418 609	25.43619	80.43631	270 840 023	8.649 044	18.63380	40.14530
648	419 904	25.45584	80.49845	272 097 792	8.653 497	18.64340	40.16598
649	421 201	25.47548	80.56054	273 359 449	8.657 947	18.65298	40.18663
650	422 500	25.49510	80.62258	274 625 000	8.662 391	18.66256	40.20726

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
650	422 500	25.49510	80 62258	274 625 000	8.662 391	18.66256	40 20726
651	423 801	25 51470	80 68457	275 894 451	8 666 831	18.67212	40 22787
652	425 104	25 53429	80 74652	277 167 808	8 671 266	18 68168	40 24845
653	426 409	25 55386	80 80842	278 445 077	8 675 697	18 69122	40 26902
654	427 716	25 57342	80.87027	279 726 264	8.680 124	18 70076	40 28957
655	429 025	25 59297	80.93207	281 011 375	8.684 546	18 71029	40 31009
656	430 336	25 61250	80 99383	282 300 416	8 688 963	18 71980	40 33059
657	431 649	25 63201	81 05554	283 593 393	8 693 376	18 72931	40 35108
658	432 964	25 65151	81.11720	284 890 312	8 697 784	18 73881	40 37154
659	434 281	25.67100	81 17881	286 191 179	8.702 188	18 74830	40 39198
660	435 600	25 69047	81 24038	287 496 000	8 706 588	18 75777	40 41240
661	436 921	25.70992	81 30191	288 804 781	8.710 983	18 76724	40 43280
662	438 244	25 72936	81 36338	290 117 528	8.715 373	18 77670	40 45318
663	439 569	25 74879	81 42481	291 434 247	8.719 760	18 78615	40 47354
664	440 896	25.76820	81 48620	292 754 944	8.724 141	18 79559	40 49388
665	442 225	25 78759	81 54753	294 079 625	8.728 519	18 80502	40 51420
666	443 556	25 80698	81 60882	295 408 296	8 732 892	18 81444	40 53449
667	444 889	25 82634	81 67007	296 740 963	8 737 260	18 82386	40 55477
668	446 224	25 84570	81 73127	298 077 632	8 741 625	18 83326	40 57503
669	447 561	25 86503	81 79242	299 418 309	8 745 985	18 84265	40 59526
670	448 900	25 88436	81 85353	300 763 000	8 750 340	18 85204	40 61548
671	450 241	25 90367	81.91459	302 111 711	8.754 691	18 86141	40 63568
672	451 584	25 92296	81 97561	303 464 448	8.759 038	18 87078	40 65585
673	452 929	25 94224	82 03658	304 821 217	8 763 381	18 88013	40 67601
674	454 276	25 96151	82 09750	306 182 024	8.767 719	18 88948	40 69615
675	455 625	25 98076	82 15838	307 546 875	8 772 053	18 89882	40 71626
676	456 976	26 00000	82 21922	308 915 776	8 776 383	18 90814	40 73636
677	458 329	26 01922	82.28001	310 288 733	8.780 708	18 91746	40 75644
678	459 684	26 03843	82 34076	311 665 752	8.785 030	18 92677	40 77650
679	461 041	26.05763	82 40146	313 046 839	8.789 347	18 93607	40 79653
680	462 400	26 07681	82 46211	314 432 000	8.793 659	18 94536	40 81655
681	463 761	26 09598	82 52272	315 821 241	8 797 968	18.95465	40 83655
682	465 124	26 11513	82 58329	317 214 568	8 802 272	18.96392	40 85653
683	466 489	26 13427	82 64381	318 611 987	8 806 572	18.97318	40 87649
684	467 856	26 15339	82 70429	320 013 504	8 810 868	18.98244	40 89643
685	469 225	26 17250	82 76473	321 419 125	8 815 160	18 99169	40 91635
686	470 596	26 19160	82 82512	322 828 856	8.819 447	19 00092	40 93625
687	471 969	26 21068	82.88546	324 242 703	8.823 731	19.01015	40 95613
688	473 344	26 22975	82.94577	325 660 672	8.828 010	19 01937	40 97599
689	474 721	26 24881	83 00602	327 082 769	8.832 285	19 02858	40 99584
690	476 100	26.26785	83.06624	328 509 000	8 836 556	19 03778	41 01566
691	477 481	26 28688	83.12641	329 939 371	8 840 823	19 04698	41 03546
692	478 864	26 30589	83.18654	331 373 888	8 845 085	19 05616	41 05525
693	480 249	26 32489	83 24662	332 812 557	8.849 344	19 06533	41 07502
694	481 636	26 34388	83 30666	334 255 384	8 853 599	19 07450	41 09476
695	483 025	26 36285	83.36666	335 702 375	8.857 849	19.08366	41 11449
696	484 416	26 38181	83 42661	337 153 536	8.862 095	19 09281	41 13420
697	485 809	26 40076	83.48653	338 608 873	8.866 338	19.10195	41 15389
698	487 204	26 41969	83 54639	340 068 392	8 870 576	19.11108	41 17357
699	488 601	26 43861	83.60622	341 532 099	8.874 810	19.12020	41 19322
700	490 000	26 45751	83 66600	343 000 000	8.879 040	19 12931	41.21285

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
700	490 000	26 45751	83 66600	343 000 000	8 879 040	19.12931	41 21285
701	491 401	26.47640	83.72574	344 472 101	8.883 266	19.13842	41 23247
702	492 804	26 49528	83.78544	345 948 408	8 887 488	19 14751	41.25207
703	494 209	26 51415	83 84510	347 428 927	8 891 706	19.15660	41 27164
704	495 616	26.53300	83 90471	348 913 664	8.895 920	19.16568	41.29120
705	497 025	26.55184	83.96428	350 402 625	8 900 130	19.17475	41.31075
706	498 436	26 57066	84.02381	351 895 816	8 904 337	19.18381	41 33027
707	499 849	26.58947	84.08329	353 393 243	8,908 539	19 19286	41 34977
708	501 264	26.60827	84.14274	354 894 912	8.912 737	19 20191	41 36926
709	502 681	26.62705	84.20214	356 400 829	8,916 931	19 21095	41 38873
710	504 100	26.64583	84.26150	357 911 000	8.921 121	19 21997	41 40818
711	505 521	26 66458	84.32082	359 425 431	8.925 308	19 22899	41 42761
712	506 944	26 68333	84.38009	360 944 128	8 929 490	19 23800	41 44702
713	508 369	26 70206	84.43933	362 467 097	8.933 669	19 24701	41 46642
714	509 796	26 72078	84.49852	363 994 344	8.937 843	19 25600	41 48579
715	511 225	26 73948	84.55767	365 525 875	8.942 014	19 26499	41 50515
716	512 656	26 75818	84.61678	367 061 696	8.946 181	19 27396	41 52449
717	514 089	26.77686	84.67585	368 601 813	8.950 344	19 28293	41 54382
718	515 524	26 79552	84.73488	370 146 232	8.954 503	19 29189	41 56312
719	516 961	26 81418	84.79387	371 694 959	8.958 658	19 30084	41 58241
720	518 400	26 83282	84.85281	373 248 000	8.962 809	19 30979	41.60168
721	519 841	26 85144	84 91172	374 805 361	8 966 957	19 31872	41.62093
722	521 284	26 87006	84.97058	376 367 048	8.971 101	19.32765	41.64016
723	522 729	26.88866	85.02941	377 933 067	8 975 241	19 33657	41 65938
724	524 176	26.90725	85.08819	379 503 424	8.979 377	19.34548	41 67857
725	525 625	26.92582	85.14693	381 078 125	8.983 509	19 35438	41.69775
726	527 076	26 94439	85.20563	382 657 176	8.987 637	19 36328	41 71692
727	528 529	26 96294	85.26429	384 240 583	8.991 762	19 37216	41.73606
728	529 984	26 98148	85.32292	385 828 352	8.995 883	19 38104	41.75519
729	531 441	27 00000	85.38150	387 420 489	9.000 000	19 38991	41 77430
730	532 900	27 01851	85.44004	389 017 000	9 004 113	19 39877	41.79339
731	534 361	27 03701	85.49854	390 617 891	9.008 223	19 40763	41.81247
732	535 824	27.05550	85 55700	392 223 168	9 012 329	19 41647	41 83152
733	537 289	27 07397	85 61542	393 832 837	9 016 431	19 42531	41 85056
734	538 756	27.09243	85.67380	395 446 904	9.020 529	19 43414	41.86959
735	540 225	27.11088	85.73214	397 065 375	9 024 624	19 44296	41.88859
736	541 696	27.12932	85.79044	398 688 256	9.028 715	19 45178	41.90758
737	543 169	27 14774	85.84870	400 315 553	9.032 802	19 46058	41 92655
738	544 644	27.16616	85.90693	401 947 272	9.036 886	19 46938	41 94551
739	546 121	27.18455	85.96511	403 583 419	9.040 966	19 47817	41.96444
740	547 600	27 20294	86.02325	405 224 000	9 045 042	19 48695	41 98336
741	549 081	27.22132	86.08136	406 869 021	9 049 114	19 49573	42 00227
742	550 564	27.23968	86.13942	408 518 488	9 053 183	19.50449	42,02115
743	552 049	27.25803	86.19745	410 172 407	9 057 248	19.51325	42 04002
744	553 536	27 27636	86.25543	411 830 784	9.061 310	19 52200	42 05887
745	555 025	27.29469	86.31338	413 493 625	9 065 368	19 53074	42 07771
746	556 516	27.31300	86.37129	415 160 936	9 069 422	19.53948	42 09653
747	558 009	27 33130	86.42916	416 832 723	9.073 473	19 54820	42.11533
748	559 504	27.34959	86.48699	418 508 992	9.077 520	19 55692	42 13411
749	561 001	27.36786	86.54479	420 189 749	9.081 563	19.56563	42 15288
750	562 500	27.38613	86.60254	421 875 000	9.085 603	19 57434	42.17163

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
750	562 500	27.38613	86.60254	421 875 000	9 085 603	19 57434	42.17163
751	564 001	27.40438	86.66026	423 564 751	9 089 639	19.58303	42.19037
752	565 504	27 42262	86 71793	425 259 008	9.093 672	19.59172	42.20909
753	567 009	27 44085	86.77557	426 957 777	9.097 701	19.60040	42.22779
754	568 516	27 45906	86.83317	428 661 064	9.101 727	19.60908	42 24647
755	570 025	27.47726	86 89074	430 368 875	9.105 748	19 61774	42 26514
756	571 536	27 49545	86 94826	432 081 216	9.109 767	19 62640	42 28379
757	573 049	27 51363	87.00575	433 798 093	9.113 782	19 63505	42 30243
758	574 564	27 53180	87.06320	435 519 512	9.117 793	19 64369	42 32105
759	576 081	27.54995	87.12061	437 245 479	9.121 801	19 65232	42.33965
760	577 600	27.56810	87 17798	438 976 000	9.125 805	19 66095	42 35824
761	579 121	27.58623	87 23531	440 711 081	9 129 806	19 66957	42.37681
762	580 644	27.60435	87 29261	442 450 728	9 133 803	19 67818	42.39536
763	582 169	27 62245	87 34987	444 194 947	9.137 797	19 68679	42.41390
764	583 696	27.64055	87.40709	445 943 744	9 141 787	19.69538	42.43242
765	585 225	27.65863	87.46428	447 697 125	9.145 774	19 70397	42.45092
766	586 756	27.67671	87.52143	449 455 096	9.149 758	19 71256	42 46941
767	588 289	27 69476	87 57854	451 217 663	9 153 738	19.72113	42 48789
768	589 824	27.71281	87.63561	452 984 832	9.157 714	19 72970	42 50634
769	591 361	27 73085	87.69265	454 756 609	9.161 687	19 73826	42.52478
770	592 900	27 74887	87.74964	456 533 000	9 165 656	19 74681	42.54321
771	594 441	27 76689	87 80661	458 314 011	9 169 623	19 75535	42 56162
772	595 984	27 78489	87 86353	460 099 648	9.173 585	19 76389	42 58001
773	597 529	27 80288	87 92042	461 889 917	9 177 544	19 77242	42 59839
774	599 076	27 82086	87 97727	463 684 824	9.181 500	19 78094	42.61675
775	600 625	27 83882	88 03408	465 484 375	9.185 453	19 78946	42 63509
776	602 176	27 85678	88 09086	467 288 576	9.189 402	19 79797	42 65342
777	603 729	27.87472	88 14760	469 097 433	9 193 347	19 80647	42 67174
778	605 284	27 89265	88.20431	470 910 952	9 197 290	19 81496	42 69004
779	606 841	27.91057	88 26098	472 729 139	9 201 229	19 82345	42.70832
780	608 400	27 92848	88 31761	474 552 000	9 205 164	19 83192	42 72659
781	609 961	27 94638	88 37420	476 379 541	9 209 096	19 84040	42 74484
782	611 524	27 96426	88 43076	478 211 768	9 213 025	19 84886	42 76307
783	613 089	27 98214	88 48729	480 048 687	9 216 950	19 85732	42 78129
784	614 656	28 00000	88 54377	481 890 304	9 220 873	19 86577	42.79950
785	616 225	28 01785	88 60023	483 736 625	9 224 791	19 87421	42 81769
786	617 796	28 03569	88 65664	485 587 656	9 228 707	19 88265	42 83586
787	619 369	28 05352	88 71302	487 443 403	9 232 619	19 89107	42 85402
788	620 944	28 07134	88 76936	489 303 872	9 236 528	19 89950	42.87216
789	622 521	28.08914	88 82567	491 169 069	9 240 433	19 90791	42.89029
790	624 100	28 10694	88.88194	493 039 000	9 244 335	19 91632	42 90840
791	625 681	28 12472	88 93818	494 913 671	9 248 234	19 92472	42 92650
792	627 264	28.14249	88 99438	496 793 088	9 252 130	19 93311	42.94458
793	628 849	28 16026	89 05055	498 677 257	9 256 022	19 94150	42 96265
794	630 436	28 17801	89 10668	500 566 184	9.259 911	19.94987	42 98070
795	632 025	28.19574	89.16277	502 459 875	9 263 797	19 95825	42.99874
796	633 616	28 21347	89.21883	504 358 336	9.267 680	19 96661	43 01676
797	635 209	28 23119	89 27486	506 261 573	9.271 559	19 97497	43.03477
798	636 804	28 24889	89.33085	508 169 592	9.275 435	19.98332	43.05276
799	638 401	28 26659	89.38680	510 082 399	9.279 308	19.99166	43.07073
800	640 000	28.28427	89.44272	512 000 000	9.283 178	20.00000	43.08869

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
800	640 000	28.28427	89.44272	512 000 000	9.283 178	20.00000	43 08869
801	641 601	28.30194	89 49860	513 922 401	9 287 044	20 00833	43.10664
802	643 204	28.31960	89.55445	515 849 608	9 290 907	20 01665	43 12457
803	644 809	28 33725	89.61027	517 781 627	9 294 767	20 02497	43 14249
804	646 416	28.35489	89.66605	519 718 464	9.298 624	20.03328	43.16039
805	648 025	28.37252	89.72179	521 660 125	9.302 477	20.04158	43 17828
806	649 636	28 39014	89.77750	523 606 616	9.306 328	20 04988	43 19615
807	651 249	28.40775	89 83318	525 557 943	9.310 175	20 05816	43.21400
808	652 864	28 42534	89 88882	527 514 112	9.314 019	20 06645	43.23185
809	654 481	28.44293	89.94443	529 475 129	9.317 860	20.07472	43.24967
810	656 100	28.46050	90 00000	531 441 000	9 321 698	20 08299	43.26749
811	657 721	28.47806	90 05554	533 411 731	9 325 532	20 09125	43 28529
812	659 344	28 49561	90 11104	535 387 328	9.329 363	20 09950	43.30307
813	660 969	28 51315	90.16651	537 367 797	9.333 192	20 10775	43 32084
814	662 596	28 53069	90 22195	539 353 144	9.337 017	20 11599	43.33859
815	664 225	28.54820	90 27735	541 343 375	9 340 839	20 12423	43 35633
816	665 856	28 56571	90 33272	543 338 496	9 344 657	20.13245	43.37406
817	667 489	28 58321	90 38805	545 338 513	9 348 473	20 14067	43 39177
818	669 124	28.60070	90 44335	547 343 432	9 352 286	20.14889	43 40947
819	670 761	28 61818	90.49862	549 353 259	9.356 095	20 15710	43.42715
820	672 400	28 63564	90 55385	551 368 000	9.359 902	20 16530	43 44481
821	674 041	28 65310	90 60905	553 387 661	9 363 705	20 17349	43 46247
822	675 684	28 67054	90 66422	555 412 248	9 367 505	20 18168	43 48011
823	677 329	28 68798	90 71935	557 441 767	9 371 302	20 18986	43 49773
824	678 976	28.70540	90.77445	559 476 224	9.375 096	20 19803	43.51534
825	680 625	28 72281	90 82951	561 515 625	9.378 887	20 20620	43 53294
826	682 276	28 74022	90.88454	563 559 976	9.382 675	20 21436	43 55052
827	683 929	28 75761	90 93954	565 609 283	9.386 460	20 22252	43 56809
828	685 584	28 77499	90 99451	567 663 552	9 390 242	20 23066	43 58564
829	687 241	28 79236	91.04944	569 722 789	9.394 021	20 23880	43 60318
830	688 900	28 80972	91 10434	571 787 000	9 397 796	20 24694	43 62071
831	690 561	28 82707	91 15920	573 856 191	9 401 569	20.25507	43 63822
832	692 224	28.84441	91 21403	575 930 368	9 405 339	20.26319	43 65572
833	693 889	28 86174	91 26883	578 009 537	9 409 105	20 27130	43 67320
834	695 556	28 87906	91.32360	580 093 704	9 412 869	20 27941	43.69067
835	697 225	28 89637	91.37833	582 182 875	9 416 630	20 28751	43.70812
836	698 896	28 91366	91 43304	584 277 056	9 420 387	20 29561	43 72556
837	700 569	28 93095	91 48770	586 376 253	9.424 142	20 30370	43 74299
838	702 244	28 94823	91.54234	588 480 472	9.427 894	20 31178	43.76041
839	703 921	28.96550	91.59694	590 589 719	9.431 642	20 31986	43.77781
840	705 600	28 98275	91.65151	592 704 000	9.435 388	20 32793	43.79519
841	707 281	29 00000	91.70605	594 823 321	9.439 131	20.33599	43.81256
842	708 964	29 01724	91 76056	596 947 688	9 442 870	20 34405	43.82992
843	710 649	29.03446	91 81503	599 077 107	9 446 607	20 35210	43.84727
844	712 336	29 05168	91.86947	601 211 584	9.450 341	20.36014	43.86460
845	714 025	29 06888	91 92388	603 351 125	9 454 072	20 36818	43 88191
846	715 716	29 08608	91 97826	605 495 736	9.457 800	20 37621	43.89922
847	717 409	29.10326	92 03260	607 645 423	9 461 525	20 38424	43 91651
848	719 104	29 12044	92 08692	609 800 192	9 465 247	20 39226	43 93378
849	720 801	29.13760	92.14120	611 960 049	9.468 966	20.40027	43.95105
850	722 500	29.15476	92.19544	614 125 000	9.472 682	20.40828	43.96830

SQUARES, CUBES AND ROOTS (Continued)

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
850	722 500	29 15476	92 19544	614 125 000	9.472 682	20.40828	43 96830
851	724 201	29 17190	92 24966	616 295 051	9 476 396	20.41628	43 98553
852	725 904	29.18904	92.30385	618 470 208	9 480 106	20 42427	44 00275
853	727 609	29 20616	92 35800	620 650 477	9 483 814	20.43226	44.01996
854	729 316	29.22328	92 41212	622 835 864	9 487 518	20 44024	44 03716
855	731 025	29 24038	92 46621	625 026 375	9 491 220	20.44821	44 05434
856	732 736	29 25748	92 52027	627 222 016	9 494 919	20 45618	44 07151
857	734 449	29 27456	92 57429	629 422 793	9.498 615	20 46415	44 08866
858	736 164	29 29164	92 62829	631 628 712	9.502 308	20 47210	44 10581
859	737 881	29 30870	92 68225	633 839 779	9 505 998	20.48005	44 12293
860	739 600	29 32576	92 73618	636 056 000	9.509 685	20 48800	44 14005
861	741 321	29.34280	92.79009	638 277 381	9.513 370	20 49593	44 15715
862	743 044	29 35984	92.84396	640 503 928	9 517 052	20 50387	44 17424
863	744 769	29.37686	92 89779	642 735 647	9.520 730	20 51179	44 19132
864	746 496	29 39388	92 95160	644 972 544	9.524 406	20 51971	44 20838
865	748 225	29.41088	93 00538	647 214 625	9 528 079	20 52762	44 22543
866	749 956	29.42788	93 05912	649 461 896	9 531 750	20.53553	44 24246
867	751 689	29 44486	93 11283	651 714 363	9 535 417	20 54343	44 25949
868	753 424	29.46184	93.16652	653 972 032	9 539 082	20 55133	44 27650
869	755 161	29.47881	93 22017	656 234 909	9 542 744	20 55922	44 29349
870	756 900	29.49576	93 27379	658 503 000	9 546 403	20 56710	44 31048
871	758 641	29 51271	93 32738	660 776 311	9 550 059	20 57498	44 32745
872	760 384	29.52965	93 38094	663 054 848	9 553 712	20 58285	44.34440
873	762 129	29.54657	93.43447	665 338 617	9 557 363	20.59071	44 36135
874	763 876	29 56349	93 48797	667 627 624	9.561 011	20.59857	44 37828
875	765 625	29.58040	93.54143	669 921 875	9 564 656	20.60643	44 39520
876	767 376	29.59730	93 59487	672 221 376	9 568 298	20 61427	44 41211
877	769 129	29.61419	93 64828	674 526 133	9 571 938	20 62211	44 42900
878	770 884	29.63106	93 70165	676 836 152	9 575 574	20 62995	44 44588
879	772 641	29.64793	93 75500	679 151 439	9 579 208	20 63778	44 46275
880	774 400	29.66479	93 80832	681 472 000	9 582 840	20.64560	44 47960
881	776 161	29.68164	93 86160	683 797 841	9 586 468	20 65342	44 49644
882	777 924	29.69848	93 91486	686 128 968	9 590 094	20 66123	44.51327
883	779 689	29.71532	93 96808	688 465 387	9 593 717	20 66904	44.53009
884	781 456	29.73214	94 02127	690 807 104	9 597 337	20 67684	44 54689
885	783 225	29.74895	94 07444	693 154 125	9 600 955	20 68463	44 56368
886	784 996	29.76575	94 12757	695 506 456	9.604 570	20 69242	44 58046
887	786 769	29.78255	94 18068	697 864 103	9 608 182	20.70020	44 59723
888	788 544	29 79933	94 23375	700 227 072	9 611 791	20 70798	44 61398
889	790 321	29.81610	94 28680	702 595 369	9 615 398	20 71575	44 63072
890	792 100	29.83287	94 33981	704 969 000	9 619 002	20 72351	44 64745
891	793 881	29.84962	94 39280	707 347 971	9 622 603	20.73127	44 66417
892	795 664	29.86637	94 44575	709 732 288	9 626 202	20.73902	44.68087
893	797 449	29.88311	94 49868	712 121 957	9.629 797	20.74677	44 69756
894	799 236	29.89983	94.55157	714 516 984	9 633 391	20 75451	44 71424
895	801 025	29.91655	94 60444	716 917 375	9 636 981	20 76225	44 73090
896	802 816	29.93326	94 65728	719 323 136	9 640 569	20.76998	44 74756
897	804 609	29.94996	94 71008	721 734 273	9 644 154	20 77770	44.76420
898	806 404	29.96665	94.76286	724 150 792	9 647 737	20.78542	44.78083
899	808 201	29.98333	94.81561	726 572 699	9.651 317	20 79313	44 79744
900	810 000	30.00000	94.86833	729 000 000	9.654 894	20.80084	44.81405

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
900	810 000	30 00000	94 86833	729 000 000	9 654 894	20 80084	44 81405
901	811 801	30 01666	94 92102	731 432 701	9.658 468	20.80854	44 83064
902	813 604	30 03331	94 97368	733 870 808	9.662 040	20 81623	44 84722
903	815 409	30.04996	95 02631	736 314 327	9.665 610	20.82392	44 86379
904	817 216	30 06659	95 07891	738 763 264	9.669 176	20.83161	44 88034
905	819 025	30 08322	95 13149	741 217 625	9 672 740	20 83929	44 89688
906	820 836	30 09983	95 18403	743 677 416	9 676 302	20 84696	44.91341
907	822 649	30 11644	95 23655	746 142 643	9 679 860	20 85463	44 92993
908	824 464	30 13304	95 28903	748 613 312	9.683 417	20.86229	44.94644
909	826 281	30 14963	95.34149	751 089 429	9.686 970	20 86994	44 96293
910	828 100	30 16621	95 39392	753 571 000	9 690 521	20 87759	44 97941
911	829 921	30.18278	95 44632	756 058 031	9 694 069	20 88524	44 99588
912	831 744	30 19934	95.49869	758 550 528	9.697 615	20 89288	45 01234
913	833 569	30 21589	95.55103	761 048 497	9 701 158	20.90051	45 02879
914	835 396	30 23243	95.60335	763 551 944	9.704 699	20 90814	45.04522
915	837 225	30 24897	95.65563	766 060 875	9 708 237	20.91576	45.06164
916	839 056	30.26549	95 70789	768 575 296	9.711 772	20.92338	45 07805
917	840 889	30.28201	95.76012	771 095 213	9.715 305	20 93099	45 09445
918	842 724	30.29851	95 81232	773 620 632	9.718 835	20.93860	45 11084
919	844 561	30.31501	95 86449	776 151 559	9.722 363	20.94620	45 12721
920	846 400	30 33150	95 91663	778 688 000	9 725 888	20.95379	45 14357
921	848 241	30 34798	95 96874	781 229 961	9 729 411	20 96138	45 15992
922	850 084	30.36445	96.02083	783 777 448	9 732 931	20 96896	45 17626
923	851 929	30.38092	96.07289	786 330 467	9 736 448	20.97654	45 19259
924	853 776	30.39737	96.12492	788 889 024	9 739 963	20.98411	45 20891
925	855 625	30.41381	96 17692	791 453 125	9.743 476	20.99168	45 22521
926	857 476	30 43025	96 22889	794 022 776	9.746 986	20.99924	45 24150
927	859 329	30.44667	96 28084	796 597 983	9.750 493	21.00680	45 25778
928	861 184	30.46309	96 33276	799 178 752	9 753 998	21.01435	45 27405
929	863 041	30.47950	96 38465	801 765 089	9.757 500	21.02190	45.29030
930	864 900	30 49590	96 43651	804 357 000	9 761 000	21.02944	45 30655
931	866 761	30.51229	96 48834	806 954 491	9 764 497	21 03697	45 32278
932	868 624	30 52868	96 54015	809 557 568	9 767 992	21 04450	45 33900
933	870 489	30 54505	96 59193	812 166 237	9 771 485	21 05203	45.35521
934	872 356	30.56141	96 64368	814 780 504	9 774 974	21.05954	45.37141
935	874 225	30 57777	96 69540	817 400 375	9 778 462	21 06706	45 38760
936	876 096	30 59412	96.74709	820 025 856	9.781 946	21.07456	45 40377
937	877 969	30 61046	96.79876	822 656 953	9.785 429	21.08207	45 41994
938	879 844	30 62679	96 85040	825 293 672	9.788 909	21 08956	45 43609
939	881 721	30 64311	96 90201	827 936 019	9 792 386	21 09706	45 45223
940	883 600	30.65942	96 95360	830 584 000	9 795 861	21.10454	45 46836
941	885 481	30.67572	97 00515	833 237 621	9.799 334	21.11202	45 48448
942	887 364	30.69202	97.05668	835 896 888	9.802 804	21.11950	45 50058
943	889 249	30 70831	97 10819	838 561 807	9.806 271	21 12697	45 51668
944	891 136	30.72458	97.15966	841 232 384	9.809 736	21.13444	45 53276
945	893 025	30 74085	97 21111	843 908 625	9.813 199	21.14190	45 54883
946	894 916	30 75711	97 26253	846 590 536	9.816 659	21.14935	45 56490
947	896 809	30.77337	97.31393	849 278 123	9 820 117	21.15680	45 58095
948	898 704	30.78961	97.36529	851 971 392	9.823 572	21.16424	45 59698
949	900 601	30.80584	97 41663	854 670 349	9.827 025	21.17168	45 61301
950	902 500	30 82207	97.46794	857 375 000	9.830 476	21.17912	45.62903

n	n^2	$\sqrt{n}$	$\sqrt{10n}$	n^3	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
950	902 500	30.82207	97 46794	857 375 000	9 830 476	21.17912	45 62903
951	904 401	30.83829	97 51923	860 085 351	9 833 924	21 18655	45.64503
952	906 304	30.85450	97 57049	862 801 408	9 837 369	21 19397	45 66102
953	908 209	30 87070	97.62172	865 523 177	9 840 813	21 20139	45 67701
954	910 116	30.88689	97.67292	868 250 664	9 844 254	21 20880	45 69298
955	912 025	30.90307	97 72410	870 983 875	9 847 692	21 21621	45 70894
956	913 936	30 91925	97 77525	873 722 816	9 851 128	21 22361	45 72489
957	915 849	30 93542	97 82638	876 467 493	9 854 562	21 23101	45 74082
958	917 764	30 95158	97 87747	879 217 912	9.857 993	21 23840	45.75675
959	919 681	30 96773	97.92855	881 974 079	9.861 422	21 24579	45.77267
960	921 600	30 98387	97 97959	884 736 000	9 864 848	21 25317	45 78857
961	923 521	31 00000	98 03061	887 503 681	9 868 272	21 26055	45 80446
962	925 444	31 01612	98 08160	890 277 128	9 871 694	21 26792	45 82035
963	927 369	31 03224	98 13256	893 056 347	9 875 113	21 27529	45 83622
964	929 296	31 04835	98 18350	895 841 344	9 878 530	21.28265	45 85208
965	931 225	31.06445	98 23441	898 632 125	9 881 945	21 29001	45 86793
966	933 156	31 08054	98 28530	901 428 696	9 885 357	21 29736	45 88376
967	935 089	31 09662	98 33616	904 231 063	9 888 767	21 30470	45 89959
968	937 024	31.11270	98 38699	907 039 232	9 892 175	21 31204	45 91541
969	938 961	31 12876	98 43780	909 853 209	9 895 580	21 31938	45 93121
970	940 900	31 14482	98 48858	912 673 000	9 898 983	21 32671	45 94701
971	942 841	31 16087	98 53933	915 498 611	9 902 384	21 33404	45 96279
972	944 784	31 17691	98 59006	918 330 048	9.905 782	21 34136	45 97857
973	946 729	31 19295	98 64076	921 167 317	9 909 178	21 34868	45 99433
974	948 676	31 20897	98 69144	924 010 424	9.912 571	21 35599	46 01008
975	950 625	31 22499	98 74209	926 859 375	9 915 962	21 36329	46 02582
976	952 576	31 24100	98 79271	929 714 176	9 919 351	21.37059	46 04155
977	954 529	31 25700	98 84331	932 574 833	9 922 738	21 37789	46 05727
978	956 484	31 27299	98 89388	935 441 352	9.926 122	21.38518	46 07298
979	958 441	31 28898	98 94443	938 313 739	9.929 504	21.39247	46 08868
980	960 400	31 30495	98 99495	941 192 000	9 932 884	21.39975	46 10436
981	962 361	31 32092	99 04544	944 076 141	9 936 261	21 40703	46 12004
982	964 324	31.33688	99.09591	946 966 168	9 939 636	21.41430	46.13571
983	966 289	31 35283	99.14636	949 862 087	9.943 009	21 42156	46 15136
984	968 256	31.36877	99 19677	952 763 904	9.946 380	21.42883	46 16700
985	970 225	31 38471	99 24717	955 671 625	9 949 748	21 43608	46 18264
986	972 196	31 40064	99 29753	958 585 256	9 953 114	21.44333	46 19826
987	974 169	31.41656	99 34787	961 504 803	9 956 478	21.45058	46 21387
988	976 144	31 43247	99 39819	964 430 272	9.959 839	21.45782	46 22948
989	978 121	31.44837	99.44848	967 361 669	9.963 198	21.46506	46 24507
990	980 100	31 46427	99 49874	970 299 000	9 966 555	21.47229	46 26065
991	982 081	31 48015	99.54898	973 242 271	9 969 910	21.47952	46 27622
992	984 064	31.49603	99 59920	976 191 488	9 973 262	21 48674	46 29178
993	986 049	31.51190	99 64939	979 146 657	9 976 612	21.49396	46 30733
994	988 036	31 52777	99 69955	982 107 784	9 979 960	21 50117	46 32287
995	990 025	31 54362	99 74969	985 074 875	9 983 305	21 50838	46 33840
996	992 016	31 55947	99 79980	988 047 936	9 986 649	21 51558	46 35392
997	994 009	31 57531	99 84989	991 026 973	9 989 990	21 52278	46 36943
998	996 004	31 59114	99 89995	994 011 992	9 993 329	21 52997	46 38492
999	998 001	31 60696	99 94999	997 002 999	9 996 666	21.53716	46 40041
1000	1 000 000	31 62278	100 00000	1 000 000 000	10 000 000	21.54435	46 41589

POWERS OF NUMBERS

n	n^4	n^5	n^6	n^7	n^8
1	1	1	1	1	1
2	16	32	64	128	256
3	81	243	729	2187	6561
4	256	1024	4096	16384	65536
5	625	3125	15625	78125	390625
6	1296	7776	46656	279936	1679616
7	2401	16807	117649	823543	5764801
8	4096	32768	262144	2097152	16777216
9	6561	59049	531441	4782969	43046721
					$\times 10^8$
10	10000	100000	1000000	10000000	1.000000
11	14641	161051	1771561	19487171	2 143589
12	20736	248832	2985984	35831808	4.299817
13	28561	371293	4826809	62748517	8.157307
14	38416	537824	7529536	105413504	14 757891
15	50625	759375	11390625	170859375	25.628906
16	65536	1048576	16777216	268435456	42 949673
17	83521	1419857	24137569	410338673	69 757574
18	104976	1889568	34012224	612220032	110 199606
19	130321	2476099	47045881	893871739	169.835630
				$\times 10^9$	$\times 10^{10}$
20	160000	3200000	64000000	1.280000	2 560000
21	194481	4084101	85766121	1.801089	3 782286
22	234256	5153632	113379904	2.494358	5.487587
23	279841	6436343	148035889	3.404825	7.831099
24	331776	7962624	191102976	4 586471	11.007531
25	390625	9765625	244140625	6.103516	15.258789
26	456976	11881376	308915776	8 031810	20.882706
27	531441	14348907	387420489	10.460353	28 242954
28	614656	17210368	481890304	13 492929	37 780200
29	707281	20511149	594823321	17 249876	50 024641
			$\times 10^8$	$\times 10^{10}$	$\times 10^{11}$
30	810000	24300000	7 290000	2.187000	6.561000
31	923521	28629151	8 875037	2.751261	8 528910
32	1048576	33554432	10 737418	3 435974	10 995116
33	1185921	39135393	12 914680	4 261844	14 064086
34	1336336	45435424	15 448044	5.252335	17 857939
35	1500625	52521875	18 382656	6 433930	22 518754
36	1679616	60466176	21 767823	7.836416	28 211099
37	1874161	69343957	25 657264	9 493188	35 124795
38	2085136	79235168	30 109364	11 441558	43 477921
39	2313441	90224199	35 187438	13.723101	53 520093
			$\times 10^9$	$\times 10^{10}$	$\times 10^{12}$
40	2560000	102400000	4 096000	16 384000	6 553600
41	2825761	115856201	4 750104	19.475427	7.984925
42	3111696	130691232	5 489032	23 053933	9 682652
43	3418801	147008443	6 321363	27 181861	11 688200
44	3748096	164916224	7 256314	31 927781	14 048224
45	4100625	184528125	8 303766	37.366945	16 815125
46	4477456	205962976	9 474297	43 581766	20 047612
47	4879681	229345007	10 779215	50.662312	23 811287
48	5308416	254803968	12 230590	58 706834	28.179280
49	5764801	282475249	13 841287	67.822307	33 232931
50	6250000	312500000	15 625000	78.125000	39 062500

POWERS OF NUMBERS (Continued)

n	n^4	n^5	n^6	n^7	n^8
			$\times 10^{9}$	$\times 10^{11}$	$\times 10^{13}$
50	6250000	312500000	15 625000	7 812500	3 906250
51	6765201	345025251	17 596288	8 974107	4 576794
52	7311616	380204032	19 770610	10 280717	5 345973
53	7890481	418195493	22.164361	11 747111	6 225969
54	8503056	459165024	24 794911	13 389252	7 230196
55	9150625	503284375	27 680641	15 224352	8 373394
56	9834496	550731776	30 840979	17.270948	9 671731
57	10556001	601692057	34 296447	19.548975	11 142916
58	11316496	656356768	38 068693	22.079842	12 806308
59	12117361	714924299	42.180534	24.886515	14 683044
		$\times 10^{8}$	$\times 10^{10}$	$\times 10^{11}$	$\times 10^{13}$
60	12960000	7.776000	4 665600	27 993600	16 796160
61	13845841	8 445963	5 152037	31 427428	19 170731
62	14776336	9 161328	5 680024	35 216146	21 834011
63	15752961	9 924365	6 252350	39 389806	24 815578
64	16777216	10 737418	6 871948	43 980465	28 147498
65	17850625	11.602906	7 541889	49 022279	31 864481
66	18974736	12.523326	8 265395	54 551607	36 004061
67	20151121	13.501251	9 045838	60 607116	40 606768
68	21381376	14.539336	9 886748	67 229888	45 716324
69	22667121	15 640313	10 791816	74 463533	51 379837
		$\times 10^{8}$	$\times 10^{10}$	$\times 10^{12}$	$\times 10^{14}$
70	24010000	16.807000	11 764900	8 235430	5 764801
71	25411681	18 042294	12 810028	9 095120	6 457535
72	26873856	19 349176	13 931407	10 030613	7 222041
73	28398241	20.730716	15 133423	11 047399	8 064601
74	29986576	22 190066	16 420649	12.151280	8 991947
75	31640625	23 730469	17 797852	13 348389	10 011292
76	33362176	25 355254	19 269993	14 645195	11 130348
77	35153041	27 067842	20 842238	16 048523	12 357363
78	37015056	28 871744	22 519960	17.565569	13 701144
79	38950081	30 770564	24.308746	19 203909	15 171088
		$\times 10^{8}$	$\times 10^{10}$	$\times 10^{12}$	$\times 10^{14}$
80	40960000	32 768000	26 214400	20 971520	16 777216
81	43046721	34 867844	28 242954	22 876792	18 530202
82	45212176	37 073984	30 400667	24 928547	20 441409
83	47458321	39 390406	32 694037	27 136051	22 522922
84	49787136	41.821194	35 129803	29 509035	24 787589
85	52200625	44 370531	37 714952	32 057709	27 249053
86	54700816	47 042702	40 456724	34.792782	29 921793
87	57289761	49.842092	43 362620	37 725479	32 821167
88	59969536	52 773192	46 440409	40 867560	35 963452
89	62742241	55 840594	49 698129	44 231335	39 365888
		$\times 10^{9}$	$\times 10^{11}$	$\times 10^{13}$	$\times 10^{15}$
90	65610000	5.904900	5 314410	4 782969	4 304672
91	68574961	6 240321	5 678693	5 167610	4 702525
92	71639296	6.590815	6 063550	5 578466	5 132189
93	74805201	6.956884	6 469902	6 017009	5 595818
94	78074896	7 339040	6 898698	6 484776	6 095689
95	81450625	7 737809	7 350919	6 983373	6 634204
96	84934656	8.153727	7 827578	7 514475	7 213896
97	88529281	8 587340	8 329720	8.079828	7 837434
98	92236816	9 039208	8 858424	8 681255	8 507630
99	96059601	9 509900	9 414801	9 320653	9 227447
100	100000000	10 000000	10 000000	10 000000	10 000000

FACTORIALS AND THEIR LOGARITHMS

n	$n!$	$\log n!$	n	$n!$	$\log n!$
			50	3.0414×10^{64}	64.48307
1	1.0000	0.00000	51	1.5511×10^{66}	66.19065
2	2.0000	0.30103	52	8.0658×10^{67}	67.90665
3	6.0000	0.77815	53	4.2749×10^{69}	69.63092
4	2.4000×10	1.38021	54	2.3084×10^{71}	71.36332
5	1.2000×10^{2}	2.07918	**55**	1.2696×10^{73}	73.10368
6	7.2000×10^{2}	2.85733	56	7.1100×10^{74}	74.85187
7	5.0400×10^{3}	3.70243	57	4.0527×10^{76}	76.60774
8	4.0320×10^{4}	4.60552	58	2.3506×10^{78}	78.37117
9	3.6288×10^{5}	5.55976	59	1.3868×10^{80}	80.14202
10	3.6288×10^{6}	6.55976	**60**	8.3210×10^{81}	81.92017
11	3.9917×10^{7}	7.60116	61	5.0758×10^{83}	83.70550
12	4.7900×10^{8}	8.68034	62	3.1470×10^{85}	85.49790
13	6.2270×10^{9}	9.79428	63	1.9826×10^{87}	87.29724
14	8.7178×10^{10}	10.94041	64	1.2689×10^{89}	89.10342
15	1.3077×10^{12}	12.11650	**65**	8.2477×10^{90}	90.91633
16	2.0923×10^{13}	13.32062	66	5.4435×10^{92}	92.73587
17	3.5569×10^{14}	14.55107	67	3.6471×10^{94}	94.56195
18	6.4024×10^{15}	15.80634	68	2.4800×10^{96}	96.39446
19	1.2165×10^{17}	17.08509	69	1.7112×10^{98}	98.23331
20	2.4329×10^{18}	18.38612	**70**	1.1979×10^{100}	100.07841
21	5.1091×10^{19}	19.70834	71	8.5048×10^{101}	101.92966
22	1.1240×10^{21}	21.05077	72	6.1234×10^{103}	103.78700
23	2.5852×10^{22}	22.41249	73	4.4701×10^{105}	105.65032
24	6.2045×10^{23}	23.79271	74	3.3079×10^{107}	107.51955
25	1.5511×10^{25}	25.19065	**75**	2.4809×10^{109}	109.39461
26	4.0329×10^{26}	26.60562	76	1.8855×10^{111}	111.27543
27	1.0889×10^{28}	28.03698	77	1.4518×10^{113}	113.16192
28	3.0489×10^{29}	29.48414	78	1.1324×10^{115}	115.05401
29	8.8418×10^{30}	30.94654	79	8.9462×10^{116}	116.95164
30	2.6525×10^{32}	32.42366	**80**	7.1569×10^{118}	118.85473
31	8.2228×10^{33}	33.91502	81	5.7971×10^{120}	120.76321
32	2.6313×10^{35}	35.42017	82	4.7536×10^{122}	122.67703
33	8.6833×10^{36}	36.93869	83	3.9455×10^{124}	124.59610
34	2.9523×10^{38}	38.47016	84	3.3142×10^{126}	126.52038
35	1.0333×10^{40}	40.01423	**85**	2.8171×10^{128}	128.44980
36	3.7199×10^{41}	41.57054	86	2.4227×10^{130}	130.38430
37	1.3764×10^{43}	43.13874	87	2.1078×10^{132}	132.32382
38	5.2302×10^{44}	44.71852	88	1.8548×10^{134}	134.26830
39	2.0398×10^{46}	46.30959	89	1.6508×10^{136}	136.21769
40	8.1592×10^{47}	47.91165	**90**	1.4857×10^{138}	138.17194
41	3.3453×10^{49}	49.52443	91	1.3520×10^{140}	140.13098
42	1.4050×10^{51}	51.14768	92	1.2438×10^{142}	142.09477
43	6.0415×10^{52}	52.78115	93	1.1568×10^{144}	144.06325
44	2.6583×10^{54}	54.42460	94	1.0874×10^{146}	146.03638
45	1.1962×10^{56}	56.07781	**95**	1.0330×10^{148}	148.01410
46	5.5026×10^{57}	57.74057	96	9.9168×10^{149}	149.99637
47	2.5862×10^{59}	59.41267	97	9.6193×10^{151}	151.98314
48	1.2414×10^{61}	61.09391	98	9.4269×10^{153}	153.97437
49	6.0828×10^{62}	62.78410	99	9.3326×10^{155}	155.97000
50	3.0414×10^{64}	64.48307	**100**	9.3326×10^{157}	157.97000

FACTORS FOR COMPUTING PROBABLE ERRORS

n	$\frac{1}{\sqrt{n}}$	$\frac{1}{\sqrt{n(n-1)}}$	$\frac{.6745}{\sqrt{n-1}}$	$\frac{.6745}{\sqrt{n(n-1)}}$	$\frac{.8453}{n\sqrt{n-1}}$	$\frac{.8453}{\sqrt{n(n-1)}}$
2	.707107	.707107	.6745	.4769	.4227	.5978
3	.577350	.408248	.4769	.2754	.1993	.3451
4	.500000	.288675	.3894	.1947	.1220	.2440
5	.447214	223607	3372	.1508	0845	.1890
6	.408248	182574	3016	.1231	.0630	.1543
7	377964	154303	2754	1041	.0493	.1304
8	353553	.133631	2549	.0901	0399	.1130
9	.333333	.117851	2385	0795	.0332	.0996
10	316228	.105409	.2248	.0711	0282	0891
11	301511	095346	.2133	0643	0243	0806
12	288675	087039	.2034	0587	0212	0736
13	277350	080064	.1947	0540	0188	0677
14	267261	074125	.1871	0500	0167	0627
15	258199	.069007	.1803	.0465	0151	0583
16	250000	064550	.1742	0435	0136	0546
17	242536	060634	1686	0409	0124	0513
18	235702	057166	.1636	.0386	0114	0483
19	229416	054074	1590	0365	0105	0457
20	223607	.051299	.1547	0346	0097	0434
21	.218218	048795	.1508	0329	0090	.0412
22	213201	046524	.1472	.0314	0084	0393
23	208514	044455	1438	0300	0078	0376
24	204124	042563	1406	0287	0073	0360
25	200000	040825	1377	0275	0069	0345
26	196116	.039223	1349	0265	0065	.0332
27	192450	037743	1323	0255	0061	0319
28	188982	036370	1298	0245	0058	0307
29	185695	.035093	.1275	0237	0055	.0297
30	182574	.033903	1252	.0229	0052	0287
31	179605	032791	1231	.0221	0050	.0277
32	176777	031750	.1211	0214	0047	.0268
33	174078	030773	1192	.0208	0045	.0260
34	171499	029854	.1174	.0201	0043	0252
35	169031	028989	1157	0196	.0041	0245
36	166667	028172	.1140	0190	0040	0238
37	164399	027400	1124	0185	0038	.0232
38	162221	026669	1109	0180	.0037	0225
39	160128	025976	1094	0175	.0035	0220
40	158114	025318	1080	0171	0034	0214
41	156174	024693	1066	0167	0033	0209
42	.154303	024098	1053	0163	0031	.0204
43	152499	023531	1041	.0159	0030	0199
44	.150756	022990	1029	0155	0029	0194
45	149071	022473	1017	.0152	0028	0190
46	147442	021979	1005	0148	0027	0186
47	145865	021507	0994	.0145	0027	0182
48	144338	021054	0984	0142	0026	0178
49	.142857	.020620	0974	.0139	.0025	.0174
50	141421	020203	0964	0136	0024	0171

FACTORS FOR COMPUTING PROBABLE ERRORS
(Continued)

n	$\frac{1}{\sqrt{n}}$	$\frac{1}{\sqrt{n(n-1)}}$	$\frac{.6745}{\sqrt{n-1}}$	$\frac{6745}{\sqrt{n(n-1)}}$	$\frac{.8453}{n\sqrt{n-1}}$	$\frac{8453}{\sqrt{n(n-1)}}$
50	.141421	020203	.0964	.0136	.0024	.0171
51	.140028	.019803	.0954	.0134	.0023	.0167
52	.138675	019418	.0945	.0131	.0023	.0164
53	.137361	019048	.0935	.0129	.0022	.0161
54	.136083	018692	.0927	.0126	.0022	.0158
55	134840	018349	.0918	0124	.0021	.0155
56	133631	018019	.0910	.0122	.0020	.0152
57	.132453	017700	0901	0119	.0020	.0150
58	.131306	017392	0893	.0117	.0019	.0147
59	.130189	017095	0886	.0115	.0019	.0145
60	129099	016807	.0878	.0113	.0018	.0142
61	128037	016529	0871	0112	0018	0140
62	127000	016261	0864	0110	.0018	.0138
63	125988	016001	0857	.0108	0017	0135
64	125000	015749	0850	0106	0017	0133
65	124035	015504	.0843	0105	0016	.0131
66	.123091	015268	.0837	.0103	.0016	0129
67	.122169	015038	.0830	0101	0016	0127
68	121268	014815	.0824	0100	0015	.0125
69	120386	014599	.0818	.0099	0015	.0123
70	119523	014389	0812	0097	.0015	0122
71	118678	014185	.0806	0096	.0014	.0120
72	117851	013986	0801	0094	.0014	.0118
73	117041	013793	0795	.0093	0014	.0117
74	116248	013606	.0789	0092	0013	.0115
75	.115470	013423	0784	.0091	0013	0113
76	.114708	013245	0779	0089	0013	0112
77	113961	013072	.0773	0088	0013	.0111
78	113228	012904	0769	0087	0012	0109
79	.112509	012739	0764	.0086	0012	0108
80	111803	012579	0759	.0085	0012	.0106
81	111111	.012423	0754	0084	0012	0105
82	110432	012270	0749	.0083	0012	.0104
83	109764	012121	.0745	.0082	0011	0103
84	109109	011976	.0740	0081	0011	0101
85	108465	011835	0736	0080	0011	0100
86	107833	011696	.0732	0079	0011	0099
87	107211	.011561	0727	0078	.0011	0098
88	106600	011429	0723	0077	.0010	0097
89	106000	011300	.0719	0076	0010	0096
90	105409	.011173	.0715	0075	0010	0094
91	104828	011050	0711	0075	.0010	0093
92	104257	010929	.0707	.0074	0010	.0092
93	103695	.010811	0703	.0073	0010	.0091
94	103142	.010695	0699	.0072	0009	.0090
95	.102598	010582	.0696	.0071	.0009	.0089
96	.102062	010471	.0692	0071	0009	0089
97	.101535	010363	0688	.0070	0009	0088
98	.101015	010257	0685	0069	0009	0087
99	.100504	010152	.0681	0069	0009	.0086
100	100000	010050	0678	0068	0008	0085

PROBABILITY OF OCCURRENCE OF DEVIATIONS

Valid for thirty or more samples.

Probability of occurrence, expressed as per cent, and odds against a deviation as great or greater than that designated is given for various ratios of the deviation to the probable error and to the standard deviation.

(From Pearl, Medical Biometry and Statistics, W. B. Saunders Company, publishers, by permission.)

Ratio dev. to P.E.	Probable occurrence %	Odds against, to 1	Ratio dev. to std. dev.	Probable occurrence %	Odds against, to 1
1.0	50.00	1.00	0.67449	50.00	1.00
1.1	45.81	1.18	0.7	48.39	1.07
1.2	41.83	1.39	0.8	42.37	1.36
1.3	38.06	1.63	0.9	36.81	1.72
1.4	34.50	1.90	1.0	31.73	2.15
1.5	31.17	2.21	1.1	27.13	2.69
1.6	28.05	2.57	1.2	23.01	3.35
1.7	25.15	2.98	1.3	19.36	4.17
1.8	22.47	3.45	1.4	16.15	5.19
1.9	20.00	4.00	1.5	13.36	6.48
2.0	17.73	4.64	1.6	10.96	8.12
2.1	15.67	5.38	1.7	8.91	10.22
2.2	13.78	6.25	1.8	7.19	12.92
2.3	12.08	7.28	1.9	5.74	16.41
2.4	10.55	8.48	2.0	4.55	20.98
2.5	9.18	9.90	2.1	3.57	26.99
2.6	7.95	11.58	2.2	2.78	34.96
2.7	6.86	13.58	2.3	2.14	45.62
2.8	5.89	15.96	2.4	1.64	59.99
2.9	5.05	18.82	2.5	1.24	79.52
3.0	4.30	22.24	2.6	.932	106.3
3.1	3.65	26.37	2.7	.693	143.2
3.2	3.09	31.36	2.8	.511	194.7
3.3	2.60	37.42	2.9	.373	267.0
3.4	2.18	44.80	3.0	.270	369.4
3.5	1.82	53.82	3.1	.194	515.7
3.6	1.52	64.89	3.2	.137	726.7
3.7	1.26	78.53	3.3	.0967	1,033.
3.8	1.04	95.38	3.4	.0674	1,483.
3.9	.853	116.3	3.5	.0465	2,149.
4.0	.698	142.3	3.6	.0318	3,142.
4.1	.569	174.9	3.7	.0216	4,637.
4.2	.461	215.8	3.8	.0145	6,915.
4.3	.373	267.2	3.9	.00962	10,394.
4.4	.300	332.4	4.0	.00634	15,772.
4.5	.240	415.0	5.0	5.73×10^{-5}	1.744×10^{6}
4.6	.192	520.4	6.0	2.0×10^{-7}	5.0×10^{8}
4.7	.152	655.3	7.0	2.6×10^{-10}	3.9×10^{11}
4.8	.121	828.3			
4.9	.0950	1,052.			
5.0	.0745	1,341.			
6.0	.0052	19,300			
7.0	.00023	4.27×10^{5}			
8.0	6.8×10^{-6}	1.47×10^{7}			
9.0	1.3×10^{-7}	7.30×10^{8}			
10.0	1.5×10^{-9}	6.5×10^{10}			

AREAS, ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR

The following table gives values of the area under the curve from the ordinate at $t = 0$ to the ordinate for the values of t given in the column at the left. Values of the ordinate and of the second, third and fourth derivatives are also given.

t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative	t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative
.00	.0000	3989	− 3989	0000	1 1968	.50	1915	3521	− 2641	4841	5501
.01	0040	3989	− 3989	0120	1 1965	.51	1950	3503	− 2592	4895	.5279
.02	0080	3989	− 3987	0239	1 1956	.52	.1985	3485	−.2543	4947	.5056
.03	0120	3988	− 3984	0359	1 1941	.53	2019	3467	− 2493	4996	.4831
.04	0160	3986	− 3980	0478	1 1920	.54	2054	3448	− 2443	5043	.4605
.05	0199	3984	− 3975	0597	1 1894	.55	2088	3429	− 2392	5088	4378
.06	0239	3982	− 3968	.0716	1.1861	.56	2123	3411	− 2341	5131	4150
.07	0279	3980	− 3960	0834	1 1822	.57	2157	3391	− 2289	5171	3921
.08	0319	3977	− 3951	0952	1.1778	.58	2190	3372	− 2238	5209	3691
.09	0359	3973	− 3941	1070	1 1727	.59	2224	3352	− 2185	5245	3461
.10	0398	3970	− 3930	1187	1 1671	.60	2258	3332	− 2133	5278	3231
.11	0438	3965	− 3917	1303	1 1609	.61	2291	3312	− 2080	5309	3000
.12	0478	3961	− 3904	1419	1 1541	.62	2324	3292	− 2027	5338	2770
.13	0517	3956	− 3889	1534	1 1468	.63	2357	3271	− 1973	5365	.2539
.14	0557	3951	− 3873	1648	1 1389	.64	2389	3251	− 1919	5389	2309
.15	0596	3945	− 3856	1762	1 1304	.65	2422	3230	− 1865	5411	2078
.16	0636	3939	− 3838	1874	1 1214	.66	2454	3209	− 1811	5431	1849
.17	0675	3932	− 3819	1986	1 1118	.67	.2486	3187	− 1757	5448	1620
.18	.0714	3925	− 3798	2097	1 1017	.68	2518	3166	− 1702	5463	1391
.19	0754	3918	− 3777	2206	1 0911	.69	2549	3144	−.1647	5476	1164
.20	0793	3910	− 3754	2315	1 0799	.70	2580	3123	− 1593	5486	0937
.21	0832	3902	− 3730	2422	1 0682	.71	2612	3101	− 1538	5495	0712
.22	0871	3894	− 3706	2529	1 0560	.72	2642	3079	− 1483	5501	0487
.23	0910	3885	− 3680	2634	1 0434	.73	2673	3056	− 1428	5504	0265
.24	0948	3876	− 3653	2737	1 0302	.74	2704	3034	− 1373	5506	0043
.25	0987	3867	− 3625	2840	1 0165	.75	.2734	3011	− 1318	5505	− 0176
.26	1026	3857	− 3596	2941	1 0024	.76	2764	2989	− 1262	5502	− 0394
.27	1064	3847	− 3566	3040	0 9878	.77	.2794	2966	− 1207	5497	− 0611
.28	1103	3836	− 3535	3138	0 9727	.78	2823	2943	− 1153	5490	− 0825
.29	1141	3825	− 3504	.3235	0 9572	.79	2852	2920	−.1098	5481	− 1037
.30	1179	3814	− 3471	3330	0 9413	.80	2881	2897	−.1043	5469	− 1247
.31	1217	3802	− 3437	3423	0 9250	.81	.2910	2874	− 0988	5456	− 1455
.32	1255	3790	− 3402	3515	0 9082	.82	2939	2850	− 0934	5440	− 1660
.33	1293	3778	− 3367	3605	0 8910	.83	.2967	2827	− 0880	5423	− 1862
.34	1331	.3765	− 3330	3693	0 8735	.84	2996	2803	−.0825	5403	− 2063
.35	.1368	3752	−.3293	3779	0 8556	.85	3023	2780	− 0771	5381	− 2260
.36	1406	3739	− 3255	3864	0 8373	.86	3051	2756	− 0718	5358	− 2455
.37	1443	3726	− 3216	3947	0 8186	.87	3079	2732	− 0664	5332	− 2646
.38	1480	3712	− 3176	4028	0 7996	.88	.3106	2709	− 0611	5305	− 2835
.39	1517	3697	− 3135	4107	0 7803	.89	.3133	2685	− 0558	5276	− 3021
.40	1554	3683	−.3094	4184	0 7607	.90	3159	2661	− 0506	5245	− 3203
.41	1591	3668	−.3051	4259	0 7408	.91	3186	2637	− 0453	5212	− 3383
42	1628	3653	− 3008	.4332	0 7206	.92	.3212	2613	− 0401	5177	− 3559
.43	1664	3637	− 2965	4403	0 7001	.93	3238	2589	− 0350	5140	− 3731
.44	1700	3621	− 2920	4472	0 6793	.94	.3264	2565	− 0299	5102	− 3901
.45	1736	.3605	− 2875	4539	0 6583	.95	.3289	2541	− 0248	5062	−.4066
.46	.1772	3589	− 2830	.4603	0 6371	.96	3315	2516	−.0197	.5021	− 4228
.47	1808	3572	− 2783	4666	0 6156	.97	3340	2492	−.0147	4978	− 4387
.48	.1844	3555	− 2736	4727	0 5940	.98	3365	2468	− 0098	4933	− 4541
.49	1879	3538	− 2689	4785	0 5721	.99	3389	2444	− 0049	4887	− 4692
.50	1915	3521	− 2641	4841	0 5501	1.00	.3413	2420	.0000	.4839	−.4839

AREAS, ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR (Continued)

t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative	t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative
1.00	3413	2420	0000	4839	− 4839	**1.50**	4332	1295	1619	1457	−.7043
1.01	3438	2396	0048	4790	− 4983	1.51	4345	1276	1633	1387	− 6994
1.02	3461	.2371	0096	4740	− 5122	1.52	4357	1257	1647	1317	− 6942
1.03	3485	2347	.0143	.4688	− 5257	1.53	4370	1238	.1660	.1248	− 6888
1.04	3508	2323	0190	4635	− 5389	1.54	.4382	1219	1672	1180	− 6831
1.05	.3531	2299	0236	4580	− 5516	**1.55**	.4394	1200	1683	1111	−.6772
1.06	.3554	2275	.0281	4524	−.5639	1.56	4406	1182	1694	1044	− 6710
1.07	3577	2251	0326	4467	− 5758	1.57	4418	1163	1704	0977	−.6646
1.08	3599	2227	.0371	4409	− 5873	1.58	4430	1145	.1714	0911	−.6580
1.09	3621	2203	0414	4350	− 5984	1.59	4441	1127	1722	0846	− 6511
1.10	3643	2179	.0458	4290	− 6091	**1.60**	4452	1109	1730	0781	− 6441
1.11	3665	2155	0500	4228	− 6193	1.61	4463	1092	1738	0717	−.6368
1.12	3686	2131	0542	.4166	−.6292	1.62	4474	1074	1745	0654	−.6293
1.13	.3708	2107	0583	.4102	− 6386	1.63	4485	1057	1751	0591	− 6216
1.14	3729	2083	0624	4038	−.6476	1.64	4495	1040	1757	0529	− 6138
1.15	3749	2059	0664	3973	−.6561	**1.65**	4505	1023	1762	0468	−.6057
1.16	3770	2036	0704	3907	−.6643	1.66	4515	1006	1766	0408	− 5975
1.17	3790	2012	0742	3840	− 6720	1.67	4525	0989	1770	0349	− 5891
1.18	3810	1989	0780	3772	− 6792	1.68	4535	0973	.1773	0290	− 5806
1.19	3830	1965	0818	3704	− 6861	1.69	4545	0957	.1776	0233	− 5720
1.20	3849	1942	0854	3635	− 6926	**1.70**	4554	0941	1778	0176	−.5632
1.21	3869	1919	0890	3566	− 6986	1.71	4564	0925	1779	0120	− 5542
1.22	3888	1895	0926	3496	− 7042	1.72	4573	0909	1780	0065	−.5452
1.23	3907	1872	0960	3425	− 7094	1.73	4582	0893	1780	0011	− 5360
1.24	3925	1849	0994	3354	− 7141	1.74	4591	0878	1780	− 0042	− 5267
1.25	3944	1827	1027	3282	− 7185	**1.75**	4599	0863	1780	− 0094	− 5173
1.26	3962	1804	.1060	3210	− 7224	1.76	4608	0848	.1778	− 0146	−.5079
1.27	3980	1781	1092	3138	− 7259	1.77	4616	0833	1777	− 0196	− 4983
1.28	3997	1759	1123	3065	− 7291	1.78	4625	0818	.1774	− 0245	−.4887
1.29	4015	1736	1153	2992	− 7318	1.79	4633	0804	.1772	− 0294	−.4789
1.30	4032	1714	1182	2918	− 7341	**1.80**	4641	0790	1769	− 0341	−.4692
1.31	4049	1692	1211	2845	− 7361	1.81	4649	0775	1765	− 0388	− 4593
1.32	4066	1669	1239	2771	− 7376	1.82	4656	0761	1761	− 0433	− 4494
1.33	4082	1647	1267	2697	− 7388	1.83	4664	0748	.1756	− 0477	− 4395
1.34	4099	1626	1293	2624	− 7395	1.84	4671	0734	1751	− 0521	− 4295
1.35	4115	1604	1319	2550	− 7399	**1.85**	4678	0721	1746	− 0563	− 4195
1.36	4131	1582	1344	2476	− 7400	1.86	4686	0707	1740	− 0605	− 4095
1.37	4147	1561	.1369	2402	−.7396	1.87	4693	0694	1734	− 0645	− 3995
1.38	4162	1540	1392	2328	− 7389	1.88	4700	0681	.1727	− 0685	− 3894
1.39	4177	1518	1415	2254	− 7378	1.89	4706	0669	1720	− 0723	− 3793
1.40	4192	1497	1437	2180	− 7364	**1.90**	4713	0656	.1713	− 0761	− 3693
1.41	4207	1476	1459	2107	− 7347	1.91	4719	0644	.1705	− 0797	− 3592
1.42	4222	1456	1480	2033	− 7326	1.92	4726	0632	1697	− 0832	− 3492
1.43	4236	1435	1500	1960	− 7301	1.93	4732	0620	1688	− 0867	− 3392
1.44	4251	1415	.1519	.1887	− 7274	1.94	4738	0608	.1679	− 0900	− 3292
1.45	4265	1394	1537	1815	− 7243	**1.95**	4744	0596	.1670	− 0933	− 3192
1.46	4279	1374	1555	.1742	−.7209	1.96	4750	0584	1661	− 0964	−.3093
1.47	4292	1354	.1572	1670	−.7172	1.97	4756	0573	1651	− 0994	− 2994
1.48	4306	1334	.1588	1599	−.7132	1.98	4762	0562	.1641	− 1024	− 2895
1.49	.4319	1315	1604	1528	−.7089	1.99	4767	0551	.1630	− 1052	− 2797
1.50	.4332	.1295	.1619	1457	− 7043	**2.00**	4773	0540	1620	−.1080	− 2700

AREAS, ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR (Continued)

t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative	t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative
2.00	.4773	0540	.1620	−.1080	−.2700	2.50	.4938	.0175	.0920	−.1424	0800
2.01	.4778	.0529	.1609	−.1106	−.2603	2.51	.4940	.0171	.0906	−.1416	.0836
2.02	.4783	0519	.1598	−.1132	−.2506	2.52	.4941	.0167	.0892	−.1408	0871
2.03	4788	.0508	.1586	− 1157	− 2411	2.53	.4943	.0163	.0878	−.1399	.0905
2.04	4793	.0498	.1575	−.1180	−.2316	2.54	.4945	.0159	.0864	−.1389	0937
2.05	.4798	0488	.1563	−.1203	−.2222	2.55	.4946	.0155	.0850	−.1380	0968
2.06	.4803	.0478	.1550	−.1225	− 2129	2.56	.4948	.0151	.0836	−.1370	0998
2.07	.4808	.0468	.1538	−.1245	−.2036	2.57	.4949	.0147	.0823	− 1360	1027
2.08	.4812	.0459	.1526	−.1265	−.1945	2.58	.4951	.0143	.0809	−.1350	.1054
2.09	.4817	.0449	.1513	− 1284	−.1854	2.59	.4952	.0139	.0796	−.1339	.1080
2.10	4821	.0440	.1500	−.1302	−.1765	2.60	4953	.0136	.0782	− 1328	.1105
2.11	4826	.0431	.1487	− 1320	−.1676	2.61	4955	.0132	.0769	−.1317	1129
2.12	4830	.0422	.1474	− 1336	−.1588	2.62	4956	0129	.0756	−.1305	.1152
2.13	.4834	.0413	.1460	−.1351	− 1502	2.63	.4957	0126	.0743	− 1294	.1173
2.14	4838	0404	1446	−.1366	− 1416	2.64	.4959	.0122	.0730	−.1282	.1194
2.15	4842	0396	.1433	−.1380	−.1332	2.65	4960	0119	.0717	− 1270	.1213
2.16	.4846	0387	.1419	− 1393	−.1249	2.66	.4961	0116	.0705	− 1258	1231
2.17	4850	0379	1405	−.1405	−.1167	2.67	.4962	.0113	.0692	− 1245	1248
2.18	4854	.0371	1391	− 1416	−.1086	2.68	.4963	0110	.0680	− 1233	1264
2.19	4857	.0363	.1377	− 1426	−.1006	2.69	4964	.0107	.0668	− 1220	1279
2.20	4861	0355	.1362	− 1436	−.0927	2.70	4965	.0104	.0656	− 1207	1293
2.21	4865	0347	.1348	−.1445	− 0850	2.71	.4966	0101	.0644	− 1194	1306
2.22	4868	0339	.1333	− 1453	− 0774	2.72	.4967	0099	0632	− 1181	1317
2.23	.4871	0332	.1319	− 1460	−.0700	2.73	4968	0096	0620	− 1168	.1328
2.24	.4875	0325	1304	−.1467	− 0626	2.74	.4969	0094	.0608	− 1154	.1338
2.25	4878	0317	.1289	− 1473	− 0554	2.75	4970	.0091	.0597	− 1141	1347
2.26	4881	0310	.1275	− 1478	−.0484	2.76	4971	.0089	.0585	−.1127	1356
2.27	4884	0303	.1260	− 1483	−.0414	2.77	4972	.0086	.0574	− 1114	1363
2.28	4887	0297	.1245	− 1486	−.0346	2 78	.4973	.0084	.0563	−.1100	1369
2.29	.4890	0290	.1230	− 1490	− 0279	2.79	.4974	.0081	.0552	− 1087	.1375
2.30	4893	0283	1215	− 1492	−.0214	2.80	4974	0079	.0541	− 1073	1379
2 31	4896	0277	.1200	− 1494	−.0150	2.81	4975	.0077	0531	−.1059	1383
2.32	4898	0271	.1185	−.1495	−.0088	2.82	4976	.0075	.0520	− 1045	1386
2.33	4901	0264	.1170	− 1496	−.0027	2.83	4977	0073	.0510	− 1031	1389
2.34	4904	0258	.1155	− 1496	.0033	2.84	4977	0071	.0500	− 1017	1390
2.35	.4906	0252	.1141	− 1495	.0092	2.85	4978	0069	.0490	− 1003	1391
2.36	.4909	0246	.1126	− 1494	.0149	2.86	4979	.0067	.0480	− 0990	1391
2.37	4911	0241	.1111	− 1492	.0204	2 87	.4980	0065	0470	− 0976	.1391
2.38	.4913	0235	.1096	− 1490	.0258	2.88	.4980	0063	.0460	− 0962	.1389
2.39	4916	0229	.1081	− 1487	.0311	2.89	4981	0061	.0451	−.0948	1388
2.40	4918	0224	.1066	− 1483	.0362	2.90	4981	0060	.0441	− 0934	1385
2.41	4920	0219	.1051	− 1480	.0412	2.91	4982	.0058	.0432	−.0920	1382
2.42	.4922	0213	.1036	− 1475	.0461	2.92	4983	0056	.0423	− 0906	1378
2.43	4925	0208	.1022	− 1470	0508	2.93	.4983	0055	.0414	−.0893	.1374
2.44	4927	.0203	.1007	−.1465	.0554	2.94	.4984	0053	.0405	− 0879	.1369
2.45	4929	0198	.0992	− 1459	.0598	2.95	.4984	0051	.0396	− 0865	1364
2.46	.4931	.0194	.0978	− 1453	.0641	2.96	.4985	0050	.0388	−.0852	.1358
2.47	4932	.0189	.0963	− 1446	.0683	2.97	.4985	0049	.0379	−.0838	.1352
2.48	4934	0184	.0949	− 1439	.0723	2.98	.4986	0047	.0371	− 0825	.1345
2.49	.4936	0180	.0935	−.1432	.0762	2.99	4986	.0046	.0363	−.0811	1337
2.50	4938	0175	0920	− 1424	.0800	3.00	.4987	0044	.0355	− 0798	1330

AREAS, ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR (Continued)

t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative	t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative
3.00	4987	0044	0355	− 0798	1330	**3.50**	4998	0009	0098	− 0283	.0694
3.01	4987	0043	0347	− 0785	1321	3.51	4998	0008	0095	− 0276	0681
3.02	.4987	0042	0339	− 0771	1313	3.52	.4998	0008	0093	− 0269	0669
3.03	4988	0041	.0331	− 0758	1304	3.53	4998	0008	0090	− 0262	0656
3.04	4988	0039	0324	− 0745	.1294	3.54	4998	0008	0087	− 0256	0643
3.05	4989	0038	0316	− 0732	1285	**3.55**	4998	0007	0085	− 0249	0631
3.06	4989	0037	0309	− 0720	1275	3.56	4998	0007	0082	− 0243	0618
3.07	4989	0036	0302	− 0707	1264	3.57	.4998	0007	0080	− 0237	0606
3.08	4990	0035	0295	− 0694	1254	3.58	4998	0007	0078	− 0231	0594
3.09	4990	0034	0288	− 0682	1243	3.59	4998	0006	0075	− 0225	0582
3.10	4990	0033	0281	− 0669	1231	**3.60**	4998	0006	0073	− 0219	0570
3.11	4991	0032	0275	− 0657	1220	3.61	4999	0006	.0071	− 0214	.0559
3.12	4991	0031	0268	− 0645	1208	3.62	4999	0006	0069	− 0208	0547
3.13	4991	0030	0262	− 0633	1196	3.63	4999	0006	0067	− 0203	0536
3.14	.4992	0029	.0256	− 0621	1184	3.64	4999	0005	0065	− 0198	0524
3.15	4992	0028	0249	− 0609	1171	**3.65**	4999	0005	0063	− 0192	0513
3.16	4992	0027	0243	− 0598	1159	3.66	4999	0005	0061	− 0187	0502
3.17	4992	0026	0237	− 0586	1146	3.67	4999	0005	0059	− 0182	0492
3.18	4993	0025	0232	− 0575	1133	3.68	4999	0005	0057	− 0177	0481
3.19	4993	0025	0226	− 0564	1120	3.69	4999	0004	0056	− 0173	.0470
3.20	4993	0024	0220	− 0552	1107	**3.70**	4999	0004	0054	− 0168	0460
3.21	4993	0023	0215	− 0541	1093	3.71	4999	0004	0052	− 0164	0450
3.22	.4994	0022	0210	− 0531	1080	3.72	4999	0004	0051	− 0159	0440
3.23	4994	0022	0204	− 0520	1066	3.73	4999	0004	0049	− 0155	.0430
3.24	4994	0021	.0199	− 0509	1053	3.74	4999	0004	0048	− 0150	.0420
3.25	4994	0020	0194	− 0499	.1039	**3.75**	4999	0004	0046	− 0146	.0410
3.26	4994	0020	0189	− 0488	1025	3.76	4999	0003	0045	− 0142	0401
3.27	4995	0019	0184	− 0478	1011	3.77	4999	0003	0043	− 0138	0392
3.28	4995	0018	0180	− 0468	0997	3.78	4999	0003	0042	− 0134	0382
3.29	4995	0018	0175	− 0458	0983	3.79	4999	0003	0041	− 0131	0373
3.30	4995	0017	0170	− 0449	0969	**3.80**	4999	0003	0039	− 0127	0365
3.31	4995	0017	0166	− 0439	0955	3.81	4999	0003	0038	− 0123	0356
3.32	4996	0016	0162	− 0429	0941	3.82	4999	0003	0037	− 0120	0347
3.33	4996	0016	0157	− 0420	0927	3.83	4999	0003	0036	− 0116	0339
3.34	4996	0015	0153	− 0411	0913	3.84	4999	0003	0034	− 0113	0331
3.35	4996	0015	0149	− 0402	0899	**3.85**	4999	0002	0033	− 0110	0323
3.36	4996	0014	0145	− 0393	0885	3.86	4999	0002	0032	− 0107	0315
3.37	4996	0014	0141	− 0384	0871	3.87	5000	0002	0031	− 0104	.0307
3.38	4996	0013	0138	− 0376	0857	3.88	5000	0002	0030	− 0100	0299
3.39	4997	0013	0134	− 0367	.0843	3.89	5000	0002	0029	− 0098	0292
3.40	4997	0012	0130	− 0359	.0829	**3.90**	5000	0002	0028	− 0095	0284
3.41	4997	0012	0127	− 0350	0815	3.91	5000	0002	0027	− 0092	0277
3.42	4997	0012	0123	− 0342	0801	3.92	5000	0002	0026	− 0089	0270
3.43	4997	0011	0120	− 0334	0788	3.93	5000	0002	0026	− 0086	0263
3.44	4997	0011	0116	− 0327	0774	3.94	5000	0002	0025	− 0084	0256
3.45	4997	0010	0113	− 0319	0761	**3.95**	5000	0002	0024	− 0081	0250
3.46	4997	0010	0110	− 0311	0747	3.96	5000	0002	0023	− 0079	0243
3.47	4997	0010	0107	− 0304	0734	3.97	5000	0002	0022	− 0076	0237
3.48	4998	0009	0104	− 0297	0721	3.98	5000	0001	0022	− 0074	0230
3.49	4998	0009	0101	− 0290	.0707	3.99	5000	0001	0021	− 0072	.0224
3.50	4998	0009	0098	− 0283	.0694	**4.00**	5000	0001	0020	− 0070	0218

AREAS, ORDINATES AND DERIVATIVES OF THE NORMAL CURVE OF ERROR (Continued)

t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative	t	Area	Ordinate	Second derivative	Third derivative	Fourth derivative
4.00	5000	0001	0020	– 0070	0218	**4.50**	5000	0000	0003	– 0012	0047
4.01	5000	0001	0019	– 0067	0212	4.51	5000	0000	0003	–.0012	0045
4.02	5000	0001	0019	– 0065	0207	4.52	5000	0000	0003	–.0012	0044
4.03	5000	0001	0018	– 0063	0201	4.53	5000	0000	0003	– 0011	0042
4.04	5000	0001	.0018	– 0061	.0195	4.54	.5000	0000	.0003	– 0011	0041
4.05	5000	0001	.0017	– 0059	0190	**4.55**	.5000	.0000	.0003	– 0010	0039
4.06	5000	0001	.0016	– 0058	.0185	4.56	.5000	0000	0002	– 0010	0038
4.07	5000	0001	0016	– 0056	0180	4.57	5000	0000	0002	– 0010	0037
4.08	5000	0001	0015	– 0054	0175	4.58	5000	0000	.0002	– 0009	0035
4 09	.5000	0001	0015	– 0052	0170	4.59	5000	0000	0002	– 0009	0034
4.10	5000	0001	0014	– 0051	0165	**4.60**	5000	0000	0002	– 0009	0033
4 11	5000	0001	0014	– 0049	0160	4.61	5000	0000	0002	– 0008	0032
4 12	5000	0001	0013	– 0047	0156	4 62	5000	0000	0002	– 0008	0031
4 13	5000	0001	0013	– 0046	0151	4.63	5000	0000	0002	–.0008	0030
4 14	5000	0001	0012	– 0044	0147	4.64	.5000	0000	.0002	– 0007	.0028
4.15	5000	0001	0012	– 0043	0143	**4.65**	5000	0000	.0002	– 0007	0027
4 16	5000	0001	0011	– 0042	0138	4.66	5000	0000	0002	– 0007	0026
4 17	5000	0001	0011	– 0040	0134	4.67	5000	0000	0002	– 0006	0026
4.18	5000	0001	0011	– 0039	0130	4.68	5000	0000	0002	– 0006	0025
4 19	5000	0001	0010	– 0038	0127	4.69	5000	0000	0001	– 0006	0024
4.20	5000	0001	0010	– 0036	0123	**4.70**	5000	0000	0001	– 0006	0023
4 21	5000	0001	.0009	– 0035	0119	4 71	5000	0000	.0001	– 0006	0022
4.22	5000	0001	0009	– 0034	0116	4 72	5000	0000	0001	– 0005	0021
4 23	5000	0001	0009	– 0033	0112	4 73	5000	0000	0001	– 0005	0020
4.24	5000	0001	0009	– 0032	0109	4 74	5000	0000	.0001	–.0005	0020
4.25	5000	0001	0008	– 0031	.0105	**4.75**	5000	0000	0001	– 0005	0019
4.26	5000	0001	0008	– 0030	0102	4.76	5000	0000	.0001	– 0005	0018
4 27	5000	0000	0008	– 0029	0099	4 77	5000	0000	0001	– 0004	0018
4.28	5000	0000	0007	– 0028	0096	4.78	5000	0000	0001	– 0004	0017
4.29	5000	0000	0007	– 0027	0093	4.79	5000	0000	.0001	– 0004	0016
4.30	5000	0000	0007	– 0026	0090	**4.80**	5000	0000	0001	– 0004	0016
4 31	5000	0000	0007	– 0025	.0087	4 81	5000	0000	0001	– 0004	0015
4 32	5000	0000	0006	– 0024	0085	4 82	5000	0000	0001	–.0004	0015
4.33	5000	0000	0006	– 0023	0082	4 83	5000	0000	0001	– 0003	0014
4.34	.5000	0000	.0006	– 0022	0079	4.84	5000	0000	0001	– 0003	0013
4.35	5000	0000	0006	– 0022	0077	**4.85**	5000	0000	0001	– 0003	0013
4 36	5000	0000	0005	– 0021	0074	4.86	5000	0000	0001	– 0003	0012
4.37	.5000	0000	0005	– 0020	0072	4.87	.5000	0000	0001	– 0003	0012
4.38	.5000	0000	0005	– 0019	0070	4 88	5000	0000	0001	– 0003	0012
4.39	.5000	0000	0005	– 0019	0067	4 89	5000	0000	0001	– 0003	0011
4.40	5000	0000	0005	– 0018	0065	**4.90**	.5000	0000	0001	– 0003	0011
4 41	5000	0000	0004	– 0017	0063	4 91	5000	0000	0001	– 0002	0010
4 42	5000	0000	.0004	– 0017	0061	4 92	.5000	0000	.0001	– 0002	0010
4.43	5000	0000	.0004	– 0016	0059	4 93	5000	0000	0001	– 0002	0009
4.44	5000	0000	0004	– 0016	0057	4.94	.5000	.0000	.0001	– 0002	0009
4.45	5000	0000	0004	– 0015	0055	**4.95**	5000	0000	.0000	– 0002	0009
4.46	5000	0000	0004	– 0014	.0053	4.96	5000	0000	0000	– 0002	0008
4.47	.5000	0000	.0004	– 0014	0052	4 97	5000	0000	0000	– 0002	0008
4.48	5000	0000	0003	– 0013	0050	4 98	5000	0000	0000	– 0002	0008
4 49	5000	0000	0003	– 0013	.0048	4 99	5000	0000	.0000	– 0002	0007
4.50	5000	0000	0003	– 0012	0047						

COMPLETE ELLIPTIC INTEGRALS

$$K = \int_0^{\pi/2} \frac{d\phi}{\sqrt{1 - k^2 \sin^2 \phi}}. \qquad E = \int_0^{\pi/2} \sqrt{1 - k^2 \sin^2 \phi} \cdot d\phi.$$

$\sin^{-1} k$	K	$\log K$	$\sin^{-1} k$	K	$\log K$
0°	1.5708	0.196120	**40°**	1.7868	0.252068
1	1.5709	0.196153	41	1.7992	0.255085
2	1.5713	0.196252	42	1.8122	0.258197
3	1.5719	0.196418	43	1.8256	0.261406
4	1.5727	0.196649	44	1.8396	0.264716
5	1.5738	0.196947	**45**	1.8541	0.268127
6	1.5751	0.197312	46	1.8691	0.271644
7	1.5767	0.197743	47	1.8848	0.275267
8	1.5785	0.198241	48	1.9011	0.279001
9	1.5805	0.198806	49	1.9180	0.282848
10	1.5828	0.199438	**50**	1.9356	0.286811
11	1.5854	0.200137	51	1.9539	0.290895
12	1.5882	0.200904	52	1.9729	0.295101
13	1.5913	0.201740	53	1.9927	0.299435
14	1.5946	0.202643	54	2.0133	0.303901
15	1.5981	0.203615	**55**	2.0347	0.308504
16	1.6020	0.204657	56	2.0571	0.313247
17	1.6061	0.205768	57	2.0804	0.318138
18	1.6105	0.206948	58	2.1047	0.323182
19	1.6151	0.208200	59	2.1300	0.328384
20	1.6200	0.209522	**60**	2.1565	0.333753
21	1.6252	0.210916	61	2.1842	0.339295
22	1.6307	0.212382	62	2.2132	0.345020
23	1.6365	0.213921	63	2.2435	0.350936
24	1.6426	0.215533	64	2.2754	0.357053
25	1.6490	0.217219	**65**	2.3088	0.363384
26	1.6557	0.218981	66	2.3439	0.369940
27	1.6627	0.220818	67	2.3809	0.376736
28	1.6701	0.222732	68	2.4198	0.383787
29	1.6777	0.224723	69	2.4610	0.391112
30	1.6858	0.226793	**70**	2.5046	0.398730
31	1.6941	0.228943	71	2.5507	0.406665
32	1.7028	0.231173	72	2.5998	0.414943
33	1.7119	0.233485	73	2.6521	0.423596
34	1.7214	0.235880	74	2.7081	0.432660
35	1.7312	0.238359	**75**	2.7681	0.442176
36	1.7415	0.240923	76	2.8327	0.452196
37	1.7522	0.243575	77	2.9026	0.462782
38	1.7633	0.246315	78	2.9786	0.474008
39	1.7748	0.249146	79	3.0617	0.485967
40	1.7868	0.252068	**80**	3.1534	0.498777

$\sin^{-1} k$	K	$\log K$	$\sin^{-1} k$	K	$\log K$
80°	3.1534	0.498777	**85°**	3.8317	0.583396
81	3.2553	0.512591	86	4.0528	0.607751
82	3.3699	0.527613	87	4.3387	0.637355
83	3.5004	0.544120	88	4.7427	0.676027
84	3.6519	0.562514	89	5.4349	0.735192
85	3.8317	0.583396	**90**	∞	∞

Values of K for $\sin^{-1} k$ = 85° to 89° by 0.1° and 89° to 90° by minutes.

$\sin^{-1} k$	K	$\log K$	$\sin^{-1} k$	K	$\log K$
85.0°	3.832	0.58343	**89° 0′**	5.435	0.73520
85.1	3.852	0.58569	89 2	5.469	0.73791
85.2	3.872	0.58794	89 4	5.504	0.74068
85.3	3.893	0.59028	89 6	5.540	0.74351
85.4	3.914	0.59262	89 8	5.578	0.74648
85.5	3.936	0.59506	**89 10**	5.617	0.74950
85.6	3.958	0.59748	89 12	5.658	0.75266
85.7	3.981	0.59999	89 14	5.700	0.75587
85.8	4.004	0.60249	89 16	5.745	0.75929
85.9	4.028	0.60509	89 18	5.791	0.76275
86.0	4.053	0.60778	**89 20**	5.840	0.76641
86.1	4.078	0.61045	89 22	5.891	0.77019
86.2	4.104	0.61321	89 24	5.946	0.77422
86.3	4.130	0.61595	89 26	6.003	0.77837
86.4	4.157	0.61878	89 28	6.063	0.78269
86.5	4.185	0.62170	**89 30**	6.128	0.78732
86.6	4.214	0.62469	89 32	6.197	0.79218
86.7	4.244	0.62778	89 34	6.271	0.79734
86.8	4.274	0.63083	89 36	6.351	0.80284
86.9	4.306	0.63407	89 38	6.438	0.80875
87.0	4.339	0.63739	**89 40**	6.533	0.81511
87.1	4.372	0.64068	89 41	6.584	0.81849
87.2	4.407	0.64414	89 42	6.639	0.82210
87.3	4.444	0.64777	89 43	6.696	0.82582
87.4	4.481	0.65137	89 44	6.756	0.82969
87.5	4.520	0.65514	**89 45**	6.821	0.83385
87.6	4.562	0.65916	89 46	6.890	0.83822
87.7	4.603	0.66304	89 47	6.964	0.84286
87.8	4.648	0.66727	89 48	7.044	0.84782
87.9	4.694	0.67154	89 49	7.131	0.85315
88.0	4.743	0.67605	**89 50**	7.226	0.85890
88.1	4.794	0.68070	89 51	7.332	0.86522
88.2	4.848	0.68556	89 52	7.449	0.87210
88.3	4.905	0.69064	89 53	7.583	0.87984
88.4	4.965	0.69592	89 54	7.737	0.88857
88.5	5.030	0.70157	**89 55**	7.919	0.89867
88.6	5.099	0.70749	89 56	8.143	0.91078
88.7	5.173	0.71374	89 57	8.430	0.92583
88.8	5.253	0.72041	89 58	8.836	0.94626
88.9	5.340	0.72754	89 59	9.529	0.97905
89.0	5.435	0.73520	**90 0**	∞	∞

COMPLETE ELLIPTIC INTEGRALS (Continued)

$\sin^{-1} k$	E	$\log E$	$\sin^{-1} k$	E	$\log E$
0°	1.5708	0 196120	**45°**	1 3506	0.130541
1	1.5707	0 196087	46	1 3418	0.127690
2	1.5703	0 195988	47	1 3329	0 124788
3	1.5697	0 195822	48	1 3238	0 121836
4	1.5689	0 195591	49	1 3147	0.118836
5	1 5678	0 195293	**50**	1 3055	0 115790
6	1 5665	0 194930	51	1.2963	0 112698
7	1 5649	0 194500	52	1 2870	0 109563
8	1 5632	0 194004	53	1 2776	0 106386
9	1.5611	0 193442	54	1 2681	0.103169
10	1 5589	0 192815	**55**	1 2587	0 099915
11	1 5564	0 192121	56	1 2492	0 096626
12	1 5537	0 191362	57	1 2397	0 093303
13	1 5507	0 190537	58	1 2301	0 089950
14	1 5476	0 189646	59	1.2206	0 086569
15	1 5442	0 188690	**60**	1.2111	0 083164
16	1 5405	0 187668	61	1 2015	0 079738
17	1 5367	0 186581	62	1.1920	0 076293
18	1 5326	0 185428	63	1 1826	0 072834
19	1 5283	0 184210	64	1 1732	0 069364
20	1 5238	0 182928	**65**	1 1638	0 065889
21	1 5191	0 181580	66	1 1545	0 062412
22	1 5141	0 180168	67	1 1453	0 058937
23	1 5090	0 178691	68	1 1362	0 055472
24	1.5037	0.177150	69	1.1272	0 052020
25	1.4981	0 175545	**70**	1 1184	0 048589
26	1 4924	0 173876	71	1 1096	0 045183
27	1 4864	0 172144	72	1 1011	0 041812
28	1 4803	0 170348	73	1 0927	0 038481
29	1 4740	0 168489	74	1 0844	0 035200
30	1 4675	0 166567	**75**	1.0764	0 031976
31	1 4608	0 164583	76	1.0686	0 028819
32	1 4539	0 162537	77	1.0611	0 025740
33	1 4469	0 160429	78	1 0538	0 022749
34	1 4397	0 158261	79	1 0468	0 019858
35	1 4323	0 156031	**80**	1.0401	0 017081
36	1 4248	0 153742	81	1.0338	0 014432
37	1 4171	0 151393	82	1 0278	0 011927
38	1 4092	0 148985	83	1.0223	0 009584
39	1 4013	0 146519	84	1.0172	0.007422
40	1 3931	0 143995	**85**	1.0127	0.005465
41	1 3849	0 141414	86	1.0086	0.003740
42	1 3765	0 138778	87	1.0053	0.002278
43	1.3680	0 136086	88	1.0026	0.001121
44	1.3594	0 133340	89	1 0008	0 000326
45	1.3506	0.130541	**90**	1 0000	0.000000

FACTORS AND PRIMES

If n is prime the mantissa of its logarithm is given

n	0	1	2	3	4
0		**0000000**	**3010300**	**4771213**	2^2
1	$2 \cdot 5$	**0413927**	$2^2 \cdot 3$	**1139434**	$2 \cdot 7$
2	$2^2 \cdot 5$	$3 \cdot 7$	$2 \cdot 11$	**3617278**	$2^3 \cdot 3$
3	$2 \cdot 3 \cdot 5$	**4913617**	2^5	$3 \cdot 11$	$2 \cdot 17$
4	$2^3 \cdot 5$	**6127839**	$2 \cdot 3 \cdot 7$	**6334685**	$2^2 \cdot 11$
5	$2 \cdot 5^2$	$3 \cdot 17$	$2^2 \cdot 13$	**7242759**	$2 \cdot 3^3$
6	$2^2 \cdot 3 \cdot 5$	**7853298**	$2 \cdot 31$	$3^2 \cdot 7$	2^6
7	$2 \cdot 5 \cdot 7$	**8512583**	$2^3 \cdot 3^2$	**8633229**	$2 \cdot 37$
8	$2^4 \cdot 5$	3^4	$2 \cdot 41$	**9190781**	$2^2 \cdot 3 \cdot 7$
9	$2 \cdot 3^2 \cdot 5$	$7 \cdot 13$	$2^2 \cdot 23$	$3 \cdot 31$	$2 \cdot 47$
10	$2^2 \cdot 5^2$	**0043214**	$2 \cdot 3 \cdot 17$	**0128372**	$2^3 \cdot 13$
11	$2 \cdot 5 \cdot 11$	$3 \cdot 37$	$2^4 \cdot 7$	**0530784**	$2 \cdot 3 \cdot 19$
12	$2^3 \cdot 3 \cdot 5$	11^2	$2 \cdot 61$	$3 \cdot 41$	$2^2 \cdot 31$
13	$2 \cdot 5 \cdot 13$	**1172713**	$2^2 \cdot 3 \cdot 11$	$7 \cdot 19$	$2 \cdot 67$
14	$2^2 \cdot 5 \cdot 7$	$3 \cdot 47$	$2 \cdot 71$	$11 \cdot 13$	$2^4 \cdot 3^2$
15	$2 \cdot 3 \cdot 5^2$	**1789769**	$2^3 \cdot 19$	$3^2 \cdot 17$	$2 \cdot 7 \cdot 11$
16	$2^5 \cdot 5$	$7 \cdot 23$	$2 \cdot 3^4$	**2121876**	$2^2 \cdot 41$
17	$2 \cdot 5 \cdot 17$	$3^2 \cdot 19$	$2^2 \cdot 43$	**2380461**	$2 \cdot 3 \cdot 29$
18	$2^2 \cdot 3^2 \cdot 5$	**2576786**	$2 \cdot 7 \cdot 13$	$3 \cdot 61$	$2^3 \cdot 23$
19	$2 \cdot 5 \cdot 19$	**2810334**	$2^6 \cdot 3$	**2855573**	$2 \cdot 97$
20	$2^3 \cdot 5^2$	$3 \cdot 67$	$2 \cdot 101$	$7 \cdot 29$	$2^2 \cdot 3 \cdot 17$
21	$2 \cdot 3 \cdot 5 \cdot 7$	**3242825**	$2^2 \cdot 53$	$3 \cdot 71$	$2 \cdot 107$
22	$2^2 \cdot 5 \cdot 11$	$13 \cdot 17$	$2 \cdot 3 \cdot 37$	**3483049**	$2^5 \cdot 7$
23	$2 \cdot 5 \cdot 23$	$3 \cdot 7 \cdot 11$	$2^3 \cdot 29$	**3673559**	$2 \cdot 3^2 \cdot 13$
24	$2^4 \cdot 3 \cdot 5$	**3820170**	$2 \cdot 11^2$	3^5	$2^2 \cdot 61$
25	$2 \cdot 5^3$	**3996737**	$2^2 \cdot 3^2 \cdot 7$	$11 \cdot 23$	$2 \cdot 127$
26	$2^2 \cdot 5 \cdot 13$	$3^2 \cdot 29$	$2 \cdot 131$	**4199557**	$2^3 \cdot 3 \cdot 11$
27	$2 \cdot 3^3 \cdot 5$	**4329693**	$2^4 \cdot 17$	$3 \cdot 7 \cdot 13$	$2 \cdot 137$
28	$2^3 \cdot 5 \cdot 7$	**4487063**	$2 \cdot 3 \cdot 47$	**4517864**	$2^2 \cdot 71$
29	$2 \cdot 5 \cdot 29$	$3 \cdot 97$	$2^2 \cdot 73$	**4668676**	$2 \cdot 3 \cdot 7^2$
30	$2^2 \cdot 3 \cdot 5^2$	$7 \cdot 43$	$2 \cdot 151$	$3 \cdot 101$	$2^4 \cdot 19$
31	$2 \cdot 5 \cdot 31$	**4927604**	$2^3 \cdot 3 \cdot 13$	**4955443**	$2 \cdot 157$
32	$2^6 \cdot 5$	$3 \cdot 107$	$2 \cdot 7 \cdot 23$	$17 \cdot 19$	$2^2 \cdot 3^4$
33	$2 \cdot 3 \cdot 5 \cdot 11$	**5198280**	$2^2 \cdot 83$	$3^2 \cdot 37$	$2 \cdot 167$
34	$2^2 \cdot 5 \cdot 17$	$11 \cdot 31$	$2 \cdot 3^2 \cdot 19$	7^3	$2^3 \cdot 43$
35	$2 \cdot 5^2 \cdot 7$	$3^3 \cdot 13$	$2^5 \cdot 11$	**5477747**	$2 \cdot 3 \cdot 59$
36	$2^3 \cdot 3^2 \cdot 5$	19^2	$2 \cdot 181$	$3 \cdot 11^2$	$2^2 \cdot 7 \cdot 13$
37	$2 \cdot 5 \cdot 37$	$7 \cdot 53$	$2^2 \cdot 3 \cdot 31$	**5717088**	$2 \cdot 11 \cdot 17$
38	$2^2 \cdot 5 \cdot 19$	$3 \cdot 127$	$2 \cdot 191$	**5831988**	$2^7 \cdot 3$
39	$2 \cdot 3 \cdot 5 \cdot 13$	$17 \cdot 23$	$2^3 \cdot 7^2$	$3 \cdot 131$	$2 \cdot 197$
40	$2^4 \cdot 5^2$	**6031444**	$2 \cdot 3 \cdot 67$	$13 \cdot 31$	$2^2 \cdot 101$
41	$2 \cdot 5 \cdot 41$	$3 \cdot 137$	$2^2 \cdot 103$	$7 \cdot 59$	$2 \cdot 3^2 \cdot 23$
42	$2^2 \cdot 3 \cdot 5 \cdot 7$	**6242821**	$2 \cdot 211$	$3^2 \cdot 47$	$2^3 \cdot 53$
43	$2 \cdot 5 \cdot 43$	**6344773**	$2^4 \cdot 3^3$	**6364879**	$2 \cdot 7 \cdot 31$
44	$2^3 \cdot 5 \cdot 11$	$3^2 \cdot 7^2$	$2 \cdot 13 \cdot 17$	**6464037**	$2^2 \cdot 3 \cdot 37$
45	$2 \cdot 3^2 \cdot 5^2$	$11 \cdot 41$	$2^2 \cdot 113$	$3 \cdot 151$	$2 \cdot 227$
46	$2^2 \cdot 5 \cdot 23$	**6637009**	$2 \cdot 3 \cdot 7 \cdot 11$	**6655810**	$2^4 \cdot 29$
47	$2 \cdot 5 \cdot 47$	$3 \cdot 157$	$2^3 \cdot 59$	$11 \cdot 43$	$2 \cdot 3 \cdot 79$
48	$2^5 \cdot 3 \cdot 5$	$13 \cdot 37$	$2 \cdot 241$	$3 \cdot 7 \cdot 23$	$2^2 \cdot 11^2$
49	$2 \cdot 5 \cdot 7^2$	**6910815**	$2^2 \cdot 3 \cdot 41$	$17 \cdot 29$	$2 \cdot 13 \cdot 19$
50	$2^2 \cdot 5^3$	$3 \cdot 167$	$2 \cdot 251$	**7015680**	$2^3 \cdot 3^2 \cdot 7$

FACTORS AND PRIMES (Continued)

If n is not prime its prime factors are given.

n	5	6	7	8	9
0	**6989700**	$2 \cdot 3$	**8450980**	2^3	3^2
1	$3 \cdot 5$	2^4	**2304489**	$2 \cdot 3^2$	**2787536**
2	5^2	$2 \cdot 13$	3^3	$2^2 \cdot 7$	**4623980**
3	$5 \cdot 7$	$2^2 \cdot 3^2$	**5682017**	$2 \cdot 19$	$3 \cdot 13$
4	$3^2 \cdot 5$	$2 \cdot 23$	**6720979**	$2^4 \cdot 3$	7^2
5	$5 \cdot 11$	$2^3 \cdot 7$	$3 \cdot 19$	$2 \cdot 29$	**7708520**
6	$5 \cdot 13$	$2 \cdot 3 \cdot 11$	**8260748**	$2^2 \cdot 17$	$3 \cdot 23$
7	$3 \cdot 5^2$	$2^2 \cdot 19$	$7 \cdot 11$	$2 \cdot 3 \cdot 13$	**8976271**
8	$5 \cdot 17$	$2 \cdot 43$	$3 \cdot 29$	$2^3 \cdot 11$	**9493900**
9	$5 \cdot 19$	$2^5 \cdot 3$	**9867717**	$2 \cdot 7^2$	$3^2 \cdot 11$
10	$3 \cdot 5 \cdot 7$	$2 \cdot 53$	**0293838**	$2^2 \cdot 3^3$	**0374265**
11	$5 \cdot 23$	$2^2 \cdot 29$	$3^2 \cdot 13$	$2 \cdot 59$	$7 \cdot 17$
12	5^3	$2 \cdot 3^2 \cdot 7$	**1038037**	2^7	$3 \cdot 43$
13	$3^3 \cdot 5$	$2^3 \cdot 17$	**1367206**	$2 \cdot 3 \cdot 23$	**1430148**
14	$5 \cdot 29$	$2 \cdot 73$	$3 \cdot 7^2$	$2^2 \cdot 37$	**1731863**
15	$5 \cdot 31$	$2^2 \cdot 3 \cdot 13$	**1958997**	$2 \cdot 79$	$3 \cdot 53$
16	$3 \cdot 5 \cdot 11$	$2 \cdot 83$	**2227165**	$2^3 \cdot 3 \cdot 7$	13^2
17	$5^2 \cdot 7$	$2^4 \cdot 11$	$3 \cdot 59$	$2 \cdot 89$	**2528530**
18	$5 \cdot 37$	$2 \cdot 3 \cdot 31$	$11 \cdot 17$	$2^2 \cdot 47$	$3^3 \cdot 7$
19	$3 \cdot 5 \cdot 13$	$2^2 \cdot 7^2$	**2944662**	$2 \cdot 3^2 \cdot 11$	**2988531**
20	$5 \cdot 41$	$2 \cdot 103$	$3^2 \cdot 23$	$2^4 \cdot 13$	$11 \cdot 19$
21	$5 \cdot 43$	$2^3 \cdot 3^3$	$7 \cdot 31$	$2 \cdot 109$	$3 \cdot 73$
22	$3^2 \cdot 5^2$	$2 \cdot 113$	**3560259**	$2^2 \cdot 3 \cdot 19$	**3598355**
23	$5 \cdot 47$	$2^2 \cdot 59$	$3 \cdot 79$	$2 \cdot 7 \cdot 17$	**3783979**
24	$5 \cdot 7^2$	$2 \cdot 3 \cdot 41$	$13 \cdot 19$	$2^3 \cdot 31$	$3 \cdot 83$
25	$3 \cdot 5 \cdot 17$	2^8	**4099331**	$2 \cdot 3 \cdot 43$	$7 \cdot 37$
26	$5 \cdot 53$	$2 \cdot 7 \cdot 19$	$3 \cdot 89$	$2^2 \cdot 67$	**4297523**
27	$5^2 \cdot 11$	$2^2 \cdot 3 \cdot 23$	**4424798**	$2 \cdot 139$	$3^2 \cdot 31$
28	$3 \cdot 5 \cdot 19$	$2 \cdot 11 \cdot 13$	$7 \cdot 41$	$2^5 \cdot 3^2$	17^2
29	$5 \cdot 59$	$2^3 \cdot 37$	$3^3 \cdot 11$	$2 \cdot 149$	$13 \cdot 23$
30	$5 \cdot 61$	$2 \cdot 3^2 \cdot 17$	**4871384**	$2^2 \cdot 7 \cdot 11$	$3 \cdot 103$
31	$3^2 \cdot 5 \cdot 7$	$2^2 \cdot 79$	**5010593**	$2 \cdot 3 \cdot 53$	$11 \cdot 29$
32	$5^2 \cdot 13$	$2 \cdot 163$	$3 \cdot 109$	$2^3 \cdot 41$	$7 \cdot 47$
33	$5 \cdot 67$	$2^4 \cdot 3 \cdot 7$	**5276299**	$2 \cdot 13^2$	$3 \cdot 113$
34	$3 \cdot 5 \cdot 23$	$2 \cdot 173$	**5403295**	$2^2 \cdot 3 \cdot 29$	**5428254**
35	$5 \cdot 71$	$2^2 \cdot 89$	$3 \cdot 7 \cdot 17$	$2 \cdot 179$	**5550944**
36	$5 \cdot 73$	$2 \cdot 3 \cdot 61$	**5646661**	$2^4 \cdot 23$	$3^2 \cdot 41$
37	$3 \cdot 5^3$	$2^3 \cdot 47$	$13 \cdot 29$	$2 \cdot 3^3 \cdot 7$	**5786392**
38	$5 \cdot 7 \cdot 11$	$2 \cdot 193$	$3^2 \cdot 43$	$2^2 \cdot 97$	**5899496**
39	$5 \cdot 79$	$2^2 \cdot 3^2 \cdot 11$	**5987905**	$2 \cdot 199$	$3 \cdot 7 \cdot 19$
40	$3^4 \cdot 5$	$2 \cdot 7 \cdot 29$	$11 \cdot 37$	$2^3 \cdot 3 \cdot 17$	**6117233**
41	$5 \cdot 83$	$2^5 \cdot 13$	$3 \cdot 139$	$2 \cdot 11 \cdot 19$	**6222140**
42	$5^2 \cdot 17$	$2 \cdot 3 \cdot 71$	$7 \cdot 61$	$2^2 \cdot 107$	$3 \cdot 11 \cdot 13$
43	$3 \cdot 5 \cdot 29$	$2^2 \cdot 109$	$19 \cdot 23$	$2 \cdot 3 \cdot 73$	**6424645**
44	$5 \cdot 89$	$2 \cdot 223$	$3 \cdot 149$	$2^6 \cdot 7$	**6522463**
45	$5 \cdot 7 \cdot 13$	$2^3 \cdot 3 \cdot 19$	**6599162**	$2 \cdot 229$	$3^3 \cdot 17$
46	$3 \cdot 5 \cdot 31$	$2 \cdot 233$	**6693169**	$2^2 \cdot 3^2 \cdot 13$	$7 \cdot 67$
47	$5^2 \cdot 19$	$2^2 \cdot 7 \cdot 17$	$3^2 \cdot 53$	$2 \cdot 239$	**6803355**
48	$5 \cdot 97$	$2 \cdot 3^5$	**6875290**	$2^5 \cdot 61$	$3 \cdot 163$
49	$3^2 \cdot 5 \cdot 11$	$2^4 \cdot 31$	$7 \cdot 71$	$2 \cdot 3 \cdot 83$	**6981005**
50	$5 \cdot 101$	$2 \cdot 11 \cdot 23$	$3 \cdot 13^2$	$2^2 \cdot 127$	**7067178**

FACTORS AND PRIMES (Continued)

n	0	1	2	3	4
50	$2^2 \cdot 5^3$	$3 \cdot 167$	$2 \cdot 251$	**7015680**	$2^3 \cdot 3^2 \cdot 7$
51	$2 \cdot 3 \cdot 5 \cdot 17$	$7 \cdot 73$	2^9	$3^3 \cdot 19$	$2 \cdot 257$
52	$2^3 \cdot 5 \cdot 13$	**7168377**	$2 \cdot 3^2 \cdot 29$	**7185017**	$2^2 \cdot 131$
53	$2 \cdot 5 \cdot 53$	$3^2 \cdot 59$	$2^2 \cdot 7 \cdot 19$	$13 \cdot 41$	$2 \cdot 3 \cdot 89$
54	$2^2 \cdot 3^3 \cdot 5$	**7331973**	$2 \cdot 271$	$3 \cdot 181$	$2^5 \cdot 17$
55	$2 \cdot 5^2 \cdot 11$	$19 \cdot 29$	$2^3 \cdot 3 \cdot 23$	$7 \cdot 79$	$2 \cdot 277$
56	$2^4 \cdot 5 \cdot 7$	$3 \cdot 11 \cdot 17$	$2 \cdot 281$	**7505084**	$2^2 \cdot 3 \cdot 47$
57	$2 \cdot 3 \cdot 5 \cdot 19$	**7566361**	$2^2 \cdot 11 \cdot 13$	$3 \cdot 191$	$2 \cdot 7 \cdot 41$
58	$2^2 \cdot 5 \cdot 29$	$7 \cdot 83$	$2 \cdot 3 \cdot 97$	$11 \cdot 53$	$2^3 \cdot 73$
59	$2 \cdot 5 \cdot 59$	$3 \cdot 197$	$2^4 \cdot 37$	**7730547**	$2 \cdot 3^3 \cdot 11$
60	$2^3 \cdot 3 \cdot 5^2$	**7788745**	$2 \cdot 7 \cdot 43$	$3^2 \cdot 67$	$2^2 \cdot 151$
61	$2 \cdot 5 \cdot 61$	$13 \cdot 47$	$2^2 \cdot 3^2 \cdot 17$	**7874605**	$2 \cdot 307$
62	$2^2 \cdot 5 \cdot 31$	$3^3 \cdot 23$	$2 \cdot 311$	$7 \cdot 89$	$2^4 \cdot 3 \cdot 13$
63	$2 \cdot 3^2 \cdot 5 \cdot 7$	**8000294**	$2^3 \cdot 79$	$3 \cdot 211$	$2 \cdot 317$
64	$2^7 \cdot 5$	**8068580**	$2 \cdot 3 \cdot 107$	**8082110**	$2^2 \cdot 7 \cdot 23$
65	$2 \cdot 5^2 \cdot 13$	$3 \cdot 7 \cdot 31$	$2^2 \cdot 163$	**8149132**	$2 \cdot 3 \cdot 109$
66	$2^2 \cdot 3 \cdot 5 \cdot 11$	**8202015**	$2 \cdot 331$	$3 \cdot 13 \cdot 17$	$2^3 \cdot 83$
67	$2 \cdot 5 \cdot 67$	$11 \cdot 61$	$2^5 \cdot 3 \cdot 7$	**8280151**	$2 \cdot 337$
68	$2^3 \cdot 5 \cdot 17$	$3 \cdot 227$	$2 \cdot 11 \cdot 31$	**8344207**	$2^2 \cdot 3^2 \cdot 19$
69	$2 \cdot 3 \cdot 5 \cdot 23$	**8394780**	$2^2 \cdot 173$	$3^2 \cdot 7 \cdot 11$	$2 \cdot 347$
70	$2^2 \cdot 5^2 \cdot 7$	**8457180**	$2 \cdot 3^3 \cdot 13$	$19 \cdot 37$	$2^6 \cdot 11$
71	$2 \cdot 5 \cdot 71$	$3^2 \cdot 79$	$2^3 \cdot 89$	$23 \cdot 31$	$2 \cdot 3 \cdot 7 \cdot 17$
72	$2^4 \cdot 3^2 \cdot 5$	$7 \cdot 103$	$2 \cdot 19^2$	$3 \cdot 241$	$2^2 \cdot 181$
73	$2 \cdot 5 \cdot 73$	$17 \cdot 43$	$2^2 \cdot 3 \cdot 61$	**8651040**	$2 \cdot 367$
74	$2^2 \cdot 5 \cdot 37$	$3 \cdot 13 \cdot 19$	$2 \cdot 7 \cdot 53$	**8709888**	$2^3 \cdot 3 \cdot 31$
75	$2 \cdot 3 \cdot 5^3$	**8756399**	$2^4 \cdot 47$	$3 \cdot 251$	$2 \cdot 13 \cdot 29$
76	$2^3 \cdot 5 \cdot 19$	**8813847**	$2 \cdot 3 \cdot 127$	$7 \cdot 109$	$2^2 \cdot 191$
77	$2 \cdot 5 \cdot 7 \cdot 11$	$3 \cdot 257$	$2^2 \cdot 193$	**8881795**	$2 \cdot 3^2 \cdot 43$
78	$2^2 \cdot 3 \cdot 5 \cdot 13$	$11 \cdot 71$	$2 \cdot 17 \cdot 23$	$3^3 \cdot 29$	$2^4 \cdot 7^2$
79	$2 \cdot 5 \cdot 79$	$7 \cdot 113$	$2^3 \cdot 3^2 \cdot 11$	$13 \cdot 61$	$2 \cdot 397$
80	$2^5 \cdot 5^2$	$3^2 \cdot 89$	$2 \cdot 401$	$11 \cdot 73$	$2^2 \cdot 3 \cdot 67$
81	$2 \cdot 3^4 \cdot 5$	**9090209**	$2^2 \cdot 7 \cdot 29$	$3 \cdot 271$	$2 \cdot 11 \cdot 37$
82	$2^2 \cdot 5 \cdot 41$	**9143432**	$2 \cdot 3 \cdot 137$	**9153998**	$2^3 \cdot 103$
83	$2 \cdot 5 \cdot 83$	$3 \cdot 277$	$2^6 \cdot 13$	$7^2 \cdot 17$	$2 \cdot 3 \cdot 139$
84	$2^3 \cdot 3 \cdot 5 \cdot 7$	29^2	$2 \cdot 421$	$3 \cdot 281$	$2^2 \cdot 211$
85	$2 \cdot 5^2 \cdot 17$	$23 \cdot 37$	$2^2 \cdot 3 \cdot 71$	**9309490**	$2 \cdot 7 \cdot 61$
86	$2^2 \cdot 5 \cdot 43$	$3 \cdot 7 \cdot 41$	$2 \cdot 431$	**9360108**	$2^5 \cdot 3^3$
87	$2 \cdot 3 \cdot 5 \cdot 29$	$13 \cdot 67$	$2^3 \cdot 109$	$3^2 \cdot 97$	$2 \cdot 19 \cdot 23$
88	$2^4 \cdot 5 \cdot 11$	**9449759**	$2 \cdot 3^2 \cdot 7^2$	**9459607**	$2^2 \cdot 13 \cdot 17$
89	$2 \cdot 5 \cdot 89$	$3^4 \cdot 11$	$2^2 \cdot 223$	$19 \cdot 47$	$2 \cdot 3 \cdot 149$
90	$2^2 \cdot 3^2 \cdot 5^2$	$17 \cdot 53$	$2 \cdot 11 \cdot 41$	$3 \cdot 7 \cdot 43$	$2^3 \cdot 113$
91	$2 \cdot 5 \cdot 7 \cdot 13$	**9595184**	$2^4 \cdot 3 \cdot 19$	$11 \cdot 83$	$2 \cdot 457$
92	$2^3 \cdot 5 \cdot 23$	$3 \cdot 307$	$2 \cdot 461$	$13 \cdot 71$	$2^2 \cdot 3 \cdot 7 \cdot 11$
93	$2 \cdot 3 \cdot 5 \cdot 31$	$7^2 \cdot 19$	$2^2 \cdot 233$	$3 \cdot 311$	$2 \cdot 467$
94	$2^2 \cdot 5 \cdot 47$	**9735896**	$2 \cdot 3 \cdot 157$	$23 \cdot 41$	$2^4 \cdot 59$
95	$2 \cdot 5^2 \cdot 19$	$3 \cdot 317$	$2^3 \cdot 7 \cdot 17$	**9790929**	$2 \cdot 3^2 \cdot 53$
96	$2^6 \cdot 3 \cdot 5$	31^2	$2 \cdot 13 \cdot 37$	$3^2 \cdot 107$	$2^2 \cdot 241$
97	$2 \cdot 5 \cdot 97$	**9872192**	$2^2 \cdot 3^5$	$7 \cdot 139$	$2 \cdot 487$
98	$2^2 \cdot 5 \cdot 7^2$	$3^2 \cdot 109$	$2 \cdot 491$	**9925535**	$2^3 \cdot 3 \cdot 41$
99	$2 \cdot 3^2 \cdot 5 \cdot 11$	**9960737**	$2^5 \cdot 31$	$3 \cdot 331$	$2 \cdot 7 \cdot 71$
100	$2^3 \cdot 5^3$	$7 \cdot 11 \cdot 13$	$2 \cdot 3 \cdot 167$	$17 \cdot 59$	$2^2 \cdot 251$

FACTORS AND PRIMES (Continued)

n	5	6	7	8	9
50	$5 \cdot 101$	$2 \cdot 11 \cdot 23$	$3 \cdot 13^2$	$2^2 \cdot 127$	**7067178**
51	$5 \cdot 103$	$2^2 \cdot 3 \cdot 43$	$11 \cdot 47$	$2 \cdot 7 \cdot 37$	$3 \cdot 173$
52	$3 \cdot 5^2 \cdot 7$	$2 \cdot 263$	$17 \cdot 31$	$2^4 \cdot 3 \cdot 11$	23^2
53	$5 \cdot 107$	$2^3 \cdot 67$	$3 \cdot 179$	$2 \cdot 269$	$7^2 \cdot 11$
54	$5 \cdot 109$	$2 \cdot 3 \cdot 7 \cdot 13$	**7379873**	$2^2 \cdot 137$	$3^2 \cdot 61$
55	$3 \cdot 5 \cdot 37$	$2^2 \cdot 139$	**7458552**	$2 \cdot 3^2 \cdot 31$	$13 \cdot 43$
56	$5 \cdot 113$	$2 \cdot 283$	$3^4 \cdot 7$	$2^3 \cdot 71$	**7551123**
57	$5^2 \cdot 23$	$2^6 \cdot 3^2$	**7611758**	$2 \cdot 17^2$	$3 \cdot 193$
58	$3^2 \cdot 5 \cdot 13$	$2 \cdot 293$	**7686381**	$2^2 \cdot 3 \cdot 7^2$	$19 \cdot 31$
59	$5 \cdot 7 \cdot 17$	$2^2 \cdot 149$	$3 \cdot 199$	$2 \cdot 13 \cdot 23$	**7774268**
60	$5 \cdot 11^2$	$2 \cdot 3 \cdot 101$	**7831887**	$2^5 \cdot 19$	$3 \cdot 7 \cdot 29$
61	$3 \cdot 5 \cdot 41$	$2^3 \cdot 7 \cdot 11$	**7902852**	$2 \cdot 3 \cdot 103$	**7916906**
62	5^4	$2 \cdot 313$	$3 \cdot 11 \cdot 19$	$2^2 \cdot 157$	$17 \cdot 37$
63	$5 \cdot 127$	$2^2 \cdot 3 \cdot 53$	$7^2 \cdot 13$	$2 \cdot 11 \cdot 29$	$3^2 \cdot 71$
64	$3 \cdot 5 \cdot 43$	$2 \cdot 17 \cdot 19$	**8109043**	$2^3 \cdot 3^4$	$11 \cdot 59$
65	$5 \cdot 131$	$2^4 \cdot 41$	$3^2 \cdot 73$	$2 \cdot 7 \cdot 47$	**8188854**
66	$5 \cdot 7 \cdot 19$	$2 \cdot 3^2 \cdot 37$	$23 \cdot 29$	$2^2 \cdot 167$	$3 \cdot 223$
67	$3^3 \cdot 5^2$	$2^2 \cdot 13^2$	**8305887**	$2 \cdot 3 \cdot 113$	$7 \cdot 97$
68	$5 \cdot 137$	$2 \cdot 7^3$	$3 \cdot 229$	$2^4 \cdot 43$	$13 \cdot 53$
69	$5 \cdot 139$	$2^3 \cdot 3 \cdot 29$	$17 \cdot 41$	$2 \cdot 349$	$3 \cdot 233$
70	$3 \cdot 5 \cdot 47$	$2 \cdot 353$	$7 \cdot 101$	$2^2 \cdot 3 \cdot 59$	**8506462**
71	$5 \cdot 11 \cdot 13$	$2^2 \cdot 179$	$3 \cdot 239$	$2 \cdot 359$	**8567289**
72	$5^2 \cdot 29$	$2 \cdot 3 \cdot 11^2$	**8615344**	$2^3 \cdot 7 \cdot 13$	3^6
73	$3 \cdot 5 \cdot 7^2$	$2^5 \cdot 23$	$11 \cdot 67$	$2 \cdot 3^2 \cdot 41$	**8686444**
74	$5 \cdot 149$	$2 \cdot 373$	$3^2 \cdot 83$	$2^2 \cdot 11 \cdot 17$	$7 \cdot 107$
75	$5 \cdot 151$	$2^2 \cdot 3^3 \cdot 7$	**8790959**	$2 \cdot 379$	$3 \cdot 11 \cdot 23$
76	$3^2 \cdot 5 \cdot 17$	$2 \cdot 383$	$13 \cdot 59$	$2^8 \cdot 3$	**8859263**
77	$5^2 \cdot 31$	$2^3 \cdot 97$	$3 \cdot 7 \cdot 37$	$2 \cdot 389$	$19 \cdot 41$
78	$5 \cdot 157$	$2 \cdot 3 \cdot 131$	**8959747**	$2^2 \cdot 197$	$3 \cdot 263$
79	$3 \cdot 5 \cdot 53$	$2^2 \cdot 199$	**9014583**	$2 \cdot 3 \cdot 7 \cdot 19$	$17 \cdot 47$
80	$5 \cdot 7 \cdot 23$	$2 \cdot 13 \cdot 31$	$3 \cdot 269$	$2^3 \cdot 101$	**9079485**
81	$5 \cdot 163$	$2^4 \cdot 3 \cdot 17$	$19 \cdot 43$	$2 \cdot 409$	$3^2 \cdot 7 \cdot 13$
82	$3 \cdot 5^2 \cdot 11$	$2 \cdot 7 \cdot 59$	**9175055**	$2^2 \cdot 3^2 \cdot 23$	**9185545**
83	$5 \cdot 167$	$2^2 \cdot 11 \cdot 19$	$3^3 \cdot 31$	$2 \cdot 419$	**9237620**
84	$5 \cdot 13$	$2 \cdot 3^2 \cdot 47$	$7 \cdot 11^2$	$2^4 \cdot 53$	$3 \cdot 283$
85	$3^2 \cdot 5 \cdot 19$	$2^3 \cdot 107$	**9329808**	$2 \cdot 3 \cdot 11 \cdot 13$	**9339932**
86	$5 \cdot 173$	$2 \cdot 433$	$3 \cdot 17^2$	$2^2 \cdot 7 \cdot 31$	$11 \cdot 79$
87	$5^3 \cdot 7$	$2^2 \cdot 3 \cdot 73$	**9429996**	$2 \cdot 439$	$3 \cdot 293$
88	$3 \cdot 5 \cdot 59$	$2 \cdot 443$	**9479236**	$2^3 \cdot 3 \cdot 37$	$7 \cdot 127$
89	$5 \cdot 179$	$2^7 \cdot 7$	$3 \cdot 13 \cdot 23$	$2 \cdot 449$	$29 \cdot 31$
90	$5 \cdot 181$	$2 \cdot 3 \cdot 151$	**9576073**	$2^2 \cdot 227$	$3^2 \cdot 101$
91	$3 \cdot 5 \cdot 61$	$2^2 \cdot 229$	$7 \cdot 131$	$2 \cdot 3^3 \cdot 17$	**9633155**
92	$5^2 \cdot 37$	$2 \cdot 463$	$3^2 \cdot 103$	$2^5 \cdot 29$	**9680157**
93	$5 \cdot 11 \cdot 17$	$2^3 \cdot 3^2 \cdot 13$	**9717396**	$2 \cdot 7 \cdot 67$	$3 \cdot 313$
94	$3^3 \cdot 5 \cdot 7$	$2 \cdot 11 \cdot 43$	**9763500**	$2^2 \cdot 3 \cdot 79$	$13 \cdot 73$
95	$5 \cdot 191$	$2^2 \cdot 239$	$3 \cdot 11 \cdot 29$	$2 \cdot 479$	$7 \cdot 137$
96	$5 \cdot 193$	$2 \cdot 3 \cdot 7 \cdot 23$	**9854265**	$2^3 \cdot 11^2$	$3 \cdot 17 \cdot 19$
97	$3 \cdot 5^2 \cdot 13$	$2^4 \cdot 61$	**9898946**	$2 \cdot 3 \cdot 163$	$11 \cdot 89$
98	$5 \cdot 197$	$2 \cdot 17 \cdot 29$	$3 \cdot 7 \cdot 47$	$2^2 \cdot 13 \cdot 19$	$23 \cdot 43$
99	$5 \cdot 199$	$2^2 \cdot 3 \cdot 83$	**9986952**	$2 \cdot 499$	$3^3 \cdot 37$
100	$3 \cdot 5 \cdot 67$	$2 \cdot 503$	$19 \cdot 53$	$2^4 \cdot 3^2 \cdot 7$	**0038912**

n	0	1	2	3	4
100	$2^3 \cdot 5^3$	$7 \cdot 11 \cdot 13$	$2 \cdot 3 \cdot 167$	$17 \cdot 59$	$2^2 \cdot 251$
101	$2 \cdot 5 \cdot 101$	$3 \cdot 337$	$2^2 \cdot 11 \cdot 23$	**0056094**	$2 \cdot 3 \cdot 13^2$
102	$2^2 \cdot 3 \cdot 5 \cdot 17$	**0090257**	$2 \cdot 7 \cdot 73$	$3 \cdot 11 \cdot 31$	2^{10}
103	$2 \cdot 5 \cdot 103$	**0132587**	$2^3 \cdot 3 \cdot 43$	**0141003**	$2 \cdot 11 \cdot 47$
104	$2^4 \cdot 5 \cdot 13$	$3 \cdot 347$	$2 \cdot 521$	$7 \cdot 149$	$2^2 \cdot 3^2 \cdot 29$
105	$2 \cdot 3 \cdot 5^2 \cdot 7$	**0216027**	$2^2 \cdot 263$	$3^4 \cdot 13$	$2 \cdot 17 \cdot 31$
106	$2^2 \cdot 5 \cdot 53$	**0257154**	$2 \cdot 3^2 \cdot 59$	**0265333**	$2^3 \cdot 7 \cdot 19$
107	$2 \cdot 5 \cdot 107$	$3^2 \cdot 7 \cdot 17$	$2^4 \cdot 67$	$29 \cdot 37$	$2 \cdot 3 \cdot 179$
108	$2^3 \cdot 3^3 \cdot 5$	$23 \cdot 47$	$2 \cdot 541$	$3 \cdot 19^2$	$2^2 \cdot 271$
109	$2 \cdot 5 \cdot 109$	**0378248**	$2^2 \cdot 3 \cdot 7 \cdot 13$	**0386202**	$2 \cdot 547$
110	$2^2 \cdot 5^2 \cdot 11$	$3 \cdot 367$	$2 \cdot 19 \cdot 29$	**0425755**	$2^4 \cdot 3 \cdot 23$
111	$2 \cdot 3 \cdot 5 \cdot 37$	$11 \cdot 101$	$2^3 \cdot 139$	$3 \cdot 7 \cdot 53$	$2 \cdot 557$
112	$2^5 \cdot 5 \cdot 7$	$19 \cdot 59$	$2 \cdot 3 \cdot 11 \cdot 17$	**0503798**	$2^2 \cdot 281$
113	$2 \cdot 5 \cdot 113$	$3 \cdot 13 \cdot 29$	$2^2 \cdot 283$	$11 \cdot 103$	$2 \cdot 3^4 \cdot 7$
114	$2^2 \cdot 3 \cdot 5 \cdot 19$	$7 \cdot 163$	$2 \cdot 571$	$3^2 \cdot 127$	$2^3 \cdot 11 \cdot 13$
115	$2 \cdot 5^2 \cdot 23$	**0610753**	$2^7 \cdot 3^2$	**0618293**	$2 \cdot 577$
116	$2^3 \cdot 5 \cdot 29$	$3^3 \cdot 43$	$2 \cdot 7 \cdot 83$	**0655797**	$2^2 \cdot 3 \cdot 97$
117	$2 \cdot 3^2 \cdot 5 \cdot 13$	**0685569**	$2^2 \cdot 293$	$3 \cdot 17 \cdot 23$	$2 \cdot 587$
118	$2^2 \cdot 5 \cdot 59$	**0722499**	$2 \cdot 3 \cdot 197$	$7 \cdot 13^2$	$2^5 \cdot 37$
119	$2 \cdot 5 \cdot 7 \cdot 17$	$3 \cdot 397$	$2^3 \cdot 149$	**0766404**	$2 \cdot 3 \cdot 199$
120	$2^4 \cdot 3 \cdot 5^2$	**0795430**	$2 \cdot 601$	$3 \cdot 401$	$2^2 \cdot 7 \cdot 43$
121	$2 \cdot 5 \cdot 11^2$	$7 \cdot 173$	$2^2 \cdot 3 \cdot 101$	**0838608**	$2 \cdot 607$
122	$2^2 \cdot 5 \cdot 61$	$3 \cdot 11 \cdot 37$	$2 \cdot 13 \cdot 47$	**0874265**	$2^3 \cdot 3^2 \cdot 17$
123	$2 \cdot 3 \cdot 5 \cdot 41$	**0902581**	$2^4 \cdot 7 \cdot 11$	$3^2 \cdot 137$	$2 \cdot 617$
124	$2^3 \cdot 5 \cdot 31$	$17 \cdot 73$	$2 \cdot 3^3 \cdot 23$	$11 \cdot 113$	$2^2 \cdot 311$
125	$2 \cdot 5^4$	$3^2 \cdot 139$	$2^2 \cdot 313$	$7 \cdot 179$	$2 \cdot 3 \cdot 11 \cdot 19$
126	$2^2 \cdot 3^2 \cdot 5 \cdot 7$	$13 \cdot 97$	$2 \cdot 631$	$3 \cdot 421$	$2^4 \cdot 79$
127	$2 \cdot 5 \cdot 127$	$31 \cdot 41$	$2^3 \cdot 3 \cdot 53$	$19 \cdot 67$	$2 \cdot 7^2 \cdot 13$
128	$2^8 \cdot 5$	$3 \cdot 7 \cdot 61$	$2 \cdot 641$	**1082267**	$2^2 \cdot 3 \cdot 107$
129	$2 \cdot 3 \cdot 5 \cdot 43$	**1109262**	$2^2 \cdot 17 \cdot 19$	$3 \cdot 431$	$2 \cdot 647$
130	$2^2 \cdot 5^2 \cdot 13$	**1142773**	$2 \cdot 3 \cdot 7 \cdot 31$	**1149444**	$2^3 \cdot 163$
131	$2 \cdot 5 \cdot 131$	$3 \cdot 19 \cdot 23$	$2^5 \cdot 41$	$13 \cdot 101$	$2 \cdot 3^2 \cdot 73$
132	$2^3 \cdot 3 \cdot 5 \cdot 11$	**1209028**	$2 \cdot 661$	$3^3 \cdot 7^2$	$2^2 \cdot 331$
133	$2 \cdot 5 \cdot 7 \cdot 19$	11^3	$2^2 \cdot 3^2 \cdot 37$	$31 \cdot 43$	$2 \cdot 23 \cdot 29$
134	$2^2 \cdot 5 \cdot 67$	$3^2 \cdot 149$	$2 \cdot 11 \cdot 61$	$17 \cdot 79$	$2^6 \cdot 3 \cdot 7$
135	$2 \cdot 3^3 \cdot 5^2$	$7 \cdot 193$	$2^3 \cdot 13^2$	$3 \cdot 11 \cdot 41$	$2 \cdot 677$
136	$2^4 \cdot 5 \cdot 17$	**1338581**	$2 \cdot 3 \cdot 227$	$29 \cdot 47$	$2^2 \cdot 11 \cdot 31$
137	$2 \cdot 5 \cdot 137$	$3 \cdot 457$	$2^2 \cdot 7^3$	**1376705**	$2 \cdot 3 \cdot 229$
138	$2^2 \cdot 3 \cdot 5 \cdot 23$	**1401937**	$2 \cdot 691$	$3 \cdot 461$	$2^3 \cdot 173$
139	$2 \cdot 5 \cdot 139$	$13 \cdot 107$	$2^4 \cdot 3 \cdot 29$	$7 \cdot 199$	$2 \cdot 17 \cdot 41$
140	$2^3 \cdot 5^2 \cdot 7$	$3 \cdot 467$	$2 \cdot 701$	$23 \cdot 61$	$2^2 \cdot 3^3 \cdot 13$
141	$2 \cdot 3 \cdot 5 \cdot 47$	$17 \cdot 83$	$2^2 \cdot 353$	$3^2 \cdot 157$	$2 \cdot 7 \cdot 101$
142	$2^2 \cdot 5 \cdot 71$	$7^2 \cdot 29$	$2 \cdot 3^2 \cdot 79$	**1532049**	$2^4 \cdot 89$
143	$2 \cdot 5 \cdot 11 \cdot 13$	$3^3 \cdot 53$	$2^3 \cdot 179$	**1562462**	$2 \cdot 3 \cdot 239$
144	$2^5 \cdot 3^2 \cdot 5$	$11 \cdot 131$	$2 \cdot 7 \cdot 103$	$3 \cdot 13 \cdot 37$	$2^2 \cdot 19^2$
145	$2 \cdot 5^2 \cdot 29$	**1616674**	$2^2 \cdot 3 \cdot 11^2$	**1622656**	$2 \cdot 727$
146	$2^2 \cdot 5 \cdot 73$	$3 \cdot 487$	$2 \cdot 17 \cdot 43$	$7 \cdot 11 \cdot 19$	$2^3 \cdot 3 \cdot 61$
147	$2 \cdot 3 \cdot 5 \cdot 7^2$	**1676127**	$2^6 \cdot 23$	$3 \cdot 491$	$2 \cdot 11 \cdot 67$
148	$2^3 \cdot 5 \cdot 37$	**1705551**	$2 \cdot 3 \cdot 13 \cdot 19$	**1711412**	$2^2 \cdot 7 \cdot 53$
149	$2 \cdot 5 \cdot 149$	$3 \cdot 7 \cdot 71$	$2^2 \cdot 373$	**1740598**	$2 \cdot 3^2 \cdot 83$
150	$2^2 \cdot 3 \cdot 5^3$	$19 \cdot 79$	$2 \cdot 751$	$3^2 \cdot 167$	$2^5 \cdot 47$

FACTORS AND PRIMES (Continued)

n	5	6	7	8	9
100	$3 \cdot 5 \cdot 67$	$2 \cdot 503$	$19 \cdot 53$	$2^4 \cdot 3^2 \cdot 7$	**0038912**
101	$5 \cdot 7 \cdot 29$	$2^3 \cdot 127$	$3^2 \cdot 113$	$2 \cdot 509$	**0081742**
102	$5^2 \cdot 41$	$2 \cdot 3^3 \cdot 19$	$13 \cdot 79$	$2^2 \cdot 257$	$3 \cdot 7^3$
103	$3^2 \cdot 5 \cdot 23$	$2^2 \cdot 7 \cdot 37$	$17 \cdot 61$	$2 \cdot 3 \cdot 173$	**0166155**
104	$5 \cdot 11 \cdot 19$	$2 \cdot 523$	$3 \cdot 349$	$2^3 \cdot 131$	**0207755**
105	$5 \cdot 211$	$2^5 \cdot 3 \cdot 11$	$7 \cdot 151$	$2 \cdot 23^2$	$3 \cdot 353$
106	$3 \cdot 5 \cdot 71$	$2 \cdot 13 \cdot 41$	$11 \cdot 97$	$2^2 \cdot 3 \cdot 89$	**0289777**
107	$5^2 \cdot 43$	$2^2 \cdot 269$	$3 \cdot 359$	$2 \cdot 7^2 \cdot 11$	$13 \cdot 83$
108	$5 \cdot 7 \cdot 31$	$2 \cdot 3 \cdot 181$	**0362295**	$2^6 \cdot 17$	$3^2 \cdot 11^2$
109	$3 \cdot 5 \cdot 73$	$2^3 \cdot 137$	**0402066**	$2 \cdot 3^2 \cdot 61$	$7 \cdot 157$
110	$5 \cdot 13 \cdot 17$	$2 \cdot 7 \cdot 79$	$3^3 \cdot 41$	$2^2 \cdot 277$	**0449315**
111	$5 \cdot 223$	$2^2 \cdot 3^2 \cdot 31$	**0480532**	$2 \cdot 13 \cdot 43$	$3 \cdot 373$
112	$3^2 \cdot 5^3$	$2 \cdot 563$	$7^2 \cdot 23$	$2^3 \cdot 3 \cdot 47$	**0526939**
113	$5 \cdot 227$	$2^4 \cdot 71$	$3 \cdot 379$	$2 \cdot 569$	$17 \cdot 67$
114	$5 \cdot 229$	$2 \cdot 3 \cdot 191$	$31 \cdot 37$	$2^2 \cdot 7 \cdot 41$	$3 \cdot 383$
115	$3 \cdot 5 \cdot 7 \cdot 11$	$2^2 \cdot 17^2$	$13 \cdot 89$	$2 \cdot 3 \cdot 193$	$19 \cdot 61$
116	$5 \cdot 233$	$2 \cdot 11 \cdot 53$	$3 \cdot 389$	$2^4 \cdot 73$	$7 \cdot 167$
117	$5^2 \cdot 47$	$2^3 \cdot 3 \cdot 7^2$	$11 \cdot 107$	$2 \cdot 19 \cdot 31$	$3^2 \cdot$ [illegible]
118	$3 \cdot 5 \cdot 79$	$2 \cdot 593$	**0744507**	$2^2 \cdot 3^3 \cdot 11$	$29 \cdot 41$
119	$5 \cdot 239$	$2^2 \cdot 13 \cdot 23$	$3^2 \cdot 7 \cdot 19$	$2 \cdot 599$	$11 \cdot 109$
120	$5 \cdot 241$	$2 \cdot 3^2 \cdot 67$	$17 \cdot 71$	$2^3 \cdot 151$	$3 \cdot 13 \cdot 31$
121	$3^5 \cdot 5$	$2^6 \cdot 19$	**0852906**	$2 \cdot 3 \cdot 7 \cdot 29$	$23 \cdot 53$
122	$5^2 \cdot 7^2$	$2 \cdot 613$	$3 \cdot 409$	$2^2 \cdot 307$	**0895519**
123	$5 \cdot 13 \cdot 19$	$2^2 \cdot 3 \cdot 103$	**0923697**	$2 \cdot 619$	$3 \cdot 7 \cdot 59$
124	$3 \cdot 5 \cdot 83$	$2 \cdot 7 \cdot 89$	$29 \cdot 43$	$2^5 \cdot 3 \cdot 13$	**0965624**
125	$5 \cdot 251$	$2^3 \cdot 157$	$3 \cdot 419$	$2 \cdot 17 \cdot 37$	**1000257**
126	$5 \cdot 11 \cdot 23$	$2 \cdot 3 \cdot 211$	$7 \cdot 181$	$2^2 \cdot 317$	$3^3 \cdot 47$
127	$3 \cdot 5^2 \cdot 17$	$2^2 \cdot 11 \cdot 29$	**1061909**	$2 \cdot 3^2 \cdot 71$	**1068705**
128	$5 \cdot 257$	$2 \cdot 643$	$3^2 \cdot 11 \cdot 13$	$2^3 \cdot 7 \cdot 23$	**1102529**
129	$5 \cdot 7 \cdot 37$	$2^4 \cdot 3^4$	**1129400**	$2 \cdot 11 \cdot 59$	$3 \cdot 433$
130	$3^2 \cdot 5 \cdot 29$	$2 \cdot 653$	**1162756**	$2^2 \cdot 3 \cdot 109$	$7 \cdot 11 \cdot 17$
131	$5 \cdot 263$	$2^2 \cdot 7 \cdot 47$	$3 \cdot 439$	$2 \cdot 659$	**1202448**
132	$5^2 \cdot 53$	$2 \cdot 3 \cdot 13 \cdot 17$	**1228709**	$2^4 \cdot 83$	$3 \cdot 443$
133	$3 \cdot 5 \cdot 89$	$2^3 \cdot 167$	$7 \cdot 191$	$2 \cdot 3 \cdot 223$	$13 \cdot 103$
134	$5 \cdot 269$	$2 \cdot 673$	$3 \cdot 449$	$2^2 \cdot 337$	$19 \cdot 71$
135	$5 \cdot 271$	$2^2 \cdot 3 \cdot 113$	$23 \cdot 59$	$2 \cdot 7 \cdot 97$	$3^2 \cdot 151$
136	$3 \cdot 5 \cdot 7 \cdot 13$	$2 \cdot 683$	**1357685**	$2^3 \cdot 3^2 \cdot 19$	37^2
137	$5^3 \cdot 11$	$2^5 \cdot 43$	$3^4 \cdot 17$	$2 \cdot 13 \cdot 53$	$7 \cdot 197$
138	$5 \cdot 277$	$2 \cdot 3^2 \cdot 7 \cdot 11$	$19 \cdot 73$	$2^2 \cdot 347$	$3 \cdot 463$
139	$3^2 \cdot 5 \cdot 31$	$2^2 \cdot 349$	$11 \cdot 127$	$2 \cdot 3 \cdot 233$	**1458177**
140	$5 \cdot 281$	$2 \cdot 19 \cdot 37$	$3 \cdot 7 \cdot 67$	$2^7 \cdot 11$	**1489110**
141	$5 \cdot 283$	$2^3 \cdot 3 \cdot 59$	$13 \cdot 109$	$2 \cdot 709$	$3 \cdot 11 \cdot 43$
142	$3 \cdot 5^2 \cdot 19$	$2 \cdot 23 \cdot 31$	**1544240**	$2^2 \cdot 3 \cdot 7 \cdot 17$	**1550322**
143	$5 \cdot 7 \cdot 41$	$2^2 \cdot 359$	$3 \cdot 479$	$2 \cdot 719$	**1580608**
144	$5 \cdot 17^2$	$2 \cdot 3 \cdot 241$	**1604685**	$2^3 \cdot 181$	$3^2 \cdot 7 \cdot 23$
145	$3 \cdot 5 \cdot 97$	$2^4 \cdot 7 \cdot 13$	$31 \cdot 47$	$2 \cdot 3^6$	**1640553**
146	$5 \cdot 293$	$2 \cdot 733$	$3^2 \cdot 163$	$2^2 \cdot 367$	$13 \cdot 113$
147	$5^2 \cdot 59$	$2^2 \cdot 3^2 \cdot 41$	$7 \cdot 211$	$2 \cdot 739$	$3 \cdot 17 \cdot 29$
148	$3^3 \cdot 5 \cdot 11$	$2 \cdot 743$	**1723110**	$2^4 \cdot 3 \cdot 31$	**1728947**
149	$5 \cdot 13 \cdot 23$	$2^3 \cdot 11 \cdot 17$	$3 \cdot 499$	$2 \cdot 7 \cdot 107$	**1758016**
150	$5 \cdot 7 \cdot 43$	$2 \cdot 3 \cdot 251$	$11 \cdot 137$	$2^2 \cdot 13 \cdot 29$	$3 \cdot 503$

n	0	1	2	3	4
150	$2^2 \cdot 3 \cdot 5^3$	$19 \cdot 79$	$2 \cdot 751$	$3^2 \cdot 167$	$2^5 \cdot 47$
151	$2 \cdot 5 \cdot 151$	**1792645**	$2^3 \cdot 3^3 \cdot 7$	$17 \cdot 89$	$2 \cdot 757$
152	$2^4 \cdot 5 \cdot 19$	$3^2 \cdot 13^2$	$2 \cdot 761$	**1826999**	$2^2 \cdot 3 \cdot 127$
153	$2 \cdot 3^2 \cdot 5 \cdot 17$	**1849752**	$2^2 \cdot 383$	$3 \cdot 7 \cdot 73$	$2 \cdot 13 \cdot 59$
154	$2^2 \cdot 5 \cdot 7 \cdot 11$	$23 \cdot 67$	$2 \cdot 3 \cdot 257$	**1883659**	$2^3 \cdot 193$
155	$2 \cdot 5^2 \cdot 31$	$3 \cdot 11 \cdot 47$	$2^4 \cdot 97$	**1911715**	$2 \cdot 3 \cdot 7 \cdot 37$
156	$2^3 \cdot 3 \cdot 5 \cdot 13$	$7 \cdot 223$	$2 \cdot 11 \cdot 71$	$3 \cdot 521$	$2^2 \cdot 17 \cdot 23$
157	$2 \cdot 5 \cdot 157$	**1961762**	$2^2 \cdot 3 \cdot 131$	$11^2 \cdot 13$	$2 \cdot 787$
158	$2^2 \cdot 5 \cdot 79$	$3 \cdot 17 \cdot 31$	$2 \cdot 7 \cdot 113$	**1994809**	$2^4 \cdot 3^2 \cdot 11$
159	$2 \cdot 3 \cdot 5 \cdot 53$	$37 \cdot 43$	$2^3 \cdot 199$	$3^3 \cdot 59$	$2 \cdot 797$
160	$2^6 \cdot 5^2$	**2043913**	$2 \cdot 3^2 \cdot 89$	$7 \cdot 229$	$2^2 \cdot 401$
161	$2 \cdot 5 \cdot 7 \cdot 23$	$3^2 \cdot 179$	$2^2 \cdot 13 \cdot 31$	**2076344**	$2 \cdot 3 \cdot 269$
162	$2^2 \cdot 3^4 \cdot 5$	**2097830**	$2 \cdot 811$	$3 \cdot 541$	$2^3 \cdot 7 \cdot 29$
163	$2 \cdot 5 \cdot 163$	$7 \cdot 233$	$2^5 \cdot 3 \cdot 17$	$23 \cdot 71$	$2 \cdot 19 \cdot 43$
164	$2^3 \cdot 5 \cdot 41$	$3 \cdot 547$	$2 \cdot 821$	$31 \cdot 53$	$2^2 \cdot 3 \cdot 137$
165	$2 \cdot 3 \cdot 5^2 \cdot 11$	$13 \cdot 127$	$2^2 \cdot 7 \cdot 59$	$3 \cdot 19 \cdot 29$	$2 \cdot 827$
166	$2^2 \cdot 5 \cdot 83$	$11 \cdot 151$	$2 \cdot 3 \cdot 277$	**2208922**	$2^7 \cdot 13$
167	$2 \cdot 5 \cdot 167$	$3 \cdot 557$	$2^3 \cdot 11 \cdot 19$	$7 \cdot 239$	$2 \cdot 3^3 \cdot 31$
168	$2^4 \cdot 3 \cdot 5 \cdot 7$	41^2	$2 \cdot 29^2$	$3^2 \cdot 11 \cdot 17$	$2^2 \cdot 421$
169	$2 \cdot 5 \cdot 13^2$	$19 \cdot 89$	$2^2 \cdot 3^2 \cdot 47$	**2286570**	$2 \cdot 7 \cdot 11^2$
170	$2^2 \cdot 5^2 \cdot 17$	$3^5 \cdot 7$	$2 \cdot 23 \cdot 37$	$13 \cdot 131$	$2^3 \cdot 3 \cdot 71$
171	$2 \cdot 3^2 \cdot 5 \cdot 19$	$29 \cdot 59$	$2^4 \cdot 107$	$3 \cdot 571$	$2 \cdot 857$
172	$2^3 \cdot 5 \cdot 43$	**2357809**	$2 \cdot 3 \cdot 7 \cdot 41$	**2362853**	$2^2 \cdot 431$
173	$2 \cdot 5 \cdot 173$	$3 \cdot 577$	$2^2 \cdot 433$	**2387986**	$2 \cdot 3 \cdot 17^2$
174	$2^2 \cdot 3 \cdot 5 \cdot 29$	**2407988**	$2 \cdot 13 \cdot 67$	$3 \cdot 7 \cdot 83$	$2^4 \cdot 109$
175	$2 \cdot 5^3 \cdot 7$	$17 \cdot 103$	$2^3 \cdot 3 \cdot 73$	**2437819**	$2 \cdot 877$
176	$2^5 \cdot 5 \cdot 11$	$3 \cdot 587$	$2 \cdot 881$	$41 \cdot 43$	$2^2 \cdot 3^2 \cdot 7^2$
177	$2 \cdot 3 \cdot 5 \cdot 59$	$7 \cdot 11 \cdot 23$	$2^2 \cdot 443$	$3^2 \cdot 197$	$2 \cdot 887$
178	$2^2 \cdot 5 \cdot 89$	$13 \cdot 137$	$2 \cdot 3^4 \cdot 11$	**2511513**	$2^3 \cdot 223$
179	$2 \cdot 5 \cdot 179$	$3^2 \cdot 199$	$2^8 \cdot 7$	$11 \cdot 163$	$2 \cdot 3 \cdot 13 \cdot 23$
180	$2^3 \cdot 3^2 \cdot 5^2$	**2555137**	$2 \cdot 17 \cdot 53$	$3 \cdot 601$	$2^2 \cdot 11 \cdot 41$
181	$2 \cdot 5 \cdot 181$	**2579185**	$2^2 \cdot 3 \cdot 151$	$7^2 \cdot 37$	$2 \cdot 907$
182	$2^2 \cdot 5 \cdot 7 \cdot 13$	$3 \cdot 607$	$2 \cdot 911$	**2607867**	$2^5 \cdot 3 \cdot 19$
183	$2 \cdot 3 \cdot 5 \cdot 61$	**2626883**	$2^3 \cdot 229$	$3 \cdot 13 \cdot 47$	$2 \cdot 7 \cdot 131$
184	$2^4 \cdot 5 \cdot 23$	$7 \cdot 263$	$2 \cdot 3 \cdot 307$	$19 \cdot 97$	$2^2 \cdot 461$
185	$2 \cdot 5^2 \cdot 37$	$3 \cdot 617$	$2^2 \cdot 463$	$17 \cdot 109$	$2 \cdot 3^2 \cdot 103$
186	$2^2 \cdot 3 \cdot 5 \cdot 31$	**2697464**	$2 \cdot 7^2 \cdot 19$	$3^4 \cdot 23$	$2^3 \cdot 233$
187	$2 \cdot 5 \cdot 11 \cdot 17$	**2720738**	$2^4 \cdot 3^2 \cdot 13$	**2725378**	$2 \cdot 937$
188	$2^3 \cdot 5 \cdot 47$	$3^2 \cdot 11 \cdot 19$	$2 \cdot 941$	$7 \cdot 269$	$2^2 \cdot 3 \cdot 157$
189	$2 \cdot 3^3 \cdot 5 \cdot 7$	$31 \cdot 61$	$2^2 \cdot 11 \cdot 43$	$3 \cdot 631$	$2 \cdot 947$
190	$2^2 \cdot 5^2 \cdot 19$	**2789821**	$2 \cdot 3 \cdot 317$	$11 \cdot 173$	$2^4 \cdot 7 \cdot 17$
191	$2 \cdot 5 \cdot 191$	$3 \cdot 7^2 \cdot 13$	$2^3 \cdot 239$	**2817150**	$2 \cdot 3 \cdot 11 \cdot 29$
192	$2^7 \cdot 3 \cdot 5$	$17 \cdot 113$	$2 \cdot 31^2$	$3 \cdot 641$	$2^2 \cdot 13 \cdot 37$
193	$2 \cdot 5 \cdot 193$	**2857823**	$2^2 \cdot 3 \cdot 7 \cdot 23$	**2862319**	$2 \cdot 967$
194	$2^2 \cdot 5 \cdot 97$	$3 \cdot 647$	$2 \cdot 971$	$29 \cdot 67$	$2^3 \cdot 3^5$
195	$2 \cdot 3 \cdot 5^2 \cdot 13$	**2902573**	$2^5 \cdot 61$	$3^2 \cdot 7 \cdot 31$	$2 \cdot 977$
196	$2^3 \cdot 5 \cdot 7^2$	$37 \cdot 53$	$2 \cdot 3^2 \cdot 109$	$13 \cdot 151$	$2^2 \cdot 491$
197	$2 \cdot 5 \cdot 197$	$3^3 \cdot 73$	$2^2 \cdot 17 \cdot 29$	**2951271**	$2 \cdot 3 \cdot 7 \cdot 47$
198	$2^2 \cdot 3^2 \cdot 5 \cdot 11$	$7 \cdot 283$	$2 \cdot 991$	$3 \cdot 661$	$2^6 \cdot 31$
199	$2 \cdot 5 \cdot 199$	$11 \cdot 181$	$2^3 \cdot 3 \cdot 83$	**2995073**	$2 \cdot 997$
200	$2^4 \cdot 5^3$	$3 \cdot 23 \cdot 29$	$2 \cdot 7 \cdot 11 \cdot 13$	**3016809**	$2^2 \cdot 3 \cdot 167$

FACTORS AND PRIMES (Continued)

n	5	6	7	8	9
150	$5 \cdot 7 \cdot 43$	$2 \cdot 3 \cdot 251$	$11 \cdot 137$	$2^2 \cdot 13 \cdot 29$	$3 \cdot 503$
151	$3 \cdot 5 \cdot 101$	$2^2 \cdot 379$	$37 \cdot 41$	$2 \cdot 3 \cdot 11 \cdot 23$	$7^2 \cdot 31$
152	$5^2 \cdot 61$	$2 \cdot 7 \cdot 109$	$3 \cdot 509$	$2^3 \cdot 191$	$11 \cdot 139$
153	$5 \cdot 307$	$2^9 \cdot 3$	$29 \cdot 53$	$2 \cdot 769$	$3^4 \cdot 19$
154	$3 \cdot 5 \cdot 103$	$2 \cdot 773$	$7 \cdot 13 \cdot 17$	$2^2 \cdot 3^2 \cdot 43$	**1900514**
155	$5 \cdot 311$	$2^2 \cdot 389$	$3^2 \cdot 173$	$2 \cdot 19 \cdot 41$	**1928461**
156	$5 \cdot 313$	$2 \cdot 3^3 \cdot 29$	**1950690**	$2^5 \cdot 7^2$	$3 \cdot 523$
157	$3^2 \cdot 5^2 \cdot 7$	$2^3 \cdot 197$	$19 \cdot 83$	$2 \cdot 3 \cdot 263$	**1983821**
158	$5 \cdot 317$	$2 \cdot 13 \cdot 61$	$3 \cdot 23^2$	$2^2 \cdot 397$	$7 \cdot 227$
159	$5 \cdot 11 \cdot 29$	$2^2 \cdot 3 \cdot 7 \cdot 19$	**2033049**	$2 \cdot 17 \cdot 47$	$3 \cdot 13 \cdot 41$
160	$3 \cdot 5 \cdot 107$	$2 \cdot 11 \cdot 73$	**2060159**	$2^3 \cdot 3 \cdot 67$	**2065560**
161	$5 \cdot 17 \cdot 19$	$2^4 \cdot 101$	$3 \cdot 7^2 \cdot 11$	$2 \cdot 809$	**2092468**
162	$5^3 \cdot 13$	$2 \cdot 3 \cdot 271$	**2113876**	$2^2 \cdot 11 \cdot 37$	$3^2 \cdot 181$
163	$3 \cdot 5 \cdot 109$	$2^2 \cdot 409$	**2140487**	$2 \cdot 3^2 \cdot 7 \cdot 13$	$11 \cdot 149$
164	$5 \cdot 7 \cdot 47$	$2 \cdot 823$	$3^4 \cdot 61$	$2^4 \cdot 103$	$17 \cdot 97$
165	$5 \cdot 331$	$2^3 \cdot 3^2 \cdot 23$	**2193225**	$2 \cdot 829$	$3 \cdot 7 \cdot 79$
166	$3^2 \cdot 5 \cdot 37$	$2 \cdot 7^2 \cdot 17$	**2219356**	$2^2 \cdot 3 \cdot 139$	**2224563**
167	$5^2 \cdot 67$	$2^2 \cdot 419$	$3 \cdot 13 \cdot 43$	$2 \cdot 839$	$23 \cdot 73$
168	$5 \cdot 337$	$2 \cdot 3 \cdot 281$	$7 \cdot 241$	$2^3 \cdot 211$	$3 \cdot 563$
169	$3 \cdot 5 \cdot 113$	$2^5 \cdot 53$	**2296818**	$2 \cdot 3 \cdot 283$	**2301934**
170	$5 \cdot 11 \cdot 31$	$2 \cdot 853$	$3 \cdot 569$	$2^2 \cdot 7 \cdot 61$	**2327421**
171	$5 \cdot 7^3$	$2^2 \cdot 3 \cdot 11 \cdot 13$	$17 \cdot 101$	$2 \cdot 859$	$3^2 \cdot 191$
172	$3 \cdot 5^2 \cdot 23$	$2 \cdot 863$	$11 \cdot 157$	$2^6 \cdot 3^3$	$7 \cdot 13 \cdot 19$
173	$5 \cdot 347$	$2^3 \cdot 7 \cdot 31$	$3^2 \cdot 193$	$2 \cdot 11 \cdot 79$	$37 \cdot 47$
174	$5 \cdot 349$	$2 \cdot 3^2 \cdot 97$	**2422929**	$2^2 \cdot 19 \cdot 23$	$3 \cdot 11 \cdot 53$
175	$3^3 \cdot 5 \cdot 13$	$2^2 \cdot 439$	$7 \cdot 251$	$2 \cdot 3 \cdot 293$	**2452658**
176	$5 \cdot 353$	$2 \cdot 883$	$3 \cdot 19 \cdot 31$	$2^3 \cdot 13 \cdot 17$	$29 \cdot 61$
177	$5^2 \cdot 71$	$2^4 \cdot 3 \cdot 37$	**2496874**	$2 \cdot 7 \cdot 127$	$3 \cdot 593$
178	$3 \cdot 5 \cdot 7 \cdot 17$	$2 \cdot 19 \cdot 47$	**2521246**	$2^2 \cdot 3 \cdot 149$	**2526103**
179	$5 \cdot 359$	$2^2 \cdot 449$	$3 \cdot 599$	$2 \cdot 29 \cdot 31$	$7 \cdot 257$
180	$5 \cdot 19^2$	$2 \cdot 3 \cdot 7 \cdot 43$	$13 \cdot 139$	$2^4 \cdot 113$	$3^3 \cdot 67$
181	$3 \cdot 5 \cdot 11^2$	$2^3 \cdot 227$	$23 \cdot 79$	$2 \cdot 3^2 \cdot 101$	$17 \cdot 107$
182	$5^2 \cdot 73$	$2 \cdot 11 \cdot 83$	$3^2 \cdot 7 \cdot 29$	$2^2 \cdot 457$	$31 \cdot 59$
183	$5 \cdot 367$	$2^2 \cdot 3^3 \cdot 17$	$11 \cdot 167$	$2 \cdot 919$	$3 \cdot 613$
184	$3^2 \cdot 5 \cdot 41$	$2 \cdot 13 \cdot 71$	**2664669**	$2^3 \cdot 3 \cdot 7 \cdot 11$	43^2
185	$5 \cdot 7 \cdot 53$	$2^6 \cdot 29$	$3 \cdot 619$	$2 \cdot 929$	$11 \cdot 13^2$
186	$5 \cdot 373$	$2 \cdot 3 \cdot 311$	**2711443**	$2^2 \cdot 467$	$3 \cdot 7 \cdot 89$
187	$3 \cdot 5^4$	$2^2 \cdot 7 \cdot 67$	**2734643**	$2 \cdot 939$	**2739268**
188	$5 \cdot 13 \cdot 29$	$2 \cdot 23 \cdot 41$	$3 \cdot 17 \cdot 37$	$2^5 \cdot 59$	**2762320**
189	$5 \cdot 379$	$2^3 \cdot 3 \cdot 79$	$7 \cdot 271$	$2 \cdot 13 \cdot 73$	$3^2 \cdot 211$
190	$3 \cdot 5 \cdot 127$	$2 \cdot 953$	**2803507**	$2^2 \cdot 3^2 \cdot 53$	$23 \cdot 83$
191	$5 \cdot 383$	$2^2 \cdot 479$	$3^3 \cdot 71$	$2 \cdot 7 \cdot 137$	$19 \cdot 101$
192	$5^2 \cdot 7 \cdot 11$	$2 \cdot 3^2 \cdot 107$	$41 \cdot 47$	$2^3 \cdot 241$	$3 \cdot 643$
193	$3^2 \cdot 5 \cdot 43$	$2^4 \cdot 11^2$	$13 \cdot 149$	$2 \cdot 3 \cdot 17 \cdot 19$	$7 \cdot 277$
194	$5 \cdot 389$	$2 \cdot 7 \cdot 139$	$3 \cdot 11 \cdot 59$	$2^2 \cdot 487$	**2898118**
195	$5 \cdot 17 \cdot 23$	$2^2 \cdot 3 \cdot 163$	$19 \cdot 103$	$2 \cdot 11 \cdot 89$	$3 \cdot 653$
196	$3 \cdot 5 \cdot 131$	$2 \cdot 983$	$7 \cdot 281$	$2^4 \cdot 3 \cdot 41$	$11 \cdot 179$
197	$5^2 \cdot 79$	$2^3 \cdot 13 \cdot 19$	$3 \cdot 659$	$2 \cdot 23 \cdot 43$	**2964458**
198	$5 \cdot 397$	$2 \cdot 3 \cdot 331$	**2981979**	$2^2 \cdot 7 \cdot 71$	$3^2 \cdot 13 \cdot 17$
199	$3 \cdot 5 \cdot 7 \cdot 19$	$2^2 \cdot 499$	**3003781**	$2 \cdot 3^3 \cdot 37$	**3008128**
200	$5 \cdot 401$	$2 \cdot 17 \cdot 59$	$3^2 \cdot 223$	$2^3 \cdot 251$	$7^2 \cdot 41$

CALCULUS

DIFFERENTIALS

$d\,ax = a dx$

$d(u + v) = du + dv$

$d\,uv = udv + vdu$

$d\frac{u}{v} = \frac{vdu - udv}{v^2}$

$d\,x^n = n\,x^{n-1}dx$

$dx^y = yx^{y-1}dx + x^y \log_e x\,dy$

$d\,e^x = e^x\,dx$

$d\,e^{ax} = a\,e^{ax}dx$

$d\,a^x = a^x \log_e a\,dx$

$d \log_e x = x^{-1}dx$

$d \log_a x = x^{-1} \log_a e\,dx$

$d\,x^x = x^x\,(1 + \log_e x)\,dx$

$d \sin x = \cos x\,dx$

$d \cos x = -\sin x\,dx$

$d \tan x = \sec^2 x\,dx$

$d \cot x = -\csc^2 x\,dx$

$d \sec x = \tan x \sec x\,dx$

$d \csc x = -\cot x \cdot \csc x\,dx$

$d \operatorname{vers} x = \sin x\,dx$

$d \sin^{-1}x = (1 - x^2)^{-\frac{1}{2}}dx$

$d \cos^{-1}x = -(1 - x^2)^{-\frac{1}{2}}dx$

$d \tan^{-1}x = (1 + x^2)^{-1}dx$

$d \cot^{-1}x = -(1 + x^2)^{-1}dx$

$d \sec^{-1}x = x^{-1}(x^2 - 1)^{-\frac{1}{2}}dx$

$d \csc^{-1}x = -x^{-1}(x^2 - 1)^{-\frac{1}{2}}dx$

$d \operatorname{vers}^{-1} x = (2x - x^2)^{-\frac{1}{2}}\,dx$

$d \sinh x = \cosh x\,dx$

$d \cosh x = \sinh x\,dx$

$d \tanh x = \operatorname{sech}^2 x\,dx$

$d \coth x = -\operatorname{csch}^2 x\,dx$

$d \operatorname{sech} x = -\operatorname{sech} x \tanh x\,dx$

$d \operatorname{csch} x = -\operatorname{csch} x \coth x\,dx$

$d \sinh^{-1} x = (x^2 + 1)^{-\frac{1}{2}}dx$

$d \cosh^{-1} x = (x^2 - 1)^{-\frac{1}{2}}dx$

$d \tanh^{-1} x = (1 - x^2)^{-1}dx$

$d \coth^{-1} x = -(x^2 - 1)^{-1}dx$

$d \operatorname{sech}^{-1} x = -x^{-1}(1 - x^2)^{-\frac{1}{2}}dx$

$d \operatorname{csch}^{-1} x = -x^{-1}(x^2 + 1)^{-\frac{1}{2}}dx$

INTEGRALS

Elementary Forms

1. $\int a\,dx = ax.$
2. $\int a \cdot f(x)dx = a \int f(x)dx.$
3. $\int \phi(y)dx = \int \frac{\phi(y)}{y'}\,dy,$ where $y' = dy/dx.$
4. $\int (u + v)\,dx = \int u\,dx + \int v\,dx,$ where u and v are any functions of x.
5. $\int u\,dv = uv - \int v\,du.$
6. $\int u\frac{dv}{dx}\,dx = uv - \int v\frac{du}{dx}\,dx.$
7. $\int x^n\,dx = \frac{x^{n+1}}{n+1},$ except $n = -1.$
8. $\int \frac{f'(x)\,dx}{f(x)} = \log f(x),$ $[d\,f(x) = f'(x)\,dx].$
9. $\int \frac{dx}{x} = \log x,$ or $\log(-x).$
10. $\int \frac{f'(x)\,dx}{2\sqrt{f(x)}} = \sqrt{f(x)}.$ $[d\,f(x) = f'(x)\,dx].$
11. $\int e^x\,dx = e^x.$
12. $\int e^{ax}\,dx = e^{ax}/a.$
13. $\int b^{ax}\,dx = \frac{b^{ax}}{a\log b}.$
14. $\int \log x\,dx = x\log x - x.$
15. $\int a^x \log a\,dx = a^x.$
16. $\int \frac{dx}{a^2+x^2} = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right),$ or $-\frac{1}{a}\cot^{-1}\left(\frac{x}{a}\right).$
17. $\int \frac{dx}{a^2-x^2} = \frac{1}{a}\tanh^{-1}\left(\frac{x}{a}\right),$ or $\frac{1}{2a}\log\frac{a+x}{a-x}.$
18. $\int \frac{dx}{x^2-a^2} = -\frac{1}{a}\coth^{-1}\left(\frac{x}{a}\right),$ or $\frac{1}{2a}\log\frac{x-a}{x+a}.$
19. $\int \frac{dx}{\sqrt{a^2-x^2}} = \sin^{-1}\left(\frac{x}{a}\right),$ or $-\cos^{-1}\left(\frac{x}{a}\right).$
20. $\int \frac{dx}{\sqrt{x^2 \pm a^2}} = \log\left(x + \sqrt{x^2 \pm a^2}\right).$
21. $\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a}\cos^{-1}\left(\frac{a}{x}\right).$
22. $\int \frac{dx}{x\sqrt{a^2 \pm x^2}} = -\frac{1}{a}\log\left(\frac{a+\sqrt{a^2 \pm x^2}}{x}\right).$

23. $$\int \frac{dx}{x\sqrt{a+bx}} = \frac{2}{\sqrt{-a}} \tan^{-1} \sqrt{\frac{a+bx}{-a}}, \text{ or } \frac{-2}{\sqrt{a}} \tanh^{-1} \sqrt{\frac{a+bx}{a}}.$$

FORMS CONTAINING $(a + bx)$

24. $$\int (a+bx)^n dx = \frac{(a+bx)^{n+1}}{(n+1)b}, \text{ except } n = -1.$$

25. $$\int x(a+bx)^n dx = \frac{1}{b^2(n+2)}(a+bx)^{n+2} - \frac{a}{b^2(n+1)}(a+bx)^{n+1}, \text{ except } n = -1 \text{ or } -2.$$

26. $$\int x^2 (a+bx)^n\, dx = \frac{1}{b^3}\left[\frac{(a+bx)^{n+3}}{n+3} - 2a\frac{(a+bx)^{n+2}}{n+2} + a^2\frac{(a+bx)^{n+1}}{n+1}\right].$$

27. $$\int x^m (a+bx)^n\, dx = \frac{x^{m+1}(a+bx)^n}{m+n+1} + \frac{an}{m+n+1}\int x^m (a+bx)^{n-1}\, dx.$$

28. $$\int \frac{dx}{a+bx} = \frac{1}{b}\log(a+bx).$$

29. $$\int \frac{dx}{(a+bx)^2} = -\frac{1}{b(a+bx)}.$$

30. $$\int \frac{dx}{(a+bx)^3} = -\frac{1}{2b(a+bx)^2}.$$

31. $$\int \frac{xdx}{a+bx} = \frac{1}{b^2}[a+bx-a\log(a+bx)].$$

32. $$\int \frac{xdx}{(a+bx)^2} = \frac{1}{b^2}\left[\log(a+bx)+\frac{a}{a+bx}\right].$$

33. $$\int \frac{xdx}{(a+bx)^3} = \frac{1}{b^2}\left[-\frac{1}{a+bx}+\frac{a}{2(a+bx)^2}\right].$$

34. $$\int \frac{x^2\,dx}{a+bx} = \frac{1}{b^3}\left[\frac{1}{2}(a+bx)^2 - 2a(a+bx) + a^2\log(a+bx)\right]$$

35. $$\int \frac{x^2\,dx}{(a+bx)^2} = \frac{1}{b^3}\left[a+bx-2a\log(a+bx)-\frac{a^2}{a+bx}\right]$$

36. $$\int \frac{x^2\,dx}{(a+bx)^3} = \frac{1}{b^3}\left[\log(a+bx)+\frac{2a}{a+bx}-\frac{a^2}{2(a+bx)^2}\right]$$

37. $$\int \frac{dx}{x(a+bx)} = -\frac{1}{a}\log\frac{a+bx}{x}.$$

38. $$\int \frac{dx}{x(a+bx)^2} = \frac{1}{a(a+bx)} - \frac{1}{a^2}\log\frac{a+bx}{x}.$$

39. $$\int \frac{dx}{x^2(a+bx)} = -\frac{1}{ax} + \frac{b}{a^2}\log\frac{a+bx}{x}$$

40. $$\int \frac{dx}{x^2(a+bx)^2} = -\frac{a+2bx}{a^2x(a+bx)} + \frac{2b}{a^3}\log\frac{a+bx}{x}.$$

FORMS CONTAINING $c^2 \pm x^2$, $x^2 - c^2$

41. $$\int \frac{dx}{c^2+x^2} = \frac{1}{c}\tan^{-1}\frac{x}{c}, \text{ or } \frac{1}{c}\sin^{-1}\frac{x}{\sqrt{c^2+x^2}}.$$

42. $$\int \frac{dx}{c^2-x^2} = \frac{1}{2c}\log\frac{c+x}{c-x}, \text{ or } \frac{1}{c}\tanh^{-1}\left(\frac{x}{c}\right).$$

43. $$\int \frac{dx}{x^2-c^2} = \frac{1}{2c}\log\frac{x-c}{x+c}, \text{ or } -\frac{1}{c}\coth^{-1}\left(\frac{x}{c}\right).$$

FORMS CONTAINING $a + bx$ AND $a' + b'x$

44. $$\int \frac{dx}{(a+bx)(a'+b'x)} = \frac{1}{ab'-a'b}\cdot\log\left(\frac{a'+b'x}{a+bx}\right).$$

45. $$\int \frac{x\,dx}{(a+bx)(a'+b'x)} = \frac{1}{ab'-a'b}\left[\frac{a}{b}\log(a+bx) - \frac{a'}{b'}\log(a'+b'x)\right].$$

46. $$\int \frac{dx}{(a+bx)^2(a'+b'x)} = \frac{1}{ab'-a'b}\left(\frac{1}{a+bx} + \frac{b'}{ab'-a'b}\log\frac{a'+b'x}{a+bx}\right).$$

47. $$\int \frac{x\,dx}{(a+bx)^2(a'+b'x)} = \frac{-a}{b(ab'-a'b)(a+bx)} - \frac{a'}{(ab'-a'b)^2}\log\frac{a'+b'x}{a+bx}.$$

48. $$\int \frac{x^2\,dx}{(a+bx)^2(a'+b'x)} = \frac{a^2}{b^2(ab'-a'b)(a+bx)} + \frac{1}{(ab'-a'b)^2}\left[\frac{a'^2}{b'}\log(a'+b'x) + \frac{a(ab'-2a'b)}{b^2}\log(a+bx)\right].$$

49. $$\int \frac{dx}{(a+bx)^n(a'+b'x)^m} = \frac{1}{(m-1)(ab'-a'b)}\cdot\left(\frac{1}{(a+bx)^{n-1}(a'+b'x)^{m-1}} - (m+n-2)b\int\frac{dx}{(a+bx)^n(a'+b'x)^{m-1}}\right).$$

FORMS CONTAINING $\sqrt{a+bx}$ AND $\sqrt{a'+b'x}$ $\quad u = a + bx$
$v = a' + b'x \quad k = ab' - a'b$

50. $$\int \sqrt{uv}\,dx = \frac{k + 2\,bv}{4\,bb'}\sqrt{uv} - \frac{k^2}{8\,bb'}\int \frac{dx}{\sqrt{uv}}.$$

51. $$\int \frac{dx}{v\sqrt{u}} = \frac{1}{\sqrt{kb'}}\log\frac{b'\sqrt{u} - \sqrt{kb'}}{b'\sqrt{u} + \sqrt{kb'}} = \frac{2}{\sqrt{-kb'}}\tan^{-1}\frac{b'\sqrt{u}}{\sqrt{-kb'}}.$$

52. $$\int \frac{dx}{\sqrt{uv}} = \frac{2}{\sqrt{bb'}}\log\left(\sqrt{bb'u} + b\sqrt{v}\right) = \frac{2}{\sqrt{-bb'}}\tan^{-1}\sqrt{\frac{-b'u}{bv}},$$

$$\text{or } \frac{2}{\sqrt{bb'}}\tanh^{-1}\sqrt{\frac{b'u}{bv}} = \frac{1}{\sqrt{-bb'}}\sin^{-1}\frac{2bb'x + a'b + ab'}{k}.$$

53. $$\int \frac{xdx}{\sqrt{uv}} = \frac{\sqrt{uv}}{bb'} - \frac{ab' + a'b}{2bb'}\int \frac{dx}{\sqrt{uv}}.$$

54. $$\int \frac{dx}{v\sqrt{uv}} = -\frac{2\sqrt{u}}{k\sqrt{v}}.$$

55. $$\int \frac{\sqrt{v}\,dx}{\sqrt{u}} = \frac{1}{b}\sqrt{uv} - \frac{k}{2b}\int \frac{dx}{\sqrt{uv}}.$$

56. $$\int v^m\sqrt{u}\,dx = \frac{1}{(2m+3)b'}\left(2v^{m+1}\sqrt{u} + k\int \frac{v^m dx}{\sqrt{u}}\right).$$

57. $$\int \frac{dx}{v^m\sqrt{u}} = -\frac{1}{(m-1)k}\left(\frac{\sqrt{u}}{v^{m-1}} + \left(m - \frac{3}{2}\right)b\int \frac{dx}{v^{m-1}\sqrt{u}}\right).$$

FORMS CONTAINING $(a + bx^n)$

58. $$\int \frac{dx}{a + bx^2} = \frac{1}{\sqrt{ab}}\tan^{-1}\frac{x\sqrt{ab}}{a}.$$

59. $$\int \frac{dx}{a + bx^2} = \frac{1}{2\sqrt{-ab}}\log\frac{a + x\sqrt{-ab}}{a - x\sqrt{-ab}}, \text{ or } \frac{1}{\sqrt{-ab}}\tanh^{-1}\frac{x\sqrt{-ab}}{a}.$$

60. $$\int \frac{xdx}{a + bx^2} = \frac{1}{2\,b}\log\left(x^2 + \frac{a}{b}\right).$$

61. $$\int \frac{x^2\,dx}{a + bx^2} = \frac{x}{b} - \frac{a}{b}\int \frac{dx}{a + bx^2}.$$

62. $$\int \frac{dx}{(a+bx^2)^2} = \frac{x}{2a(a+bx^2)} + \frac{1}{2a}\int \frac{dx}{a+bx^2}.$$

63. $$\int \frac{dx}{(a+bx^2)^{m+1}} = \frac{1}{2\,ma}\,\frac{x}{(a+bx^2)^m} + \frac{2m-1}{2\,ma}\int \frac{dx}{(a+bx^2)^m}.$$

64. $$\int \frac{xdx}{(a+bx^2)^{m+1}} = \frac{1}{2}\int \frac{dz}{(a+bz)^{m+1}}, \qquad [z = x^2].$$

65. $$\int \frac{x^2dx}{(a+bx^2)^{m+1}} = \frac{-x}{2\,mb(a+bx^2)^m} + \frac{1}{2\,mb}\int \frac{dx}{(a+bx^2)^m}.$$

66. $$\int \frac{dx}{x^2(a+bx^2)^{m+1}} = \frac{1}{a}\int \frac{dx}{x^2(a+bx^2)^m} - \frac{b}{a}\int \frac{dx}{(a+bx^2)^{m+1}}.$$

67. $$\int \frac{dx}{x(a+bx^2)} = \frac{1}{2\,a}\log\frac{x^2}{a+bx^2}.$$

68. $$\int \frac{dx}{x^2(a+bx^2)} = -\frac{1}{ax} - \frac{b}{a}\int \frac{dx}{a+bx^2}.$$

69. $$\int \frac{dx}{a+bx^3} = \frac{k}{3\,a}\left[\frac{1}{2}\log\frac{(k+x)^2}{k^2-kx+x^2} + \sqrt{3}\tan^{-1}\frac{2\,x-k}{k\sqrt{3}}\right], \quad [bk^3 = a].$$

70. $$\int \frac{xdx}{a+bx^3} = \frac{1}{3bk}\left[\frac{1}{2}\log\frac{k^2-kx+x^2}{(k+x)^2} + \sqrt{3}\tan^{-1}\frac{2x-k}{k\sqrt{3}}\right], \quad [bk^3 = a].$$

71. $$\int \frac{dx}{x(a+bx^n)} = \frac{1}{an}\log\frac{x^n}{a+bx^n}.$$

72. $$\int \frac{dx}{(a+bx^n)^{m+1}} = \frac{1}{a}\int \frac{dx}{(a+bx^n)^m} - \frac{b}{a}\int \frac{x^ndx}{(a+bx^n)^{m+1}}.$$

73. $$\int \frac{x^mdx}{(a+bx^n)^{p+1}} = \frac{1}{b}\int \frac{x^{m-n}dx}{(a+bx^n)^p} - \frac{a}{b}\int \frac{x^{m-n}dx}{(a+bx^n)^{p+1}}.$$

74. $$\int \frac{dx}{x^m(a+bx^n)^{p+1}} = \frac{1}{a}\int \frac{dx}{x^m(a+bx^n)^p} - \frac{b}{a}\int \frac{dx}{x^{m-n}(a+bx^n)^{p+1}}.$$

75. $$\int x^m(a+bx^n)^pdx = \frac{x^{m-n+1}(a+bx^n)^{p+1}}{b(np+m+1)} - \frac{a(m-n+1)}{b(np+m+1)}\int x^{m-n}(a+bx^n)^p\,dx.$$

76. $\int x^m(a + bx^n)^p \, dx = \dfrac{x^{m+1}(a + bx^n)^p}{np + m + 1} + \dfrac{anp}{np + m + 1} \int x^m(a + bx^n)^{p-1} \, dx.$

77. $\int x^{m-1}(a + bx^n)^p \, dx = \dfrac{1}{b(m + np)}[x^{m-n}(a + bx^n)^{p+1} - (m - n)\, a \int x^{m-n-1}(a + bx^n)^p \, dx].$

78. $\int x^{m-1}(a + bx^n)^p \, dx = \dfrac{1}{m + np}[x^m(a + bx^n)^p + npa \int x^{m-1}(a + bx^n)^{p-1} \, dx].$

79. $\int x^{m-1}(a + bx^n)^p \, dx = \dfrac{1}{ma}[x^m(a + bx^n)^{p+1} - (m + np + n)b \int x^{m+n-1}(a + bx^n)^p \, dx].$

80. $\int x^{m-1}(a + bx^n)^p \, dx = \dfrac{1}{an(p + 1)}[-x^m(a + bx^n)^{p+1} + (m + np + n) \int x^{m-1}(a + bx^n)^{p+1} \, dx].$

FORMS CONTAINING $(a + bx + cx^2)$

$X = a + bx + cx^2$ and $q = 4\,ac - b^2$

81. $\int \dfrac{dx}{X} = \dfrac{2}{\sqrt{q}} \tan^{-1} \dfrac{2\,cx + b}{\sqrt{q}}.$

82. $\int \dfrac{dx}{X} = \dfrac{-2}{\sqrt{-q}} \tanh^{-1} \dfrac{2\,cx + b}{\sqrt{-q}}.$

83. $\int \dfrac{dx}{X} = \dfrac{1}{\sqrt{-q}} \log \dfrac{2\,cx + b - \sqrt{-q}}{2\,cx + b + \sqrt{-q}}.$

84. $\int \dfrac{dx}{X^2} = \dfrac{2\,cx + b}{qX} + \dfrac{2\,c}{q} \int \dfrac{dx}{X}.$

85. $\int \dfrac{dx}{X^3} = \dfrac{2\,cx + b}{q}\left(\dfrac{1}{2\,X^2} + \dfrac{3\,c}{qX}\right) + \dfrac{6\,c^2}{q^2} \int \dfrac{dx}{X}.$

86. $\int \dfrac{dx}{X^{n+1}} = \dfrac{2\,cx + b}{nqX^n} + \dfrac{2\,(2\,n - 1)\,c}{qn} \int \dfrac{dx}{X^n}.$

87. $\int \dfrac{xdx}{X} = \dfrac{1}{2\,c} \log X - \dfrac{b}{2\,c} \int \dfrac{dx}{X}.$

88. $\int \dfrac{xdx}{X^2} = -\dfrac{bx + 2a}{qX} - \dfrac{b}{q} \int \dfrac{dx}{X}.$

89. $\int \dfrac{xdx}{X^{n+1}} = -\dfrac{2\,a + bx}{nqX^n} - \dfrac{b\,(2\,n - 1)}{nq} \int \dfrac{dx}{X^n}.$

90. $\int \dfrac{x^2}{X} dx = \dfrac{x}{c} - \dfrac{b}{2\,c^2} \log X + \dfrac{b^2 - 2\,ac}{2\,c^2} \int \dfrac{dx}{X}.$

91. $\int \dfrac{x^2}{X^2} dx = \dfrac{(b^2 - 2\,ac)x + ab}{cqX} + \dfrac{2\,a}{q} \int \dfrac{dx}{X}.$

92. $$\int \frac{x^m\,dx}{X^{n+1}} = -\frac{x^{m-1}}{(2n-m+1)cX^n} - \frac{n-m+1}{2n-m+1}\cdot\frac{b}{c}\int\frac{x^{m-1}\,dx}{X^{n+1}} + \frac{m-1}{2n-m+1}\cdot\frac{a}{c}\int\frac{x^{m-2}\,dx}{X^{n+1}}.$$

93. $$\int \frac{dx}{xX} = \frac{1}{2a}\log\frac{x^2}{X} - \frac{b}{2a}\int\frac{dx}{X}.$$

94. $$\int \frac{dx}{x^2X} = \frac{b}{2a^2}\log\frac{X}{x^2} - \frac{1}{ax} + \left(\frac{b^2}{2a^2} - \frac{c}{a}\right)\int\frac{dx}{X}.$$

95. $$\int \frac{dx}{xX^n} = \frac{1}{2a(n-1)X^{n-1}} - \frac{b}{2a}\int\frac{dx}{X^n} + \frac{1}{a}\int\frac{dx}{xX^{n-1}}.$$

96. $$\int \frac{dx}{x^mX^{n+1}} = -\frac{1}{(m-1)ax^{m-1}X^n} - \frac{n+m-1}{m-1}\cdot\frac{b}{a}\int\frac{dx}{x^{m-1}X^{n+1}} - \frac{2n+m-1}{m-1}\cdot\frac{c}{a}\int\frac{dx}{x^{m-2}X^{n+1}}.$$

Forms Containing $\sqrt{a+bx}$

97. $$\int\sqrt{a+bx}\,dx = \frac{2}{3b}\sqrt{(a+bx)^3}.$$

98. $$\int x\sqrt{a+bx}\,dx = -\frac{2(2a-3bx)\sqrt{(a+bx)^3}}{15b^2}.$$

99. $$\int x^2\sqrt{a+bx}\,dx = \frac{2(8a^2-12abx+15b^2x^2)\sqrt{(a+bx)^3}}{105b^3}.$$

100. $$\int\frac{\sqrt{a+bx}}{x}\,dx = 2\sqrt{a+bx} + a\int\frac{dx}{x\sqrt{a+bx}}.$$

101. $$\int\frac{dx}{\sqrt{a+bx}} = \frac{2\sqrt{a+bx}}{b}.$$

102. $$\int\frac{x\,dx}{\sqrt{a+bx}} = -\frac{2(2a-bx)}{3b^2}\sqrt{a+bx}.$$

103. $$\int\frac{x^2\,dx}{\sqrt{a+bx}} = \frac{2(8a^2-4abx+3b^2x^2)}{15b^3}\sqrt{a+bx}.$$

104. $$\int\frac{x^m\,dx}{\sqrt{a+bx}} = \frac{2x^m\sqrt{a+bx}}{(2m+1)b} - \frac{2ma}{(2m+1)b}\int\frac{x^{m-1}\,dx}{\sqrt{a+bx}}.$$

105. $$\int\frac{dx}{x\sqrt{a+bx}} = \frac{1}{\sqrt{a}}\log\left(\frac{\sqrt{a+bx}-\sqrt{a}}{\sqrt{a+bx}+\sqrt{a}}\right).$$

106. $$\int\frac{dx}{x\sqrt{a+bx}} = \frac{-2}{\sqrt{a}}\tanh^{-1}\sqrt{\frac{a+bx}{a}}.$$

107. $\int \frac{dx}{x^2\sqrt{a+bx}} = -\frac{\sqrt{a+bx}}{ax} - \frac{b}{2a}\int \frac{dx}{x\sqrt{a+bx}}.$

108. $\int \frac{dx}{x^n\sqrt{a+bx}} = -\frac{\sqrt{a+bx}}{(n-1)ax^{n-1}} - \frac{(2n-3)b}{(2n-2)a}$

$$\int \frac{dx}{x^{n-1}\sqrt{a+bx}}.$$

109. $\int (a+bx)^{\pm n/2}dx = \frac{2(a+bx)^{\frac{2\pm n}{2}}}{b(2\pm n)}.$

110. $\int x(a+bx)^{\pm n/2}dx = \frac{2}{b^2}\left[\frac{(a+bx)^{\frac{4\pm n}{2}}}{4\pm n} - \frac{a(a+bx)^{\frac{2\pm n}{2}}}{2\pm n}\right].$

111. $\int \frac{dx}{x(a+bx)^{m/2}} = \frac{1}{a}\int \frac{dx}{x(a+bx)^{\frac{m-2}{2}}} - \frac{b}{a}\int \frac{dx}{(a+bx)^{m/2}}.$

112. $\int \frac{(a+bx)^{n/2}dx}{x} = b\int (a+bx)^{\frac{n-2}{2}}dx + a$

$$\int \frac{(a+bx)^{\frac{n-2}{2}}}{x}dx.$$

Forms Containing $\sqrt{x^2 \pm a^2}$

113. $\int \sqrt{x^2 \pm a^2}\,dx = \frac{1}{2}[x\sqrt{x^2 \pm a^2} \pm a^2 \log$

$$(x + \sqrt{x^2 \pm a^2})].$$

114. $\int \frac{dx}{\sqrt{x^2 \pm a^2}} = \log(x + \sqrt{x^2 \pm a^2}).$

115. $\int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a}\cos^{-1}\left(\frac{a}{x}\right)$, or $\frac{1}{a}\sec^{-1}\left(\frac{x}{a}\right).$

116. $\int \frac{dx}{x\sqrt{x^2 + a^2}} = -\frac{1}{a}\log\left(\frac{a + \sqrt{x^2 + a^2}}{x}\right).$

117. $\int \frac{\sqrt{x^2 + a^2}}{x}dx = \sqrt{x^2 + a^2} - a\log\left(\frac{a + \sqrt{x^2 + a^2}}{x}\right).$

118. $\int \frac{\sqrt{x^2 - a^2}}{x}dx = \sqrt{x^2 - a^2} - a\cos^{-1}\frac{a}{x}.$

119. $\int \frac{x\,dx}{\sqrt{x^2 \pm a^2}} = \sqrt{x^2 \pm a^2}.$

120. $\int x\sqrt{x^2 \pm a^2}dx = \frac{1}{3}\sqrt{(x^2 \pm a^2)^3}.$

121. $\int \sqrt{(x^2 \pm a^2)^3}\,dx = \frac{1}{4}\left[x\sqrt{(x^2 \pm a^2)^3} \pm \frac{3a^2x}{2}\sqrt{x^2 \pm a^2} + \frac{3a^4}{2}\log\left(x + \sqrt{x^2 \pm a^2}\right)\right].$

122. $\int \frac{dx}{\sqrt{(x^2 \pm a^2)^3}} = \frac{\pm x}{a^2\sqrt{x^2 \pm a^2}}.$

123. $\int \frac{x\,dx}{\sqrt{(x^2 \pm a^2)^3}} = \frac{-1}{\sqrt{x^2 \pm a^2}}.$

124. $\int x\sqrt{(x^2 \pm a^2)^3}\,dx = \frac{1}{5}\sqrt{(x^2 \pm a^2)^5}.$

125. $\int x^2\sqrt{x^2 \pm a^2}\,dx = \frac{x}{4}\sqrt{(x^2 \pm a^2)^3} \mp \frac{a^2}{8}x\sqrt{x^2 \pm a^2} - \frac{a^4}{8}\log\left(x + \sqrt{x^2 \pm a^2}\right).$

126. $\int \frac{x^2\,dx}{\sqrt{x^2 \pm a^2}} = \frac{x}{2}\sqrt{x^2 \pm a^2} \mp \frac{a^2}{2}\log\left(x + \sqrt{x^2 \pm a^2}\right).$

127. $\int \frac{dx}{x^2\sqrt{x^2 \pm a^2}} = \mp\frac{\sqrt{x^2 \pm a^2}}{a^2x}.$

128. $\int \frac{\sqrt{x^2 \pm a^2}\,dx}{x^2} = -\frac{\sqrt{x^2 \pm a^2}}{x} + \log\left(x + \sqrt{x^2 \pm a^2}\right).$

129. $\int \frac{x^2\,dx}{\sqrt{(x^2 \pm a^2)^3}} = \frac{-x}{\sqrt{x^2 \pm a^2}} + \log\left(x + \sqrt{x^2 \pm a^2}\right).$

Forms Containing $\sqrt{a^2 - x^2}$

130. $\int \sqrt{a^2 - x^2}\,dx = \frac{1}{2}\left[x\sqrt{a^2 - x^2} + a^2\sin^{-1}\left(\frac{x}{a}\right)\right].$

131. $\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\left(\frac{x}{a}\right)$, or $-\cos^{-1}\left(\frac{x}{a}\right).$

132. $\int \frac{dx}{x\sqrt{a^2 - x^2}} = -\frac{1}{a}\log\left(\frac{a + \sqrt{a^2 - x^2}}{x}\right).$

133. $\int \frac{\sqrt{a^2 - x^2}}{x}\,dx = \sqrt{a^2 - x^2} - a\log\left(\frac{a + \sqrt{a^2 - x^2}}{x}\right).$

134. $\int \frac{x\,dx}{\sqrt{a^2 - x^2}} = -\sqrt{a^2 - x^2}.$

135. $\int x\sqrt{a^2 - x^2}\,dx = -\frac{1}{3}\sqrt{(a^2 - x^2)^3}.$

136. $\int \sqrt{(a^2 - x^2)^3}\,dx = \frac{1}{4}\left[x\sqrt{(a^2 - x^2)^3} + \frac{3a^2x}{2}\sqrt{a^2 - x^2} + \frac{3a^4}{2}\sin^{-1}\frac{x}{a}\right].$

137. $\int \frac{dx}{\sqrt{(a^2 - x^2)^3}} = \frac{x}{a^2\sqrt{a^2 - x^2}}.$

138. $\int \frac{x\,dx}{\sqrt{(a^2 - x^2)^3}} = \frac{1}{\sqrt{a^2 - x^2}}.$

139. $\int x\sqrt{(a^2 - x^2)^3}\,dx = -\tfrac{1}{5}\sqrt{(a^2 - x^2)^5}.$

140. $\int x^2\sqrt{a^2 - x^2}\,dx = -\frac{x}{4}\sqrt{(a^2 - x^2)^3} + \frac{a^2}{8}$

$$\left(x\sqrt{a^2 - x^2} + a^2 \sin^{-1}\frac{x}{a}\right).$$

141. $\int \frac{x^2\,dx}{\sqrt{a^2 - x^2}} = -\frac{x}{2}\sqrt{a^2 - x^2} + \frac{a^2}{2}\sin^{-1}\frac{x}{a}.$

142. $\int \frac{dx}{x^2\sqrt{a^2 - x^2}} = -\frac{\sqrt{a^2 - x^2}}{a^2 x}.$

143. $\int \frac{\sqrt{a^2 - x^2}}{x^2}\,dx = -\frac{\sqrt{a^2 - x^2}}{x} - \sin^{-1}\frac{x}{a}.$

144. $\int \frac{x^2\,dx}{\sqrt{(a^2 - x^2)^3}} = \frac{x}{\sqrt{a^2 - x^2}} - \sin^{-1}\frac{x}{a}.$

FORMS CONTAINING $\sqrt{a + bx + cx^2}$

$X = a + bx + cx^2$, $q = 4\,ac - b^2$, and $k = \frac{4\,c}{q}$.

145. $\int \frac{dx}{\sqrt{X}} = \frac{1}{\sqrt{c}}\log\left(\sqrt{X} + x\sqrt{c} + \frac{b}{2\sqrt{c}}\right).$

146. $\int \frac{dx}{\sqrt{X}} = \frac{1}{\sqrt{c}}\sinh^{-1}\left(\frac{2cx + b}{\sqrt{4\,ac - b^2}}\right).$ if $c > 0$.

147. $\int \frac{dx}{\sqrt{X}} = \frac{1}{\sqrt{-c}}\sin^{-1}\left(\frac{-2\,cx - b}{\sqrt{b^2 - 4\,ac}}\right),$ if $c < 0$

148. $\int \frac{dx}{X\sqrt{X}} = \frac{2\,(2\,cx + b)}{q\sqrt{X}}.$

149. $\int \frac{dx}{X^2\sqrt{X}} = \frac{2(2\,cx + b)}{3q\sqrt{X}}\left(\frac{1}{X} + 2\,k\right).$

150. $\int \frac{dx}{X^n\sqrt{X}} = \frac{2\,(2\,cx + b)\sqrt{X}}{(2\,n - 1)qX^n} + \frac{2k\,(n - 1)}{2n - 1}$

$$\int \frac{dx}{X^{n-1}\sqrt{X}}.$$

151. $\int \sqrt{X}\,dx = \frac{(2\,cx + b)\sqrt{X}}{4\,c} + \frac{1}{2\,k}\int \frac{dx}{\sqrt{X}}.$

152. $\int X\sqrt{X}\,dx = \frac{(2cx+b)\sqrt{X}}{8c}\left(X+\frac{3}{2k}\right) + \frac{3}{8k^2}\int\frac{dx}{\sqrt{X}}.$

153. $\int X^2\sqrt{X}\,dx = \frac{(2cx+b)\sqrt{X}}{12c}\left(X^2+\frac{5X}{4k}+\frac{15}{8k^2}\right) + \frac{5}{16k^3}\int\frac{dx}{\sqrt{X}}.$

154. $\int X^n\sqrt{X}\,dx = \frac{(2cx+b)X^n\sqrt{X}}{4(n+1)c} + \frac{2n+1}{2(n+1)k}\int\frac{X^n\,dx}{\sqrt{X}}.$

155. $\int\frac{x\,dx}{\sqrt{X}} = \frac{\sqrt{X}}{c} - \frac{b}{2c}\int\frac{dx}{\sqrt{X}}.$

156. $\int\frac{x\,dx}{X\sqrt{X}} = -\frac{2(bx+2a)}{q\sqrt{X}}.$

157. $\int\frac{x\,dx}{X^n\sqrt{X}} = -\frac{\sqrt{X}}{(2n-1)cX^n} - \frac{b}{2c}\int\frac{dx}{X^n\sqrt{X}}.$

158. $\int\frac{x^2\,dx}{\sqrt{X}} = \left(\frac{x}{2c}-\frac{3b}{4c^2}\right)\sqrt{X} + \frac{3b^2-4ac}{8c^2}\int\frac{dx}{\sqrt{X}}.$

159. $\int\frac{x^2\,dx}{X\sqrt{X}} = \frac{(2b^2-4ac)x+2ab}{cq\sqrt{X}} + \frac{1}{c}\int\frac{dx}{\sqrt{X}}.$

160. $\int\frac{x^2\,dx}{X^n\sqrt{X}} = \frac{(2b^2-4ac)x+2ab}{(2n-1)cqX^{n-1}\sqrt{X}} + \frac{4ac+(2n-3)b^2}{(2n-1)cq}\int\frac{dx}{X^{n-1}\sqrt{X}}.$

161. $\int\frac{x^3\,dx}{\sqrt{X}} = \left(\frac{x^2}{3c}-\frac{5bx}{12c^2}+\frac{5b^2}{8c^3}-\frac{2a}{3c^2}\right)\sqrt{X} + \left(\frac{3ab}{4c^2}-\frac{5b^3}{16c^3}\right)\int\frac{dx}{\sqrt{X}}.$

162. $\int x\sqrt{X}\,dx = \frac{X\sqrt{X}}{3c} - \frac{b}{2c}\int\sqrt{X}\,dx.$

163. $\int xX\sqrt{X}\,dx = \frac{X^2\sqrt{X}}{5c} - \frac{b}{2c}\int X\sqrt{X}\,dx.$

164. $\int\frac{xX^n\,dx}{\sqrt{X}} = \frac{X^n\sqrt{X}}{(2n+1)c} - \frac{b}{2c}\int\frac{X^n dx}{\sqrt{X}}.$

165. $\int x^2 \sqrt{X}dx = \left(x - \frac{5b}{6c}\right)\frac{X\sqrt{X}}{4c} + \frac{5b^2 - 4ac}{16c^2}\int \sqrt{X}\,dx.$

166. $\int \frac{dx}{x\sqrt{X}} = -\frac{1}{\sqrt{a}}\log\left(\frac{\sqrt{X}+\sqrt{a}}{x} + \frac{b}{2\sqrt{a}}\right),$ if $a > 0$.

167. $\int \frac{dx}{x\sqrt{X}} = \frac{1}{\sqrt{-a}}\sin^{-1}\left(\frac{bx + 2a}{x\sqrt{b^2 - 4ac}}\right),$ if $a < 0$.

168. $\int \frac{dx}{x\sqrt{X}} = -\frac{2\sqrt{X}}{bx},$ if $a = 0$.

169. $\int \frac{dx}{x^2\sqrt{X}} = -\frac{\sqrt{X}}{ax} - \frac{b}{2a}\int \frac{dx}{x\sqrt{X}}.$

170. $\int \frac{\sqrt{X}\,dx}{x} = \sqrt{X} + \frac{b}{2}\int \frac{dx}{\sqrt{X}} + a\int \frac{dx}{x\sqrt{X}}.$

171. $\int \frac{\sqrt{X}\,dx}{x^2} = -\frac{\sqrt{X}}{x} + \frac{b}{2}\int \frac{dx}{x\sqrt{X}} + c\int \frac{dx}{\sqrt{X}}.$

MISCELLANEOUS ALGEBRAIC FORMS

172. $\int \sqrt{2ax - x^2}\,dx = \frac{1}{2}\left[(x - a)\sqrt{2ax - x^2} + a^2\sin^{-1}(x - a)/a\right].$

173. $\int \sqrt{ax^2 + c}\,dx = \frac{x}{2}\sqrt{ax^2 + c} + \frac{c}{2\sqrt{a}}\log\left(x\sqrt{a} + \sqrt{ax^2 + c}\right),\quad [a > 0].$

$= \frac{x}{2}\sqrt{ax^2 + c} + \frac{c}{2\sqrt{-a}}\sin^{-1}\left(x\sqrt{\frac{-a}{c}}\right),\quad [a < 0]$

174. $\int \frac{dx}{\sqrt{2ax - x^2}} = \cos^{-1}\left(\frac{a - x}{a}\right).$

175. $\int \frac{dx}{\sqrt{a + bx}\cdot\sqrt{a' + b'x}} = \frac{2}{\sqrt{-bb'}}\tan^{-1}\sqrt{\frac{-b'(a + bx)}{b(a' + b'x)}}.$

176. $\int \sqrt{\frac{1 + x}{1 - x}}\,dx = \sin^{-1}x - \sqrt{1 - x^2}.$

177. $\int \frac{dx}{\sqrt{a \pm 2bx + cx^2}} = \frac{1}{\sqrt{c}}\log\left(\pm b + cx + \sqrt{c}\sqrt{a \pm 2bx + cx^2}\right).$

178. $\int \frac{dx}{\sqrt{a \pm 2bx - cx^2}} = \frac{1}{\sqrt{c}} \sin^{-1} \frac{cx \mp b}{\sqrt{b^2 + ac}}.$

179. $\int \frac{xdx}{\sqrt{a \pm 2bx + cx^2}} = \frac{1}{c} \sqrt{a \pm 2bx + cx^2} - \frac{b}{\sqrt{c^3}} \log (\pm b + cx + \sqrt{c}\sqrt{a \pm 2bx + cx^2}).$

180. $\int \frac{xdx}{\sqrt{a \pm 2bx - cx^2}} = -\frac{1}{c} \sqrt{a \pm 2bx - cx^2} \pm \frac{b}{\sqrt{c^3}} \sin^{-1} \frac{cx \mp b}{\sqrt{b^2 + ac}}.$

Trigonometric Forms

181. $\int \sin x \, dx = -\cos x$, or versin x.
182. $\int \cos x \, dx = \sin x$, or $-$ coversin x.
183. $\int \tan x \, dx = -\log \cos x$, or $\log \sec x$.
184. $\int \cot x \, dx = \log \sin x$.
185. $\int \sec x \, dx = \log \tan \left(\frac{\pi}{4} + \frac{x}{2}\right).$
186. $\int \csc x \, dx = \log \tan \frac{1}{2} x.$
187. $\int \sin^2 x \, dx = -\frac{1}{2} \cos x \sin x + \frac{1}{2} x = \frac{1}{2} x - \frac{1}{4} \sin 2x.$
188. $\int \sin^3 x \, dx = -\frac{1}{3} \cos x (\sin^2 x + 2).$
189. $\int \sin^n x \, dx = -\frac{\sin^{n-1} x \cos x}{n} + \frac{n-1}{n} \int \sin^{n-2} x \, dx.$
190. $\int \cos^2 x \, dx = \frac{1}{2} \sin x \cos x + \frac{1}{2} x = \frac{1}{2} x + \frac{1}{4} \sin 2x.$
191. $\int \cos^3 x \, dx = \frac{1}{3} \sin x (\cos^2 x + 2).$
192. $\int \cos^n x \, dx = \frac{1}{n} \cos^{n-1} x \sin x + \frac{n-1}{n} \int \cos^{n-2} x \, dx.$
193. $\int \sin \frac{x}{a} \, dx = -a \cos \frac{x}{a}.$
194. $\int \cos \frac{x}{a} \, dx = a \sin \frac{x}{a}.$
195. $\int \sin (a + bx) \, dx = -\frac{1}{b} \cos (a + bx).$
196. $\int \cos (a + bx) \, dx = \frac{1}{b} \sin (a + bx).$
197. $\int \frac{dx}{\sin x} = -\frac{1}{2} \log \frac{1 + \cos x}{1 - \cos x} = \log \tan \frac{x}{2}.$
198. $\int \frac{dx}{\cos x} = \log \tan \left(\frac{\pi}{4} + \frac{x}{2}\right) = \frac{1}{2} \log \left(\frac{1 + \sin x}{1 - \sin x}\right).$
199. $\int \frac{dx}{\cos^2 x} = \tan x.$

200. $\int \frac{dx}{\cos^n x} = \frac{1}{n-1} \cdot \frac{\sin x}{\cos^{n-1} x} + \frac{n-2}{n-1} \int \frac{dx}{\cos^{n-2} x}.$

201. $\int \frac{dx}{1 \pm \sin x} = \mp \tan \left(\frac{\pi}{4} \mp \frac{x}{2}\right).$

202. $\int \frac{dx}{1 + \cos x} = \tan \frac{x}{2}.$

203. $\int \frac{dx}{1 - \cos x} = -\cot \frac{x}{2}.$

204. $\int \frac{dx}{a + b \sin x} = \frac{2}{\sqrt{a^2 - b^2}} \tan^{-1} \frac{a \tan \frac{1}{2} x + b}{\sqrt{a^2 - b^2}},$

$$= \frac{1}{\sqrt{b^2 - a^2}} \log \frac{a \tan \frac{1}{2} x + b - \sqrt{b^2 - a^2}}{a \tan \frac{1}{2} x + b + \sqrt{b^2 - a^2}}.$$

205. $\int \frac{dx}{a + b \cos x} = \frac{2}{\sqrt{a^2 - b^2}} \tan^{-1} \frac{\sqrt{a^2 - b^2} \tan \frac{1}{2} x}{a + b},$

$$= \frac{1}{\sqrt{b^2 - a^2}} \log \left(\frac{\sqrt{b^2 - a^2} \tan \frac{1}{2} x + a + b}{\sqrt{b^2 - a^2} \tan \frac{1}{2} x - a - b}\right).$$

206. $\int \sin mx \sin nx \, dx = \frac{\sin (m - n) x}{2(m - n)} - \frac{\sin (m + n) x}{2(m + n)},$ $[m^2 \neq n^2].$

207. $\int x \sin^2 x \, dx = \frac{x^2}{4} - \frac{x \sin 2x}{4} - \frac{\cos 2x}{8}.$

208. $\int x^2 \sin^2 x \, dx = \frac{x^3}{6} - \left(\frac{x^2}{4} - \frac{1}{8}\right) \sin 2x - \frac{x \cos 2x}{4}.$

209. $\int x \sin^3 x \, dx = \frac{x \cos 3x}{12} - \frac{\sin 3x}{36} - \frac{3}{4} x \cos x + \frac{3}{4} \sin x.$

210. $\int \sin^4 x \, dx = \frac{3x}{8} - \frac{\sin 2x}{4} + \frac{\sin 4x}{32}.$

211. $\int \cos mx \cos nx \, dx = \frac{\sin (m - n)x}{2(m - n)} + \frac{\sin (m + n)x}{2(m + n)},$ $[m^2 \neq n^2].$

212. $\int x \cos^2 x \, dx = \frac{x^2}{4} + \frac{x \sin 2x}{4} + \frac{\cos 2x}{8}.$

213. $\int x^2 \cos^2 x \, dx = \frac{x^3}{6} + \left(\frac{x^2}{4} - \frac{1}{8}\right) \sin 2x + \frac{x \cos 2x}{4}.$

214. $\int x \cos^3 x \, dx = \frac{x \sin 3x}{12} + \frac{\cos 3x}{36} + \frac{3}{4} x \sin x + \frac{3}{4} \cos x.$

215. $\int \cos^4 x \, dx = \frac{3x}{8} + \frac{\sin 2x}{4} + \frac{\sin 4x}{32}.$

216. $\int \frac{\sin x\,dx}{x^m} = -\frac{\sin x}{(m-1)\,x^{m-1}} + \frac{1}{m-1}\int \frac{\cos x\,dx}{x^{m-1}}.$

217. $\int \frac{\cos x\,dx}{x^m} = -\frac{\cos x}{(m-1)x^{m-1}} - \frac{1}{m-1}\int \frac{\sin x\,dx}{x^{m-1}}.$

218. $\int \tan^3 x\,dx = \frac{1}{2}\tan^2 x + \log\cos x.$

219. $\int \tan^4 x\,dx = \frac{1}{3}\tan^3 x - \tan x + x.$

220. $\int \cot^3 x\,dx = -\frac{1}{2}\cot^2 x - \log\sin x.$

221. $\int \cot^4 x\,dx = -\frac{1}{3}\cot^3 x + \cot x + x.$

222. $\int \cot^n x\,dx = -\frac{\cot^{n-1} x}{n-1} - \int \cot^{n-2} x\,dx,\ [n \neq 1].$

223. $\int \sin x\cos x\,dx = \frac{1}{2}\sin^2 x$

224. $\int \sin mx\cos nx\,dx = -\frac{\cos(m-n)x}{2(m-n)} - \frac{\cos(m+n)x}{2(m+n)}.$

225. $\int \sin^2 x\cos^2 x\,dx = -\frac{1}{8}(\frac{1}{4}\sin 4x - x).$

226. $\int \sin x\cos^m x\,dx = -\frac{\cos^{m+1}x}{m+1}.$

227. $\int \sin^m x\cos x\,dx = \frac{\sin^{m+1}x}{m+1}.$

228. $\int \cos^m x\sin^n x\,dx = \frac{\cos^{m-1}x\sin^{n+1}x}{m+n} + \frac{m-1}{m+n}\int \cos^{m-2}x\sin^n x\,dx.$

229. $\int \cos^m x\sin^n x\,dx = -\frac{\sin^{n-1}x\cos^{m+1}x}{m+n} + \frac{n-1}{m+n}\int \cos^m x\sin^{n-2}x\,dx.$

230. $\int \frac{\cos^m x\,dx}{\sin^n x} = -\frac{\cos^{m+1}x}{(n-1)\sin^{n-1}x} - \frac{m-n+2}{n-1}\int \frac{\cos^m x\,dx}{\sin^{n-2}x}.$

231. $\int \frac{\cos^m x\,dx}{\sin^n x} = \frac{\cos^{m-1}x}{(m-n)\sin^{n-1}x} + \frac{m-1}{m-n}\int \frac{\cos^{m-2}x\,dx}{\sin^n x}.$

232. $\int \frac{\sin^m x\,dx}{\cos^n x} = -\int \frac{\cos^m\left(\frac{\pi}{2}-x\right)d\left(\frac{\pi}{2}-x\right)}{\sin^n\left(\frac{\pi}{2}-x\right)}.$

233. $\int \frac{\sin x\,dx}{\cos^2 x} = \frac{1}{\cos x} = \sec x.$

234. $\int \frac{\sin^2 x\,dx}{\cos x} = -\sin x + \log\tan\left(\frac{\pi}{4} + \frac{x}{2}\right).$

235. $\int \frac{\cos x\,dx}{\sin^2 x} = \frac{-1}{\sin x} = -\operatorname{cosec} x$

236. $\int \frac{dx}{\sin x \cos x} = \log\tan x$

237. $\int \frac{dx}{\sin x \cos^2 x} = \frac{1}{\cos x} + \log\tan\frac{x}{2}$

238. $\int \frac{dx}{\sin x \cos^n x} = \frac{1}{(n-1)\cos^{n-1} x} + \int \frac{dx}{\sin x \cos^{n-2} x}.$ $[n \neq 1].$

239. $\int \frac{dx}{\sin^2 x \cos x} = -\frac{1}{\sin x} + \log\tan\left(\frac{\pi}{4} + \frac{x}{2}\right).$

240. $\int \frac{dx}{\sin^2 x \cos^2 x} = -2\cot 2x.$

241. $\int \frac{dx}{\sin^m x \cos^n x} = -\frac{1}{m-1} \cdot \frac{1}{\sin^{m-1} x \cdot \cos^{n-1} x} + \frac{m+n-2}{m-1} \int \frac{dx}{\sin^{m-2} x \cdot \cos^n x}.$

242. $\int \frac{dx}{\sin^m x} = -\frac{1}{m-1} \cdot \frac{\cos x}{\sin^{m-1} x} + \frac{m-2}{m-1} \int \frac{dx}{\sin^{m-2} x}.$

243. $\int \frac{dx}{\sin^2 x} = -\cot x.$

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244. $\int \tan^2 x\,dx = \tan x - x.$

245. $\int \tan^n x\,dx = \frac{\tan^{n-1} x}{n-1} - \int \tan^{n-2} x\,dx.$

246. $\int \cot^2 x\,dx = -\cot x - x.$

247. $\int \cot^n x\,dx = -\frac{\cot^{n-1} x}{n-1} - \int \cot^{n-2} x\,dx.$

248. $\int \sec^2 x\,dx = \tan x.$

249. $\int \sec^n x\,dx = \int \frac{dx}{\cos^n x}.$

250. $\int \csc^2 x\,dx = -\cot x.$

251. $\int \csc^n x\,dx = \int \frac{dx}{\sin^n x}.$

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252. $\int x \sin x\,dx = \sin x - x\cos x.$

253. $\int x^2 \sin x\,dx = 2x\sin x - (x^2 - 2)\cos x.$

254. $\int x^3 \sin x\,dx = (3x^2 - 6)\sin x - (x^3 - 6x)\cos x.$

255. $\int x^m \sin x\,dx = -x^m \cos x + m \int x^{m-1} \cos x\,dx.$

256. $\int x \cos x\, dx = \cos x + x \sin x.$

257. $\int x^2 \cos x\, dx = 2x \cos x + (x^2 - 2) \sin x.$

258. $\int x^3 \cos x\, dx = (3x^2 - 6) \cos x + (x^3 - 6x) \sin x.$

259. $\int x^m \cos x\, dx = x^m \sin x - m \int x^{m-1} \sin x\, dx.$

260. $\int \frac{\sin x}{x}\, dx = x - \frac{x^3}{3 \cdot 3!} + \frac{x^5}{5 \cdot 5!} - \frac{x^7}{7 \cdot 7!} + \frac{x^9}{9 \cdot 9!} \cdots$

261. $\int \frac{\cos x}{x}\, dx = \log x - \frac{x^2}{2 \cdot 2!} + \frac{x^4}{4 \cdot 4!} - \frac{x^6}{6 \cdot 6!} + \frac{x^8}{8 \cdot 8!} \cdots$

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262. $\int \sin^{-1} x\, dx = x \sin^{-1} x + \sqrt{1 - x^2}.$

263. $\int \cos^{-1} x\, dx = x \cos^{-1} x - \sqrt{1 - x^2}.$

264. $\int \tan^{-1} x\, dx = x \tan^{-1} x - \frac{1}{2} \log (1 + x^2).$

265. $\int \cot^{-1} x\, dx = x \cot^{-1} x + \frac{1}{2} \log (1 + x^2).$

266. $\int \sec^{-1} x\, dx = x \sec^{-1} x - \log (x + \sqrt{x^2 - 1}).$

267. $\int \csc^{-1} x\, dx = x \csc^{-1} x + \log (x + \sqrt{x^2 - 1}).$

268. $\int \operatorname{vers}^{-1} x\, dx = (x - 1) \operatorname{vers}^{-1} x + \sqrt{2x - x^2}.$

269. $\int \sin^{-1} \frac{x}{a}\, dx = x \sin^{-1} \frac{x}{a} + \sqrt{a^2 - x^2}.$

270. $\int \cos^{-1} \frac{x}{a}\, dx = x \cos^{-1} \frac{x}{a} - \sqrt{a^2 - x^2}.$

271. $\int \tan^{-1} \frac{x}{a}\, dx = x \tan^{-1} \frac{x}{a} - \frac{a}{2} \log (a^2 + x^2).$

272. $\int \cot^{-1} \frac{x}{a}\, dx = x \cot^{-1} \frac{x}{a} + \frac{a}{2} \log (a^2 + x^2).$

273. $\int (\sin^{-1} x)^2\, dx = x(\sin^{-1} x)^2 - 2x + 2\sqrt{1 - x^2}\,(\sin^{-1} x).$

274. $\int (\cos^{-1} x)^2\, dx = x(\cos^{-1} x)^2 - 2x - 2\sqrt{1 - x^2}\,(\cos^{-1} x).$

275. $\int x \cdot \sin^{-1} x\, dx = \frac{1}{4} [(2x^2 - 1) \sin^{-1} x + x \sqrt{1 - x^2}].$

276. $\int x^n \sin^{-1} x\, dx = \frac{x^{n+1} \sin^{-1} x}{n + 1} - \frac{1}{n + 1} \int \frac{x^{n+1}\, dx}{\sqrt{1 - x^2}}.$

277. $\int x^n \cos^{-1} x\, dx = \frac{x^{n+1} \cos^{-1} x}{n + 1} + \frac{1}{n + 1} \int \frac{x^{n+1}\, dx}{\sqrt{1 - x^2}}.$

278. $\int x^n \tan^{-1} x\, dx = \frac{x^{n+1} \tan^{-1} x}{n + 1} - \frac{1}{n + 1} \int \frac{x^{n+1}\, dx}{1 + x^2}.$

279. $\int \frac{\sin^{-1} x\, dx}{x^2} = \log \left(\frac{1 - \sqrt{1 - x^2}}{x} \right) - \frac{\sin^{-1} x}{x}.$

280. $\int \frac{\tan^{-1} x\, dx}{x^2} = \log x - \frac{1}{2} \log (1 + x^2) - \frac{\tan^{-1} x}{x}.$

INTEGRALS (Continued)

Logarithmic Forms

281. $\int \log x\, dx = x \log x - x.$

282. $\int x \log x\, dx = \frac{x^2}{2} \log x - \frac{x^2}{4}.$

283. $\int x^2 \log x\, dx = \frac{x^3}{3} \log x - \frac{x^3}{9}.$

284. $\int x^p \log (ax)\, dx = \frac{x^{p+1}}{p+1} \log (ax) - \frac{x^{p+1}}{(p+1)^2}\ [p \neq -1].$

285. $\int (\log x)^2\, dx = x (\log x)^2 - 2x \log x + 2x.$

286. $\int (\log x)^n\, dx = x (\log x)^n - n \int (\log x)^{n-1}\, dx,$
$[n \neq -1].$

287. $\int \frac{(\log x)^n}{x}\, dx = \frac{1}{n+1} (\log x)^{n+1}.$

288. $\int \frac{dx}{\log x} = \log (\log x) + \log x + \frac{(\log x)^2}{2 \cdot 2!} + \frac{(\log x)^3}{3 \cdot 3!} + \cdots$

289. $\int \frac{dx}{x \log x} = \log (\log x)$

290. $\int \frac{dx}{x (\log x)^n} = - \frac{1}{(n-1)(\log x)^{n-1}}.$

291. $\int \frac{x^m\, dx}{(\log x)^n} = - \frac{x^{m+1}}{(n-1)(\log x)^{n-1}} + \frac{m+1}{n-1} \int \frac{x^m\, dx}{(\log x)^{n-1}}$

292. $\int x^m \log x\, dx = x^{m+1} \left[\frac{\log x}{m+1} - \frac{1}{(m+1)^2} \right]$

293. $\int x^m (\log x)^n\, dx = \frac{x^{m+1} (\log x)^n}{m+1} - \frac{n}{m+1} \int x^m (\log x)^{n-1}$
$dx,\ [m, n \neq -1].$

294 $\int \sin \log x\, dx = \frac{1}{2}x \sin \log x - \frac{1}{2}x \cos \log x.$

295. $\int \cos \log x\, dx = \frac{1}{2}x \sin \log x + \frac{1}{2}x \cos \log x.$

Exponential Forms

296. $\int e^x\, dx = e^x.$

297. $\int e^{-x}\, dx = -e^{-x}.$

298. $\int e^{ax}\, dx = \frac{e^{ax}}{a}.$

299. $\int x\, e^{ax}\, dx = \frac{e^{ax}}{a^2} (ax - 1).$

300. $\int x^m e^{ax}\, dx = \frac{x^m e^{ax}}{a} - \frac{m}{a} \int x^{m-1} e^{ax}\, dx.$

301. $\int \frac{e^{ax}\, dx}{x} = \log x + \frac{ax}{1!} + \frac{a^2x^2}{2 \cdot 2!} + \frac{a^3x^3}{3 \cdot 3!} + \cdots$

302. $\int \frac{e^{ax}}{x^m}\, dx = - \frac{1}{m-1} \frac{e^{ax}}{x^{m-1}} + \frac{a}{m-1} \int \frac{e^{ax}}{x^{m-1}}\, dx.$

303. $\int e^{ax} \log x\,dx = \frac{e^{ax}\log x}{a} - \frac{1}{a}\int \frac{e^{ax}}{x}\,dx.$

304. $\int e^{ax} \cdot \sin px\,dx = \frac{e^{ax}\,(a \sin px - p \cos px)}{a^2 + p^2}.$

305. $\int e^{ax} \cdot \cos px\,dx = \frac{e^{ax}\,(a \cos px + p \sin px)}{a^2 + p^2}.$

306. $\int \frac{dx}{1 + e^x} = x - \log\,(1 + e^x) = \log \frac{e^x}{1 + e^x}.$

307. $\int \frac{dx}{a + be^{px}} = \frac{x}{a} - \frac{1}{ap}\log\,(a + be^{px}).$

308. $\int \frac{dx}{ae^{mx} + be^{-mx}} = \frac{1}{m\sqrt{ab}}\tan^{-1}\left(e^{mx}\sqrt{\frac{a}{b}}\right).$

310. $\int e^{ax} \cos px\,dx = \frac{e^{ax}\,(a \cos px + p \sin px)}{a^2 + p^2}.$

311. $\int e^{ax} \sin^n bx\,dx = \frac{1}{a^2 + n^2b^2}\Big((a \sin bx - nb \cos bx)$

$e^{ax} \sin^{n-1} bx + n\,(n - 1)b^2 \int e^{ax} \sin^{n-2} bx \cdot dx\Big).$

312. $\int e^{ax} \cos^n bx\,dx = \frac{1}{a^2 + n^2b^2}\Big((a \cos bx + nb \sin bx)$

$e^{ax} \cos^{n-1} bx + n\,(n - 1)b^2 \int e^{ax} \cos^{n-2} bx\,dx\Big).$

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313. $\int \sinh x\,dx = \cosh x.$
314. $\int \cosh x\,dx = \sinh x.$
315. $\int \tanh x\,dx = \log \cosh x.$
316. $\int \coth x\,dx = \log \sinh x.$
317. $\int \operatorname{sech} x\,dx = 2 \tan^{-1}\,(e^x).$

318. $\int \operatorname{csch} x\,dx = \log \tanh \left(\frac{x}{2}\right).$

319. $\int x \sinh x\,dx = x \cosh x - \sinh x.$
320. $\int x \cosh x\,dx = x \sinh x - \cosh x.$
321. $\int \operatorname{sech} x \tanh x\,dx = -\operatorname{sech} x.$
322. $\int \operatorname{csch} x \coth x\,dx = -\operatorname{csch} x.$

DEFINITE INTEGRALS

323. $\int_0^\infty x^{n-1}\,e^{-x}\,dx = \int_0^1 \left(\log \frac{1}{x}\right)^{n-1} dx = \Gamma\,(n).$

324. $\Gamma\,(n)$, the gamma function is finite if $n > 0$.

325. $\Gamma\,(n + 1) = n\Gamma\,(n).$

326. $\Gamma(n) \cdot \Gamma(1-n) = \dfrac{\pi}{\sin n\pi}$.

327. $\Gamma(n) = (n-1)!$ if $n =$ integer > 0.

328. $\Gamma(\frac{1}{2}) = \sqrt{\pi}$.

(See values of $\Gamma(n)$ at end of integral table.)

329. $$\int_0^1 x^{m-1}(1-x)^{n-1}\,dx = \int_0^\infty \frac{x^{m-1}\,dx}{(1+x)^{m+n}} = \frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}.$$

330. $$\int_1^\infty \frac{dx}{x^m} = \frac{1}{m-1}, \qquad [m > 1].$$

331. $$\int_0^\infty \frac{dx}{(1+x)x^p} = \pi \csc p\pi, \qquad [p < 1].$$

332. $$\int_0^\infty \frac{dx}{(1-x)x^p} = -\pi \cot p\pi, \qquad [p < 1].$$

333. $$\int_0^\infty \frac{x^{p-1}\,dx}{1+x} = \frac{\pi}{\sin p\pi}, \qquad [0 < p < 1].$$

334. $$\int_0^\infty \frac{x^{m-1}\,dx}{1+x^n} = \frac{\pi}{n \sin \dfrac{m\pi}{n}}, \qquad [0 < m < n].$$

335. $$\int_0^\infty \frac{dx}{(1+x)\sqrt{x}} = \pi.$$

336. $$\int_0^\infty \frac{a\,dx}{a^2+x^2} = \frac{\pi}{2}, \text{ if } a > 0;\ 0, \text{ if } a = 0;\ -\frac{\pi}{2}, \text{ if } a < 0.$$

337. $$\int_0^{\pi/2} \sin^n x\,dx = \int_0^{\pi/2} \cos^n x\,dx$$
$$= \frac{1 \cdot 3 \cdot 5 \cdots (n-1)}{2 \cdot 4 \cdot 6 \cdots (n)} \cdot \frac{\pi}{2}, \qquad [n \text{ an even integer}],$$
$$= \frac{2 \cdot 4 \cdot 6 \cdots (n-1)}{1 \cdot 3 \cdot 5 \cdot 7 \cdots n}, \qquad [n \text{ an odd integer}],$$
$$= \frac{1}{2}\sqrt{\pi}\,\frac{\Gamma\left(\dfrac{n+1}{2}\right)}{\Gamma\left(\dfrac{n}{2}+1\right)}, \qquad [n > -1].$$

338. $$\int_0^\infty \frac{\sin mx\,dx}{x} = \frac{\pi}{2}, \text{ if } m > 0;\ 0, \text{ if } m = 0;\ -\frac{\pi}{2}, \text{ if } m < 0.$$

339. $$\int_0^\infty \frac{\cos x\,dx}{x} = \infty.$$

340. $$\int_0^\infty \frac{\tan x\,dx}{x} = \frac{\pi}{2}.$$

341. $\int_0^\pi \sin kx \cdot \sin mx\, dx = \int_0^\pi \cos kx \cdot \cos mx\, dx = 0,$

$[k \neq m;\ m, n = \text{integers}].$

342. $\int_0^\infty \frac{\sin x \cos mx\, dx}{x} = 0,\ m < -1 \text{ or } m > 1,$

$= \frac{\pi}{4}, \text{ if } m = \pm 1;\ = \frac{\pi}{2}, \text{ if } m^2 < 1.$

343. $\int_0^\pi \sin^2 mx\, dx = \int_0^\pi \cos^2 mx\, dx = \frac{\pi}{2}.$

344. $\int_0^\infty \frac{\sin^2 x\, dx}{x^2} = \frac{\pi}{2}.$

345. $\int_0^\infty \frac{\cos mx}{1 + x^2}\, dx = \frac{\pi}{2} e^{-m},$ $[m > 0],$

$= \frac{\pi}{2} e^{m},$ $[m < 0].$

346. $\int_0^\infty \cos (x^2)\, dx = \int_0^\infty \sin (x^2)\, dx = \frac{1}{2}\sqrt{\frac{\pi}{2}}.$

347. $\int_0^\infty \frac{\sin x\, dx}{\sqrt{x}} = \int_0^\infty \frac{\cos x\, dx}{\sqrt{x}} = \sqrt{\frac{\pi}{2}}.$

348. $\int_0^{\pi/2} \frac{dx}{1 + a \cos x} = \frac{\cos^{-1} a}{\sqrt{1 - a^2}},$ $[a < 1].$

349. $\int_0^{2\pi} \frac{dx}{1 + a \cos x} = \frac{2\pi}{\sqrt{1 - a^2}},$ $[a^2 < 1].$

350. $\int_0^\infty e^{-ax}\, dx = \frac{1}{a}.$

351. $\int_0^\infty x^n e^{-ax}\, dx = \frac{\Gamma(n + 1)}{a^{n+1}},$ $[n > -1, a > 0],$

$= \frac{n!}{a^{n+1}},$ $[n \text{ pos. integ.}, a > 0].$

352. $\int_0^\infty e^{-a^2x^2}\, dx = \frac{1}{2a}\sqrt{\pi} = \frac{1}{2a}\Gamma\left(\frac{1}{2}\right),$ $[a > 0].$

353. $\int_0^\infty xe^{-x^2}\, dx = \frac{1}{2}.$

354. $\int_0^\infty x^2 e^{-x^2}\, dx = \frac{\sqrt{\pi}}{4}.$

355. $\int_0^\infty x^{2n} e^{-ax^2}\, dx = \frac{1 \cdot 3 \cdot 5 \cdots (2n - 1)}{2^{n+1} a^n}\sqrt{\frac{\pi}{a}}.$

356. $\int_0^\infty e^{(-x^2 - a^2/x^2)}\, dx = \frac{e^{-2a}\sqrt{\pi}}{2}.$

357. $\int_0^\infty e^{-nx}\sqrt{x}\,dx = \frac{1}{2n}\sqrt{\frac{\pi}{n}}.$

358. $\int_0^\infty \frac{e^{-nx}}{\sqrt{x}}\,dx = \sqrt{\frac{\pi}{n}}.$

359. $\int_0^\infty e^{-ax}\cos mx\,dx = \frac{a}{a^2+m^2},$ $[a > 0].$

360. $\int_0^\infty e^{-ax}\sin mx\,dx = \frac{m}{a^2+m^2},$ $[a > 0].$

361. $\int_0^\infty e^{-a^2x^2}\cos bx\,dx = \frac{\sqrt{\pi}\cdot e^{-b^2/4a^2}}{2a},$ $[a > 0].$

362. $\int_0^1 (\log x)^n\,dx = (-1)^n\cdot n!.$

363. $\int_0^1 \left(\log\frac{1}{x}\right)^{\frac{1}{2}} dx = \frac{\sqrt{\pi}}{2}.$

364. $\int_0^1 \left(\log\frac{1}{x}\right)^{-\frac{1}{2}} dx = \sqrt{\pi}.$

365. $\int_0^1 \left(\log\frac{1}{x}\right)^{n} dx = n!.$

366. $\int_0^1 x\log(1-x)\,dx = -\frac{3}{4}.$

367. $\int_0^1 x\log(1+x)\,dx = \frac{1}{4}.$

368. $\int_0^1 \frac{\log x}{1+x}\,dx = -\frac{\pi^2}{12}.$

369. $\int_0^1 \frac{\log x}{1-x}\,dx = -\frac{\pi^2}{6}.$

370. $\int_0^1 \frac{\log x}{1-x^2}\,dx = -\frac{\pi^2}{8}.$

371. $\int_0^1 \log\left(\frac{1+x}{1-x}\right)\cdot\frac{dx}{x} = \frac{\pi^2}{4}.$

372. $\int_0^1 \frac{\log x\,dx}{\sqrt{1-x^2}} = -\frac{\pi}{2}\log 2.$

373. $\int_0^1 x^m\log\left(\frac{1}{x}\right)^n dx = \frac{\Gamma(n+1)}{(m+1)^{n+1}},$ if $m+1>0,$
$n+1>0.$

374. $\int_0^1 \frac{(x^p-x^q)dx}{\log x} = \log\left(\frac{p+1}{q+1}\right),$ $[p+1>0, q+1>0].$

375. $\int_0^1 \frac{dx}{\sqrt{\log\left(\frac{1}{x}\right)}} = \sqrt{\pi}.$

DEFINITE INTEGRALS (Continued)

376. $\int_0^\infty \log\left(\frac{e^x+1}{e^x-1}\right) dx = \frac{\pi^2}{4}.$

377. $\int_0^\pi x \cdot \log \sin x \, dx = -\frac{\pi^2}{2} \log 2.$

378. $\int_0^{\pi/2} \log \sin x \, dx = \int_0^{\pi/2} \log \cos x \, dx = -\frac{\pi}{2} \cdot \log 2.$

379. $\int_0^{\pi/2} \sin x \log \sin x \, dx = \log 2 - 1.$

380. $\int_0^{\pi/2} \log \tan x \, dx = 0.$

381. $\int_0^\pi \log(a \pm b \cos x) \, dx = \pi \log\left(\frac{a+\sqrt{a^2-b^2}}{2}\right), [a \geqq b].$

GAMMA FUNCTION

Values of $\Gamma(n) = \int_0^\infty \epsilon^{-x} x^{n-1} dx$

n	$\Gamma(n)$	n	$\Gamma(n)$	n	$\Gamma(n)$	n	$\Gamma(n)$
1 00	1 00000	1 25	90640	1 50	88623	1 75	91906
1 01	.99433	1 26	.90440	1.51	.88659	1.76	92137
1 02	98884	1 27	.90250	1.52	.88704	1.77	92376
1 03	98355	1 28	90072	1 53	88757	1 78	92623
1.04	.97844	1 29	89904	1 54	.88818	1.79	.92877
1 05	97350	1 30	.89747	1.55	.88887	1.80	.93138
1 06	96874	1 31	89600	1 56	.88964	1 81	93408
1 07	96415	1 32	.89464	1 57	.89049	1 82	.93685
1 08	.95973	1 33	89338	1.58	.89142	1 83	.93969
1.09	.95546	1 34	.89222	1 59	.89243	1 84	.94261
1 10	.95135	1 35	89115	1.60	.89352	1 85	94561
1 11	.94739	1 36	.89018	1.61	89468	1 86	94869
1 12	.94359	1.37	88931	1 62	89592	1.87	95184
1 13	93993	1 38	88854	1.63	.89724	1.88	.95507
1 14	.93642	1 39	88785	1 64	.89864	1 89	.95838
1 15	93304	1 40	.88726	1.65	.90012	1.90	96177
1.16	.92980	1 41	.88676	1 66	90167	1.91	96523
1 17	.92670	1.42	.88636	1 67	.90330	1.92	.96878
1 18	.92373	1 43	.88604	1.68	.90500	1.93	.97240
1 19	.92088	1 44	.88580	1.69	90678	1.94	.97610
1 20	.91817	1.45	.88565	1.70	.90864	1.95	.97988
1 21	.91558	1.46	.88560	1.71	.91057	1.96	.98374
1 22	.91311	1 47	.88563	1.72	.91258	1.97	.98768
1 23	91075	1 48	.88575	1.73	.91466	1.98	99171
1.24	.90852	1.49	.88595	1.74	.91683	1 99	.99581
						2.00	1.00000

ALGEBRA

Factors and Expansions

$$(a \pm b)^2 = a^2 \pm 2ab + b^2.$$
$$(a \pm b)^3 = a^3 \pm 3a^2b + 3ab^2 \pm b^3.$$
$$(a \pm b)^4 = a^4 \pm 4a^3b + 6a^2b^2 \pm 4ab^3 + b^4.$$
$$a^2 - b^2 = (a - b)(a + b).$$
$$a^2 + b^2 = \left(a + b\sqrt{-1}\right)\left(a - b\sqrt{-1}\right).$$
$$a^3 - b^3 = (a - b)(a^2 + ab + b^2).$$
$$a^3 + b^3 = (a + b)(a^2 - ab + b^2).$$
$$a^4 + b^4 = \left(a^2 + ab\sqrt{2} + b^2\right)\left(a^2 - ab\sqrt{2} + b^2\right).$$
$$a^n - b^n = (a - b)(a^{n-1} + a^{n-2}b + \ldots . + b^{n-1}).$$
$$a^n - b^n = (a + b)(a^{n-1} - a^{n-2}b + \ldots . - b^{n-1}),$$
for even values of n.
$$a^n + b^n = (a + b)\ (a^{n-1} - a^{n-2}b + \ldots . + b^{n-1}),$$
for odd values of n.
$$a^4 + a^2b^2 + b^4 = (a^2 + ab + b^2)(a^2 - ab + b^2).$$
$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2ac + 2bc.$$
$$(a + b + c)^3 = a^3 + b^3 + c^3 + 3a^2(b + c) + 3b^2(a + c) + 3c^2(a + b) + 6abc$$
$$(a + b + c + d + \ldots)^2 = a^2 + b^2 + c^2 + d^2 + \ldots + 2a(b + c + d + \ldots) + 2b(c + d + \ldots) + 2c(d + \ldots) + \ldots$$

See also under Series

Powers and Roots

$$a^x \times a^y = a^{(x+y)}.\qquad a^0 = 1\ [\text{if } a \neq 0].\qquad (ab)^x = a^xb^x.$$

$$\frac{a^x}{a^y} = a^{(x-y)}.\qquad a^{-x} = \frac{1}{a^x}.\qquad \left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}.$$

$$(a^x)^y = a^{xy}.\qquad a^{\frac{1}{x}} = \sqrt[x]{a}.\qquad \sqrt[x]{ab} = \sqrt[x]{a}\,\sqrt[x]{b}.$$

$$\sqrt[x]{\sqrt[y]{a}} = \sqrt[xy]{a}.\qquad a^{\frac{x}{y}} = \sqrt[y]{a^x}.\qquad \sqrt[x]{\frac{a}{b}} = \frac{\sqrt[x]{a}}{\sqrt[x]{b}}.$$

Proportion

If $\dfrac{a}{b} = \dfrac{c}{d}$, then $\dfrac{a + b}{b} = \dfrac{c + d}{d}$,

$$\frac{a - b}{b} = \frac{c - d}{d},\qquad \frac{a - b}{a + b} = \frac{c - d}{c + d}.$$

SUMS OF NUMBERS

The sum of the first n numbers,—

$$\Sigma(n) = 1+2+3+4+5 \ldots . + n = \frac{n(n+1)}{2}$$

The sum of the squares of the first n numbers,

$$\Sigma(n^2) = 1^2+2^2+3^2+4^2+5^2 \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

The sum of the cubes of the first n numbers,

$$\Sigma(n^3) = 1^3+2^3+3^3+4^3+5^3 \ldots . + n^3 = \frac{n^2(n+1)^2}{4}$$

ARITHMETICAL PROGRESSION

If a is the first term; l, the last term; d, the common difference; n, the number of terms and s, the sum of n terms,—

$$l = a + (n-1)d \qquad s = \frac{n}{2}(a+l)$$

$$s = \frac{n}{2}\left\{ 2a + (n-1)d \right\}$$

GEOMETRICAL PROGRESSION

If a is the first term; l, the last term; r, the common ratio; n. the number of terms and s, the sum of n terms,—

$$l = ar^{n-1} \qquad s = a\frac{(1-r^n)}{1-r}$$

$$s = a\frac{(r^n-1)}{r-1} \qquad s = \frac{lr-a}{r-1}$$

If n is infinity and r^2 less than unity,—

$$s = \frac{a}{1-r}$$

FACTORIALS

$$\underline{|n} = n! = e^{-n}n^n\sqrt{2\pi n}, \text{ approximately.}$$

PERMUTATIONS

If M denote the number of permutations of n things taken p at a time,—

$$M = n(n-1)(n-2) \ldots . (n-p+1)$$

COMBINATIONS

If M denote the number of combinations of n things taken p at a time,—

$$M = \frac{n(n-1)(n-2) \ldots . (n-p+1)}{p!}$$

$$M = \frac{n!}{p!(n-p)!}$$

Quadratic Equations

Any quadratic equation may be reduced to the form, —

$$ax^2 + bx + c = 0$$

Then $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

If $b^2 - 4ac$ is positive the roots are real and unequal.
If $b^2 - 4ac$ is zero the roots are real and equal.
If $b^2 - 4ac$ is negative the roots are imaginary and unequal.
If $b^2 - 4ac$ is a perfect square the roots are rational and unequal.

Cubic Equations

A cubic equation, $y^3 + py^2 + qy + r = 0$ may be reduced to the form, —

$$x^3 + ax + b = 0$$

by substituting for y the value, $\left(x - \frac{p}{3}\right)$. Here

$$a = \tfrac{1}{3}(3q - p^2) \text{ and } b = \tfrac{1}{27}(2p^3 - 9pq + 27r).$$

For solution let, —

$$A = \sqrt[3]{-\frac{b}{2} + \sqrt{\frac{b^2}{4} + \frac{a^3}{27}}}, \qquad B = \sqrt[3]{-\frac{b}{2} - \sqrt{\frac{b^2}{4} + \frac{a^3}{27}}},$$

then the values of x will be given by,

$$x = A + B,\quad -\frac{A+B}{2} + \frac{A-B}{2}\sqrt{-3},\quad -\frac{A+B}{2} - \frac{A-B}{2}\sqrt{-3}$$

If $\frac{b^2}{4} + \frac{a^3}{27} > 0$, there will be one real root and two conjugate imaginary roots.

If $\frac{b^2}{4} + \frac{a^3}{27} = 0$, there will be three real roots of which two at least are equal

If $\frac{b^2}{4} + \frac{a^3}{27} < 0$, there will be three real and unequal roots.

In the last case a trigonometric solution is useful. Compute the value of the angle ϕ in the expression, —

$$\cos\phi = -\frac{b}{2} \div \sqrt{\left(-\frac{a^3}{27}\right)},$$

then x will have the following values:—

$$2\sqrt{-\frac{a}{3}}\cos\frac{\phi}{3}, \qquad 2\sqrt{-\frac{a}{3}}\cos\left(\frac{\phi}{3} + 120^\circ\right),$$

$$2\sqrt{-\frac{a}{3}}\cos\left(\frac{\phi}{3} + 240^\circ\right).$$

APPROXIMATIONS

If a and b are small quantities, the following relations are approximately true,—

$$(1 \pm a)^m = 1 \pm ma,$$

$$(1 \pm a)^m (1 \pm b)^n = 1 \pm ma \pm nb.$$

If n is nearly equal to m,

$$\sqrt{mn} = \frac{n+m}{2}, \text{ approximately.}$$

If θ is a very small angle expressed in radians,—

$$\frac{\sin \theta}{\theta} = 1 \text{ and } \frac{\tan \theta}{\theta} = 1, \text{ approximately.}$$

SERIES

The expression in parentheses following certain of the series indicates the region of convergence. If not otherwise indicated it is to be understood that the series converges for all finite values of x.

Binomial

$$(x+y)^n = x^n + nx^{n-1}y + \frac{n(n-1)}{2!} x^{n-2}y^2 + \frac{n(n-1)(n-2)}{3!} x^{(n-3)} y^3 + \dots \quad (y^2 < x^2)$$

$$(1 \pm x)^n = 1 \pm nx + \frac{n(n-1)x^2}{2!} \pm \frac{n(n-1)(n-2)x^3}{3!} + \dots \text{ etc.} \quad (x^2 < 1)$$

$$(1 \pm x)^{-n} = 1 \mp nx + \frac{n(n+1)x^2}{2!} \mp \frac{n(n+1)(n+2)x^3}{3!} + \dots \text{ etc.} \quad (x^2 < 1)$$

$$(1 \pm x)^{-1} = 1 \mp x + x^2 \mp x^3 + x^4 \mp x^5 + \dots \quad (x^2 < 1)$$

$$(1 \pm x)^{-2} = 1 \mp 2x + 3x^2 \mp 4x^3 + 5x^4 \mp 6x^5 + \dots \quad (x^2 < 1)$$

Taylor's Series

$$f(x+h) = f(x) + hf'(x) + \frac{h^2}{2!} f''(x) + \frac{h^3}{3!} f'''(x) + \dots$$

$$= f(h) + xf'(h) + \frac{x^2}{2!} f''(h) + \frac{x^3}{3!} f'''(h) + \dots$$

Maclaurin's Series

$$f(x) = f(o) + xf'(o) + \frac{x^2}{2!} f''(o) + \frac{x^3}{3!} f'''(o) + \dots$$

Exponential

$$e = 1 + \frac{1}{1} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots$$

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$$

$$a^x = 1 + x \log a + \frac{(x \log a)^2}{2!} + \frac{(x \log a)^3}{3!} + \dots$$

LOGARITHMIC

$$\log_e x = \frac{x-1}{x} + \frac{1}{2}\left(\frac{x-1}{x}\right)^2 + \frac{1}{3}\left(\frac{x-1}{x}\right)^3 + \ldots \qquad (x > \tfrac{1}{2})$$

$$\log_e x = (x-1) - \tfrac{1}{2}(x-1)^2 + \tfrac{1}{3}(x-1)^3 - \ldots \qquad (2 > x > 0)$$

$$\log_e x = 2\left[\frac{x-1}{x+1} + \frac{1}{3}\left(\frac{x-1}{x+1}\right)^3 + \frac{1}{5}\left(\frac{x-1}{x+1}\right)^5 + \ldots\right] \qquad (x > 0)$$

$$\log_e(1+x) = x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \ldots \qquad (-1 < x < 1)$$

$$\log_e(n+1) - \log_e(n-1) = 2\left[\frac{1}{n} + \frac{1}{3n^3} + \frac{1}{5n^5} + \ldots\right]$$

$$\log_e(a+x) = \log_e a + 2\left[\frac{x}{2a+x} + \frac{1}{3}\left(\frac{x}{2a+x}\right)^3 + \frac{1}{5}\left(\frac{x}{2a+x}\right)^5 + \ldots\right] \qquad (a > 0,\ -a < x < +\infty)$$

TRIGONOMETRIC

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$$

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots$$

$$\tan x = x + \frac{x^3}{3} + \frac{2x^5}{15} + \frac{17x^7}{315} + \frac{62x^9}{2835} + \ldots \qquad \left(x^2 < \frac{\pi^2}{4}\right)$$

$$\sin^{-1} x = x + \frac{x^3}{6} + \frac{1}{2}\cdot\frac{3}{4}\cdot\frac{x^5}{5} + \frac{1}{2}\cdot\frac{3}{4}\cdot\frac{5}{6}\cdot\frac{x^7}{7} + \ldots \qquad (x^2 < 1)$$

$$\tan^{-1} x = x - \tfrac{1}{3}x^3 + \tfrac{1}{5}x^5 - \tfrac{1}{7}x^7 + \ldots \qquad (x^2 < 1)$$

$$= \frac{\pi}{2} - \frac{1}{x} + \frac{1}{3x^3} - \frac{1}{5x^5} + \ldots \qquad (x^2 > 1)$$

$$\log_e \sin x = \log_e x - \frac{x^2}{6} - \frac{x^4}{180} - \frac{x^6}{2835} - \ldots \qquad (x^2 < \pi^2)$$

$$\log_e \cos x = -\frac{x^2}{2} - \frac{x^4}{12} - \frac{x^6}{45} - \frac{17x^8}{2520} - \ldots \qquad \left(x^2 < \frac{\pi^2}{4}\right)$$

$$\log_e \tan x = \log_e x + \frac{x^2}{3} + \frac{7x^4}{90} + \frac{62x^6}{2835} + \ldots \qquad \left(x^2 < \frac{\pi^2}{4}\right)$$

$$e^{\sin x} = 1 + x + \frac{x^2}{2!} - \frac{3x^4}{4!} - \frac{8x^5}{5!} - \frac{3x^6}{6!} + \frac{56x^7}{7!} + \ldots$$

$$e^{\cos x} = e\left(1 - \frac{x^2}{2!} + \frac{4x^4}{4!} - \frac{31x^6}{6!} + \ldots\right)$$

$$e^{\tan x} = 1 + x + \frac{x^2}{2!} + \frac{3x^3}{3!} + \frac{9x^4}{4!} + \frac{37x^5}{5!} + \ldots \qquad \left(x^2 < \frac{\pi^2}{4}\right)$$

MISCELLANEOUS

The Sum (Σ, = Sigma) and Product (Π, = Pi) Notations

Σ denotes the **sum**, and Π, the **product** of all quantities of a given collection. In particular,

$$\sum_{i=m}^{m+n} x_i \text{ means } x_m + x_{m+1} + \ldots + x_{m+n}, \ (n + 1 \text{ terms in all}),$$

$$\prod_{i=m}^{m+n} x_i \text{ means } x_m x_{m+1} \ldots x_{m+n}, \ (n + 1 \text{ factors in all}).$$

For indicated **range**, R, (such as $m \leqq i \leqq m + n$), one may write $\sum_R x_i$, $\prod_R x_i$, respectively. Where the range is clear from the context one writes Σx_i, Πx_i, or even Σx, Πx, respectively. For c a constant and for x_i and y_i with common range (say of n elements),

$$\Sigma c x_i = c \Sigma x_i, \ \Sigma(x_i + y_i) = \Sigma x_i + \Sigma y_i, \ \Sigma(x_i + c) = nc + \Sigma x_i.$$

Special Numerical Relations

(i) For range, $i = 1, 2, \ldots, n$, with $x_i = i$.
$\Sigma x_i = n(n + 1)/2$, $\Sigma(2x_i - 1) = n^2$,
$\Sigma x_i^2 = n(n + 1)(2n + 1)/6$.
$\Sigma x_i^3 = (\Sigma x_i)^2$, $\Sigma x_i^4 = (\Sigma x_i^2)[6(\Sigma x_i) - 1]/5$.
$\Pi(c + 1 - x_i) = c^{(n)}$, $\Pi x_i = n^{(n)} = n!$ ("**factorial** n").
Hence $n! = n \, . \, (n - 1)!$ $0!$ is defined to be 1.
Stirling's formula (used for n large),

$$\sqrt{2n\pi}(n/e)^n < n! < \sqrt{2n\pi}(n/e)^n\left(1 + \frac{1}{12n - 1}\right),$$
$$(\pi = 3.14159 \ldots, e = 2.71828 \ldots).$$

$n!/(n-m)!$ gives the number of **permutations of** n **distinct things taken** m **at a time.**

(ii) For range, $i = -\left(\frac{n-1}{2}\right), -\left(\frac{n-1}{2}\right) + 1, \ldots, \left(\frac{n-1}{2}\right) - 1, \left(\frac{n-1}{2}\right)$, with $x_i = i$ (whether n is odd or even),

$$\sum x_i = \sum x_i^3 = 0, \sum x_i^2 = \frac{n(n^2 - 1)}{12}, \sum x_i^4 = \frac{3n^2 - 7}{20} \sum x_i^2.$$

(iii) The Binomial Coefficients, $\binom{n}{m}$.

$\binom{n}{m} = n!/[(n-m)!m!]$, for integers m, n, $0 \leqq m \leqq n$. $\binom{n}{0} = \binom{n}{n} = 1$.

$(x+c)^n = \sum_r \binom{n}{r} x^{n-r} c^r$, $(0 \leqq r \leqq n)$, the **binomial expansion.** $\binom{n}{m}$ gives also the number of **combinations of n distinct things taken m at a time.**

$\binom{n}{m} + \binom{n}{m+1} = \binom{n+1}{m+1}$, **recursion relation** for binomial coefficients.

$$\binom{n}{n-m} = \binom{n}{m}, \quad \sum_r (-1)^r \binom{n}{r} = 0, \quad \sum_r \binom{n}{r}^2 = \binom{2n}{n}, \quad \sum_{s=m}^{n} \binom{s}{m} = \binom{n+1}{m+1}.$$

Table of Binomial Coefficients

n	$\binom{n}{0}$	$\binom{n}{1}$	$\binom{n}{2}$	$\binom{n}{3}$	$\binom{n}{4}$	$\binom{n}{5}$	$\binom{n}{6}$	$\binom{n}{7}$	$\binom{n}{8}$	$\binom{n}{9}$	$\binom{n}{10}$
0	1										
1	1	1									
2	1	2	1								
3	1	3	3	1							
4	1	4	6	4	1						
5	1	5	10	10	5	1					
6	1	6	15	20	15	6	1				
7	1	7	21	35	35	21	7	1			
8	1	8	28	56	70	56	28	8	1		
9	1	9	36	84	126	126	84	36	9	1	
10	1	10	45	120	210	252	210	120	45	10	1
11	1	11	55	165	330	462	462	330	165	55	11
12	1	12	66	220	495	792	924	792	495	220	66
13	1	13	78	286	715	1287	1716	1716	1287	715	286
14	1	14	91	364	1001	2002	3003	3432	3003	2002	1001
15	1	15	105	455	1365	3003	5005	6435	6435	5005	3003
16	1	16	120	560	1820	4368	8008	11440	12870	11440	8008
17	1	17	136	680	2380	6188	12376	19448	24310	24310	19448
18	1	18	153	816	3060	8568	18564	31824	43758	48620	43758
19	1	19	171	969	3876	11628	27132	50388	75582	92378	92378
20	1	20	190	1140	4845	15504	38760	77520	125970	167960	184756

NOTE: $\binom{n}{m} = \dfrac{n(n-1)(n-2)\ldots(n-m+1)}{m(m-1)(m-2)\ldots 3.2.1}$; $\binom{n}{0} = 1$; $\binom{n}{1} = n$.

For coefficients missing from the above table, use the relation

$\binom{n}{m} = \binom{n}{n-m}$, e.g. $\binom{20}{11} = \binom{20}{9} = 167960$.

Finite Differences

For equi-spaced arguments x_i, and associated y_i, the successive **advancing y-differences** are, $\Delta^0 y_i = y_i$, $\Delta y_i = y_{i+1} - y_i$, $\Delta^2 y_i = \Delta y_{i+1} - \Delta y_i = y_{i+2} - 2y_{i+1} + y_i, \ldots,$ $\Delta^m y_i = \Delta^{m-1} y_{i+1} - \Delta^{m-1} y_i = \sum_r (-1)^r \binom{m}{r} y_{i+m-r}$. With arbitrary origin A and class-interval length, $x_{i+1} - x_i = h$, using $u_i = (x_i - A)/h$, write $y(u_i)$ for y_i. Then if for some fixed m, for the portion of the table considered, the values of $\Delta^{m+1} y_i$ be zero (or approximately, if these be regarded as negligible) **Newton's formula** gives

$$y(u) = \sum \frac{u^{(r)}}{r!} \Delta^r y(0) = y(0) + u\Delta y(0) + \frac{u(u-1)}{1 \cdot 2} \Delta^2 y(0) + \cdots + \frac{u(u-1)\ldots(u-m+1)}{m!} \Delta^m y(0).$$

This formula reduces to an identity for $u = u_0, u_1, \ldots, u_n$, $(u_i = i)$, and may be used to interpolate for intermediate values.

Example. Given

x	−4,	−2,	0,	2,	4,	6,	8,	...
y	10,	14,	30,	64,	122,	210,	334,	...

to find a value for y when $x = 10$, and when $x = 1$. Suppose for some reason A has been taken at $x = 2$. The work may be arranged as follows:

u	x	y	Δ	Δ^2	Δ^3	Δ^4
−3	−4	10				
			4			
−2	−2	14		12		
			16		6	
−1	0	30		18		0
			34		6	
0	2	64		24		0
			58		6	
1	4	122		30		0
			88		6	
2	6	210		36		—
			124		—	
3	8	334		—		—
			—		—	
—	—	—		—		—

$$y(u) = 64 + 58u + 30\frac{u(u-1)}{1 \cdot 2} + 6\frac{u(u-1)(u-2)}{1 \cdot 2 \cdot 3}$$
$$= 64 + 58u + 15u(u-1) + u(u-1)(u-2).$$

At $x = 10$, $u = 4$. Substituting $u = 4$, one has $y|_{x=10} = 500$.
At $x = 1$, $u = -\frac{1}{2}$. Substituting $u = -\frac{1}{2}$, one has $y|_{x=1} = 44\frac{5}{8}$.

STATISTICS

Central Measures

Here the range of i is from 1 to n. With each value x_i is associated a weighting factor $f_i \geq 0$ (such as the frequency, the probability, the mass, the reliability, or other multiplier).

N, the **total weight**, $= \Sigma f_i$.

$\bar{x}$, the **arithmetic mean**, $= \Sigma f_i x_i / N = \Sigma f_i x_i / \Sigma f_i$.

GM, the **geometric mean** (available when each x_i is positive), $= \sqrt[N]{\Pi x_i^{f_i}}$. $\operatorname{Log} GM = \Sigma f_i \log x_i / N$.

Mo, the **mode**, = value among $(x_1, \ldots, x_n)$ having maximum associated f_i (usually obtained by interpolating after the data are graduated). For unweighted items, x_i, a mode is a value about which the values of x_i cluster most densely.

RMS, the **root-mean-square**, $= \sqrt{\Sigma f_i x_i^2 / N}$.

Md, the **median** (see below). For unweighted items, the median is the value, equaled or exceeded by exactly half of the values x_i in the given list. In case of a central pair, the median is usually taken as the arithmetic mean of this pair.

Mm, the **mid-mean** (see below). For unweighted items, the mid-mean is the arithmetic mean of the half-list obtained upon dropping out the highest quarter and lowest quarter of the items.

Cum $f|_X$, the value of "cumulative f" at X, $= \sum_{x_i < X} f_i$ (interpolation being used for X if necessary).

The M-Tiles

For **ungrouped data**, X is called the **r**th **m-tile** (or **r**th **m-tile mark**) ($r = 0, 1, \ldots, m$) if simultaneously, $\sum_{x_i < X} f_i / N \leq r/m$, and $\sum_{x_i > X} f_i / N \leq (m - r)/m$. In particular the zeroth m-tile is **min**, the minimal value among the list $(x_1, \ldots, x_n)$, and the mth m-tile is **max**, the maximal value among the list.

For **grouped data**, the rth m-tile mark, X, is such that

$$\text{Cum } f|_X = Nr/m, \quad (r = 0, 1, 2, \ldots, m).$$

$$\text{Cum } f|_{\min} = 0, \qquad \text{Cum } f|_{\max} = N.$$

In particular, certain intermediate $(0 < r < m)$ m-tile marks are named as follows:

m	$r = 1$	2	3	. . .
2	Md (median)			
3	T_1 (lower tertile)	T_2 (upper tertile)		
4	Q_1 (lower quartile)	Md	Q_3 (upper quartile)	
10	D_1 (first decile)	D_2	D_3	etc.
100	PC_1 (first percentile)	PC_2	PC_3	etc.

The term "rth **m-tile**" ($r = 1, \ldots, m$) is also used to denote the class interval extending from the $(r-1)$st to rth m-tile mark as defined above.

Mm, the **mid-mean,** =

$$2 \sum_{Q_1 \le x_i \le Q_3} f_i x_i / N = \sum_{Q_1 \le x_i \le Q_3} f_i x_i \Big/ \sum_{Q_1 \le x_i \le Q_3} f_i.$$

When each x_i is positive, and not all are equal, one always has $0 < \min < GM < \bar{x} < RMS < \max$.

For moderately-skewed distributions, one has approximately $Mo - \bar{x} = 3(Md - \bar{x})$, or $3Md = Mo + 2\bar{x}$.

Measures of Dispersion and Skewness

Here A is an arbitrary reference value, usually a convenient integral measure near $\bar{x}$.

ν_k, kth **moment about** A, $= \Sigma f_i(x_i - A)^k/N$, $(k = 0, 1, \ldots)$.

$\nu_0 = 1$, $\nu_1 = \bar{x} - A$. ν_2 as function of A is minimum for $A = \bar{x}$.

μ_k, kth **moment about** $\bar{x}$, $= \Sigma f_i(x_i - \bar{x})^k/N$, $(k = 0, 1, \ldots)$.

$$\begin{aligned}
\mu_0 &= 1,\\
\mu_1 &= 0,\\
\mu_2 &= \nu_2 - \nu_1^2 \ (\mu_2 = \text{variance}),\\
\mu_3 &= \nu_3 - 3\nu_1\nu_2 + 2\nu_1^3,\\
\mu_4 &= \nu_4 - 4\nu_1\nu_3 + 6\nu_1^2\nu_2 - 3\nu_1^4.\\
\beta_1 &= \mu_3^2/\mu_2^3,\ \beta_2 = \mu_4/\mu_2^2.
\end{aligned}$$

σ, **standard deviation,** $= \sqrt{\mu_2}$.

$\alpha_3/2$, **momental skewness;** $\alpha_3 = \sqrt{\beta_1} = \mu_3/\sigma^3$.

$(\alpha_4 - 3)/2$, **kurtosis;** $\alpha_4 = \beta_2$.

MD, **mean deviation** (from the mean), $= \Sigma f_i|x_i - \bar{x}|/N$

$$= 2\left[\bar{x}\sum_{x_i<\bar{x}} f_i - \sum_{x_i<\bar{x}} f_i x_i\right]/N.$$ (This latter form is convenient for computation.)

s, **quartile deviation,** $= |Q_3 - Q_1|/2$.

$P.E.$, **probable error,** $= 0.6745\sigma$.

V, **coefficient of variation,** $= 100\sigma/\bar{x}\ \%$.

Pearson's measure of skewness $= (\bar{x} - Mo)/\sigma$. (Usually approximately $\alpha_3/2$.)

Bowley's measure of skewness $= (Q_3 - 2Md + Q_1)/(2s)$.

(Bowley's measure of skewness lies between -1 and $+1$.)

The Class Interval

$$\Delta x_i = x_{i+1} - x_i.$$

For equi-spaced arguments, $\Delta x_i = h$, the **length of the class interval,** x_i is the **mid-value** or **class mark.** The interval from $x_i - (h/2)$ to $x_i + (h/2)$ is the **class interval** with these as given **initial** and **terminal end values.**

$$\begin{aligned} u_i &= (x_i - A)/h. \\ \bar{u} &= \Sigma f_i u_i/N,\ \bar{x} = h\bar{u} + A. \\ (\mu_k)_x &= h^k(\mu_k)_u,\ (k = 0, 1, \ldots). \\ \sigma_u{}^2 &= [\Sigma f_i u_i{}^2/N] - \bar{u}^2,\ \sigma_x = h\sigma_u. \\ (\beta_1)_x &= (\beta_1)_u,\ (\beta_2)_x = (\beta_2)_u. \end{aligned}$$

Sheppard's corrections (to correct approximately for the error due to treating all elements in a given class interval of length h as though concentrated at the class mark).

For μ_0, μ_1, μ_3, no corrections.

In x-units,

corrected $(\mu_2)_x$ = uncorrected $(\mu_2)_x - h^2/12$,

corrected $(\mu_4)_x$ = uncorrected $(\mu_4)_x - h^2$ uncorrected $(\mu_2)_x/2 + 7h^4/240$.

In u-units, replace h by 1 in the formulae given above.

Least Squares

The **normal equations** for finding coefficients, $a_0, a_1, \ldots, a_m$, in fitting a curve of the form $y = a_0 + a_1x + \ldots + a_mx^m$ to data (X_i, Y_i), $i = 1, \ldots, n$, $(n > m)$, are $m + 1$ in number as follows:

$$\begin{aligned} \Sigma Y_i &= a_0n + a_1\Sigma X_i + a_2\Sigma X_i{}^2 + \ldots + a_m\Sigma X_i{}^m, \\ \Sigma X_iY_i &= a_0\Sigma X_i + a_1\Sigma X_i{}^2 + a_2\Sigma X_i{}^3 + \ldots + a_m\Sigma X_i{}^{m+1}, \\ &\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \Sigma X_i{}^mY_i &= a_0\Sigma X_i{}^m + a_1\Sigma X_i{}^{m+1} + a_2\Sigma X_i{}^{m+2} + \ldots + a_m\Sigma X_i{}^{2m}. \end{aligned}$$

Deviation from fitted curve,

$$d_i = Y_i - (a_0 + a_1X_i + \ldots + a_mX_i{}^m).$$

$$\Sigma d_i{}^2 = \Sigma Y_i{}^2 - (a_0\Sigma Y_i + a_1\Sigma X_iY_i + \ldots + a_m\Sigma X_i{}^mY_i).$$

For $z = ab^x$, use $y = \log z$, $a_0 = \log a$, $a_1 = \log b$.

For $z = at^p$, use $y = \log z$, $a_0 = \log a$, $a_1 = p$, $x = \log t$.

S_y, **standard error of estimate,** = root-mean-square of the y-deviations about a fitted curve $= \sqrt{\Sigma d_i{}^2/n}$.

Simple Correlation

Product Moment Method

Given n equi-spaced measurements X_i, $i = 1, 2, \ldots, n$, with $h = X_{i+1} - X_i$, $x_i = X_i - \bar{X}$; and m equi-spaced measurements Y_j, $j = 1, 2, \ldots, m$, with $k = Y_{j+1} - Y_j$, $y_j = Y_j - \bar{Y}$; and a weight (frequency, probability, etc.) e_{ij} (≥ 0), associated with (X_i, Y_j). Here e_{ij} is an entry in the table.

$$f_i = \sum_j e_{ij},\; g_j = \sum_i e_{ij}.$$

$$N = \sum_{ij} e_{ij} = \sum_i f_i = \sum_j g_j. \quad \text{(Check)}$$

$$\bar{x} = \sum_{ij} e_{ij}X_i/N = \sum_i f_i X_i/N;\; \bar{y} = \sum_{ij} e_{ij}Y_j/N = \sum_j g_j Y_j/N.$$

Let A and B be arbitrary reference values, usually convenient integral measures near $\bar{X}$ and $\bar{Y}$, respectively.

$u_i = (X_i - A)/h,\; v_j = (Y_j - B)/k;$

$\bar{u} = \Sigma f_i u_i/N,\; \bar{X} = h\bar{u} + A,\; \bar{v} = \Sigma g_j v_j/N,\; \bar{Y} = k\bar{v} + B.$

$\sigma_u^2 = (\mu_2)_u = (\Sigma f_i u_i^2/N) - \bar{u}^2,\; \sigma_x = h\sigma_u.$ } Apply Sheppard's

$\sigma_v^2 = (\mu_2)_v = (\Sigma g_j v_j^2/N) - \bar{v}^2,\; \sigma_y = k\sigma_v.$ } corrections.

$$U_j = \sum_i e_{ij}u_i,\; V_i = \sum_j e_{ij}v_j,\; P = \sum u_i V_i = \sum v_j U_j. \quad \text{(Check)}$$

$$p_{uv} = \sum_{ij} e_{ij}(u_i - \bar{u})(v_j - \bar{v})/N$$

$$= (P/N) - \bar{u}\bar{v}.$$

$p_{xy} = hkp_{uv}.$

$r = p_{uv}/(\sigma_u\sigma_v) = p_{xy}/(\sigma_x\sigma_y)$ **(product-moment) coefficient of correlation.** In every case $-1 \leq r \leq 1$.

$Y - \bar{Y} = r\dfrac{\sigma_y}{\sigma_x}(X - \bar{X})$, or $y = r\dfrac{\sigma_y}{\sigma_x}x$, **regression line of y on x.**

$X - \bar{X} = r\dfrac{\sigma_x}{\sigma_y}(Y - \bar{Y})$, or $x = r\dfrac{\sigma_x}{\sigma_y}y$, **regression line of x on y.**

Example of Computation for Product-Moment Coefficient of Correlation

v_j	u_i / y_j \ x_i	-3 / 12	-2 / 16	-1 / 20	0 / 24	1 / 28	2 / 32	g_j	g_jv_j	$g_jv_j^2$	$U_j \left(= \sum_i e_{ij}u_i\right)$	v_jU_j
2	21			1	5	7	1	14	28	56	8	16
1	18		1	3	7	5	2	18	18	18	4	4
0	15		2	3	4	1		10	0	0		0
-1	12		3	1	1			5	-5	5	-7	7
-2	9	2	1					3	-6	12	-8	16
f_i		2	7	8	17	13	3	50	35	91		43
f_iu_i		-6	-14	-8	0	13	6	-9				
$f_iu_i^2$		18	28	8	0	13	12	79				
$V_i \left(= \sum_j e_{ij}v_j\right)$		-4	-4	4		19	4					
u_iV_i		12	8	-4	0	19	8	43				

$A = 24,\; B = 15,$
$h = 4,\; k = 3,$
$N = \Sigma f_i = \Sigma g_j = 50,$
$\Sigma f_i u_i = -9,\; \Sigma g_j v_j = 35,$
$\Sigma f_i u_i^2 = 79,\; \Sigma g_j v_j^2 = 91,$
$P = \Sigma u_i V_i = \Sigma v_j U_j = 43.$

$\bar{u} = -9/50 = -.18 \qquad \bar{v} = 85/50 = .70$

$\sigma_u^2 = (79/50) - (-.18)^2 - .083 = 1.46, \qquad \sigma_u = 1.083$

$\sigma_v^2 = (91/50) - (.70)^2 - .083 = 1.247, \qquad \sigma_v = 1.117$

$p_{uv} = (43/50) - (-.18)(.70) = +0.986$

$r = +0\,986/(1.21 \times 1.117) = +.725 \qquad$ Ans. $r = +.815$

Rank Difference Method

Given n corresponding pairs of measured items (X_i, Y_i), $(i = 1, \ldots, n)$. Let (u_i, v_i) be the corresponding rank numbers. Here $u_i = 1$ for the largest X_i, 2 for the next largest X_i, etc., and similarly $v_i = 1$ for the largest Y_i, 2 for the next largest Y_i, etc. $\rho = 1 - \dfrac{6\Sigma(u_i - v_i)^2}{n(n^2 - 1)}$, **(rank difference) coefficient of correlation.** In every case $-1 \leq \rho \leq 1$. Check: $\Sigma(u_i - v_i) = 0$.

Example of Computation for Rank-Difference Coefficient of Correlation

X_i	Y_i	u_i	v_i	$u_i - v_i$	$(u_i - v_i)^2$	
76	52	3	1	+2	4	Check: $\Sigma(u_i - v_i) = 0$.
66	34	8	9	−1	1	
63	32	10	10	0	0	
74	45	4	4	0	0	$\rho = 1 - \dfrac{6 \times 62}{10(10^2 - 1)}$
79	50	1	2	−1	1	
69	37	7	7	0	0	
77	35	2	8	−6	36	$= +0.63$
65	42	9	5	+4	16	
71	40	6	6	0	0	Ans. $\rho = +.63$
73	48	5	3	+2	4	
$N=10$				0	62	

Probability

If among $a + b$ equi-probable and mutually exclusive events, a are regarded as favorable and b unfavorable, then for a single trial

p, probability of favorable outcome, $= \dfrac{a}{a + b}$,

q, probability of unfavorable outcome, $= 1 - p = \dfrac{b}{a + b}$.

The successive terms in the binomial expansion $(p + q)^n = \sum\limits_r \binom{n}{r} p^{n-r} q^r$ give the respective probabilities that in n trials, the event will be favorable exactly $n - r$ times, $r = 0, \ldots, n$.

The mean number of favorable events is np, of unfavorable, nq; the standard deviation is $\sigma = \sqrt{npq}$, $\alpha_3 = (p - q)/\sigma$ (the positive direction being that of increasing unfavorability).

Normal curve (x measured in σ-units from the mean, and with area = 1):

$$y = \frac{1}{\sqrt{2\pi}} e^{-x^2/2} = 0.3989 e^{-x^2/2}.$$

STATISTICS (Continued)

MD (mean deviation from the mean) $= \sigma\sqrt{2/\pi} = 0.7979\sigma$.
s (quartile deviation from the mean) $= 0.6745\sigma = 0.845\ MD$.
Percentage areas, under normal curve, for successive **class** intervals measured from the mean:

Multiples of σ: 34 %, 14 %, 2 %.
Multiples of s: 25 %, 16 %, 7 %, 2 %.

Normal surface (x measured in σ_x-units y in σ_y-units from their means),

$$z = \frac{1}{2\pi\sqrt{1 - r^2}} e^{-(x^2 - 2rxy + y^2)/[2(1-r^2)]}.$$

Goodness of Fit. For a universe of objects falling into n mutually exclusive classes with class marks, $x_i (i = 1, 2, \ldots, n)$, let p_i be the probability for the ith class. Given a sample of N items, with f_i items in the ith class ($\Sigma f_i = N$), the probability that a random sample of N items gives no better fit, expressed in terms of n and χ^2 ("Chi square"), $= \Sigma(f_i - Np_i)^2/(Np_i)$, is given by a table, portions of which are as follows:

Probability that a Random Sample Gives no Better Fit

n \ χ^2	1	2	3	4	6	8	10	15	20
3	.607	.368	.223	.135	.050	.018	.007	.001	.000
4	.801	.572	.392	.261	.112	.046	.019	.002	.000
5	.910	.736	.558	.406	.199	.092	.040	.005	.000
6	.963	.849	.700	.549	.306	.156	.075	.010	.001
7	.986	.920	.809	.677	.423	.238	.125	.020	.003
8	995	.960	.885	.780	.540	.333	.189	.036	.006
9	.998	.981	.934	.857	.647	.433	.265	.059	.010
10	.999	.991	.964	.911	.740	.534	.350	.091	.018
11	1.000	.996	.981	.947	.815	.629	.440	.132	.029
12	1.000	.998	.991	.970	.873	.713	.530	.182	.045

n \ χ^2	8	10	12	14	16	18	20	25	30
10	.534	.350	.213	.122	.067	.035	.018	.003	.000
11	.629	.440	.285	.173	.100	.055	.029	.005	.001
12	.713	.530	.363	.233	.141	.082	.045	.009	.002
13	.785	.616	.446	.301	.191	.116	.067	.015	.003
14	.844	.694	.528	.374	.249	.158	.095	.023	.005
15	.889	.762	.606	.450	.313	.207	.130	.035	.008
16	.924	.820	.679	.526	.382	.263	.172	.050	.012
17	.949	.867	.744	.599	.453	.324	.220	.070	.018
18	.967	.904	.800	.667	.524	.389	.274	.095	.026
19	.979	.932	.847	.729	.593	.456	.333	.125	.037
20	.987	.953	.886	.784	.657	.522	.395	.161	.052

MENSURATION FORMULÆ

Plane Figures Bounded by Straight Lines

The **area of a triangle** whose base is b and altitude h

$$= \frac{hb}{2}.$$

The area of a **triangle** with angles A, B, and C and sides opposite a, b, and c, respectively

$$= \tfrac{1}{2}ab \sin C.$$

or $$= \sqrt{s(s-a)(s-b)(s-c)},$$

where $s = \frac{1}{2}(a + b + c)$.

A **rectangle** with sides a and b has an area $= ab$.

The area of a **parallelogram** with side b and the perpendicular distance to the parallel side h

$$= bh.$$

The area of a **parallelogram** with sides a and b and the included angle θ

$$= ab \sin \theta.$$

The area of a **rhombus** with diagonals c and d,

$$= \tfrac{1}{2}cd.$$

The **area** of a **trapezoid** whose parallel sides are a and b and altitude h

$$= \tfrac{1}{2}(a + b)h.$$

The area of any **quadrilateral** with diagonals a and b and the angle between them θ

$$= \tfrac{1}{2}ab \sin \theta.$$

The area of a **regular polygon** with n sides, each of length l,

$$= \tfrac{1}{4}nl^2 \cot \frac{180}{n}.$$

For a regular polygon of n sides, each side of length l, the radius of the **inscribed circle**,

$$= \frac{l}{2} \cot \frac{180}{n}.$$

The radius of the **circumscribed circle**,

$$= \frac{l}{2} \operatorname{cosec} \frac{180}{n}.$$

Area, Radius of Inscribed and Circumscribed Circles for Regular Polygons

l = length of one side.

Name.	Number of sides.	Area.	Radius of inscribed circle.	Radius of circumscribed circle.
Triangle, equilateral	3	$0.43301l^2$	$0.28867l$	$0.57735l$
Square	4	$1.00000l^2$	$0.50000l$	$0.70710l$
Pentagon	5	$1.72048l^2$	$0.68819l$	$0.85065l$
Hexagon	6	$2.59808l^2$	$0.86602l$	$1.0000l$
Heptagon	7	$3.63391l^2$	$1.0383l$	$1.1523l$
Octagon	8	$4.82843l^2$	$1.2071l$	$1.3065l$
Nonagon	9	$6.18182l^2$	$1.3737l$	$1.4619l$
Decagon	10	$7.69421l^2$	$1.5388l$	$1.6180l$
Undecagon	11	$9.36564l^2$	$1.7028l$	$1.7747l$
Dodecagon	12	$11.19615l^2$	$1.8660l$	$1.9318l$

Radius of circle inscribed in any triangle, whose sides are a, b, and c, where $s = \frac{1}{2}(a + b + c)$

$$= \frac{\sqrt{s(s-a)(s-b)(s-c)}}{s}.$$

The radius of the circumscribed circle

$$= \frac{abc}{4\sqrt{s(s-a)(s-b)(s-c)}}.$$

The perimeter of a polygon inscribed in a circle of radius r, where n is the number of sides,

$$= 2nr \sin\frac{\pi}{n}. \qquad (\pi \text{ radians} = 180°)$$

The area of the inscribed polygon,

$$= \tfrac{1}{2}nr^2 \sin\frac{2\pi}{n}.$$

The perimeter of a polygon circumscribed about a circle of radius r, number of sides n

$$= 2nr \tan\frac{\pi}{n}.$$

The area of the circumscribed polygon

$$= nr^2 \tan\frac{\pi}{n}.$$

Plane Figures Bounded by Curved Lines

The **circumference of a circle** whose radius is r and **diameter** $d (d = 2r)$

$$= 2\pi r = \pi d. \qquad (\pi = 3.14159)$$

The area of a circle

$$= \pi r^2 = \tfrac{1}{4}\pi d^2 = .7854d^2.$$

The **length of an arc** of a circle for an arc of θ degrees

$$= \frac{\pi r \theta}{180}.$$

NOTE. — In this and following similar formulæ r denotes **the radius** of the circle, (OC, Fig. 1).

For an arc of θ radians the length

$$= r\theta.$$

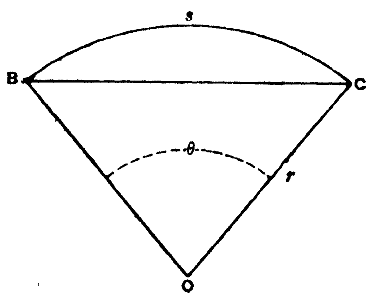


FIG 1.

The **length of a chord** subtending an angle θ

$$= 2r \sin \tfrac{1}{2}\theta.$$

The **area of a sector** where θ is the angle between the **radii** in degrees

$$= \frac{\pi r^2 \theta}{360}.$$

If s is the length of the arc, the area of the sector

$$= \frac{sr}{2}.$$

The area of a segment where θ is the angle between the two radii in degrees

$$= \frac{\pi r^2 \theta}{360} - \frac{r^2 \sin \theta}{2}.$$

If θ is in radians the area $= \frac{1}{2}r^2(\theta - \sin\theta)$.

The area of the segment of a circle

$$=\frac{\pi r^2}{2}-\left[x\sqrt{r^2-x^2}+r^2\sin^{-1}\left(\frac{x}{r}\right)\right]$$

where r is the radius of the circle and x the perpendicular distance of the chord from the center. The angle must be expressed in radians.

The area of the ring between two circles of radius r_1 and r_2, one of which encloses the other,

$$=\pi(r_1+r_2)\ (r_1-r_2).$$

The two circles are not necessarily concentric.

Area of the sector of an annulus. (Fig. 2.)—If angle $GOH = \theta$ and the lines GO and $JO = r_1$ and r_2 respectively, the area $GHIJ = \frac{1}{2}\theta(r_1+r_2)\ (r_1-r_2)$.

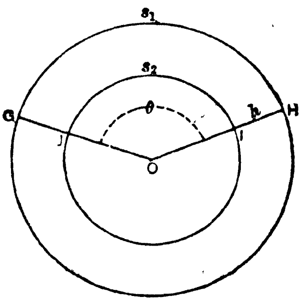


Fig. 2

If s_1 = the length of the arc GH and s_2 = the arc JI and $h = HI = r_1 - r_2$, the area $GHIJ = \frac{1}{2}h(s_1+s_2)$.

The circumference of an ellipse whose semiaxes are a and b

$$=2\pi\sqrt{\frac{a^2+b^2}{2}}\ \text{(approx.)} = 4aE \text{ exactly.}$$

See tables of elliptic integrals for E, using $K = \sqrt{\frac{a^2+b^2}{a}}$

The **area of an ellipse** $= \pi ab$.

The length of the **arc of a parabola**, as arc SPQ in Fig. 3, where $x = PR$, and $y = QR$

$$=2\sqrt{y^2+\frac{4x^2}{3}}, \text{ approximately.}$$

The **area of the section of the parabola** $PQRS$, $= \frac{4}{3}xy$.

MENSURATION FORMULAE (Continued)

Solids Bounded by Planes

The lateral area of a regular prism = perimeter of a right section $\times$ the length.

The volume of a regular prism = area of base $\times$ the altitude.

The lateral area of a regular pyramid, slant height l, length of one side of base a, and a number of sides n,

$$= \tfrac{1}{2}nal.$$

The volume of a pyramid = $\tfrac{1}{3}$ area of base $\times$ altitude.

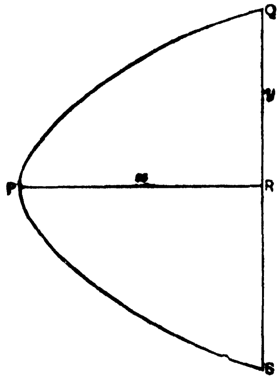


FIG. 3.

Surface and Volume of Regular Polyhedra

Surface and volume of regular polyhedra in terms of the length of one edge l.

Name.	Nature of surface.	Surface.	Volume.
Tetrahedron...	4 equilateral triangles	$1.73205l^2$	$0.11785l^3$
Hexahedron or cube	6 squares..........	$6.00000l^2$	$1.00000l^3$
Octahedron....	8 equilateral triangles	$3.46410l^2$	$0.47140l^3$
Dodecahedron .	12 pentagons........	$20.64573l^2$	$7.66312l^3$
Icosahedron ...	20 equilateral triangles	$8.66025l^2$	$2.18170l^3$

Solids Bounded by Curved Surfaces

The surface of a sphere of radius r and diameter $d(= 2r)$

$$= 4\pi r^2 = \pi d^2 = 12.57r^2.$$

The volume of a sphere

$$= \tfrac{4}{3}\pi r^3 = \tfrac{1}{6}\pi d^3 = 4.189r^3.$$

MENSURATION FORMULAE (Continued)

The **area of a lune** on the surface of a sphere of radius r, included between two great circles whose inclination is θ radians.

$$= 2r^2\theta.$$

The **area of a spherical triangle** whose angles are A, B, and C (radians) on a sphere of radius r

$$= (A + B + C - \pi)r^2.$$

The **area of a spherical polygon** of n sides where θ is the sum of its angles in radians

$$= [\theta - (n - 2)\pi]r^2.$$

The area of the curved surface of a **spherical segment** of height h, radius of sphere r

$$= 2\pi\, rh.$$

The **volume** of a **spherical segment**, data as above

$$= \tfrac{1}{3}\pi h^2 (3r - h).$$

If a = radius of the base of the segment, the volume

$$= \tfrac{1}{6}\pi h\,(h^2 + 3a^2).$$

The **curved surface** of a **right cylinder** where r = the radius of the base and h, the altitude,

$$= 2\pi rh.$$

The **volume** of a **cylinder**, data as above,

$$= \pi r^2 h.$$

The **curved surface** of a **right cone** whose altitude is h and radius of base r

$$= \pi r\,\sqrt{r^2 + h^2}.$$

The **volume** of a **cone**, data as above,

$$= \frac{\pi}{3} r^2 h = 1.047\, r^2 h.$$

The **curved surface** of the **frustum** of a **right cone**, radius of base r_1, of top r_2 and altitude h,

$$= \pi(r_1 + r_2)\,\sqrt{h^2 + (r_1 - r_2)^2}.$$

The **volume** of the **frustum** of a **cone**, data as above,

$$= \pi\frac{h}{3}\,(r_1^2 + r_1 r_2 + r_2^2).$$

The **oblate spheroid** is formed by the rotation of an ellipse about its minor axis. If a and b are the major and minor semi-axes respectively, and e the eccentricity, the surface

$$= 2\pi a^2 + \pi\frac{b^2}{e}\log_\epsilon \frac{1 + e}{1 - e},$$

and volume $= \tfrac{4}{3}\pi a^2 b.$

The prolate spheroid is formed by the rotation of an ellipse about its major axis ($2a$), data as above.

Surface $=2\pi b^2+2\pi \frac{ab}{e}\sin^{-1}e$,

volume $=\frac{4}{3}\pi ab^2$.

SIMPSON'S RULE FOR IRREGULAR AREAS

Divide the area into an even number ($2m$) of panels by means of $2m+1$ parallel lines, drawn at constant distance h apart; and denote the lengths of the intercepted segments by $y_0, y_1, \ldots, y_{2m-1}, y_{2m}$. The first and last of these may be zero. The area will then be

$$A=\frac{1}{3}h[(y_0+y_{2m})+4(y_1+y_3+\ldots+y_{2m-1})+2(y_2+y_4+\ldots+y_{2m-2})]$$

While the formula is exact in many simple cases, ordinarily the formula provides only an approximation, for which the accuracy increases with an increase in the number of divisions. Simpson's Rule may be applied to finding volumes, if the measures $y_0, y_1, \ldots, y_{2m}$ be interpreted as the areas of parallel plane sections at constant distance h apart.

PRISMOIDAL FORMULA

As a special case where $m=1$, and H, $(=2h)$ is the distance between two limiting parallel planes, one has for the volume of a solid figure,

$$V=\frac{1}{6}H(S_0+4S_1+S_2).$$

Here S_0 and S_2 are the cross-sectional areas in these limiting planes (lower and upper bases, respectively), and S_1 is the cross section of the mid-section. The formula is exact for the cone, sphere, ellipsoid, and prismoid.

TRIGONOMETRIC FUNCTIONS IN A RIGHT-ANGLED TRIANGLE

If A, B, and C are the vertices (C the right angle), and a, b, and h the sides opposite respectively,

$$\text{sine } A = \sin A = \frac{a}{h}, \qquad \text{cosine } A = \cos A = \frac{b}{h},$$

$$\text{tangent } A = \tan A = \frac{a}{b}, \qquad \text{cotangent } A = \cot A = \text{ctn } A = \frac{b}{a},$$

$$\text{secant } A = \sec A = \frac{h}{b}, \qquad \text{cosecant } A = \csc A = \frac{h}{a}.$$

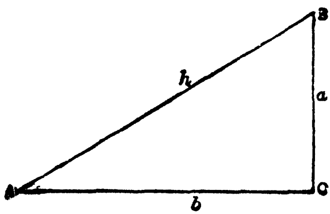


Fig. 4.

$$\text{exsecant } A = \text{exsec } A = \sec A - 1$$

$$\text{versine } A = \text{vers } A = 1 - \cos A$$

$$\text{coversine } A = \text{covers } A = 1 - \sin A$$

$$\text{haversine } A = \text{hav } A = \tfrac{1}{2} \text{ vers } A$$

SIGNS AND LIMITS OF VALUE ASSUMED BY THE FUNCTIONS

Function.	Quadrant I.		Quadrant II.		Quadrant III.		Quadrant IV.	
	Sign	Value.	Sign.	Value.	Sign.	Value.	Sign.	Value.
sin.....	+	0 to 1	+	1 to 0	−	0 to 1	−	1 to 0
cos.....	+	1 to 0	−	0 to 1	−	1 to 0	+	0 to 1
tan.....	+	0 to ∞	−	∞ to 0	+	0 to ∞	−	∞ to 0
cot.....	+	∞ to 0	−	0 to ∞	+	∞ to 0	−	0 to ∞
sec.....	+	1 to ∞	−	∞ to 1	−	1 to ∞	+	∞ to 1
cosec...	+	∞ to 1	+	1 to ∞	−	∞ to 1	−	1 to ∞

VALUE OF THE FUNCTIONS OF VARIOUS ANGLES

	0°	30°	45°	60°	90°	180°	270°
sin	0	$\frac{1}{2}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}\sqrt{3}$	1	0	-1
cos	1	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}$	0	-1	0
tan	0	$\frac{1}{3}\sqrt{3}$	1	$\sqrt{3}$	∞	0	∞
cot	∞	$\sqrt{3}$	1	$\frac{1}{3}\sqrt{3}$	0	∞	0

RELATIONS OF THE FUNCTIONS

$\sin x = \frac{1}{\operatorname{cosec} x}$.

$\operatorname{cosec} x = \frac{1}{\sin x}$.

$\cos x = \frac{1}{\sec x}$.

$\sec x = \frac{1}{\cos x}$.

$\tan x = \frac{1}{\cot x} = \frac{\sin x}{\cos x}$.

$\sin^2 x + \cos^2 x = 1$

$1 + \tan^2 x = \sec^2 x$

$\cot x = \frac{1}{\tan x} = \frac{\cos x}{\sin x}$.

$1 + \cot^2 x = \operatorname{cosec}^2 x$

$\sin x = \sqrt{1 - \cos^2 x}$.

$\cos x = \sqrt{1 - \sin^2 x}$.

$\tan x = \sqrt{\sec^2 x - 1}$.

$\sec x = \sqrt{\tan^2 x + 1}$.

$\cot x = \sqrt{\operatorname{cosec}^2 x - 1}$.

$\operatorname{cosec} x = \sqrt{\cot^2 x + 1}$.

$\sin x = \cos(90 - x) = \sin(180 - x)$.

$\cos x = \sin(90 - x) = -\cos(180 - x)$.

$\tan x = \cot(90 - x) = -\tan(180 - x)$.

$\cot x = \tan(90 - x) = -\cot(180 - x)$.

$\operatorname{cosec} x = \cot \frac{x}{2} - \cot x$.

FUNCTIONS OF SUMS OF ANGLES

$\sin(x+y) = \sin x \cos y + \cos x \sin y$.

$\sin(x-y) = \sin x \cos y - \cos x \sin y$.

$\cos(x+y) = \cos x \cos y - \sin x \sin y$.

$\cos(x-y) = \cos x \cos y + \sin x \sin y$.

$$\tan(x+y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}.$$

$$\tan(x-y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}.$$

FUNCTIONS OF MULTIPLE ANGLES

$\sin 2x = 2 \sin x \cos x.$
$\cos 2x = \cos^2 x - \sin^2 x = 2 \cos^2 x - 1 = 1 - 2 \sin^2 x.$
$\sin 3x = 3 \sin x - 4 \sin^3 x.$
$\cos 3x = 4 \cos^3 x - 3 \cos x.$
$\sin 4x = 8 \cos^3 x \sin x - 4 \cos x \sin x.$
$\cos 4x = 8 \cos^4 x - 8 \cos^2 x + 1.$
$\sin 5x = 5 \sin x - 20 \sin^3 x + 16 \sin^5 x.$
$\cos 5x = 16 \cos^5 x - 20 \cos^3 x + 5 \cos x.$
$\sin 6x = 32 \cos^5 x \sin x - 32 \cos^3 x \sin x + 6 \cos x \sin x.$
$\cos 6x = 32 \cos^6 x - 48 \cos^4 x + 18 \cos^2 x - 1.$

$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}.$$

$$\cot 2x = \frac{\cot^2 x - 1}{2 \cot x}.$$

$$\tan 3x = \frac{3 \tan x - \tan^3 x}{1 - 3 \tan^2 x}.$$

$$\sin \tfrac{1}{2}x = \pm \sqrt{\frac{1 - \cos x}{2}}.$$

$$\cos \tfrac{1}{2}x = \pm \sqrt{\frac{1 + \cos x}{2}}$$

$$\tan \tfrac{1}{2}x = \pm \sqrt{\frac{1 - \cos x}{1 + \cos x}} = \frac{1 - \cos x}{\sin x} = \frac{\sin x}{1 + \cos x}.$$

MISCELLANEOUS RELATIONS

$\sin x \pm \sin y = 2 \sin \tfrac{1}{2} (x \pm y) . \cos \tfrac{1}{2} (x \mp y).$
$\cos x + \cos y = 2 \cos \tfrac{1}{2} (x + y) . \cos \tfrac{1}{2} (x - y).$
$\cos x - \cos y = -2 \sin \tfrac{1}{2} (x + y) . \sin \tfrac{1}{2} (x - y).$

$$\tan x \pm \tan y = \frac{\sin (x \pm y)}{\cos x . \cos y}. \quad \cot x \pm \cot y = \frac{\pm \sin (x \pm y)}{\sin x \cdot \sin y}.$$

$$\frac{1 + \tan x}{1 - \tan x} = \tan (45 + x) \qquad \frac{\cot x + 1}{\cot x - 1} = \cot (45 - x)$$

$$\frac{\sin x \pm \sin y}{\cos x + \cos y} = \tan \tfrac{1}{2} (x \pm y).$$

$$\frac{\sin x \pm \sin y}{\cos x - \cos y} = -\cot \tfrac{1}{2} (x \mp y).$$

$$\frac{\sin x + \sin y}{\sin x - \sin y} = \frac{\tan \frac{1}{2} (x + y)}{\tan \frac{1}{2} (x - y)}.$$

$\sin^2 x - \sin^2 y = \sin (x + y) . \sin (x - y).$
$\cos^2 x - \cos^2 y = -\sin (x + y) \sin (x - y).$
$\cos^2 x - \sin^2 y = \cos (x + y) \cos (x - y).$

TRIGONOMETRIC FORMULAE (Continued)

RELATIONS BETWEEN SIDES AND ANGLES OF ANY PLANE TRIANGLE

In a triangle with angles A, B, and C and sides opposite a, b, and c respectively,

$$\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}=\text{diameter of the circumscribed circle.}$$

$$a^2=b^2+c^2-2bc\cos A.$$

$$a=b\cos C+c\cos B.$$

$$\cos A=\frac{b^2+c^2-a^2}{2bc}.$$

$$\tan\frac{A-B}{2}=\frac{a-b}{a+b}\cot\frac{C}{2}.$$

$$\sin A=\frac{2}{bc}\sqrt{s(s-a)(s-b)(s-c)},$$

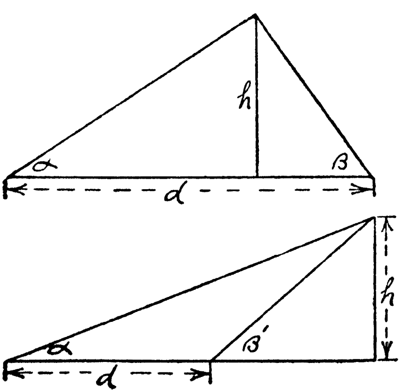
where $s=\frac{1}{2}(a+b+c)$ and $r=\sqrt{\dfrac{(s-a)(s-b)(s-c)}{s}}$.

$$\sin\frac{A}{2}=\sqrt{\frac{(s-b)(s-c)}{bc}}.$$

$$\cos\frac{A}{2}=\sqrt{\frac{s(s-a)}{bc}}.$$

$$\tan\frac{A}{2}=\sqrt{\frac{(s-b)(s-c)}{s(s-a)}}=\frac{r}{s-a}.$$

$$\frac{a+b}{a-b}=\frac{\sin A+\sin B}{\sin A-\sin B}=\frac{\tan\frac{1}{2}(A+B)}{\tan\frac{1}{2}(A-B)}=\frac{\cot\frac{1}{2}C}{\tan\frac{1}{2}(A-B)}.$$



$$h=d\frac{\sin\alpha\sin\beta}{\sin(\alpha+\beta)}=\frac{d}{\cot\alpha+\cot\beta}$$

Similarly

$$h=d\frac{\sin\alpha\sin\beta'}{\sin(\beta'-\alpha)}=\frac{d}{\cot\alpha-\cot\beta'}$$

Fig. 5.

RELATIONS IN ANY SPHERICAL TRIANGLE

If A, B and C be the three angles and a, b, and c the opposite sides,

$$\frac{\sin A}{\sin a}=\frac{\sin B}{\sin b}=\frac{\sin C}{\sin c}.$$

$$\cos a=\cos b\cos c+\sin b\sin c\cos A=\frac{\cos b\cos(c\pm\theta)}{\cos\theta}.$$

where $\tan\theta=\tan b\cos A$.

$$\cos A=-\cos B\cos C+\sin B\sin C\cos a.$$

$$\sin\tfrac{1}{2}A=\sqrt{\frac{\sin(s-b)\sin(s-c)}{\sin b\sin c}}.$$

where $s=\tfrac{1}{2}(a+b+c)$.

$$\cos\tfrac{1}{2}A=\sqrt{\frac{\sin s\sin(s-a)}{\sin b\sin c}}.$$

$$\tan\tfrac{1}{2}A=\frac{r}{\sin(s-a)}.$$

where $r=\sqrt{\dfrac{\sin(s-a)\sin(s-b)\sin(s-c)}{\sin s}}$.

$$\cos\tfrac{1}{2}a=\sqrt{\frac{\cos(S-B)\cos(S-C)}{\sin B\sin C}}.$$

where $S=\tfrac{1}{2}(A+B+C)$.

$$\sin\tfrac{1}{2}a=\sqrt{-\frac{\cos S\cos(S-A)}{\sin B\sin C}}.$$

$$\tan\tfrac{1}{2}a=R\cos(S-A)$$

where $R=\sqrt{\dfrac{-\cos S}{\cos(S-A)\cos(S-B)\cos(S-C)}}$.

$$\frac{\tan\frac{a+b}{2}}{\tan\frac{c}{2}}=\frac{\cos\frac{A-B}{2}}{\cos\frac{A+B}{2}},\quad\frac{\tan\frac{A+B}{2}}{\cot\frac{C}{2}}=\frac{\cos\frac{a-b}{2}}{\cos\frac{a+b}{2}}.$$

$$\frac{\tan\frac{a-b}{2}}{\tan\frac{c}{2}}=\frac{\sin\frac{A-B}{2}}{\sin\frac{A+B}{2}},\quad\frac{\tan\frac{A-B}{2}}{\cot\frac{C}{2}}=\frac{\sin\frac{a-b}{2}}{\sin\frac{a+b}{2}}$$

$$\operatorname{hav} a=\operatorname{hav}(b\sim c)+\sin b\sin c\operatorname{hav} A$$

$$\operatorname{hav} A=\frac{\sqrt{\operatorname{hav}[a+(b\sim c)]\operatorname{hav}[a-(b\sim c)]}}{\sin b\sin c}$$

ANALYTICAL GEOMETRY

The distance between two points x_1, y_1, and x_2, y_2, — rectangular coördinates:

$$d = \pm \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

For polar coördinates and points r_1, θ_1, and r_2, θ_2:

$$d = \pm \sqrt{r_1^2 + r_2^2 - 2r_1r_2 \cos(\theta_1 - \theta_2)}$$

The area of a triangle whose vertices are x_1, y_1; x_2, y_2, and x_3, y_3:

$$A = \tfrac{1}{2}(x_1y_2 - x_2y_1 + x_2y_3 - x_3y_2 + x_3y_1 - x_1y_3)$$

For polar coördinates and vertices, r_1, θ_1; r_2, θ_2, and r_3, θ_3:

$$A = \tfrac{1}{2}\{(r_1r_2 \sin(\theta_2 - \theta_1) + r_2r_3 \sin(\theta_3 - \theta_2) + r_3r_1 \sin(\theta_1 - \theta_3)\}$$

The equation of a straight line where m is the tangent of the angle of inclination and c, the distance of intersection with the Y axis from the origin:

$$y = mx + c$$

If a line of slope m passes through the point x_1, y_1 its equation is:

$$y - y_1 = m(x - x_1)$$

The equation of a line through the points x_1, y_1, and x_2, y_2 is:

$$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$$

If the intercepts on the X and Y axes are a and b respectively, the equation is:

$$\frac{x}{a} + \frac{y}{b} = 1$$

If the length of the perpendicular from the origin is p and its angle of inclination θ the equation is:

$$x \cos\theta + y \sin\theta = p$$

General equation of the straight line:

$$Ax + By + C = 0$$

The equation of a circle whose center is at a, b, and whose radius is c:

$$(x - a)^2 + (y - b)^2 = c^2$$

If the origin is at the center:

$$x^2 + y^2 = c^2$$

The polar equation of a circle with the origin on the circumference and its center at point c, α:

$$r = 2c \cos(\theta - \alpha).$$

If the origin is not on the circumference, the radius a and the center at a point l, α, the equation becomes:

$$a^2 = r^2 + l^2 - 2rl \cos(\theta - \alpha)$$

The equation of a parabola with the origin at the vertex, where f is the distance from the focus to the vertex:

$$y^2 = 4fx$$

If p is the semi-latus rectum ($=2f$) the equation is:

$$y^2 = 2px$$

The polar equation where the pole is at the focus and p the semi-latus rectum is:

$$r = \frac{p}{1 - \cos\theta}$$

If the pole is at the vertex and p as above:

$$r = \frac{2p\cos\theta}{\sin^2\theta}$$

The equation of the ellipse with the origin at the center and semi-axes a and b:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

Polar equation where the pole is at the center:

$$r^2 = \frac{a^2b^2}{a^2\sin^2\theta + b^2\cos^2\theta}$$

The equation of the hyperbola with the origin at the center, semi-axes a and b:

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

Polar equation, pole at center:

$$r^2 = \frac{a^2b^2}{a^2\sin^2\theta - b^2\cos^2\theta}$$

HYPERBOLIC FUNCTIONS

Definitions

An hyperbolic function represents a relation between the coordinates of a given portion on the arc of a rectangular hyperbola.

If O is the center, A the vertex, and P any point of the hyperbola APB,

$OM = x$, $MP = y$, $OA = a$.

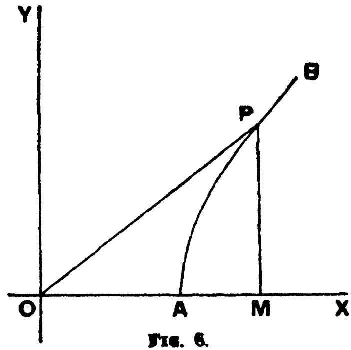


FIG. 6.

The function u may be defined by the following relation,

$$u = \frac{2 \times \text{Area OAP}}{OA^2}$$

The hyperbolic sine of $u = \sinh u = y/a$.
The hyperbolic cosine of $u = \cosh u = x/a$.

$$\sinh u = \frac{1}{2}(e^u - e^{-u}) = u + \frac{u^3}{3!} + \frac{u^5}{5!} + \cdots$$

$$\cosh u = \frac{1}{2}(e^u + e^{-u}) = 1 + \frac{u^2}{2!} + \frac{u^4}{4!} + \cdots$$

$$\tanh u = u - \frac{u^3}{3} + \frac{2u^5}{15} - \frac{17u^7}{315} + \cdots \qquad \left(u^2 < \frac{1}{4}\pi^2\right).$$

$$\sinh^{-1} u = u - \frac{1}{2}\cdot\frac{u^3}{3} + \frac{1\cdot 3}{2\cdot 4}\cdot\frac{u^5}{5} - \frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6}\cdot\frac{u^7}{7} + \cdots \qquad (u^2 < 1).$$

$$\sinh^{-1} u = \log 2u + \frac{1}{2}\cdot\frac{1}{2u^2} - \frac{1\cdot 3}{2\cdot 4}\cdot\frac{1}{4u^4} + \frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6}\cdot\frac{1}{6u^6} - \cdots \qquad (u^2 > 1).$$

$$\cosh^{-1} u = \log 2u - \frac{1}{2}\cdot\frac{1}{2u^2} - \frac{1\cdot 3}{2\cdot 4}\cdot\frac{1}{4u^4} - \frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6}\cdot\frac{1}{6u^6} - \cdots \qquad (u^2 > 1).$$

$$\tanh^{-1} u = u + \frac{u^3}{3} + \frac{u^5}{5} + \frac{u^7}{7} + \cdots \qquad (u^2 < 1).$$

$$\tanh u = \frac{\sinh u}{\cosh u}. \qquad \operatorname{sech} u = \frac{1}{\cosh u}.$$

$$\coth u = \frac{1}{\tanh u}. \qquad \operatorname{csch} u = \frac{1}{\sinh u}.$$

Relations of the Functions

$$\sinh x = -\sinh(-x). \qquad \operatorname{sech} x = \operatorname{sech}(-x).$$
$$\cosh x = \cosh(-x). \qquad \operatorname{csch} x = -\operatorname{csch}(-x).$$
$$\tanh x = -\tanh(-x). \qquad \coth x = -\coth(-x).$$

$$\sinh x = \frac{2 \tanh \frac{1}{2}x}{1 - \tanh^2 \frac{1}{2}x} = \frac{\tanh x}{\sqrt{1 - \tanh^2 x}}.$$

$$\cosh x = \frac{1 + \tanh^2 \frac{1}{2}x}{1 - \tanh^2 \frac{1}{2}x} = \frac{1}{\sqrt{1 - \tanh^2 x}}.$$

$$\cosh^2 x - \sinh^2 x = 1.$$

$$\tanh x = \sqrt{1 - \operatorname{sech}^2 x}. \qquad \operatorname{sech} x = \sqrt{1 - \tanh^2 x}.$$
$$\coth x = \sqrt{\operatorname{csch}^2 x + 1}. \qquad \operatorname{csch} x = \sqrt{\coth^2 x - 1}.$$

$\sinh(\frac{1}{2}x) = \sqrt{\frac{1}{2}(\cosh x - 1)}.$
$\cosh(\frac{1}{2}x) = \sqrt{\frac{1}{2}(\cosh x + 1)}.$
$\tanh(\frac{1}{2}x) = (\cosh x - 1) \div \sinh x = \sinh x \div (\cosh x + 1).$
$\sinh(2x) = 2 \sinh x \cosh x.$
$\cosh(2x) = \cosh^2 x + \sinh^2 x = 2\cosh^2 x - 1 = 1 + 2\sinh^2 x$
$\tanh(2x) = 2 \tanh x \div (1 + \tanh^2 x).$
$\sinh 3x = 3 \sinh x + 4 \sinh^3 x.$
$\cosh 3x = 4 \cosh^3 x - 3 \cosh x.$
$\tanh 3x = (3 \tanh x + \tanh^3 x) \div (1 + 3 \tanh^2 x).$
$\sinh(x \pm y) = \sinh x \cdot \cosh y \pm \cosh x \cdot \sinh y.$
$\cosh(x \pm y) = \cosh x \cdot \cosh y \pm \sinh x \cdot \sinh y.$
$\tanh(x \pm y) = (\tanh x \pm \tanh y) \div (1 \pm \tanh x \cdot \tanh y).$
$\sinh x + \sinh y = 2 \sinh \frac{1}{2}(x + y) \cdot \cosh \frac{1}{2}(x - y).$
$\sinh x - \sinh y = 2 \cosh \frac{1}{2}(x + y) \cdot \sinh \frac{1}{2}(x - y).$
$\cosh x + \cosh y = 2 \cosh \frac{1}{2}(x + y) \cdot \cosh \frac{1}{2}(x - y).$
$\cosh x - \cosh y = 2 \sinh \frac{1}{2}(x + y) \cdot \sinh \frac{1}{2}(x - y).$

$$\sinh x + \cosh x = \frac{1 + \tanh \frac{1}{2}x}{1 - \tanh \frac{1}{2}x}$$

$$\tanh x \pm \tanh y = \frac{\sinh(x \pm y)}{\cosh x \cosh y}.$$

$$\coth x \pm \coth y = \pm \frac{\sinh(x \pm y)}{\sinh x \sinh y}.$$

Inverse Functions

$$\sinh^{-1} x = \log(x + \sqrt{x^2 + 1}) = \int \frac{dx}{\sqrt{x^2 + 1}} = \cosh^{-1} \sqrt{x^2 + 1}$$

HYPERBOLIC FUNCTIONS (Continued)

$$\cosh^{-1} x = \log\left(x + \sqrt{x^2 - 1}\right) = \int \frac{dx}{\sqrt{x^2 - 1}} = \sinh^{-1} \sqrt{x^2 - 1}.$$

$$\tanh^{-1} x = \frac{1}{2}\log(1 + x) - \frac{1}{2}\log(1 - x) = \int \frac{dx}{1 - x^2}.$$

$$\coth^{-1} x = \frac{1}{2}\log(1 + x) - \frac{1}{2}\log(x - 1) = \int \frac{dx}{1 - x^2}.$$

$$\operatorname{sech}^{-1} x = \log\left(\frac{1}{x} + \sqrt{\frac{1}{x^2} - 1}\right) = -\int \frac{dx}{x\sqrt{1 - x^2}}.$$

$$\operatorname{csch}^{-1} x = \log\left(\frac{1}{x} + \sqrt{\frac{1}{x^2} + 1}\right) = -\int \frac{dx}{x\sqrt{x^2 + 1}}.$$

Relations to Circular Functions

$$\sinh x = -i \sin ix. \qquad \sinh ix = i \sin x.$$
$$\cosh x = \cos ix. \qquad \cosh ix = \cos x.$$
$$\tanh x = -i \tan ix. \qquad \tanh ix = i \tan x.$$

If $x = \log \tan\left(\frac{\pi}{4} + \frac{\theta}{2}\right) = \log(\sec\theta + \tan\theta)$,

θ = the **gudermannian** of x = gd x.

$$\sinh x = \tan \operatorname{gd} x. \qquad \tanh x = \sin \operatorname{gd} x.$$
$$\cosh x = \sec \operatorname{gd} x. \qquad \tanh \tfrac{1}{2} x = \tan \tfrac{1}{2} \operatorname{gd} x.$$

$$\frac{d \operatorname{gd} x}{dx} = \operatorname{sech} x.$$

Differentials

$$d \sinh x = \cosh x \cdot dx. \qquad d \coth x = -\operatorname{csch}^2 x \cdot dx.$$
$$d \cosh x = \sinh x \cdot dx. \qquad d \operatorname{sech} x = -\operatorname{sech} x \cdot \tanh x \cdot dx.$$
$$d \tanh x = \operatorname{sech}^2 x \cdot dx. \qquad d \operatorname{csch} x = -\operatorname{csch} x \cdot \coth x \cdot dx.$$

$$d \sinh^{-1} x = \frac{dx}{\sqrt{1 + x^2}}. \qquad d \coth^{-1} x = -\frac{dx}{x^2 - 1}.$$

$$d \cosh^{-1} x = \frac{dx}{\sqrt{x^2 - 1}}. \qquad d \operatorname{sech}^{-1} x = -\frac{dx}{x\sqrt{1 - x^2}}.$$

$$d \tanh^{-1} x = \frac{dx}{1 - x^2}. \qquad d \operatorname{csch}^{-1} x = -\frac{dx}{x\sqrt{x^2 + 1}}.$$

Integrals involving the hyperbolic functions will be found in the table of integrals.

ELLIPTIC FUNCTIONS

$$u = F(k, \phi) = \int_0^\phi \frac{d\phi}{\sqrt{1 - k^2 \sin^2 \phi}}, \qquad (k^2 < 1),$$
$$= \text{elliptic integral of the first kind.}$$
$$u = \int_0^x \frac{dx}{\sqrt{(1 - x^2)(1 - k^2x^2)}}, \qquad \text{where } x = \sin \phi.$$

ϕ is called the amplitude of u or am u.
k is called the modulus.

$$k' = \sqrt{1 - k^2} = \text{the complementary modulus.}$$

$\sin \phi = \text{sn } u = x.$ $\qquad \tan \phi = \text{tn } u = \dfrac{x}{\sqrt{1 - x^2}}.$

$\cos \phi = \text{cn } u = \sqrt{1 - x^2}.$ $\qquad \Delta\phi = \text{dn } u = \sqrt{1 - k^2x^2}.$
am $0 = 0.$ $\qquad$ sn $0 = 0.$
cn $0 = 1.$ $\qquad$ dn $0 = 1.$
am $(-u) = -$am $u.$ $\qquad$ sn $(-u) = -$sn $u.$
cn $(-u) =$ cn $u.$ $\qquad$ dn $(-u) =$ dn $u.$
tn $(-u) = -$tn $u.$
$\text{sn}^2 u + \text{cn}^2 u = 1.$
$\text{dn}^2 u + k^2 \text{sn}^2 u = 1.$
$\text{dn}^2 u - k^2 \text{cn}^2 u = 1 - k^2 = k'^2.$

$$E(\phi, k) = \int_0^\phi \sqrt{1 - k^2 \sin^2 \phi}\, d\phi$$
$$= \int_0^x \frac{\sqrt{1 - k^2x^2}}{\sqrt{1 - x^2}}\, dx \qquad \text{where } x = \sin \phi,$$
$$= \text{the elliptic integral of the second kind.}$$

Complete Elliptic Integrals

$$K = \int_0^{\pi/2} \frac{d\phi}{\sqrt{1 - k^2 \sin^2 \phi}}.$$
$$E = \int_0^{\pi/2} \sqrt{1 - k^2 \sin^2 \phi}\, d\phi.$$

See tables of values, page 209–211.

PROPERTIES AND PHYSICAL CONSTANTS

ATOMIC WEIGHTS

Values in parentheses are approximate only and have not been adopted by the Committee on Atomic Weights

Name	Symbol	At No	International atomic weight 1925	International atomic weight 1942	Valence
Actinium	Ac	89	....	(227)	
Alabamine (?)	Ab	85	.	(221)	1, 3, 5, 7
Aluminum	Al	13	26 97	26 97	3
Antimony, stibium	Sb	51	121 77	121 76	3, 5
Argon	A	18	39 91	39 944	0
Arsenic	As	33	74.96	74 91	3, 5
Barium	Ba	56	137 37	137 36	2
Beryllium, glucinum	Be	4	9 02	9 02	2
Bismuth	Bi	83	209 00	209 00	3, 5
Boron	B	5	10 82	10 82	3
Bromine	Br	35	79 916	79 916	1, 3, 5, 7
Cadmium	Cd	48	112 41	112 41	2
Calcium	Ca	20	40 07	40.08	2
Carbon	C	6	12 000	12.01	2, 4
Cassiopeium, see *Lutecium*.	....	.....	....	....	....
Cerium	Ce	58	140 25	140 13	3, 4
Cesium	Cs	55	132 81	132 91	1
Chlorine	Cl	17	35 457	35 457	1, 3, 5, 7
Chromium	Cr	24	52 01	52 01	2, 3, 6
Cobalt	Co	27	58 94	58 94	2, 3
Columbium, niobium	Cb	41	93.1	92 91	3, 5
Copper	Cu	29	63 57	63 57	1, 2
Dysprosium	Dy	66	162 52	162.46	3
Erbium	Er	68	167.7	167.2	3
Europium	Eu	63	152 0	152 0	2, 3
Fluorine	F	9	19 00	19 000	1
Gadolinium	Gd	64	157 26	156 9	3
Gallium	Ga	31	69 72	69 72	2, 3
Germanium	Ge	32	72 60	72 60	4
Gold, aurum	Au	79	197 2	197 2	1, 3
Hafnium, celtium	Hf	72		178 6	4
Helium	He	2	4 00	4 003	0
Holmium	Ho	67	163 4	164 94	3
Hydrogen	H	1	1 008	1.0080	1
Illinium	Il	61	.	(146)	(3)
Indium	In	49	114 8	114 76	3
Iodine	I	53	126 932	126 92	1, 3, 5, 7
Iridium	Ir	77	193 1	193 1	3, 4
Iron, ferrum	Fe	26	55 84	55.85	2, 3
Krypton	Kr	36	82 9	83.7	0

ATOMIC WEIGHTS (Continued)

Name	Symbol	At No	International atomic weight 1925	International atomic weight 1942	Valence
Lanthanum	La	57	138.90	138.92	3
Lead, plumbum	Pb	82	207.20	207.21	2, 4
Lithium	Li	3	6.940	6.940	1
Luteeium	Lu	71	175.0	174.99	3
Magnesium	Mg	12	24.32	24.32	2
Manganese	Mn	25	54.93	54.93	2, 3, 4, 6, 7
Masurium	Ma	43	...		......
Mercury, hydrargyrum	Hg	80	200.61	200.61	1, 2
Molybdenum	Mo	42	96.0	95.95	3, 4, 6
Neodymium	Nd	60	144.27	144.27	3
Neon	Ne	10	20.2	20.183	0
Nickel	Ni	28	58.69	58.69	2, 3
Niton, see *Radon*					
Nitrogen	N	7	14.008	14.008	3, 5
Osmium	Os	76	190.8	190.2	2, 3, 4, 8
Oxygen	O	8	16.000	16.000	2
Palladium	Pd	46	106.7	106.7	2, 4
Phosphorus	P	15	31.027	30.98	3, 5
Platinum	Pt	78	195.23	195.23	2, 4
Polonium	Po	84		(210)	
Potassium, kalium	K	19	39.096	39.096	1
Praseodymium	Pr	59	140.92	140.92	3
Protoactinium	Pa	91		231	
Radium	Ra	88	225.95	226.05	2
Radon, niton	Rn	86	222	222	0
Rhenium	Re	75		186.31	
Rhodium	Rh	45	102.91	102.91	3
Rubidium	Rb	37	85.44	85.48	1
Ruthenium	Ru	44	101.7	101.7	3, 4, 6, 8
Samarium	Sm, Sa	62	150.43	150.43	3
Scandium	Sc	21	45.10	45.10	3
Selenium	Se	34	79.2	78.96	2, 4, 6
Silicon	Si	14	28.06	28.06	4
Silver, argentum	Ag	47	107.880	107.880	1
Sodium, natrium	Na	11	22.997	22.997	1
Strontium	Sr	38	87.63	87.63	2
Sulfur	S	16	32.064	32.06	2, 4, 6
Tantalum	Ta	73	181.5	180.88	5
Tellurium	Te	52	127.5	127.61	2, 4, 6
Terbium	Tb	65	159.2	159.2	3
Thallium	Tl	81	204.39	204.39	1, 3
Thorium	Th	90	232.15	232.12	4
Thulium	Tm	69	169.4	169.4	3
Tin, stannum	Sn	50	118.70	118.70	2, 4
Titanium	Ti	22	48.1	47.90	3, 4
Tungsten, wolframium	W	74	184.0	183.92	6
Uranium	U	92	238.17	238.07	4, 6
Vanadium	V	23	50.96	50.95	3, 5
Virginium (?)	Vi	87		(224)	1
Xenon	Xe	54	130.2	131.3	0
Ytterbium	Yb	70	173.6	173.04	3
Yttrium	Y	39	88.9	88.92	3
Zinc	Zn	30	65.38	65.38	2
Zirconium	Zr	40	91	91.22	4

ARRANGEMENT OF ELECTRONS IN ORBITS

The following table gives, for each element, the atomic number and the arrangement of electrons in orbits. For a complete explanation of the significance of the data presented a text on the subject should be consulted.

Element	At. No.	Shell																
		K	L		M			N				O			P			Q
		Orbit																
		1s	2s	2p	3s	3p	3d	4s	4p	4d	4f	5s	5p	5d	6s	6p	6d	7s
H	1	1																
He	2	2																
Li	3	2	1															
Be	4	2	2															
B	5	2	2	1														
C	6	2	2	2														
N	7	2	2	3														
O	8	2	2	4														
F	9	2	2	5														
Ne	10	2	2	6	(3s)	(3p)	(3d)											
Na	11	2	2	6	1													
Mg	12				2													
Al	13				2	1												
Si	14				2	2												
P	15	(10, Ne Core)			2	3												
S	16				2	4												
Cl	17				2	5												
A	18				2	6		(4s)	(4p)	(4d)	(4f)							
K	19	2	2	6	2	6		1										
Ca	20							2										
Sc	21						1	2										
Ti	22						2	2										
V	23						3	2										
Cr	24	(18, A Core)					5	1										
Mn	25						5	2										
Fe	26						6	2										
Co	27						7	2										
Ni	28						8	2										
Cu	29	2	2	6	2	6	10	1										
Zn	30							2										
Ga	31							2	1									
Ge	32							2	2									
As	33	(28, Cu Core)						2	3									
Se	34							2	4									
Br	35							2	5									
Kr	36							2	6			(5s)	(5p)	(5d)				
Rb	37	2	2	6	2	6	10	2	6			1						
Sr	38											2						
Y	39									1		2						
Zr	40									2		2						
Cb	41									4		1						
Mo	42	(36, Kr Core)								5		1						
Ma	43									6		1						
Ru	44									7		1						
Rh	45									8		1						
Pd	46									10								

ARRANGEMENT OF ELECTRONS IN ORBITS (Continued)

Element	At. No.	Shell: K	L		M			N				O			P			Q
		Orbit: 1s	2s	2p	3s	3p	3d	4s	4p	4d	4f	5s	5p	5d	6s	6p	6d	7s
Ag	47	2	2	6	2	6	10	2	6	10		1						
Cd	48	(46, Ag Core)										2						
In	49											2	1					
Sn	50											2	2					
Sb	51											2	3					
Te	52											2	4					
I	53											2	5					
Xe	54											2	6		(6s)	(6p)	(6d)	
Cs	55	2	2	6	2	6	10	2	6	10		2	6		1			
Ba	56	(54, Xe Core)													2			
La	57													1	2			
Ce	58	2	2	6	2	6	10	2	6	10	1	2	6	1	2			
Pr	59										2			1	2			
Nd	60										3			1	2			
Il	61										4			1	2			
Sa	62										5			1	2			
Eu	63										6			1	2			
Gd	64										7			1	2			
Tb	65	(46, La)									8	(8, La)		1	2			
Ds	66										9			1	2			
Ho	67										10			1	2			
Er	68										11			1	2			
Tu	69										12			1	2			
Yb	70										13			1	2			
Lu	71										14			1	2			
Hf	72	2	2	6	2	6	10	2	6	10	14	2	6	2	2			
Ta	73	(68, Hf Core)												3	2			
W	74													4	2			
Re	75													5	2			
														6	1			
Os	76													6	2			
														7	1			
Ir	77													7	2			
														8	1			
Pt	78													9	1			
														10				
Au	79	2	2	6	2	6	10	2	6	10	14	2	6	10	1			
Hg	80	(78, Au Core)													2			
Tl	81														2	1		
Pb	82														2	2		
Bi	83														2	3		
Po	84														2	4		
—	85														2	5		
Rn	86														2	6		(7s)
—	87	2	2	6	2	6	10	2	6	10	14	2	6	10	2	6		1
Ra	88	(86, Rn Core)																2
Ac	89																1	2
Th	90																2	2
Pa	91																3	2
U	92																4	2

THE ELEMENTS

Revised by Harrison Hale

The most striking fact about the elements is their unequal distribution and occurrence. In the earth's crust, including the ocean and the atmosphere, F. W. Clarke reported after careful calculation that oxygen makes up 50% and silicon 25%, the two elements being three-fourths of all matter. Further he concludes that twelve elements form 99% of all this material, leaving only 1% for the other eighty elements. Fully half of the elements are of minor commercial importance at present. No one knows when an element may become of unusual commercial importance. Several theories have been suggested to explain this wide difference in occurrence, but none of these is generally accepted. Of the twelve most common elements only one has an atomic weight of more than 40, iron with 56. The lightness of these common elements is emphasized by the heaviness of twelve or more other elements with atomic weights above 200. And yet by no means are all the light elements common.

Actinium (Gr. *aktis*, *aktinos*, beam or ray), Ac; at. wt. 227 (approx.); at. no. 89. Discovered in 1899 by Andre Debierne and independently by F. Giesel in 1902. Radioactive, decomposing into other elements of smaller atomic weight at certain intervals of time. (See Radioactive Elements.)

***Alabamine** (State of Alabama), Ab; at. wt. 221; at. no. 85; valence 1, 3, 5 or 7. Discovered in 1931 by Dr. Fred Allison and co-workers at Alabama Polytechnic Institute, by the magneto-optic method of analysis. Minima for HAb, HAbO, $HAbO_3$ and $HAbO_4$ were measured. Ab can be oxidized in alkaline solution but more readily in acid solution. The peralabamates are the most stable compounds. (Existence questioned Ed.)

Aluminum (L. *alumen*, alum), Al, at. wt. 26.97; at. no. 13; m.p. 659.7°C; b.p. 1800°C; sp. gr. 2.699 (20°C); valence 3. Wöhler is generally accredited with obtaining the metal in 1827, though an impure form was prepared by Oersted two years earlier. The method of obtaining the metal by electrolysis of pure alumina dissolved in cryolite was patented independently by Hall in the United States and Heroult in France, soon after its discovery in 1886. Although aluminum occurs in larger quantities than any other metal, ranking third among all elements, it does not appear free. It is found as the silicate in clays, feldspars, etc., while the commercial ore at present is bauxite, an impure hydrated oxide. Its production from clay is possible. The metal is white and strongly resists the action of the air, becoming covered with a white oxide coating in time; it was selected as the cap for Washington's monument, and is widely used for outside building decoration. It stands second among metals in the scale of malleability, sixth in ductility. The electrical conductivity is about 60% that of copper per area of cross-section, but aluminum is much lighter, giving it use for transmission lines. It is but slightly magnetic and is strongly electro-positive, so that in contact with many other metals it corrodes rapidly. Its many alloys have strength and lightness, finding increasing use. . The compounds of greatest importance are its oxide, its sulfate, and its double sulfate with potassium

* See element 85 at end of list.

(alum). The oxide, alumina, occurs naturally as ruby, sapphire, corundum and emery, and is very hard, ranking next to the diamond. War's necessity has increased greatly the aluminum produced and this will widely extend its use in time of peace. In 1856 the price was about $90 a pound; thirty years later just before Hall's discovery about $5. Then the price dropped rapidly to 30¢ and has gone as low as 15¢.

* **Antimony** (L. *antimonium*), Sb (L. *stibium*, mark); at. wt. 121.76; at. no. 51; m.p. 630.5°C; b.p. 1380°C; sp. gr. 6.691 (20°C); valence 3 or 5. Recognized in compounds by the ancients; known as a metal at the beginning of the seventeenth century and possibly before that date. Antimony is a metallic element, common, but neither abundant nor widely diffused; sometimes found native, but more frequently as the sulfide, *stibnite* (Sb_2S_3); also as antimonides and sulfantimonides of the heavy metals, and as oxides. It is extracted from the sulfide by roasting to the oxide, which is reduced by salt and scrap iron; from its oxides it is also prepared by reduction with carbon. Antimony is an extremely brittle metal of a flaky, crystalline texture, blue-white color and metallic luster; hardness, 3 to 3.5; not acted on by air at room temperature, but burns brilliantly when heated with formation of white fumes of oxide Sb_2O_3. It is a poor conductor of heat and electricity. Important alloys include type metal and friction reducing metals. The principal compounds are the sulfides, chlorides, and tartar emetic (hydrated potassium antimonyl tartrate).

Argon (Gr. *argon*, inactive), A; at. wt. 39.944; at. no. 18; m.p. −189.2°C; b.p. −185.7°C; density 1.78394 g/l; valence 0 (does not combine with any other element). Its presence in air was suspected by Cavendish in 1785; discovered by Lord Rayleigh and Sir William Ramsay in 1894. The gas is prepared by fractionation of liquid air, the atmosphere containing 0.94% argon. It is 2½ times as soluble in water as nitrogen, having about the same solubility as oxygen; best recognized by the characteristic lines in the red end of the spectrum. It is used in electric light bulbs and in fluorescent tubes at a pressure of about 3 mm.

Arsenic (L. *arsenicum*, Gr. *arsenikon*, yellow orpiment—identified with *arsenikos*, male, from the belief that metals were of different sexes—Arab. *az-zernikh*, the orpiment from Persian *zerni-zar*. gold-), As; at. wt. 74.91; at. no. 33; m.p. sublimes (500°C m.p. under pressure); b.p. 615°C; sp. gr. 5.73; valence 3 or 5. The amorphous form of arsenic has a sp. gr. of 3.70. It is believed that Albertus Magnus obtained the element in 1250. In 1649 Schroeder published two methods of preparing it. Found native, in sulfides, *realgar* and *orpiment*, as arsenides and sulfarsenides of heavy metals and as oxide, and arsenate. *Mispickel* or arsenopyrite (FeSAs) is the most common mineral, from which on heating the arsenic sublimes leaving ferrous sulfide. The element is a steel gray, very brittle, crystalline, semi-metallic solid, which sublimes on heating, being deposited partly as crystals and partly as a black, amorphous solid; it tarnishes in air and when heated is rapidly oxidized to arsenous

* Americium, see end of list

oxide (As_2O_3) with the odor of garlic. Though the free element is not considered poisonous, many of its compounds are extremely so, being used as insecticides. Arsenic is also used in bronzing pyrotechny, and for hardening and improving the sphericity of shot. The most important compounds are white arsenic (As_2O_3), the sulfide, Paris green ($CuHAsO_3$), calcium arsenate and lead arsenate, the last three being used in agricultural poisons. Marsh's test makes use of the formation and ready decomposition of arsine (AsH_3). Important war gases as Adamsite and Lewisite, are compounds of arsenic.

Barium (Gr. *barys*, heavy), Ba; at. wt. 137.36; at. no. 56; m.p. 850°C; b.p. 1140°C; sp. gr. 3.5 (20°C); valence 2. Baryta was distinguished from lime by Scheele in 1774; the element was discovered by Sir Humphry Davy in 1808. It is found only in combination with other elements chiefly in *barite* or *heavy spar* (sulfate) and *witherite* (carbonate) and is prepared by electrolysis of the chloride. Barium is a metallic element, soft and silvery white like lead; it belongs to the alkaline earth group, resembling calcium chemically. The most important compounds are the peroxide (BaO_2), chloride, sulfate, carbonate, nitrate and chlorate. The sulfate, as permanent white or *blanc fixé*, is used in paint, the carbonate as a rat poison, while the nitrate and chlorate give green colors in pyrotechny. The sulfide phosphoresces after exposure to the light. The compounds are not expensive and the metal is not in great demand.

Beryllium (L. fr. *beryl;* also called *Glucinum*, Gr. *glykys*, sweet), Be; at. wt. 9.02; at. no. 4; m.p. 1350°C; b.p. 1500°C (5 mm.) sp. gr. 1.8 (20°C); valence 2. Discovered as the oxide by Vauquelin in beryl and in emerald in 1798; the metal was isolated in 1828 by Wohler and by Bussy independently. Beryllium aluminum silicates are the chief sources of the metal today. It is prepared by electrolysis of the double fluoride, K_2BeF_4. Hard enough to scratch glass, the metal resembles magnesium in appearance and chemical properties. Its soluble compounds are sweet. Its alloys are strong, light and resistant to corrosion. The metal is widely found, but in only small quantities of ore. The use in light alloys is increasing with the decrease in price of the metal. Addition of small amounts brings to the alloy much higher fatigue endurance.

Bismuth (Ger. *Weisse Masse*, white mass; later *Wismuth*). Bi; at. wt. 209.00; at. no. 83; m.p. 271.3°C; b. p. 1450°C; sp. gr, 9.78 (20°C); valence 3 or 5. In early times bismuth was confused with tin and lead. Claude Geoffroy showed it to be distinct from lead in 1753. It is a white, crystalline, brittle metal with a pinkish tinge. It occurs native, but the common ore is the sulfide, *bismuthinite;* from this it is extracted by melting out the free metal, the oxides and sulfides being decomposed by the addition of carbon and iron. It is also recovered as a by-product in lead smelting. Bismuth is a poor conductor of electricity, is very diamagnetic, solidifies with expansion, heated in air it burns with a blue flame forming yellow fumes of the oxide. It forms many alloys with metals, which are often used for their property of low melting (fusible metals) and because of

their expansion on cooling, making them particularly suited for sharp castings of objects subject to damage by high temperatures. Its soluble salts are characterized by forming insoluble basic salts on the addition of water—a property sometimes used in detection. The important compounds are the trioxides and the subnitrates of medicinal use, (*pearl white*, *pearl powder*, *blanc de fard* and *blanc d'Espagne*).

Boron (Ar. *būraq*, Pers. *būrah*), B; at. wt. 10.82; at. no. 5; m.p. 2300°C; b.p. sublimes 2550°C; sp. gr. of crystals 2.54, of amorphous variety 2.45; valence 3. Discovered in 1808 by Sir Humphry Davy and by Gay-Lussac and Thenard. The element is not found free in nature, but occurs as orthoboric acid usually in certain volcanic spring waters and as borates in *borax* and *colemanite*. Boron is obtained by heating the trioxide with magnesium powder, and has little or no commercial value. The most important compounds are boric, or boracic, acid widely used as a mild antiseptic, and borax ($Na_2 B_4 O_7.10H_2O$), which serves as a cleansing flux in welding and as a water softener in washing powders.

Bromine (Gr. *bromos*, stench), Br; at. wt. 79.916; at. no. 35; m.p. −7.2°C; b.p. 58.78°C; density of gas 7.59 g/l, liquid 3.12 (20°C); valence 1, 3, 5, or 7. Discovered by Balard in 1826, but not prepared in quantity until 1860. A member of the halogen group of elements, it is obtained from natural brines from wells in Michigan and West Virginia and from sea water by displacement with chlorine; electrolysis might be used. Bromine is the only liquid non-metallic element. It is a heavy, mobile, reddish-brown liquid, volatilizing readily at room temperature to a red vapor with a strong disagreeable odor, resembling chlorine, and having a very irritating effect on the eyes and throat; it is readily soluble in water or carbon disulfide, forming a red solution; it is less active than chlorine but more so than iodine; it unites readily with many elements and has a bleaching action; when spilled on the skin it produces painful sores. It is chiefly employed for the preparation of its compounds, which are useful in photography, medicine, coal tar derivatives, and as ethylene bromide in anti-knock gasoline. Organic compounds are important.

Cadmium (Gr. *kadmia*, earth), Cd; at. wt. 112.41; at. no. 48; m.p. 320.9°C; b.p. 767°C; sp. gr. 8.65 (20°C); valence 2. Discovered by Stromeyer in 1817 from an impurity in zinc carbonate. Cadmium occurs in small quantities associated with zinc. It comes off before zinc in the preparation of the metal, condensing as the brown oxide, which is then reduced with carbon. It tarnishes in air and burns when heated, forming the oxide. It is a soft, bluish-white metal, used in standard cells for the accurate determination of E.M.F. The use of the metal industrially has increased greatly; it is a component of one of the lowest melting alloys; it is extensively used in bearing alloys with low coefficients of friction and great resistance to fatigue; it is used in electroplating. It forms a number of salts of which the sulfate is the most common; the sulfide is used as a yellow pigment.

Calcium (L. *calx*, lime), Ca; at. wt. 40.08; at. no. 20; m.p. 810°C; b.p. 1170°C; sp. gr. 1.55 (20°C); valence 2. Though lime was prepared by the Romans in the first century under the name calx, not until 1808 was the metal discovered by Davy and by Berzelius and Pontin independently by preparation of an amalgam electrolytically and removal of the mercury by distillation. Calcium is a metallic element, fifth in abundance in the earth's crust, of which it forms more than three per cent; an essential constituent of leaves, bones, teeth and shells. Never found in nature uncombined, it occurs abundantly as *limestone* ($CaCO_3$), *gypsum* ($CaSO_4.2H_2O$) and fluorite (CaF_2); *apatite* is the fluophosphate or chlorophosphate of calcium. It is prepared by electrolysis of the fused chloride; chemically it is one of the alkaline earth elements; it readily forms a white coating of oxide in the air, reacts with water, burns with a yellow red flame to the oxide. Its natural and prepared compounds are widely used. Quick lime (CaO) made by heating limestone and changed into slaked lime by the careful addition of water is the great cheap base of chemical industry with countless uses. Mixed with sand it hardens as mortar and plaster by taking up carbon dioxide from the air. The solubility of the carbonate in water containing carbon dioxide causes the formation of caves with stalactites and stalagmites and hardness in water. Other important compounds are the carbide (CaC_2), chloride ($CaCl_2$), cyanamide $CaCN_2$) hypochlorite ($Ca(OCl)_2$), nitrate $Ca(NO_3)_2$, and sulfide (CaS).

Carbon (L. *carbo*, charcoal), C; at. wt. 12.010; at. no. 6; m.p. sublimes above 3500°C; b.p. 4200°C; sp. gr. amorphous 1.88, graphite 2.25, diamond 3.51; valence 2, 3 or 4. Carbon, an element of prehistoric discovery and characteristic of organic matter, is very widely distributed in nature, occurring free as diamond and graphite. In combination it is found as carbon dioxide in the atmosphere and dissolved in all natural waters, as great rock masses composed of carbonates of calcium, magnesium and iron, as hydrocarbons in supplies of petroleum and natural gas. Coal consists chiefly of carbon compounds. It appears in three allotropic forms, diamond, graphite and amorphous, all solids, insoluble in any common solvent but dissolving in melted metals from which it crystallizes on cooling in the form of graphite; when the cooling takes place under pressure some of the carbon is obtained as diamond. Carbon is unique is forming an almost infinite number of compounds, often linking carbon atom to carbon atom, there being at present half a million known compounds. Some of the most important compounds are carbon dioxide, carbon monoxide, carbon disulfide, chloroform ($CHCl_3$), carbon tetrachloride (CCl_4), methane (CH_4), ethylene (C_2H_4), acetylene (C_2H_2), benzene (C_6H_6), ethyl alcohol (C_2H_5OH), acetic acid (CH_3COOH) and countless derivatives.

Cerium (named for the planetoid *Ceres*, which was discovered in 1801 only two years before the element), Ce; at. wt. 140.13; at. no. 58; m.p. 640°C; b.p. 1400°C; sp. gr. 6.90 (20°C); valence 3 or 4. Discovered in 1803 by Klaproth and by Berzelius and

Hisinger; metal prepared by Hillebrand and Norton in 1875. Cerium is the most abundant of the metals from the so-called rare earths; it is found in a number of minerals including *orthite*, *cerite* and *samarskite* of North Carolina. Prepared by the electrolysis of the chloride it is a steel-gray lustrous metal; used as a pyrophoric alloy with iron, it gives off showers of sparks when struck. As the oxide it is an important constituent of incandescent gas mantles; as ceric sulfate it finds extensive use as a volumetric oxidizing agent in quantitative analysis.

Cesium (L. *caesius*, sky blue), Cs; at. wt. 132.91; at. no. 55; m.p. 28.5°C; b.p. 670°C; sp. gr. 1.873 (20°C); valence 1. The first metal discovered by Bunsen and Kirchhoff with the spectroscope. This was in 1860, the source being a mineral water from Dürkheim. Cesium is an alkali metal occurring in *lepidolite*, *pollucite* (a hydrated silicate of aluminum and cesium) and in the water from certain mineral springs; it is isolated by electrolysis of the fused cyanide. The metal is characterized by a spectrum containing two bright lines in the blue along with several others in the red, yellow and green. Because of its great affinity for oxygen the metal is used as a "getter" in radio tubes. It is also used in photo-electric cells, as well as for a catalyst in the hydrogenation of certain organic compounds. Its chief compounds are the chloride and the nitrate.

Chlorine (Gr. *chloros*, greenish-yellow), Cl; at. wt. 35.457; at. no. 17; m.p. −101.6°C; b.p. −34.6°C; density 3.214 g/l; sp. gr. 1.56 (−33.6°C); valence 1, 3, 5 or 7. Discovered in 1774 by Scheele, who thought it contained oxygen; named in 1810 by Davy, who insisted it was an element. In nature it is found in the combined state only, chiefly with sodium as common salt ($NaCl$), *carnallite* ($KMgCl_3.6H_2O$), and *sylvite* (KCl). A member of the halogen (salt forming) group of elements it is obtained from chlorides by the action of oxidizing agents and more often by electrolysis; it is a greenish-yellow gas, with an irritating and suffocating odor, attacking the respiratory tract; combines directly with nearly all elements. At 10°C one volume of water dissolves 3.10 volumes of chlorine, at 30° only 1.77 volumes. Being a heavy gas, it was first used as a war gas by the Germans in 1915; most war gases contain chlorine. Berthollet suggested its use for bleaching, a most important reagent for vegetable fibers to-day. Around the globe it is used as a germicide in drinking water; further use is in the manufacture of bleaching powder, hypochlorites and chlorates, chloroform, carbon tetrachloride and in the extraction of bromine. Organic chemistry demands much both as an oxidizing agent and in substitution, since it often brings desired properties in an organic compound when substituted for hydrogen, as in one form of synthetic rubber.

Chromium (Gr. *chroma*, color), Cr; at. wt. 52.01; at. no. 24; m.p. 1615°C; b.p. 2200°C; sp. gr 7.1 (20°C); valence 2, 3, or 6. Discovered in 1797 by Vauquelin, who prepared the metal the next year. Chromium is a metallic element, resembling iron, occurring chiefly in chrome iron ore ($FeO.Cr_2O_3$); prepared by the reduction of the oxide with aluminum; it is a very infusible,

hard gray metal, used to harden steel, to manufacture stainless steel and in many very useful alloys. Much is used in plating, giving a hard, beautiful surface. All compounds of chromium are colored; the most important are the chromates of sodium and potassium (K_2CrO_4) and the dichromates ($K_2Cr_2O_7$) and the potassium and ammonium chrome alums $KCr(SO_4)_2.12H_2O$. The dichromates are used as oxidizing agents in quantitative analysis, also in tanning leather. Other compounds are of industrial value; lead chromate is chrome yellow, a valued pigment.

Cobalt (*kobold*, from the Greek, goblin or evil spirit), Co; at. wt. 58.94; at. no. 27; m.p. 1480°C; b.p. 3000°C; sp. gr. 8.9 (20°C); valence 2 or 3. Discovered by Brandt in 1735. Cobalt is a metal occurring in ores sparingly distributed, usually sulfide or arsenide. It is prepared by reducing the oxide with aluminum; it is brittle, hard, very magnetic, and of a gray color with a reddish tinge. Its alloys are important, as stainless steel, it is used in electroplating because of its appearance, hardness and resistance. The salts have been used for centuries for the production of brilliant and permanent blue colors in porcelain, glass, pottery, tiles and enamels, being the principal ingredient in *Sevres blue* and *Thenard's blue*. As little as 0.1% of the metal gives an intense blue color. A solution of the chloride ($CoCl_2$.-$6H_2O$) is used as sympathetic ink, the solution being pink and practically colorless when spread on paper, turns blue on heating which removes the water of crystallization. The cobalt ammines are of interest; the oxide and the nitrate are important.

Columbium (*Columbia*, also called Niobium), Cb (or Nb); at. wt. 92.91; at. no. 41; m.p. 1950°C; b.p. 2900°C; sp. gr. 8.4 (20°C); valence 3 or 5. Discovered in 1801 by Hatchett in an ore sent to England more than a century before by John Winthrop, first governor of Connecticut. Metal prepared by Blomstrand, who reduced the chloride by heating in hydrogen in 1864. Columbium is a rare metallic element, found as *columbite* in pegmatite veins, volcanic intrusions through the earth's crust. Added to stainless steel this metal by combining with carbon preserves the corrosion resistance even when heated. This use has greatly increased the demand for the metal now obtained from an African ore. After removing tin from this ore, the residue is reduced with silicon or aluminum in an electric furnace, giving ferro-columbium, suited to steel making. The metal is gray; it forms an acid oxide, Cb_2O_5, from which salts are derived.

Copper (L. *cuprum*, from the island of Cyprus), Cu; at. wt. 63.57; at. no. 29; m.p. 1083°C; b.p. 2300°C; sp. gr. 8.93–8.95; valence 1 or 2. The discovery of copper dates from prehistoric times; it is said to have been mined for more than 5000 years. Copper is a metallic element, reddish colored, bright, metallic luster, malleable, ductile, a good conductor of heat and electricity (second only to silver in electrical conductivity). It occurs native and in many minerals; the most important of these compounds are sulfides, oxides and carbonates. From these it is obtained by smelting, leaching or electrolysis. Its alloys, brass

and bronze, long used are still most important; all American coins are copper alloys; monel and gun metals also contain copper. The most important compounds are the oxide and the sulfate, blue vitriol; the latter has wide use as an agricultural poison and as an algicide in water purification. Copper compounds are widely used in analytical chemistry, as Fehling's solution in tests for sugar.

***Deuterium,** an isotope of hydrogen—see later paragraph.

Dysprosium (Gr. *dysprositos*, hard to get at), Dy; at. wt. 162.46; at. no. 66; m.p. . . . . . ; b.p. . . . ; sp. gr. . . . ; valence 3. Discovered in 1886 by Lecoq de Boisbaudran. The so-called rare earths may be divided into two groups, the cerium and the yttrium. Dysprosium is in the latter group, a member of the erbium family, closely related to holmium. It occurs in the minerals usually found in granite or in pegmatite veins, such as *xenotime*, *fergusonite*, *gadolinite*, *euxonite*, *polycrase* and *blomstrandine*. The free element has never been isolated; its salts are highly colored.

Erbium (Ytterby, a town in Sweden), Er; at. wt. 167.2; at. no. 68; m.p. . . . . . ; b.p. . . . . . ; sp. gr. 4.77 (?); valence 3. Discovered in 1843 by Mosander. Erbium is in the yttrium group of rare earth metals with atomic numbers of 64 to 71 in addition to yttrium, 39. In order of increasing basicity are included thulium, erbium, holmium and dysprosium, with decreasing atomic weights. Erbium occurs in the minerals mentioned under dysprosium above. It forms an oxide Er_2O_3 and highly colored salts.

Europium (Europe), Eu; at. wt. 152.0; at. no. 63; m.p. . . . . ; b.p. . . . . . ; sp. gr. . . . . . ; valence 2 or 3. Discovered in 1901 by Demarcay. Europium is in the cerium group with atomic numbers from 57 to 63 and related in order of discovery. It is very sparsely distributed and of slight importance at present. Salts of the type EuX_3 and EuX_2, where X is a univalent atom or radical, are known.

Fluorine (L. *fluo*, flow), F; at. wt. 19.000; at. no. 9; m.p. −223°C; b.p. −187°C; density 1.69 g/l (15°C); sp. gr. of liquid 1.11 (−187°C); valence 1. Discovered by Scheele in 1771, but not isolated until 1886, by Moissan. It occurs chiefly in *fluor spar* (CaF_2) and *cryolite* (Na_3AlF_6), but seems rather widely distributed. Fluorine, a member of the halogen family of elements, is obtained by electrolyzing a solution of potassium hydrogen fluoride in anhydrous hydrogen fluoride in a vessel of metal or transparent fluorspar. It is a pale yellow gas, uniting directly with silicon, carbon, hydrogen and nearly all other elements in the dark; decomposes almost all compounds to form fluorides. The most important compounds are hydrogen fluoride, which is used in etching glass, and calcium fluoride. Freeon, used in air conditioning, is difluoro di chloro methane. Both the element and hydrofluoric acid are dangerous poisons. The presence of fluorides in drinking water to the extent of two parts per million, or less, causes mottled enamel in teeth, when used by children acquiring permanent teeth. Organic compounds of fluorine are now receiving attention.

* Curium, see end of list.

Gadolinium (*gadolinite*, name for Gadolin, a chemist of Finland), Gd; at. wt. 156.9; at. no. 64; m.p. . . . ; b.p. . . . . ; sp. gr. . . . . . ; valence 3. Separated by Marignac in 1880 and by Lecoq de Boisbaudran in 1886. In order of discovery gadolinium belongs in the yttrium group, being a member of the terbium family. It is named for the mineral from which the earth was obtained. The free element has never been isolated; the element forms oxides of the type R_2O_3, and its salts are usually more soluble than the corresponding terbium salts; its compounds are more plentiful than those of terbium or of europium. These elements decrease in order of basicity, Eu, Gd, Tb.

Gallium (L. *Gallia*, France), Ga; at. wt. 69.72; at. no. 31; m.p. 29.75°C; b.p. 1600°C; sp. gr. 5.91 (20°C); valence 2 or 3. Discovered spectroscopically by Lecoq de Boisbaudran in 1875, who in the same year obtained the free metal by electrolysis of a solution of the hydroxide in potassium hydroxide. A very rare metal, whose salts resemble those of aluminum; found in traces in many zinc blendes and nearly always in bauxite. Gallium was discovered in zinc blende from a mine in Hautes-Pyrenees; had been predicted and described as eka-aluminum by Mendeleeff. Besides mercury, cesium and rubidium, gallium is the only metal which can be liquid at near room temperatures; this makes possible its use in high temperature thermometers; the solid is hard and grayish-white. The metal forms two sets of oxides and salts in which it has a valence of two or of three.

Germanium (L. *Germania*, Germany), Ge; at. wt. 72.60; at. no. 32; m.p. 958.5°C; b.p. volatilizes at 2700°C; sp. gr. 5.36 (20°C); valence 4. Discovered by Winkler in 1886; had been predicted and described as eka-silicon by Mendeleeff. The metal is prepared by reducing the oxide with carbon or with hydrogen. The oxide was first obtained from *argyrodite*, a sulfide of germanium and silver; in 1916 the mineral, *germanite*, containing 8% of germanium was discovered. Being in the silicon group, the metal lies between silicon and tin in physical and chemical properties; it is a gray-white, brittle, crystalline metal, retaining its luster in air at room temperatures. The most important compounds are the oxide GeO_2, and the halides, as $GeCl_4$, which is volatile.

Glucinum—see *Beryllium*.

Gold (Sanskrit *Jval;* Anglo-Saxon *gold*), Au (L. *aurum*, shining dawn); at. wt. 197 2; at. no. 79; m.p. 1063°C; b.p. 2600°C; sp. gr. 19.32 (17.5C); valence 1 or 3. Known and highly valued from earliest times. Gold is found in nature as the free metal and in tellurides; very widely distributed but almost always associated with quartz or pyrite; occurs in veins and in alluvial deposits. The metal is obtained from its ores by cyanidation, amalgamation and smelting. Refining is frequently done by electrolysis. It has been estimated that all the gold in the world could be placed in a single cube, forty feet on the side. As with most metals, recent production has greatly increased. Gold is a metallic element, having a yellow color when in mass, but when finely divided it may be black,

ruby or purple; colloidal gold has been used to color ruby cathedral glass windows. It is the most malleable and ductile, and also one of the softest of the metals; it is a good conductor of heat and electricity and is not affected by air and most reagents. Its chief use is in coinage and jewelry, when it is alloyed with other metals, pure gold being expressed as 24 carat. When used as a standard of value by the United States, one Troy ounce was worth $20.67 plus; since 1934 this value has been fixed by law and the President's order at $35.00 per ounce. The commonest compounds are auric chloride ($AuCl_3$) and chlorauric acid ($HAuCl_4$), the latter being used in photography for toning the silver image. A mixture of one part of nitric acid with three of hydrochloric acid is called *aqua regia*, because it dissolves Gold, the King of Metals.

Hafnium (*Hafnia*, Copenhagen), Hf; at. wt. 178.6; at. no. 72; m.p. 1700°C; b.p. above 3200°C; sp. gr. 13.3; valence 4. Discovered in 1923 by D. Coster and G. von Hevesy in a *zircon* from Norway by means of Röntgen spectroscopic analysis. On the basis of the Bohr theory the new element was expected to be associated with zirconium. On treatment of the mineral with potassium bifluoride and separation K_2ZrF_6, the mother liquors became richer in the new element. All the zirconium minerals examined except one contained hafnium. It has been separated from zirconia by repeated recrystallization of the double ammonium or potassium fluorides. Metallic hafnium was prepared by passing the vapor of the tetraiodide over a heated tungsten filament; this was done by van Arkel and deBoer; it has the same crystalline structure as zirconium. Hafnium also resembles zirconium in chemical properties. There is an oxide (HfO_2), a white powder, with corresponding hydroxide and salts.

Helium (Gr. *helios*, the sun), He; at. wt. 4.003; at. no. 2; m.p. below −272.2°C (26 atm.); b.p. −268.9°C; density 0.177 g/l; valence 0. Evidence of the existence of helium was first obtained by Janssen during the eclipse of 1868, when he detected a new line in the solar spectrum; Lockyer and Frankland suggested the name for the new element; in 1895 Ramsay isolated helium from *uraninite*. Helium is a gas, inert chemically, obtained by compression and fractionation of the gas from certain wells and from many radioactive minerals. Onnes has cooled the element to the lowest temperature ever obtained, −272.918°C, and expressed the opinion that helium may remain a liquid even at absolute zero under normal pressure. In 1926 Keesom solidified it under a pressure of 26 atmospheres. Approximately twice as heavy as hydrogen it is used for inflating balloons because it will not burn. A mixture of 80% helium and 20% oxygen is used as an artificial atmosphere for divers and others working under pressure; since helium is less soluble in the blood than nitrogen it does not produce the "bends."

Holmium (L. *Holmia*, for Stockholm), Ho; at. wt. 164.94; at. no. 67; m.p. . . . . . ; b.p. . . . . ; sp. gr. . . . . . ; valence 3. Discovered by Cleve while working on erbia earth in 1879; pure holmia earth was isolated by Homberg in 1911. Holmium is in the yttrium group of rare earth metals in order of

discovery; it is a member of the erbium family, which includes thulium, erbium, holmium, dysprosium in the order of increasing basicity. It occurs in gadolinite and similar minerals. The element has not been isolated, but the oxide (Ho_2O_3), a grayish-white powder, and corresponding salts have been prepared.

Hydrogen (Gr *hydro*, water, and *genes*, forming), H; at. wt. 1.0080; at. no. 1; m.p. −259.14°C; b.p. −252.7°C, density 0.08988 g/l; sp. gr. liquid 0.070 (−252°C); valence 1. First recognized as a distinct substance by Cavendish in 1766; named by Lavoisier. Hydrogen occurs chiefly in combination with oxygen as water; also in acids, bases and alcohols as well as in carbohydrates, in petroleum and other hydrocarbons. It is usually a constituent of organic compounds, especially those used as fuels and as food. It is the lightest of all gases, insoluble in water, uniting with many elements to form compounds; it is used as a reducing agent, as a means of obtaining high temperature flames, in atomic hydrogen welding and for inflating balloons. Great quantities are required commercially for the fixation of nitrogen from the air in the Haber ammonia process and for the hydrogenation of fats and oils. It is prepared by action of steam on heated carbon, by the electrolysis of water, or by the displacement from acids by certain metals. In 1932 Urey announced the preparation of the isotope with an atomic weight of 2, commonly called deuterium; tritium with an atomic weight of 3 was discovered two years later. One part of deuterium is found to about 5000 ordinary hydrogen atoms; with tritium the ratio is only one to a billion.

***Illinium** (University and State of Illinois), Il; at. wt. estimated 146; at. no. 61; m.p. . . . . ; b.p. . . . . . ; sp. gr. . . . . ; valence doubtless 3. The discovery of illinium was announced in 1926 by Hopkins, Yntema and Harris on the basis of absorption, arc, and X-ray emission spectra. Later in the same year Rolla and Fernandez in Italy claimed prior discovery and proposed the name florentium. The late Charles James at the University of New Hampshire concentrated considerable illinium and other investigators have since confirmed the existence of the element in this material. Hopkins used material obtained from monazite sand. Illinium is a member of the cerium group of rare earth metals which includes lanthanum, cerium, praseodymium, neodymium, illinium and samamrium in order of decreasing basicity. Neither the metal nor its salts have been prepared in an entirely pure state.

Indium (from its indigo blue spectrum), In; at. wt. 114.76; at. no. 49; m.p. 155°C; b.p. 1450°C; sp. gr. 7.28 (20°C); valence 1 or 3. Discovered in 1863 by the use of the spectroscope by Reich and Richter, who later isolated the metal. Indium is a rare metallic element, occurring usually in zinc blendes, sometimes with pyrites and siderite. The metal is obtained by electrolysis from baths of complex cyanide, chloride and sulfate. It belongs to the aluminum group in properties, being a very soft, silvery metal, not acted on by water or air, burning to the oxide (In_2O_3). Electroplates of indium increase the resist-

* See element 61 at end of list.

ance of certain bearing alloys to organic acid corrosion. The metal finds use in alloys for jewelry and in dental alloys.

Iodine (Gr. *iodes*, violet), I; at. wt. 126.92, at. no. 53; m.p. 113.5°C; b.p. 184.35°; density of the gas 11.27 g/l; sp gr. solid 4.93 (20°C); valence 1, 3, 5, or 7. Discovered by Courtois in 1811. Iodine, a halogen, occurs sparingly in the form of iodides in sea water from which it is assimilated by seaweeds, in Chile saltpeter, in brines from old sea deposits and in caliche (as sodium iodate); from iodides it is obtained on treatment with sulfuric acid and some oxidizing agent (MnO_2) and from the iodates by heating with sodium bisulfite; for about ten years it has been obtained from brines from salt wells by a new process using finely divided silver, which has so increased production that the price has been reduced to about one-third. It is a grayish-black, lustrous solid, volatilizing at ordinary temperatures into a blue-violet gas with an irritating odor; it forms compounds with many elements, but is less active than the other halogens, which displace it from iodides. It dissolves slightly in water, readily in chloroform, carbon tetrachloride or carbon disulfide to beautiful purple solutions. Iodine compounds are important in organic chemistry. The most common compounds are the iodides of sodium and potassium (KI) and the iodates (KIO_3). Lack of iodine is the cause of goiter The iodide and thyroxin, which contains iodine, are used internally in medicine, and a solution of iodine in alcohol for external wounds. Potassium iodide finds some use in photography. The deep blue color with starch solution is characteristic of the free element.

Iridium (L. *iris*, rainbow), Ir; at. wt. 193.1; at. no. 77; m.p. 2350°C; b.p. above 4800°C; sp. gr. 22.42 (17°C); valence 3 or 4. Discovered in 1803 by Tennant in the residue left when crude platinum is dissolved by aqua regia. The name shows the colors of its salts—green, red, violet. Iridium, a metal of the platinum family, is white, very hard and brittle. It occurs uncombined with platinum and other metals of this family in alluvial deposits. It is used in apparatus for high temperatures; alloyed with platinum for standard weights and measures; alloyed with osmium in tipping pens and compass bearings. Iridium black, prepared by exposing alcoholic solutions of the sulfate to light, is used as a catalytic agent. The most important salt is $IrCl_4$.

Iron (Anglo-Saxon, *iron*), Fe (L. *ferrum*); at. wt. 55.85; at. no. 26; m.p. 1535°C; b.p. 3000°C; sp. gr. 7.85–7.88 (20°C); valence 2, 3, or 6. Iron implements are said to have been made by the Egyptians 3000 B.C. The most common ore is *hematite* (Fe_2O_3), from which the metal is obtained by reduction with carbon. Iron is the most abundantly produced of the metals, though aluminum occurs in larger percentage in the earth's crust than iron. The pure metal, which is practically unknown in industry (although some grades of soft steel have a very high percentage of iron), is silver-white, very ductile and magnetic; the pure metal may be prepared by electrolytic deposition from ferrous sulfate, or by reduction of the pure oxide with hydrogen

or aluminum. Pig iron is hard, brittle and fairly fusible, containing about 3% carbon and varying amounts of sulfur, silicon, manganese and phosphorus; wrought iron is tough, grayish-white and malleable, having usually a fibrous structure, very infusible, with only a few tenths per cent or less of carbon; steel is a solid solution of iron carbide in iron with a carbon content usually below 2%. Iron is the cheapest metal known, pig iron usually costing less than a cent a pound and steel about twice as much. Alloying with other metals has greatly improved the properties and widened the use of steel.

Krypton (Gr. *kryptos*, hidden), Kr; at. wt. 83.7; at. no. 36; m.p. −157°C; b.p. −152.9°C; density 3.708 g/l (0°C); valence 0. Discovered in 1898 by Ramsay and Travers in the residue left after liquid air had nearly boiled away. There is one part of krypton in a million parts of air; it is an inert, rare, gaseous element, and is characterized by brilliant green and yellow lines in its spectrum.

Lanthanum (Gr. *lanthano*, to conceal), La; at. wt. 138.92; at. no. 57; m.p. 826°C; b.p. 1800°C; sp. gr. 6.155; valence 3. Occurs in the cerium group of the rare earth metals, lanthana being separated from ceria by Mosander in 1839. It is found in ores *cerite*, *orthite* and *monazite*. The metal is prepared from the chloride by treatment with sodium, or by electrolysis of a fused bath of lanthanum and potassium chlorides and calcium fluoride. Lanthanum resembles iron in its physical properties, burning brilliantly in the air to form La_2O_3.

Lead (Anglo-Saxon *lead*), Pb (L. *plumbum*); at. wt. 207.21; at. no. 82; m.p. 327.4°C; b.p. 1620°C; sp. gr. 11.35 (20°C); valence 2 or 4. Long known; mentioned in Exodus. Lead is obtained chiefly from galena (PbS) by a roasting process. It is a bluish-white metal of bright luster, very soft, highly malleable; has slight tenacity, is ductile and a poor conductor of electricity; lasts very long, since lead pipes bearing the insignia of Roman emperors, used as drains from the baths, are still in service. It is also used as containers for corrosive liquids, as in sulfuric acid chambers; it may be toughened by the addition of a small percentage of antimony or other metal. Its alloys include solder, type metal and various antifriction metals. Great weights of lead both as the metal and as the dioxide are used in storage batteries. White lead, the basic lead carbonate, sublimed white lead ($PbSO_4$), chrome yellow ($PbCrO_4$), red lead (Pb_3O_4) and other lead compounds are extensively used in paints. The nitrate and the acetate are soluble salts. Lead salts are used in medicine, as antiseptics and astringents. Care must be used in both medicine and industry as lead is a cumulative poison.

Lithium (Gr. *lithos*, stone), Li; at. wt. 6.940; at. no. 3; m.p. 186°C; b.p. above 1220°C; sp. gr. 0.534 (20°C); valence 1. Discovered by Arfvedson in 1817. Lithium is the lightest alkali metal; never found free in nature, traces of it occur in nearly all igneous rocks and in the waters of many mineral springs. *Lepidolite*, *spodumene*, *petalite* and *amblygonite* are the more important minerals containing it. The metal is pro-

duced from the fused chloride electrolytically. It is the lightest metal known, soft and white; burned in air it forms Li_2O; its salts are analogous to those of sodium and potassium. The carbonate and citrate are used in medicine to remove uric acid from the body, since lithium urate is soluble. To a limited extent the metal is used industrially in various alloys increasing tensile strength and resistance to corrosion. In the flame test for lithium a brilliant crimson is given.

Lutecium (*Lutetia*, ancient name of Paris—sometimes called cassiopeium by the Germans), Lu; at. wt. 174.99; at. no. 71; m.p. . . . . ; b.p. . . . . . . ; sp. gr. . . . . . . ; valence 3 or 4. In 1907 Urbain and in 1908 von Welsbach described a process by which Marignac's ytterbium (1879) could be separated into the two elements, ytterbium (neoytterbium) and lutecium. Both elements occur in very small amounts in nearly all minerals containing yttrium. Charles James of New Hampshire prepared lutecia independently. This rare earth has little practical use. The oxide, chloride and sulfate have been prepared.

Magnesium (Magnesia, district in Thessaly), Mg; at. wt. 24.32; at. no. 12; m.p. 651°C; b.p. 1110°C; sp. gr. 1.74 (20°C); valence 2. Compounds long known, recognized by Black as an element in 1755, isolated by Davy in 1808, prepared in coherent form by Bussy in 1831. Magnesium is one of the most abundant metals and the eighth element in estimated amount in the earth's crust. It does not occur uncombined but many carbonates and silicates contain considerable percentages, while soluble sulfate and chloride are found in mineral springs and in the ocean. It has been obtained by the electrolysis of the fused chloride; this method has been used for commercial production in the U.S. since 1916, using brines from wells and recently sea water from the Gulf of Mexico also. Electrothermic methods have also been proposed, being difficult because the metal combines when heated both with oxygen and with nitrogen. Recognition of its importance in war caused the one producing company in the U.S. in 1939 to expand its productive capacity six fold. By government direction this was expected to be increased ten times, raising an annual production of six to 400 million tons. It is a light, white and fairly tough metal; tarnishes slightly in air, and as ribbon, wire or powder ignites on heating, burning with a dazzling white flame. It is useful in flash-light photography, flares and for pyrotechnics, including incendiary bombs. It is one-third lighter than aluminum and in its alloys is essential for airplane construction. The first metallic magnesium produced commercially sold for $10 a pound; the price is now less than 30¢. Important compounds are the oxide, chloride, sulfate and citrate, which find use in medicine. In Grignard's reaction, organic magnesium compounds are useful.

Manganese (L. *magnes*, magnet), Mn; at. wt. 54.93; at. no. 25; m.p. 1260°C; b.p. 1900°C; sp. gr. 7.2 (20°C); valence 2, 3, 4, 6, or 7. Recognized by Bergman, Scheele and others, discovered by Gahn in 1774 by reduction of dioxide with carbon.

Manganese minerals are widely distributed, oxides, silicates and carbonates being most common. Pyrolusite (MnO_2) and psilomelane are common ores. The metal is obtained by reduction of the oxide with sodium, magnesium, aluminum, or by electrolysis. It is gray-white, resembling iron, but is harder and very brittle. Its alloys with iron, copper and nickel are important. The mineral, *pyrolusite,* has been used since very early times to give color to glass; a smaller amount gives a weaker amethyst color which removes the greenish color due to iron and other impurities and makes colorless glass. Other compounds are the chloride, sulfate and permanganate, which is used as an antiseptic and in quantitative analysis because of its oxidizing power.

***Masurium** (Masurenland, in East Prussia), Ma; at. wt. 98, estimated; at. no. 43;* m.p. 2300°C; b.p. . . . . . ; sp. gr. . . . . . ; valence 2, 3, 4 or 6. Masurium is one of the eka-manganeses discovered by Noddack, Tacke (now Frau Noddack) and Berg in 1925 and occurs in the minerals *columbite, sperrylite, gadolinite* and *fergusonite.* These minerals were examined in a search for elements 43 and 75, the detection being made with the aid of the Röntgen spectrum. The quantity of masurium in these minerals and in the earth's crust, seems to be relatively very small.

Mercury (Planet Mercury), Hg (*hydrargyrum,* liquid silver); at. wt. 200.61; at. no. 80; m p. −38.87°C; b.p. 356.9°C; sp. gr. 13.546 (20°C); valence 1 or 2. Known to ancient Chinese and Hindus; found in Egyptian tombs of 1500 B.C. Mercury, the only common metal liquid at ordinary temperatures, occurs free in nature, but the chief source is the sulfide (*cinnabar,* HgS), from which it may be obtained by heating in a current of air. It is a heavy silver-white, shining metal, a fair conductor of heat and electricity, having a regular coefficient of expansion. These properties make it generally useful in the laboratory for thermometers, barometers and many other instruments. It tarnishes but slightly in the air except when heated to near the boiling point, where it is slowly converted to the oxide (HgO), from which the oxygen is set free again at higher temperatures. Mercury forms alloys, called *amalgams,* with many metals. The most important salts are mercuric chloride ($HgCl_2$, violent poison and antiseptic), mercurous chloride (HgCl, calomel laxative of medicine), mercury fulminate ($Hg(ONC)_2$, a detonator widely used in explosives), and mercuric sulfide (HgS, vermilion, a high grade red paint). Organic mercury compounds are likewise important.

Molybdenum (Gr. *molybdos,* lead), Mo; at. wt. 95.95; at. no. 42; m.p. 2620°C; b.p. 3700°C; sp. gr. 10.2; valence 2, 3, 4, 5, or 6. Recognized by Scheele; prepared in an impure form in 1782 by Hjelm. Molybdenum does not occur native, being obtained from *molybdenite* (MoS_2) and from *wulfenite*($PbMoO_4$). The metal is prepared by the reduction of the oxide with carbon, usually in the electric furnace. It is a very hard silver-white metal; it is widely used in the manufacture of certain grades of tool steel, boiler plate, rifle barrels and large cranks, as

* See element 43 at end of list.

it increases toughness and tensile strength. Being softer and more ductile than tungsten it is invaluable for the filaments, grids and screens for radios.

Neodymium (Gr. *neos*, new and *didymos*, twin), Nd; at. wt. 144.27; at. no. 60; m.p. 840°C; b.p. . . . . . . ; sp. gr. 6.95; valence 3. In 1843 reported the supposed element didymium obtained from *cerite*. In 1885 von Welsbach separated didymium into two new elements, neodymium and praseodymium by repeated fractionation of ammonium didymium nitrate. Neodymium is a metallic element, belonging to the rare earths, forming a series of pink salts with a characteristic absorption spectrum.

***Neon** (Gr. *neos*, new), Ne; at. wt. 20.183; at. no. 10; m.p. −248.67°C; b.p. −245.9°C; density 0.8990 g/l (0°C); valence 0. Discovered by Ramsay and Travers in 1898. Neon is a gaseous element present in the atmosphere to the extent of 18 parts per million. It is obtained by liquefaction of air and separated from the other elements by fractional distillation. It is an inert element forming no compounds. Neon glows red-orange in a vacuum tube and is therefore widely used in electric signs and beacons. Its spectrum is marked by pronounced red and green lines.

Nickel (Sw. abbr. of *kopparnickel*, false copper), Ni; at. wt. 58.69; at. no. 28; m.p. 1455°C; b.p. 2900°C; sp. gr. 8.90 (20°C); valence 2 or 3. Discovered by Cronstedt in 1751. Nickel is obtained chiefly from the nickel bearing *pyrrhotite* of Ontario and the *garnierite* (hydrated silicate of nickel, iron and magnesium found in New Caledonia) by roasting to the oxide, which is then reduced with carbon or carbon monoxide, volatile nickel carbonyl being formed and then decomposed by heat. The metal is hard, malleable, ductile and tenacious, of a white color, somewhat magnetic, a fair conductor of heat and electricity; it belongs to the iron-cobalt group of metals. Nickel is chiefly valuable for the alloys it forms; coinage with 75% of copper, Monel metal with copper and iron, nickel steel for armor plates and burglar proof safes, invar, constantan, permalloy, nichrome, platinite and others. Nickel plate by electrodeposition is used as a protective coating for metals, and finely divided nickel as a catalyst in the hydrogenation of vegetable oils. The sulfate and the oxides, NiO and Ni_2O_3, are important compounds.

Niobium, see *Columbium*.

Nitrogen (L. niter forming), N; at. wt. 14.008; at. no. 7; m.p. −209.86°C; b.p. −195.8°C; density 1.2506 g/l; sp. gr. liquid 0.808 (−195.8°C) solid 1.026 (−252°C) valence 3 or 5. Discovered by Daniel Rutherford in 1772. Nitrogen makes up 78% of the air by volume, the estimated amount in the atmosphere being more than 4000 billion tons; from this inexhaustible source it can be obtained by liquefaction and fractional distillation. The element is so inert that Lavoisier named it *azote*, without life, yet its compounds are so active as to be most important in foods, poisons, fertilizers and explosives. It is also prepared easily by heating a water solution of ammonium nitrite (made from ammonium chloride and sodium nitrite).

* Neptunium, see end of list.

Nitrogen is colorless, odorless and generally inert element. When heated it will combine directly with magnesium, lithium or calcium; when mixed with oxygen and subjected to electric sparks it forms first nitric oxide (NO) and then the peroxide (NO_2); when heated under pressure with a catalyst with hydrogen ammonia is formed (Haber process). The ammonia thus formed is of the utmost importance, and may be oxidized to nitric acid (Ostwald process). Sodium and potassium nitrates are formed by the decomposition of organic matter with compounds of the metals present; in certain dry areas these saltpeters are found in quantity. The chief compounds are ammonia, nitric acid, the nitrates, the five oxides (N_2O, NO, N_2O_3, NO_2, and N_2O_5) as well as very many organic substances.

Osmium (Gr. *osme*, odor) Os; at. wt. 190.2; at. no. 76; m.p. 2700°C; b.p. above 5300°C; sp. gr. 22.48 (20°C); valence 2, 3, 4, or 8. Discovered in 1803 by Tennant in the residue left when crude platinum is dissolved by *aqua regia*. Osmium occurs in *iridosime* and in platinum bearing river sands of the Urals, North America and South America. The metal is bluish-white, hard and crystalline, belonging to the platinum family. It is the heaviest known form of matter and is very infusible. When heated in air it is oxidized to OsO_4 with a pungent, irritating and poisonous vapor, which is easily reduced by organic matter. The oxide gives the element its name, and is useful in making microscopic slides. The metal has been used in making lamp filaments and with iridium forms the alloy osmiridium, which is very hard, suggesting its use for tipping gold pen points and for fine machine bearings.

Oxygen (Gr. *oxys*, acid, and *genes*, forming, acid former), O; at. wt. 16.0000; at. no. 8; m.p. −218.4°C; b.p. −183.0°C; density 1.429 g/l (0°C); sp. gr. liquid 1.14 (−183°C); valence 2. Discovered in 1774 by Priestley, who obtained it by heating mercuric oxide, using the sun's rays with a burning glass; independently by Scheele from other sources. Oxygen as a gaseous element forms 21% of the atmosphere by volume, from which it can be obtained by liquefaction and fractional distillation. Free and in compounds it makes up approximately one half of the total material on the surface of the earth, forming by weight more than one fifth of the air, about two-thirds of the human body and eight-ninths of the water, with a very high percentage in the minerals of the earth's crust. In the laboratory it is usually prepared by the electrolysis of water, or by heating potassium chlorate with manganese dioxide as a catalyst. The critical temperature and pressure are −118°C and 50 atmospheres. The gas is colorless, odorless, and tasteless; the liquid and solid forms are a pale blue color and are magnetic, but much less so than iron. Oxygen is very reactive, capable of combining with all the other elements except the inert gases in Group O and bromine. Its atomic weight is the standard of comparison for the atomic weight of each of the other elements. It is used with combustible gases in the oxy-hydrogen and oxy-acetylene flames. It is essential for respira-

tion of all animals and for practically all combustion; in medicine it is used to aid respiration.

Palladium (Planetoid Pallas), Pd; at. wt. 106.7; at. no. 46; m.p. 1553°C; b.p. 2200°C; sp. gr. 12.16 (20°C); valence 2 or 4. Discovered in 1803 by Wollaston. Palladium occurs with platinum and is obtained by ignition of the precipitated cyanide. It is a steel-white metal of the platinum family; does not tarnish in air and has the property of taking up large volumes of hydrogen with the formation of the hydride. It is used in the construction of non-magnetic watches and parts of delicate balances and in surgical instruments. The most important compound is the chloride, $PdCl_2$.

Phosphorus (Gr. *phosphoros*, light bearing), P; at. wt. 30.98; at. no. 15; m.p. 44.1°C; b.p. 280°C; sp. gr. yellow 1.82, red 2.20; valence 3 or 5. Discovered in 1669 by Brand, who prepared it from urine. Phosphorus may be prepared in three allotropic forms; white or yellow, red, black. Never found free in nature, it is widely distributed in combination in minerals, the most important being the *apatites* ($3Ca_3(PO_4)_2.CaF_2$ and $3Ca_3(PO_4)_2.CaCl_2$), which are the chief ingredients of commercial phosphates derived from South Carolina, Florida, Canada and Spain; it is an essential ingredient of all cell protoplasm, nervous tissue and bones. It may be obtained from phosphates by treatment with dilute sulfuric acid to form *o*-phosphoric acid, the concentrated solution of which is mixed with crushed charcoal or coke and dried; on heating this mixture in retorts, the phosphorus distils and is condensed. It is also prepared by heating crude phosphate with sand and coke in the electric furnace, the phosphorus distilling off. Ordinary phosphorus is a waxy solid, which is colorless when very pure, insoluble in water but soluble in carbon disulfide. It takes fire spontaneously in air, burning to the pentoxide; it is very poisonous. When heated in its own vapor to 250°C it is converted into the red variety, which does not glow in the air, does not ignite spontaneously, and is not poisonous. The production of phosphorus and its compounds has increased very rapidly in recent years; phosphoric acid is replacing sulfuric acid in the treatment of natural phosphates to make them soluble for use as fertilizers, since this causes a great increase in the percentage of P_2O_5 present and available. Organic compounds are increasing in number and in importance. Di- and tri-sodium phosphates are used as detergents in large quantities, while hexa-metaphosphate is in frequent use for the prevention of boiler scale and of corrosion in pipes and boiler tubes. Other important compounds are the phosphoric anhydride, used as a toxic smoke in warfare and made from burning phosphorus, and the chlorides, PCl_3 and PCl_5.

Platinum (Sp. *platina*, little silver), Pt; at. wt. 195.23; at. no. 78; m.p. 1773.5°C; b.p. 4300°C; sp. gr. 21.37 (20°C); valence 2 or 4. Discovered in South America by Ulloa in 1735 and by Wood in 1744. Platinum usually occurs native, accompanied by small quantities of iridium, osmium, ruthenium, rhodium and palladium, all belonging to the same group of metals.

These are usually found in alluvial deposits in the Ural mountains, in Colombia and in certain western American states. Sperrylite ($PtAs_2$) occurring with nickel bearing deposits in Canada is the source of a considerable weight of the platinum metals, which are recovered as by-products in refining the nickel. The heavy nickel production offsets the fact that there is only one part of the platinum metals in two million parts of ore. Platinum is a tin-white metal of metallic luster, tenacious, malleable and ductile; it is welded at a red heat; has a coefficient of expansion approximately equal to that of glass. The metal does not oxidize in air at any temperature, but is corroded by halogens, cyanide, sulfur and caustic alkalies; it is insoluble in hydrochloric or nitric acids, but dissolves when they are mixed as *aqua regia,* forming chloroplatinic acid (H_2PtCl_6), a very important compound. The metal is extensively used in jewelry, in wire and vessels for laboratory use, as well as many valuable instruments; in finely divided state it is an excellent catalyst, having long been used in the contact process for sulfuric acid, of which it does not now have a monopoly. The price of platinum has varied widely, being used a century or more ago to adulterate South American gold; in 1920 it was nearly eight times as valuable as gold at its price then, while it now practically equals the new value assigned to gold.

***Polonium** (Poland, native country of Mme. Marie Curie), Po; at. wt. approximately 210; at. no. 84. First element discovered by Mme. Curie (1898) in seeking cause of radioactivity of pitchblende from Joachimisthal, Bohemia. The electroscope, claimed to be 500,000 times more sensitive than the spectroscope, showed it separating with the bismuth. Polonium is also called Radium F. (See Radioactive Elements.)

Potassium (English *potash*), K (L. *kalium*); at. wt. 39.096; at. no. 19; m.p. 62.3°C; b.p. 760°C; sp. gr. 0.87 (20°C); valence 1. Discovered in 1807 by Davy, who obtained it from caustic potash (KOH); this was the first metal isolated by the aid of the electric current. The metal occurs abundantly, being the eighth element in the earth's crust, of which it makes more than 2%; most of its minerals are insoluble and the metal is obtained from them with great difficulty. Under certain conditions the salts of potassium have been concentrated from ancient ocean beds; before World War I the principal source of potassium was the mines of Stassfurt in Prussian Saxony from such beds. During this war the United States suffered a severe shortage of potassium salts, which form an essential constituent of fertilizers. Before World War II began the American production was sufficient to meet all needs; this supply came from mines in New Mexico, ancient lake beds in California and Utah, as a by-product from cement plant dust and from distillery waste. Potassium is never found free but is obtained by the electrolysis of the hydroxide. On exposure to moist air it becomes coated with a film of the oxide, and so is preserved by immersion in kerosene or naphtha. It is a soft, bright, silvery metal belonging to the alkali group; dropped on water it evolves hydrogen which takes fire spontaneously, the flame being colored violet

* Plutonium, see end of list.

by the potassium. In some cases its compounds are more readily purified by crystallization than those of sodium; important are the hydroxide, carbonate, nitrate, chloride, chlorate, bromide, iodide, cyanide, sulfate, chromate, dichromate and silicate.

Praseodymium (Gr. *prasious*, green, and *didymos*, twin), Pr; at wt. 140.92; at. no. 59; m.p. 940°C; b.p. . . . . . ; sp. gr. 6.5 (20°C); valence 3, 4 or 5. In 1843 Mosander reported the rare earth didymia obtained from lanthana; in 1879 Lecoq de Boisbaudran isolated a new earth from didymia extracted from samarskite and called it samaria. Six years later Von Welsbach separated it into two earths which gave salts of different colors Praseodymium is a metallic element from the cerium group of rare earths. It forms green salts with a characteristic absorption spectrum. The metal has been prepared by the electrolysis of the chloride.

Protoactinium (Gr. *protos*, first), Pa; at. wt. 231; at. no. 91. The first element of the actinium series of radioactive elements was discovered by Soddy and Cranston and independently by Hahn and Meitner, both in 1917. Later Grosse prepared the pure pentoxide and from this in 1934 the metal. Protoactinium has been called the "mother substance" or the "parent" of actinium, which it forms by the loss of an alpha particle, and the "patriarch" of the series; known also as ekatantalum and uranium X_2. (See Radioactive Elements.)

Radium (L. *radius*, ray) Ra; at. wt. 226.05; at. no. 88; m.p. 960°C; b.p. 1140°C; sp. gr. 5 (?); valence 2. In the form of a salt ($RaBr_2$) it was first separated by M. and Mme. Curie in 1898 from the *pitchblende* in North Bohemia, in which it occurs in about one part in three million. Isolated in 1911 by Mme. Curie and Debierne by the electrolysis of a solution of pure radium chloride, employing a mercury cathode; on distillation in an atmosphere of hydrogen this amalgam yielded the pure metal. The *carnotite* sands of Colorado furnished some radium, but richer ores were found in the Belgian Congo and later in the Great Bear Lake region of Canada, which is now the principal source. Radium is obtained commercially as the bromide or chloride. The metal is brilliant white, shows luminescence, alters very rapidly in contact with the air, decomposes water, and is somewhat more volatile than barium. The primary uses of the compounds are in producing self-luminous paints and in the treatment of certain types of cancer and skin affections. One gram of radium produces about 0.1 cubic millimeter of emanation per day; this is pumped from the radium and sealed in minute tubes, which are then applied to the diseased parts. Radium loses about 1% of its activity in 25 years, being transformed into elements of lower atomic weights. Study of radium and its activity has decidedly changed our ideas of the structure of the atom. (See Radioactive Elements.)

Radon (from radium, called niton at first, L. *nitens*, shining), Rn; at. wt. 222; at. no. 86; valence 0; m.p. −110°C; b.p. −61.8°C; sp. gr. 9.73 g/l. Discovered in 1900 by Dorn and called radium emanation; isolated in 1908 by Ramsay and Gray,

who named it niton. They determined its density, finding it to be the heaviest gas known. It occupies the last place in the zero group of gases in the Periodic Table. Since 1923 it has been called radon to show its origin from radium. Thoron and actinon are isotopes. (See Radioactive Elements.)

Rhenium (L. *Rhenus*, Rhine), Re; at. wt. 186.31; at. no. 75; m.p. 3000°C; b.p. . . . . . . ; sp. gr. 20.53 (20°C); valence 4, 5, 6, 7, 8. One of the eka-manganeses (dwi-manganese) discovered in 1925 by Noddack, Tacke and Berg in the minerals *columbite*, *tantalite* and *wolframite*. Rhenium was detected with the aid of the Röntgen spectrum; its arc spectrum has been carefully studied by Meggers. The metal can be hot forged or rolled; dissolved readily in nitric acid, slowly in sulfuric, hardly at all in hydrochloric. The price of $10,000 per gram in 1928 dropped to $3 in 1930, the production increasing a thousand fold. This has made possible the use of the element as a catalyst for dehydrogenation and in connection with other metals.

Rhodium (Gr. *rhodon*, rose), Rh; at. wt. 102.91; at. no. 45; m.p. 1985°C; b.p. above 2500°C; sp. gr. 12.5 (20°C); valence 3. Discovered in 1803 by Wollaston. Rhodium is a silver-white metal of the platinum family, occurring native with other members of this family in river sands in the Urals and in North and South America. The salts form red solutions. An alloy with platinum is used in connection with pure platinum to make thermojunctions in some forms of pyrometers. In electroplating it gives a surface unaffected by exposure to air or to strong acids or alkalies.

Rubidium (L. *rubidius*, dark red), Rb; at. wt. 85.48; at. no. 37; m.p. 38.5°C; b.p. 700°C; sp. gr. 1.53 (20°C); valence 1. Discovered in 1861 by Bunsen and Kirchhoff by the use of the spectroscope in the mineral *lepidolite*. Rubidium occurs in small quantities, also, in some mineral springs and in the rare minerals, *castor* and *pollux*, found in Elba. It is prepared by the electrolysis of the cyanide. Rubidium is a soft, white, rare, metallic element of the alkali group; it forms salts similar to those of potassium and colors the flame dark red, when held in a burner.

Ruthenium (Ruthenia, Russia), Ru; at. wt. 101.7; at. no. 44; m.p. 2450°C; b.p. above 2700°C; sp. gr. 12.2 (20°C); valence 3, 4, 6 or 8. Discovered in 1844 by Klaus more than a century after the discovery of platinum. Ruthenium, belonging to the platinum group, occurs native with the other members of this group. The metal is hard, gray, and brittle; it forms red or brown salts; ruthenous chloride ($RuCl_3$) gives a characterstic fine black precipitate with water.

Samarium (Samarski, a Russian), Sm; at. wt. 150.43; at. no. 62; m.p. above 1300°C; b.p. . . . . . ; sp. gr. 7.7–7.8; valence 2 or 3. Discovered in 1879 by Lecoq de Boisbaudran in the mineral *samarskite*, named in honor of a Russian mine official. Samarium is a metallic element belonging to the cerium group of the rare earths, occurring in very minute quantities in *samarskite*, *cerite* and certain Scandinavian minerals.

Scandium (Scandinavia), Sc. at. wt. 45.10; at. no. 21; m.p. 1200°C; b.p. 2400°C, calculated; sp. gr. 3.02 (10°C) — ?; valence 3. Predicted by Mendeleeff on the basis of the Periodic Law; discovered by Nilson in 1879. By some scandium is placed in the rare earth group. The metal has not been isolated; it forms colorless salts derived from the oxide Sc_2O_3.

Selenium (Gr. *Selene*, moon), Se; wt. wt. 78.96; at. no. 34; m.p. of gray form 220°C; b.p. 688°C; sp. gr. gray 4.8 (20°C); valence 2, 4 or 6. Discovered in 1817 by Berzelius associated with tellurium, named for the earth, hence the name chosen. The principal source of selenium is the flue dust obtained in burning pyrites in the manufacture of sulfuric acid. It is prepared in red amorphous form by reduction of selenic acid, and this on melting and keeping somewhat below the melting point becomes gray and crystalline. It is in the sulfur family, which it resembles both in the various forms of the element and in its compounds. The conductivity of electricity of the gray form increases with the brightness of the light with which it is illuminated. For this reason it can be used in photo-electric cells; its chief use is in the glass and ceramic industries. Red glass may contain colloidal selenium. It occurs in some soils in amounts sufficient to produce serious effects on animals feeding on plants grown in such soils.

Silicon (L. *silex*, flint), Si; at. wt. 28.06; at. no. 14; m.p. 1420°C; b.p. 2600°C; sp. gr. 2.42 (20°C); valence 4. First prepared by Berzelius in 1823. Next to oxygen, the most abundant element; characteristic of all abundant and important rocks except carbonates. It makes up about one-fourth of the crust of the earth. Silicon is not found free, it occurs chiefly as the oxide, silica (SiO_2) (sand, quartz, rock crystal, amethyst, agate, flint, jasper, opal, etc.) both free and in combination with the metallic oxides as silicates (granite, hornblende, asbestos, feldspar, clay, mica, etc). It is obtained as an amorphous brown powder on fusion of potassium fluosilicate with sodium or potassium; the crystalline form is obtained by passing silicon tetrachloride over melted aluminum in an atmosphere of hydrogen, or by heating potassium fluosilicate with zinc and sodium at a temperature just below the boiling point of zinc. Silicon is a non-metallic element resembling carbon in having several allotropic forms and in compounds formed. It is not attacked by acids except by a mixture of nitric and hydrofluoric acids; it is soluble in hot caustic potash or soda, evolving hydrogen and forming the corresponding silicate (K_2SiO_3 or Na_2SiO_3). Sodium silicate is of wide industrial importance. Glass, cement and clay working are called the silicate industries. An alloy of iron containing 14% of silicon is brittle, but extremely resistant to the action of acids, making it widely useful in the equipment of acid plants and in laboratory drains.

Silver (Anglo-Saxon, *soelfor*), Ag (L. *argentum*); at. wt. 107.880; at. no. 47; m.p. 960.5°C; b.p. 1950°C; sp. gr. 10.50 (20°C); valence 1. Known to ancients. Silver occurs native and in ores in combination with many non-metallic elements, as *argentite* (Ag_2S) and horn silver (AgCl); lead and copper ores

yield considerable silver. It is obtained from its ores by smelting with lead or copper, by cyanidation, or by amalgation with mercury. The metal is pure white having a brilliant luster, a little harder than gold and excelled only by that metal in malleability and ductility; it excels all other metals as a conductor of heat and electricity; it undergoes no change in water or pure air, but absorbs 22 times its volume of oxygen when melted, which is again expelled on cooling; it tarnishes in the vapors of sulfur compounds forming the black sulfide (Ag_2S). The most important compounds of silver are the nitrate ($AgNO_3$), or lunar caustic, the oxide (Ag_2O), and the halides ($AgCl$, $AgBr$), which darken on exposure to light, which is the basis of photography. A dilute solution of silver nitrate is used in medicine as an antiseptic. The metal is extensively used for coins, in jewelry and in tableware.

Sodium (English, *soda*), Na (L. *natrium*); at. wt. 22.997; at. no. 11; m.p. 97.5°C; b.p. 880°C; sp. gr. 0.971 (20°C); valence 1. Long recognized in compounds; first isolated by Davy in 1807 by electrolysis. Sodium is the most abundant of the alkali metals, being the seventh element in amount in the crust of the earth. Sodium chloride is the most common compound, but it occurs in many others. Never found free, it is obtained by the electrolysis of the chloride or hydroxide; it is a soft, bright, silvery metal. On exposure to moist air it becomes coated with a film of the oxide or hydroxide, and is preserved by immersing in kerosene or naphtha. It decomposes water with the formation of hydrogen and sodium hydroxide; it burns in air with the formation of the peroxide (Na_2O_2); it is used for the reduction of organic compounds, in the preparation of the peroxide and cyanide, and for keeping mercury clean and active in gold extraction. Soap is generally a sodium salt of certain fatty acids. Its compounds are of the widest industrial importance, being manufactured in hundreds of thousands of tons annually. Some of these are common salt ($NaCl$), soda ash (Na_2CO_3), baking soda ($NaHCO_3$), caustic soda ($NaOH$), Chile saltpeter ($NaNO_3$), di- and tri-sodium phosphates, sodium thiosulfate (hypo, $Na_2S_2O_3.5H_2O$), borate (borax, $Na_2B_4O_7.10H_2O$).

Strontium (Strontian, town in Scotland), Sr; at. wt. 87.63; at. no. 38; m.p. 800°C; b.p. 1150°C; sp. gr. 2.54 (20°C); valence 2. Discovered by Crawford, a Scotchman in 1790; metal isolated by Davy by electrolysis in 1808. Strontium is found chiefly in *celestite* ($SrSO_4$) and *strontianite* ($SrCO_3$). Prepared by the electrolysis of the fused chloride, it resembles metallic calcium in its properties; it is a hard silver-white metal. The salts are generally soluble in water with the exception of the sulfate, phosphate and carbonate; they impart a brilliant, blood-red color to the flame, and are used in pyrotechny for red fire. Strontium salts are also used in beet sugar refining.

Sulfur (L. *sulfur*), S; at. wt. 32.06; at. no. 16; m.p. rhombic 112.8°C, monoclinic 119.0°C; b.p. 444.6°C; sp. gr. rhombic 2.07, monoclinic 1.957 (20°C); valence 2, 4, or 6. Known to the ancients. Formerly obtained from the vicinity of volcanoes, active or extinct, since the beginning of this century the chief

supply has come from wells sunk into the salt domes along the Gulf coast. The Frasch process of concentric pipes with great quantities of superheated water has been used to melt and raise the sulfur, giving a product of very high purity. Sulfur is widely distributed in nature in free form; in sulfides, as iron (*pyrites*), lead (*galena*), zinc (*blende*), mercury (*cinnabar*) and antimony (*stibnite*); in sulfates, as calcium (*gypsum*), magnesium (*Epsom salt*), strontium (*celestite*) and barium (*barite* or *heavy spar*). Sulfur is a pale yellow, odorless, brittle solid, which is insoluble in water, soluble in carbon disulfide. It occurs in two crystalline forms and an allotropic form known as plastic sulfur, which reverts to the crystalline form on standing; a finely divided form known as flowers of sulfur is obtained by sublimation. It readily forms compounds known as sulfides with many elements. Sulfur is a component of black gunpowder, is widely used in the vulcanization of rubber and as a fungicide. A tremendous tonnage is used after burning to form sulfur dioxide in the manufacture of sulfuric acid, the most important manufactured chemical, and in the processes for making wood pulp for paper; sulfur dioxide is also used in fumigation and in the bleaching of dried fruits. The element is a good electrical insulating agent, and organic compounds containing sulfur are very important.

Tantalum (Gr. *Tantalos*, mythological character) Ta; at. wt. 180.88; at. no. 73; m.p. 2996°C; b.p. above 4100°C; sp. gr. 16.6; valence 3 or 5. Discovered in 1802 by Ekeberg. Tantalum occurs principally in the mineral *tantalite* ($FeTa_2O_6$), very similar to columbite, and is prepared by the reduction of K_2TaF_7 with hydrogen followed by fusion in a vacuum. It can be drawn into a wire with a very high point of fusion and great tenacity, which has been used in the construction of filaments for incandescent lamps; it has been generally replaced by tungsten, but tantalum is still used when lamps have to resist more than ordinary vibration. It is also used to alloy with other metals. It is soluble in fused alkalies, insoluble in acids; especially suited for plant work with halogens, hydrochloric acid and *aqua regia*. The common oxide is Ta_2O_5.

Tellurium (L. *tellus*, earth), Te; at. wt. 127.61; at. no. 52; m.p. 452°C; b.p. 1390°C; sp. gr. 6.24 (20°C); valence 2, 4, or 6. Discovered by Muller von Richenstein in 1782; named by Klaproth in 1798. Tellurium is found native and as the telluride of gold and other metals. It is obtained by reduction of telluric oxide and forms a powder of grayish-white, metallic appearance. It is a semi-metallic element of the sulfur group and forms tellurides with hydrogen and metals similar to the sulfides; the compounds H_2TeO_3 and H_2TeO_4 are only slightly acidic. The inhalation of the vapors of tellurium produces the very offensive "tellurium breath." It is used as a coloring agent in glass, giving a blue to brown color. Certain alloys give high electrical resistance. Addition of less than a tenth of one per cent to lead greatly increases its strength and hardness.

Terbium (Ytterby, village in Sweden), Tb; at. wt. 159.2; at. no. 65; m.p. . . . . ; b.p. . . . . . ; sp. gr. . . . . . ; valence 3.

Discovered by Mosander in 1843 from *gadolinite*. Terbium is a metal of the rare earths; in order of discovery it falls in the Yttria group; the metal has not been isolated. It yields a white oxide Tb_2O_3, and forms trivalent salts. Its name together with the names yttrium, ytterbium, and erbium, are all derived from the little Swedish town, Ytterby, where the rare earth minerals were first found.

Thallium (Gr. *thallos*, budding twig), Tl; at. wt. 204.39; at. no. 81; m.p. 303.5°C; b.p. 1650°C; sp. gr. 11.85 (20°C); valence 1 or 3. Discovered by the use of the spectroscope in 1861 by Crookes, who isolated the metal in 1862. Lamy also isolated the metal in 1862. Thallium occurs in *pyrites* and is prepared from the flue dust of sulfuric acid works. The metal is obtained by heating thallium iodide with metallic sodium; it resembles lead, having a hardness of 1.2 compared with 1.5 for lead; the malleability is high and the tenacity is low; there are two allotropic forms with a transition temperature of 226°C; it is a poor conductor of electricity, tarnishes in air forming the oxide Tl_2O, or the hydroxide TlOH in the presence of water. The element is displaced from solutions of its salts by zinc. Because of its resemblance to both the alkali metals and to the metals of Group III, thallium has been called the "paradoxical metal" and the "bird-beast metal." Its salts are poisonous, and are used in the control of rodents such as squirrels.

Thorium (*Thor*, Scandinavian god of war), Th; at. wt. 232.12; at. no. 90; m.p. 1845°C; b.p. above 3000°C; sp. gr. 11.3 (20°C); valence 4. Discovered by Berzelius in 1828. Thorium occurs chiefly in *thorite* ($ThSiO_4$) and other rare minerals. In the U. S. it is obtained chiefly from *monazite*, which contains from 3 to 9% of ThO_2. The free element has been prepared by heating the double chloride or fluoride of thorium and potassium with metallic sodium or potassium; it is a heavy, gray, difficulty fusible metal, belonging to the titanium group. It burns brightly in oxygen to form ThO_2, which is also obtained on heating the nitrate, a reaction of which use is made in the manufacture of incandescent gas mantles. Thorium emits radiations similar to but not identical with those of radium. (See Radioactive Elements.)

Thulium (*Thule*, Northland), Tm; at. wt. 169.4; at. no. 69; m.p. . . . . ; b.p. . . . . . ; sp. gr. . . . . . . ; valence 3. Discovered in 1879 by Cleve; pure thulia was prepared in 1911 by James. Thulium is in the yttrium group of the rare earth metals in order of discovery and belongs to the erbium family, which includes dysprosium, holmium and erbium also. They are obtained from certain rare minerals occurring in granite or pegmatite veins. These elements are characterized by their absorption spectra and the formation of highly colored salts; they form basic oxides of the type M_2O_3 with the following order of increasing basicity; thulium, erbium, holmium and dysprosium. The free elements have not been isolated.

Tin (Anglo-Saxon *tin*), Sn (L. *stannum*); at. wt. 118.70; at. no. 50; m.p. 231.89°C; b.p. 2260°C; sp. gr. gray 5.75, rhombic 6.55, tetragonal 7.31 (20°C); valence 2 or 4. Known to the ancients.

Tin is found chiefly in the mineral *cassiterite* (SnO_2), found in association with granitic rocks, almost none found in the U. S. It is obtained by roasting to remove sulfur and arsenic and smelting with powdered anthracite in a reverberatory furnace. Tin is found in several varieties; as ordinarily used it is a silver white metal, malleable and somewhat ductile with a low tenacity and highly crystalline structure. Due to a breaking of these crystals, the "tin cry" is heard when a bar is bent. Crystalline tin changes to gray tin at low temperatures, the speed of change reaching a maximum at −50°C. Ordinarily it takes a high polish and is used to coat other metals to prevent corrosion or other chemical action. Such tin plate over steel is used in the so called tin can for preserving food; enough is used in America each year to make a 100 foot wide belt around the earth at the equator. When heated in air, tin forms SnO_2, which is feebly acid, forming stannate salts with basic oxides. The most important salt is the chloride ($SnCl_2.2H_2O$), which is used as a reducing agent and as a mordant in calico-printing. Alloys of the metal are very important, including solder, type metal, fusible metal, pewter, bronze and bell metal.

Titanium (L. *Titans*, the first sons of the Earth, myth.), Ti; at. wt. 47.90; at. no. 22; m.p. 1800°C; b.p. above 3000°C; sp. gr. 4.5 (20°C); valence 3 or 4. Discovered by Gregor in 1791; named by Klaproth in 1795; pure metal prepared in 1910 by Hunter by heating $TiCl_4$ with sodium in a steel bomb. Titanium is almost invariably present in igneous rocks and the sedimentary material derived from them, occurring as the oxide (TiO_2), in titanates and with many iron ores. The metal is prepared by heating the oxide with aluminum or by electrolysis of the oxide dissolved in fused calcium chloride. It is a lustrous white metal in the same group with tin; it burns in air and is the only element which burns in nitrogen. The most important compounds are the oxide (TiO_2), which is feebly acidic and from which the titanates are derived; the halides (TiX_4), some of which are volatile; and the nitrides (Ti_2N_2, Ti_3N_4), metallic in appearance. The oxide is used in high grade white pigments of great opacity and covering power. The metal is used in steel alloys to increase strength.

Tungsten (Sw. heavy stone), W (G. *Wolfram*); at. wt. 183.92; at. no. 74; m.p. 3370°C; b.p. 5900°C; sp. gr. 19.3 (20°C); valence 2, 4, 5 or 6. Discovered by d'Elhujar brothers in 1783. Tungsten occurs in tungstates as *wolframite* ($FeWO_4$), *scheelite* ($CaWO_4$), *hübnerite* ($MnWO_4$). The metal is obtained by reduction of the oxide (WO_3) with hydrogen, carbon or aluminum. It is hard, brittle, nonmagnetic and forms the oxide when heated in the air. The only solvent for tungsten is a mixture of nitric and hydrofluoric acids. Because its melting point is higher than that of any other known element, its vapor pressure is extremely low, making it useful for electric wiring for furnaces, targets of X-ray tubes, contacts, arcing points; its higher electrical efficiency causes its almost exclusive use in light filaments. About 90% of the world's production is used in steel manufacture, its various steel alloys being used in armor plate, projectiles and high speed cutting tools.

Uranium (Planet Uranus), U; at. wt. 238.07; at. no. 92; m.p. about 1150°C; b.p. . . . . . . ; sp. gr. 18.68 (20°C); valence 3, 4 or 6. Discovered by Klaproth in *pitchblende* in 1789; metal first prepared in 1841 by Peligot by reducing the chloride with metallic potassium. This method is still used. The chief ore is *uraninite*, or *pitchblende*, uranous uranate, $U(UO_4)_2$; the metal is hard, white, heavy. Uranium is used chiefly in compounds which give a canary-yellow fluorescent glass and a black pigment for china painting; its compounds are used in photography. Of the generally recognized elements it has the highest atomic weight and is the last in the Periodic Table. Uranium compounds are radioactive. (See Radioactive Elements.)

Vanadium (Scandinavian goddess, *Vanadis*), V; at. wt. 50.95; at. no. 23; m.p. 1710°C; b.p. 3000°C; sp. gr. 5.96 (20°C); valence 2, 3, 4 or 5. Discovered by Sefstrom in 1830; isolated by Roscoe in 1869. Though relatively rare, vanadium is found in a variety of minerals; prominent among these are *vanadinite* ($3Pb_3(VO_4)_2.PbCl_2$) and *patronite* (possibly VS_4) occurring in Peru. Vanadium is obtained by reduction of the chloride in hydrogen, forming a gray and very infusible metal. The vanadates are employed in the preparation of aniline black and for coloring glass. Most of it is produced as ferro-vanadium and used in the manufacture of steel alloys, greatly increasing toughness, elasticity and tensile strength. V_2O_5 masses are used in the contact process for manufacture of sulfuric acid.

***Virginium** (State of Virginia), Vi; at. wt. about 224; at. no. 87; valence 1. Discovered in 1929 by Dr. Fred Allison and co-workers of Alabama Polytechnic Institute by the magneto optic method of analysis of *pollucite* and *lepidolite*. It has been found also in sea water, lake brine, Stassfurt deposits and certain other minerals. Virginium has the highest equivalent weight of any element. Named in honor of Virginia, where the discoverer was born. (Existence questioned Ed.)

Xenon (Gr. *xenon*, stranger), Xe; at. wt. 131.3; at. no. 54; m.p. −112°C; b.p. −107.1°C; density 5.85 g/l, sp. gr. liquid 3.52 (−109°C); valence O. Discovered by Ramsay and Travers in 1898 in the residue left on evaporating liquid air. It is the rarest and heaviest of the gases of the argon family from the atmosphere, in which it is present to the extent of about one part in twenty million. It is inert and forms no compounds with other elements. Vacuum tubes containing it show a beautiful blue glow.

Ytterbium (Ytterby, village in Sweden), Yb; at. wt. 173.04; at. no. 70; m.p. 1800°C; b.p. . . . . ; sp. gr. . . . . . . ; valence 3. Separated by Marignac in 1878. In 1907 Urbain and in 1908 von Welsbach described a process by which this earth containing the metal, could be resolved into earths of two other metals—neo-ytterbium, or simply ytterbium, and lutecium. These elements occur in nearly all minerals which contain yttrium, but in very small amounts. The best sources are probably *gadolinite*, *xenotime*, *polycrase* and *blomstrandine*. The oxide, chloride and sulfate have been prepared.

* See element 87 at end of list.

Yttrium (Ytterby, village in Sweden), Y; at. wt. 88.92; at. no. 39; m.p. 1490°C; b.p. 2500°C; sp. gr. 5.51; valence 3. The rare earth yttria, which contained a new element, was discovered by Gadolin in 1794; in 1843 Mosander showed that yttria could be resolved into the earths of three other elements, the name yttria being reserved for the most basic one, the others being named erbia and terbia. Yttrium occurs in nearly all of the rare earths minerals. Wöhler obtained the free element by reduction of the chloride with potassium; it has also been obtained by the electrolysis of a mixture of the chloride and sodium chloride. The metal forms small scales with a metallic luster and an iron-gray color; it is readily oxidized in air and is converted to the hydroxide by boiling water.

Zinc (G. *Zink*), Zn; at. wt. 65.38; at. no. 30; m.p. 419.5°C; b.p. 907°C; sp. gr. 7.14 (20°C); valence 2. Its ores were used for making brass for centuries before it was recognized as a separate metal in 1746 by Marggraf, who obtained it by heating calamide with charcoal. The principal ores are *sphalerite* or *blende* (sulfide), *smithsonite* (carbonate) and *calamine* (silicate). The old method of heating the roasted ore with carbon in a retort is still used, being replaced to some extent by the electrolytic process. Zinc is a bluish-white metal, brittle at ordinary temperatures but malleable at 100°C, a fair conductor of electricity; it burns in air at high red heat with evolution of white clouds of the oxide; it is used to form numerous alloys with other metals, as brass with copper. Galvanizing is coating other metals, especially iron, with zinc to prevent corrosion; the coating is sometimes applied by dipping in molten zinc. It is used as the negative electrode in various types of electric batteries. Compounds are widely used in paints, the oxide being an important white pigment; its compounds have antiseptic properties and are used in medicine. Nearly a century ago Frankland showed the use of zinc in preparing organic compounds.

Zirconium (Arabic *zargun*, gold color), Zr; at. wt. 91.22; at. no. 40; m.p. 1900°C; b.p. above 2900°C; sp. gr. 6.4 (20°C); valence 4. Discovered in *zircon* by Klaproth in 1789; isolated by Berzelius in 1824. Rather widely diffused in igneous rocks, zirconium usually occurs in the silicate, $ZrSiO_4$. The element is in the titanium family, its oxide being either base or acid forming. Prepared from the tetrachloride by heating with sodium in a bomb, the metal can be pressed into rods, drawn into wire, or burnished to a bright surface. A number of alloys have been made. Ferro-zirconium, made by aluminum reduction in an electric furnace, is used for desulfurizing and deoxidizing steel. Zircon, the silicate, is sometimes a gem. The oxide has been used in gas mantles, in paints as an opacifier, in lacquers in insulators and as an abrasive.

Americium (The Americas), Am; at. no. 95. This name has been suggested for element number 95 by Seaborg, its co-discoverer, in 1945. It appears to belong to a series of elements of which actinium is the first member.

Curium (Pierre and Marie Curie), Cm; at. no. 96. Name suggested by Seaborg for element number 96, isotopes of which were identified in 1945. The element appears to belong to the "actinide" series.

Neptunium (Planet Neptune), Np; at. wt. 237; at. no. 93; three isotopes of mass numbers 237, 238 and 239 are known.

The two isotopes Np-238 and Np-239 were isolated in 1940 by McMillan and Abelson, both produced from uranium, the first by bombardment with deuterons When uranium is bombarded with neutrons, an isotope of uranium of mass number 239 is first produced which by emission of a beta particle becomes Np-239. Both of these isotopes disintegrate to form plutonium.

Np-237 was discovered by Wahl and Seaborg in 1942 as a decay product of U-237. This isotope is relatively stable.

Plutonium (Planet Pluto), Pu; at. no. 94; valence 3, 4, 5, or 6; an artificially produced radioactive element having properties somewhat similar to uranium.

The element was discovered by Seaborg, McMillan, Wahl, and Kennedy in 1940. The isotope isolated was Pu-238 formed by deuteron bombardment of uranium which first produced Np-238. This decays to produce the plutonium isotope.

The isotope of mass number 239 is formed as a result of neutron capture by uranium-238 followed by two successive beta transformations. Both isotopes disintegrate slowly; Pu-239 has a half life of about 24,000 years, thus being essentially a stable element. This latter isotope is of tremendous importance because of being fissonable with slow neutrons, and has been used in the production of atomic bombs.

Radioactive Forms of Elements 43, 61, 85, 87. Earlier reports of the discovery of these elements, found in the preceding list under the names: masurium (43), illinium (61), alabamine (85) and virginium (87) are now called in question by recent reports of radioactive forms.

Element 43. Radioactive isotopes of element 43 were produced by the bombardment of molybdenum with deuterons. Perrier and Segrè showed that the chemical properties resemble those of rhenium.

Element 61. Radioactive forms were produced by Kurbatov and Pool and independently by Wu and Segrè. The element belongs to the class of rare earths.

Element 85. An isotope of atomic mass 211 was made by bombarding bismuth with high energy alpha particles. Its general behavior is that of a metal. Its properties were investigated by Corson, Mackenzie and Segrè.

Element 87. A radioactive form called actinum K has been discovered by Perey. It has a mass number of 223 and behaves like a heavy alkali metal. It disintegrates rapidly with negative beta particle emission.

PERIODIC ARRANGEMENT OF THE ELEMENTS

Series	Period	ZERO GROUP	GROUP I R_2O	GROUP II RO	GROUP III R_2O_3	GROUP IV RH_4 RO_2
0						
1			Hydrogen H =1 0078 No. 1			
2	1	Helium He =4 002 No. 2	Lithium Li = 6 940 No. 3	Beryllium Be =9 02 No. 4	Boron B =10 82 No. 5	Carbon C =12 00 No. 6
3	2	Neon Ne =20 183 No. 10	Sodium Na =22 997 No. 11	Magnesium Mg =24 32 No. 12	Aluminum Al =26 97 No. 13	Silicon Si =28.06 No. 14
4	3	Argon A =39 944 No. 18	Potassium K =39 10 No. 19	Calcium Ca =40 08 No. 20	Scandium Sc =45 10 No. 21	Titanium Ti =47 90 No. 22
5			Copper Cu =63 57 No. 29	Zinc Zn =65 38 No. 30	Gallium Ga =69 72 No. 31	Germanium Ge =72 60 No. 32
6	4	Krypton Kr =82.9 No. 36	Rubidium Rb =85 44 No. 37	Strontium Sr =87 63 No. 38	Yttrium Y =88 92 No. 39	Zirconium Zr =91 22 No. 40
7			Silver Ag =107 880 No. 47	Cadmium Cd =112 41 No. 48	Indium In =114 8 No. 49	Tin Sn =118 70 No. 50
8	5	Xenon Xe =130 2 No. 54	Caesium Cs =132.81 No. 55	Barium Ba =137.36 No. 56	Lanthanum La =138 90 No. 57	Cerium Ce =140 13 No. 58
9						
10	6					Hafnium Hf =178 6 No. 72
11			Gold Au =197 2 No. 79	Mercury Hg =200 61 No. 80	Thallium Tl =204 39 No. 81	Lead Pb =207.22 No. 82
12	7	Radon Rn =222 No. 86	No. 87	Radium Ra =225 97 No. 88	No. 89	Thorium Th =232 12 No. 90

Elements not classified in the table above:

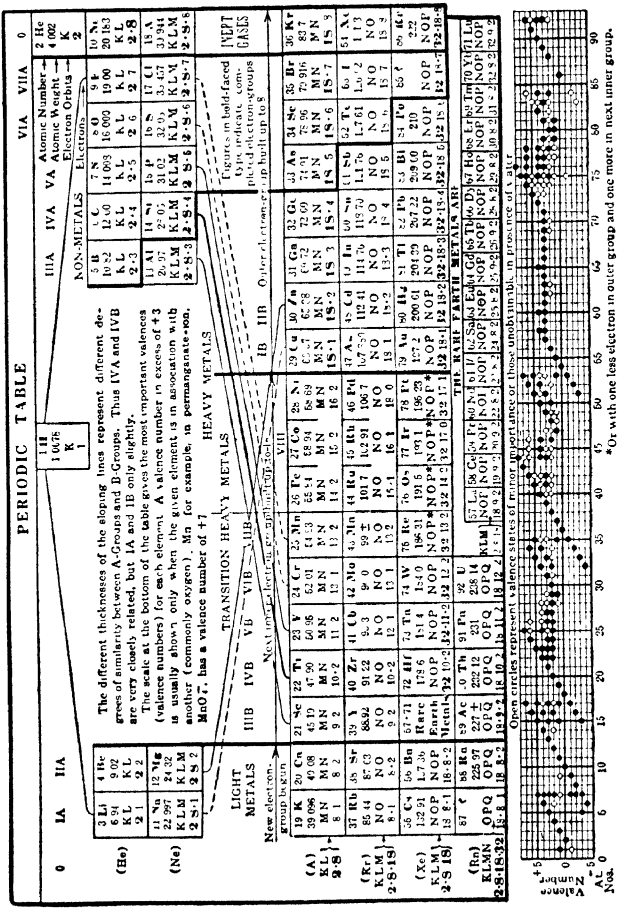
Praseodymium Pr =140 92 No. 59	Neodymium Nd =144 27 No. 60	Illinium Il =146(?) No. 61	Samarium Sm =150 43 No. 62	Europium Eu =152 0 No. 63
Gadolinium Gd =157 3 No. 64	Terbium Tb =159.2 No. 65	Dysprosium Dy =162 46 No. 66		

MENDELEEFF'S

GROUP V RH_3 R_2O_5	GROUP VI RH_2 RO_3	GROUP VII RH R_2O_7	GROUP VIII		
Nitrogen N =14 008 No. 7	Oxygen O =16 000 No. 8	Fluorine F =19 00 No. 9			
Phosphorus P =31 02 No. 15	Sulfur S =32 06 No. 16	Chlorine Cl =35 457 No. 17			
Vanadium V =50 95 No. 23	Chromium Cr =52.01 No. 24	Manganese Mn =54 93 No. 25	Iron Fe =55 84 No. 26	Cobalt Co =58 94 No. 27	Nickel Ni =58 69 No. 28
Arsenic As =74 93 No. 33	Selenium Se =79.2 No. 34	Bromine Br =79 916 No. 35			
Columbium Cb =93 3 No. 41	Molybdenum Mo =96 0 No. 42	Masurium Ma =? No. 43	Ruthenium Ru =101 7 No. 44	Rhodium Rh =102 91 No. 45	Palladium Pd =106 7 No. 46
Antimony Sb =121 76 No. 51	Tellurium Te =127 5 No. 52	Iodine I =126 932 No. 53			
Tantalum Ta =181 4 No. 73	Tungsten W =184.0 No. 74	Rhenium Re =186 31 No 75	Osmium Os =190.8 No. 76	Iridium Ir =193 1 No. 77	Platinum Pt =195.23 No. 78
Bismuth Bi =209.00 No. 83	No. 84				
No. 91	Uranium U =238.14 No. 92	No. 93			

Holmium Ho =163.5 No. 67	Erbium Er =167 64 No. 68	Thulium Tm =169.4 No. 69	Ytterbium Yb =173 5 No. 70	Lutecium Lu =175 0 No. 71

PERIODIC TABLE



From Deming's *General Chemistry*, (5th Ed.), John Wiley and Sons, publishers.

ISOTOPES

Artificial and Natural Radioactive Isotopes and Stable Isotopes

The following table is taken from a comprehensive table of isotopes compiled by Glenn T. Seaborg, Department of Chemistry, University of California, and published in Reviews of Modern Physics, January 1944. All isotopes given in the original table are listed and all data included except information as to the nuclear reaction by which the isotope was produced. For this the reader is referred to the original publication. Information may usually be obtained from the literature cited in connection with data for the isotope.

The atomic number, ***Z***, is given in the first column followed by the symbol of the isotope and the mass number ***A***. The degree of certainty is shown in the third column by letters with the following significance:

A = isotope certain (mass number and element certain)
B = isotope probable, element certain
C = one of few isotopes, element certain
D = element certain
E = element probable
F = insufficient evidence
G = probably in error (e.g., impurity or inadequate half-life determination)

The percent abundance of the stable isotopes is listed in the fourth, and the type of radiation in the fifth column. The half-life of radioactive isotopes and the energy of radiation in mega-electron volts complete the table. Symbols in parenthesis throughout the table refer to the table of references at the end.

Table of Abbreviations

α = alpha-particles
β^- = negative beta-particles
β^+ = positive beta-particles (positrons)
γ = gamma-rays
e^- = internal-conversion electrons
Be-γ-n reaction = measurement of neutron energy from Be-γ-n reaction
D-γ-n reaction = measurement of neutron energy from D-γ-n reaction
abs. = absorption
calor. = calorimetric measurements
cl. ch. = cloud chamber (with magnetic field in case of beta-particles)
cl. ch. pair = positron-electron pairs in cloud chamber with magnetic field
cl. ch. recoil = secondary electrons in cloud chamber with magnetic field
coincid. = beta- and gamma-coincidence counters (Particles column)
coincid. = gamma-gamma-coincidence counters (γ-rays column)

coincid. abs. = beta- and gamma-coincidence counters with absorbers (Particles column)

coincid. abs. = secondary electrons with coincidence counters and absorbers (γ-rays column)

d = deuteron

ion. ch. = measurement of pulse sizes in ionization chamber

I.T. = isomeric transition (transition from upper to lower isomeric state)

K = K-electron capture

K.U. = Konopinski-Uhlenbeck extrapolated value reported

n = neutron

p = proton

spect. = magnetic deflection (Particles column)

spect. = secondary electrons with magnetic spectrograph (γ-rays column)

spect. conv. = internal-conversion electrons with magnetic spectrograph

In the few cases where it is certain that no gamma-rays are emitted, this fact is expressed explicitly by the symbol "no γ." Annihilation gamma-rays are not listed.

TABLE OF ISOTOPES

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
1	H	1	...	99.98(H70)				
	H	2	...	0.02(H70)				
	H	3	*A*	....	β^-	**31 yr.(O4)**	**0.015(O3, N6) abs., cl. ch.**	
2	He	3	...	~ 10^{-5}(A7, A30)				
	He	4	...	100(T20)				
	He	6	*A*	. . .	β^-	0.8 sec.(B1)	3.7(B1, B2) cl. ch.	
3	Li	6	...	7.5(H71)				
	Li	7	...	92.5(H71)				
	Li	8	*A*	....	β^-, α	0.88 sec.(L1)	12(β^-)(B4) cl. ch.	
4	Be	7	*A*	......	*K*, γ	43 days(R13, A18)	... .	0.485(Z1) coincid. abs.
	Be	9	...	100(N30)				
	Be	10	*A*	.. . .	β^-, γ	> > 10^3 yr.(M22)	~ 0.5(M22) abs.	< 0.5(M22) abs.
5	B	10	...	18.4(O20)				
	B	11	...	81.6(O20)				
	B	12	*A*	....	β^-	0.022 sec.(C2, B22)	12(B4) cl. ch.	
6	C	10	*A*	....	β^+	8.8 sec.(B27, D26)	3.4(D26) cl. ch.	
	C	11	*A*	.. ..	β^+	20.5 min.(S8, T8)	0.95(D26) cl. ch.	
	C	12	...	98.9(N31)				
	C	13	...	1.1(N31)				
	C	14	*A*	. ...	β^-	> 10^3 yr.(K24)	0.145(R21) abs.	No γ(R21)
7	N	13	*A*	.... .	β^+, γ	9.93 min.(W14, T8)	0.92, 1.20(L22) spect.	0 28(R2) cl. ch. recoil
	N	14	...	99.62(V20)				
	N	15	...	0.38(V20)				
	N	16	*A*	....	β^-	8 sec.(C5, N1)	6.0(?)(F1) cl. ch.	
8	O	15	*A*	. .... .	β^-	126 sec.(M3, B20)	1.7(F1) cl. ch.	
	O	16	...	99.76(S60)				
	O	17	...	0.041(M50)				
	O	18	...	0.20(S60)				
	O	19	*A*	....	β^-	31 sec.(N1)		

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
9	F	17	*A*	. ..	β^+	70 sec.(N2)	2.1(K4) cl. ch.	
	F	18	*A*	. .	β^+	112 min.(S1)	0.7(Y2) cl. ch.	
	F	19	...	100(A30)				
	F	20	*A*	....	β^-, γ(B50, C47)	12 sec.(C1)	5.0(F1, B50) cl. ch.	2.2(B50) cl. ch. recoil
10	Ne	19	*A*	.....	β^+	20.3 sec.(W7)	2.20(W7) cl. ch.	
	Ne	20	...	90.00(V20)				
	Ne	21	.	0.27(V20)				
	Ne	22	.	9.73(V20)				
	Ne	23	*A*	....	β^-	40 sec.(A1, B6)	4.1(P21) abs.	
11	Na	21	*B*	.		23 sec.(C27)		
	Na	22	*A*	.	β^+, γ	3.0 yr.(L3)	0.58(L3) cl. ch.	1.3(O2) spect.
	Na	23	...	100(S61)				
	Na	24	*A*	....	β^-, γ	14.8 hr.(V1)	1.4(L21, S49) spect.	1.4, 2.8(E7, I2, E8) spect.; 2.87(G16) Be-γ-*n* reaction, D-γ-*n* reaction; 2.69, 3.22, 3.61(O10) cl. ch. pair
	Na	25	*E*		β^-, γ	62 sec.(H54)	2.8(H54) abs. A1	0.035(H54) abs. A1
12	Mg	23	*A*		β^+	11.6 sec.(W7)	2.82(W7) cl. ch.	
	Mg	24	..	77.4(A31)				
	Mg	25	. .	11.5(A12)				
	Mg	26		11.1(A12)				
	Mg	27	*A*	... .	β^-, γ	10.2 min.(H4)	1.8(C13) cl. ch.	0.64, 0.84, 1.02(I2) spect.
13	Al	26	*A*	.	β^+	7.0 sec.(W7, F2)	2.99(W7) cl. ch.	
	Al	27	..	100(A31)				
	Al	28	*A*	....	β^-, γ(W17)	2.4 min.(A1, M5, E2)	3.3(C6) cl. ch.	1.8(I2) spect.
	Al	29	*A*		β^-	6.7 min.(B25)	2.5(B25) cl. ch. and abs.	

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
14	Si	27	A		β^+	4.9 sec.(K10, C27)	3.74(M21) cl. ch.; 3.54(B8) cl. ch.	
	Si	28	. .	89.6(M51)				
	Si	29	.	6.2(M51)				
	Si	30	.	4.2(M51)				
	Si	31	A		β^-	170 min.(N3, A13)	1.8(K4) cl. ch.	No γ(N3)
15	P	29	A		β^+	4.6 sec.(W11)	3.63(W11) cl. ch.	
	P	30	A		β^+	2.55 min.(R3, B49)	3.0(B48, B49) cl. ch., 3.5(M26) spect.	
	P	31	. .	100(A31)				
	P	32	A	. . . . .	β^-	14.30 days(C8)	1.69(L5) spect.; 1.75(W29) spect.; 1.71(S49) spect.	No γ(K4)
16	S	31	A		β^+	3.2 sec.(W11, K10)	3.85(W11, E4) cl. ch.	
	S	32	. . .	95.1(N32)				
	S	33	. . .	0.74(N32)				
	S	34		4.2(N32)				
	S	35	A		β^-	87.1 days(H53)	0.107(L6) spect.; 0.120(K13) abs. Al	
	S	36	. .	0.016(N32)				
17	Cl	33	A	. .	β^+	2.4 sec.(W11)	4.13(W11) cl. ch.	
	Cl	34	A		β^+	33 min.(S2, B21)	2.5(B21) abs.	
	Cl	35	. . .	75.4(N33)				
	Cl	36	A	. . . .	β^+; K; β^-(G8)	$> 10^3$ yr.(G8, O5)	0.64(β^-)(G8) abs.	
	Cl	37	. .	24.6(N33)				
	Cl	38	A	. . . .	β^-, γ	37 min.(V1)	1.1, 2.8, 5.0(W16, W17) spect., (W17) coincid. abs.	1.65, 2.15(C28, I2) spect.

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
18	A	35	*A*	...	β^+	1.88 sec.(E4)	4.4(E4, W11) cl. ch.	
	A	36	.	0.307(N34)				
	A	37	*A*	...	...	34 days(W18)		
	A	38	.	0.061(N34)				
	A	39	*G*	...	β^-	4 min.(P2)		
	A	40	...	99.632(N34)				
	A	41	*A*	...	β^-, γ	110 min.(S3)	1.5(K4) cl. ch. (K.U.)	1.37(R8) cl. ch. recoil
19	K	38	*A*	..	β^+	7.7 min.(H5, R3)	2.3(R3) abs.	
	K	39	...	93.38(C51)				
	K (H88, S62)	40	*A*	0.012(N34)	β^-(T31, C61), γ(K52); *K*(75%)(T30)	1.42 × 10⁹ yr. (B71); 4 × 10⁸ yr. (T30)	0.40(H83), 0.725(L6) spect.; 1.3(H87) abs.	2(K52) abs. Fe
	K	41		6.61(C51)				
	K	42	*A*	..	β^-	12.4 hr.(H5)	3.5(K4) cl. ch.	
	K	43, 44	*C*		β^-	18 min.(W1, W12)		
20	Ca	39	*F*	...	β^+	4 5 min.(P2, W12)		
	Ca	39	*E*	...	...	1.06 sec.(H44)		
	Ca	40	..	96.96(N32)				
	Ca	41	*B*	...	*K*, γ, e^-(W12)	8.5 days(W12)	...	1.1(W12) abs. Pb, abs. of e^-
	Ca	42	..	0.64(N32)				
	Ca	43	.	0.15(N32)				
	Ca	44	..	2.06(N32)				
	Ca	45	*A*	...	β^-, γ	180 days(W12)	0.2, 0.9(W12) abs.	0.7(W12) abs. Pb
	Ca	46	...	0.0033(N32)				
	Ca	48	.	0.19(N32)				
	Ca	49	*A*	...	β^-, γ	2.5 hr.(W12)	2.3(W12) abs.	0.8(W12) abs. Pb
	Ca	49	*B*	...	β^-	30 min.(W12)		

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
21	Sc	41	*A*	.	β^+	0.87 sec.(K10)	4.94(E4) cl. ch.	
	Sc	42	*F*	.	β^+	13.5 days(W10)	1.4(W10) abs.	
	Sc	43	*A*	.	β^+, γ	4 hr.(W10)	0.4, 1.4(W10) abs.; 1.13(H1)	1.0(W10) abs. Pb; 1.65(H1)
	Sc	44	*A*	.. .. .	I.T., e^-, γ(W10)	52 hr.(W10)	....	0.27(H9, S19) spect. conv.; 0.28, 1.33(H1)
	Sc	44	*A*	....	β^+, γ	4.1 hr.(W10)	1.5(W10) abs., (S19) spect.; 1.33(H1)	1.80(H1)
	Sc	45	..	100(A31)				
	Sc	46	*A*	....	β^-, γ, *K*(W5)	85 days(W5)	0.26, 1.5(β^-)(W10) abs.	1.25(W10) abs. Pb
	Sc	47	*F*	... .	β^-, γ	63 hr.(W10)	1.1(W10) abs.	
	Sc	48	*A*	. ....	β^-, γ(W10)	44 hr.(W10, M2)	0.64(S19) spect.; 0.57(H1)	1.35(M2, M30) spect.; 1.33(H1) abs.
	Sc	49	*A*	... . .	β^-	57 min.(W10)	1.8(W10) abs.	No γ(W10)
	Sc		*F*	.	β^-	3.4 days(H1)	0.46(H1)	No γ(H1)
22	Ti	45	*A*	......	β^+	3.08 hr.(A17)	1.2(A17) cl. ch.	
	Ti	46	...	7.95(N32)				
	Ti	47	..	7.75(N32)				
	Ti	48	..	73.45(N32)				
	Ti	49	.	5.51(N32)				
	Ti	50	.	5.34(N32)				
	Ti	51	*A*	.. ....	β^-, γ(W4)	2.9 min.(W4)		
	Ti	51	*A*	. ....	β^-, γ	72 days(W5)	0.36(W5) abs.	1.0(W5) coincid. abs.
23	V	47	*B*	.. ...	β^+	33 min.(W4, O7)	1.9(W4, O7) abs.	
	V	48	*A*	. ....	β^+, *K*, γ(W5, H60)	16 days(W4)	1.0(W4) cl. ch.; 0.58(H60)	1.05(R4) cl. ch. recoil; 1.50(H60) abs. Pb
	V	49	*B*	.. .. .	*K*	600 days(W5)	No β^+ or e^-(W5)	No γ(W5)
	V	50	*A*	... ..	β^+	3.7 hr.(W4)		
	V	51	. .	100(A31)				
	V	52	*A*	....	β^-	3.9 min.(W4)	2.05(D24) abs.	

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
24	Cr	49	A	....	β^+, γ	41.9 min.(O7)	1.45(O7) abs., cl. ch.	0 18, 1.55(O7) abs. Pb
	Cr	50	...	4.49(N35)				
	Cr	51	B	....	K, γ, e^-(W13)	26.5 days(W13)	.	0 5, 1(W13) abs Pb, abs. of e^-
	Cr	52	..	83.78(N35)				
	Cr	53	...	9.43(N35)				
	Cr	54	...	2.30(N35)				
	Cr	55	B	....	....	1.6–2.3 hr. (A14, D14)		
25	Mn	51	A	....	β^+	46 min.(L7)	2.0(L7) abs.	
	Mn	52	A	....	β^+, γ	21 min.(L7)	2.2(H6, H12) cl. ch.	1.2(H6)
	Mn	52	A	....	β^+, γ, K(H6, H12)	6.5 days(L7)	0.77(H6, H12) cl. ch.	1.0(H6)
	Mn	54	A	....	K, γ(L7)	310 days(L7)	....	0.85(L7) abs. Pb; 0.835(D35) spect., coincid.
	Mn	55	...	100(S63)				
	Mn	56	A	....	β^-, γ	2.59 hr.(L7)	0.75, 1.05, 2.86(E12) spect., coincid.; 1.04, 2.88(T8) spect.	0.7, 1.7(B26, B14) cl. ch. recoil; 0.845, 1.81, 2.13(E9, E12) spect.; 0.800(G3) spect.
26	Fe	53	A	....	β^+	8.9 min.(R3)		
	Fe	54	...	6 04(N35)				
	Fe	55	A	. . ..	K, e^-	~ 4 yr.(V4)		
	Fe	56	...	91.57(N35)				
	Fe	57	...	2.11(N35)				
	Fe	58	...	0.28(N35)				
	Fe	59	A	. . . .	β^-, γ	47 days(L20)	0.26, 0.46(D16) spect., coincid. abs.	1 10, 1.30(D16) spect.

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
27	Co	55	A	....	β^+, γ	18.2 hr.(D5)	1.50(L21) spect.	0.16, 0.21, 0.8, 1.2(C20) cl. ch. recoil
	Co	56	A	....	β^+, γ, K(E9)	72 days(L10)	1.2(L10) abs., (C17) cl. ch., coincid.; 1.50(E9, E12) spect., coincid.	1.7(C17) abs. Pb, coincid.; 1.05(L10) abs. Pb; 0.845, 1.26, 1.74, 2.01, 2.55, 3.25(E12) spect., coincid.
	Co	57	A	......	K, γ, e^-; β^+(L10)	270 days(L10)	0.26(β^+)(L10)	0.117, 0.130, 0.202, 0.215(P3) spect.
	Co	58	A		β^+, γ, (10%) (D35), K, γ(90%)(D35)	72 days(L10)	0.4(L10) abs.; 0.470(E13, D35) spect.; (E13), coincid.	0.6(L10) abs. Pb; 0.805(D35) spect., coincid.
	Co	59	..	100(M52)				
	Co	60	A		β^-, γ	5.3 yr.(L10)	0.300(D17) spect., coincid. abs.	1.10, 1.30(D17) spect., coincid.
	Co	60	A	....	I.T., γ, e^-(L10, D17); β^-, γ(D17, N10)	10.7 min.(L10)	1.35(β^-)(N10) spect.	0.056(I.T.)(D17) spect. conv., 1.5 (with β^-) (N10) abs. Pb
28	Ni	57	A	....	β^+	36 hr.(L11)	0.67(L11) abs.	
	Ni	58	...	67.4(V21)				
	Ni	60	...	26.7(V21)				
	Ni	61	..	1.2(V21)				
	Ni	62	..	3.8(V21)				
	Ni	63	A	....	β^-, γ	2.6 hr.(L11)	1.9(L11) abs.	1.1(L11) abs. Pb; 0.280, 0.65, 0.93(G3) spect.
	Ni	64		0.88(V21)				
29	Cu	58, 60	C		β^+	81 sec.(D4)		
	Cu	58, 60	C	. . . .	β^+	7.9 min.(D4)		
	Cu	61	B	.	β^+; K(A4)	3.4 hr.(T1, R3)	0.9(R3) abs.	No γ(G2)

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
29	Cu	62	*A*	....	β^+	10.5 min.(H8)	2.6(C13) cl. ch.	
	Cu	63	..	70.13(E20)				
	Cu	64	*A*	....	β^-; β^+; K(A4)	12.8 hr.(V2)	0.58(β^-); 0.66(β^+)(T6, T11, T8) spect.	No γ(T6)
	Cu	65	...	29.87(E20)				
	Cu	66	*A*	.	β^-	5 min.(A1)	2.9(S5) cl. ch. (K.U.); 2.58(G15)	
30	Zn	63	*A*	...	β^+	38 min.(D4, B20)	2.3(S18) abs., (T11, T8) spect.	
	Zn	64	...	50.9(N34)				
	Zn	65	*A*	......	β^+, K, γ, e^-	250 days(L12)	0.4(β^+)(D9) cl. ch.	0.45, 0.65, 1.0(W15, I3) cl. ch. recoil; 1.14(D19, M34) spect.
	Zn	66	...	27.3(N34)				
	Zn	67	..	3.9(N34)				
	Zn	68	.	17.4(N34)				
	Zn	69	*A*		I.T., γ(K11)	13.8 hr.(L12)	....	0.439(H9, G3) spect. conv.
	Zn	69	*A*		β^-	57 min.(L12)	1.0(L12) abs.	No γ(L12)
	Zn	70	.	0.5(N34)				
31	Ga	64	*B*		β^-	48 min.(B13)		
	Ga	65	*A*		K, e^-	15 min.(A4, L10)	.	0.054, 0.117(D9) spect. conv.
	Ga	66	*A*		β^+	9.4 hr.(B13, R3)	3.1(M7) abs.	
	Ga	67	*A*	. .	K, γ, e^-	83 hr.(A4)	....	0.0925, 0.180, 0.297(H9) spect. conv., spect.; 0.292(G3) spect.; 0.094, 0.174, 0.187, 0.301(C21) spect.

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
31	Ga	68	*A*	...	β^+	68 min.(R3)	1.9(R3, M7) abs.	
	Ga	69	...	61.2(S61)				
	Ga	70	*A*	...	β^-, γ	20 min.(B20, A1)	1.68(S25) cl. ch. (K.U.)	
	Ga	71	...	38.8(S61)				
	Ga	72	*A*	...	β^-, γ	14.1 hr.(S6)	1.71(S25) cl. ch. (K.U.)	1.17, 2.65(M30) spect.
	Ga	74	*D*	...	β^-	9 days(S29)	0.8(S29)	
32	Ge	69	*E*	...	...	~ 195 days(M8)		
	Ge	70	...	21.2(A31)				
	Ge	71	*A*	...	*K*, e^-(?)(S30)	11 days(S30)	...	0.6(S30) abs. of *e*
	Ge	71	*A*	...	β^+	40 hr.(S30)	1.2(S30) abs.	
	Ge	72	...	27.3(A31)				
	Ge	73	...	7.9(A31)				
	Ge	74	...	37.1(A31)				
	Ge	75	*A*	...	β^-, γ(S30)	89 min.(S30)	1.1(S25, S29) cl. ch. (K.U.); 1.2(S30) abs.	
	Ge	76	...	6.5(A31)				
	Ge	77	*A*	...	β^-(S29)	12 hr.(S30)	1.9(S25, S29) cl. ch. (K.U.)	
33	As	72	*E*	...	β^+	26 hr.(V4)		
	As	72, 73	*D*	...	*K*, e^-(E10)	90 days(S26)	...	0.052(E10) spect. conv.
	As	73	*D*	...	β^+	50 hr.(S29)	0.6(S29)	
	As	74	*A*	...	β^-, β^+, γ(S26)	16 days(S26)	1.3(β^-), 0.9(β^+)(S26) cl. ch. (K.U.)	0.582(D15) spect.
	As	75	...	100(N30)				
	As	76	*A*	...	β^-, γ; β^+, *K*, γ(?)(S23)	26.8 hr.(W9, W19)	1.1, 1.7, 2.7(β^-)(S23, W9, W19) cl. ch.; 0.7, 2.6(β^+)(S23) cl. ch.; coincid.(M35)	3.2, 2.2, 1.5(S23) cl. ch. pair; 1.94, 0.83(M6) spect.; coincid.(M35)
	As	78	*A*	...	β^-, γ	65 min.(S9)	1.4(S26) cl. ch. (K.U.)	0.27(S26) abs. Pb

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
34	Se	74	...	0.9(A31)				
	Se	75	B	....	K, γ, e^-	48 days(D9); 160 days(K30)	...	0.50(D9) spect conv; several < 0 3(K30) spect conv.
	Se	76	...	9 5(A31)				
	Se	77	...	8.3(A31)				
	Se	78	...	24.0(A31)				
	Se	79, 81	C	....	I.T., e^-(L30)	57 min.(S9, L30)	....	0 099(H9) spect. conv
	Se	79, 81	C	...	β^-	19 min (L30)	1.5(L30) abs.	
	Se	80	...	48.0(A31)				
	Se	82	...	9 3(A31)				
	Se	83	A	.	β^-	30 min (L30)		
	Se		D			Several hrs.(B15)		
	Se		D	.. ..		Several days(B15)		
35	Br	78	A		β^+, e^-, γ	6 4 min.(S9)	2.3(β^+)(S9) abs.	0.046, 0.108(V7) spect. conv.
	Br	79	..	50.6(B60)				
	Br	80	A	..	I T., e^- γ(S10, V3, V7 G22)	4 4 hr (B13)	....	0 049, 0 037 or 0 025(V7) spect conv; 0.037(G22) abs. A1 < 0 5(B13 S9) abs.
	Br	80	A		β^-, γ	18 min.(S9, S10)	2.0(A2) spect	
	Br	81	..	49.4(B60)				
	Br	82	A		β^-, γ	34 hr.(S9)	0.465(R6, D21); (D23) coincid.	0 547, 0.787, 1.35(R6, D15) spect; (D23) coincid.
	Br	83	A	.	β^-	140 min.(L30)	1.05(L30) abs.	No γ(S9)
	Br	84	A		β^-	30 min (S35)	4 5(B30) abs.	
	Br	85	A			3.0 min (S35, B29)		
	Br	87	B			50 sec.(S35)		
	Br	> 82	F	. .	. .	22 hr (B15)		

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
36	Kr	78		0.35(N30)				
	Kr	79, 81	C	....	β^+(B41)	34 hr.(B41)	0.4(C41) cl ch.	
	Kr	79, 81	C	....	I.T.(?), e^-, γ; no β^+(C41)	13 sec.(C41)		0.187(C41) spect. conv.
	Kr	79, 81	C	....	I.T.(?), e^-, γ; no β^+(C41)	55 sec.(C41)		0.127(C41) spect. conv.
	Kr	80	...	2.01(N30)				
	Kr	82	...	11.53(N30)				
	Kr	83	...	11.53(N30)				
	Kr	83*	A	....	I.T., e^-(L30)	113 min (L30)		0.029, 0.046(H9) spect. conv
	Kr	84	...	57.11(N30)				
	Kr	85	A		β^-	4.0 hr.(C22)	0.85(B30) abs	
	Kr	86	...	17.47(N30)				
	Kr	87	B	....	β^-	74 min.(S9)	4(B30) abs	
	Kr	88	A	....	β^-	3 hr.(L27, H28)	2.5(W19) cl. ch (K.U.)	
	Kr	89	B	....	β^-	2.5 min.(H56)		
	Kr	> 90	D	....	β^-	< 0.5 min.(H28)		
37	Rb	82	B	....	....	20 min.(H51)		
	Rb	84	B	....	....	6.5 hr.(H51)		
	Rb	85	...	72.8(N34)				
	Rb		F	....	....	42 min.(H51)		
	Rb		F	....	....	200 hr.(H51)		
	Rb	86	A	....	β^-	19.5 days(H13)	1.56(H13) abs.; 1.60(H32) spect	
	Rb (H89, H84)	87	A	27.2(N34)	β^-(T31, C61), γ(O30)	6.3×10^{10} yr.(S74)	0.132(L6) spect.; 0.25(K53); 0.13(O30) spect.	0.034, 0.053, 0.082, 0.102, 0.129(O30) spect. conv
	Rb	88	A	....	β^-	17.5 min.(W19)	5.1(W19) cl ch	
	Rb	89	B	....	β^-, γ(G21)	15 min (G9, G21)	3.8(G21) abs.	
	Rb	> 90	D	..	β^-	80 sec.(H28)		

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
38	Sr	84		0.56(N36)				
	Sr	85	*A*		*K*, γ(D13)	65 days(D13)		0.8(D13, D25) abs. Pb
	Sr	85	*A*		I.T., e^-, γ(D25)	70 min.(D25)		0.170(D25) spect. conv.
	Sr	86		9 86(N36)				
	Sr	87		7 02(N36)				
	Sr	87*	*A*		I.T., e^-, γ(D11)	2.7 hr.(D11)		0.37(D11) spect. conv.; 0.386(H9) spect. conv.
	Sr	88		82.56(N36)				
	Sr	89	*A*		β^-	55 days(S24)	1.50(S24) cl ch.; 1.32(H32) spect.	No γ(S24)
	Sr	90	*B*			~ 5 yr.(H47)		
	Sr	> 90	*D*		β^-	2.7 hr.(G13)		
	Sr	> 90	*D*		β^-	7 min.(L26)		
	Sr	91	*B*		β^-	10 hr.(H47)		
	Sr	> 90	*D*			~ 2 min.(H47)		
39	Y	87	*B*		I.T., e^-, γ(D25)	14 hr.(S24, D13)		0.5(D25) abs.
	Y	87	*A*		*K*(D13)	80 hr.(D25)		No γ(?)(D25)
	Y	88	*A*		β^+	2.0 hr.(S24)	1.2(S11) cl. ch. (K.U.)	
	Y	88	*B*		*K*, γ(D25)	87 days(H33)		0.95, 1.92(R12) cl. ch.; 0.908, 1.89(D28) spect., coincid.; 1.87(S32) Be-γ-*n*; 1.9, 2.8(G10) D-γ-*n*
	Y	89		100(D40)				
	Y	90	*A*		β^-	60 hr.(S11)	2.6(S11) cl. ch. (K.U.)	
	Y	> 90	*D*		β^-, γ(H56)	3.5 hr.(H56)	3.6(B30) abs.	
	Y	91	*B*		β^-, γ(B30)	57 days(H42, G13)	1 6(B30) abs.	
	Y	91	*B*			50 min.(G13)		
	Y	> 90	*D*			11.5 hr.(H47)		
	Y	> 90	*D*		β^-, γ(H56)	20 min.(H47)		

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
40	Zr	89	A	....	β^+(S12, D13)	78 hr.(D25)	1.0(β^+)(S12) cl. ch. (K.U.), (D25) abs.	No γ(D25)
	Zr	89	A	....	e^-, γ, I.T. or K(D13, D25)	4.5 min.(D25)		
	Zr	90	...	48(A31)				
	Zr	91	...	11.5(A31)				
	Zr	92	...	22(A31)				
	Zr	93	D	....	β^-, γ	63 days(S46)	0.25(S46) abs.; 0.57, 0.29(M33)	0.94(M33)
	Zr	94	...	17(A31)				
	Zr	95	D		β^-	17.0 hr.(G18)	1(G18) abs.	
	Zr	96	...	1.5(A31)				
	Zr	97	E		β^-	6 min.(S46)	~ 1.9(S46) abs.	
	Zr		E		β^-	18 min.(S46)		
	Zr		F		β^-	90 min.(S12)	~ 1.5(S46) abs.	
	Zr		E		β^-	70 hr.(S46)	1.17(S46) cl. ch. (K.U.)	
41	Cb		E			4 min.		
	Cb		E			12 min.		
	Cb		E			38 min.		
	Cb		E			21 hr.		
	Cb		E			96 hr.		
	Cb	92	A		β^-, γ	11 days(S42, S13)	1.38(S42) cl. ch. (K.U.); 0.59(M33)	1.0(M33)
	Cb	93	...	100(S63)				
	Cb	93*	D	. ..	I.T., e^-	~ 55 days(S46)	....	~ 0.15(S46, M33) abs. of e^-, 0.94(M33)
	Cb	94	A		β^-, γ(S42)	6.6 min.(S42)	1.4(S42) abs.	0.4(S42) abs. Pb
	Cb	95	D		β^-	75 min.(G18)	1(G18) abs.	

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
42	Mo	92	...	14.9(V22)				
	Mo	93	*F*	.. ..	....	7 hr.(D9)		
	Mo	91, 93	*C*	.. ...	β^+	17 min.(B20, S12)	2.65(S46) cl. ch. (K.U.)	
	Mo	94	...	9.4(V22)				
	Mo	95	...	16.1(V22)				
	Mo	96	...	16.6(V22)				
	Mo	97	...	9.65(V22)				
	Mo	98	...	24.1(V22)				
	Mo	99	*B*		β^-, γ	67 hr.(S14)	1.5(S14) abs.	0.4(S14) abs.
	Mo	100	...	9.25(V22)				
	Mo	101	*B*	...	β^-, γ	14.6 min.(M25)	1.8(S40) cl. ch. (K.U.); 1.0, 2.2(M38)	0.3, 0.9(M38)
	Mo	> 101	*D*		β^-	12 min.(H41)		
	Mo		*E*		....	$\sim\sim$ 60 days(H55)		
43	43	96	*B*		β^-(?)	2.7 hr.(D4)		
	43	99	*B*		I.T., e^-, γ(S14)	6.6 hr.(S14)	....	0.136(S14) spect. conv.; $\sim$ 0.18(S14) abs.
	43	101	*B*		β^-, γ	14.0 min.(M25)	1.1(S40) cl. ch. (K.U.); 1.3(M38)	0 30(M38)
	43	> 101	*D*		β^-	< 1 min.(H41)		
	43		*D*		*K*, e^-	90 days(C12)		0.097(H9) spect. conv.
	43		*D*		*K*, γ	62 days(C12)		
	43		*D*		*K*(?) e^-, γ(E5)	110 hr.(E3)	0.6(E3)	0.05, 0.5(E5)
	43		*E*		β^-, γ(E3)	55 min.(E5)	2.5(E5) abs.	
	43		*E*		β^-	36.5 hr.(D4)		
	43		*E*		β^-	18 sec.(D9)		
	43		*D*		*K*	$\sim$ 2 days(S14)		
44	Ru	95	*F*		.	20 min (D7)		
	Ru	96	...	5.68(E20)				

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
44	Ru	98		2.22(E20)				
	Ru	99	.	12.81(E20)				
	Ru	100	.	12.70(E20)				
	Ru	101	...	16.98(E20)				
	Ru	102		31.34(E20)				
	Ru	104		18.27(E20)				
	Ru	105	*B*	.	β^-	4 hr.(D7, L13, N12)	1.5(B31) abs.	
	Ru		*G*		.	11 days(L13)		
	Ru		*E*		.	90 min.(K3)		
	Ru		*D*		β^-	4 min.(B31)	4(B31) abs.	
	Ru		*D*			45 days(N15)		
45	Rh	102	*A*		β^-, β^+, γ(M23)	210 days(M23)	1.1(β^-)(M23) abs.	
	Rh	103	...	100(C50)				
	Rh	104	*A*	.	I.T., e^-(P5)	4.2 min.(P5)	.....	0.055–0.080(P5) abs. of e^-; 0.069(O9) spect. conv.
	Rh	104	*A*		β^-	44 sec.(P5, A1)	2.3(C13) cl. ch.	
	Rh		*E*		.	3 hr.(D9)		
	Rh		*E*			10.7 hr.(D9)		
	Rh		*E*	.	....	3 days(D9)		
	Rh	105	*B*	..	β^-	34 hr (N12, N13)	0.5(N13) abs	
	Rh		*D*	..	β^-	24 min.(B31)	1.2(B31) abs.	
46	Pd	102	...	0.8(S63)				
	Pd	104	..	9.3(S63)				
	Pd	105	...	22.6(S6)				
	Pd	106	.	27.2(S63)				
	Pd	107, 109	*C*	....	β^-	13 hr (K6)	1.03(K6) cl. ch.	
	Pd	108	...	26.8(S63)				

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
46	Pd	110	...	13.5(S63)				
	Pd	111	A		β^-	26 min.(S33)	3.5(B31) abs.	
	Pd	112	A		.	17 hr.(S33, N14)		
47	Ag	102	E	.	. .	73 min.(E6)		
	Ag	104	E	.	......	16.3 min.(E6)		
	Ag	105	E	. . .	K, γ	45 days(E6)	.. ..	0.29, 0.42, 0.50, 0.62(E6) spect.; 0.282, 0.345, 0.430, 0.650, > 1.0(D19) spect.
	Ag	106	A	. . . .	β^+	24.5 min.(P6, D2)	2.04(F5) abs.	No γ(F5)
	Ag	106	A	..	K, e^-, γ(H50, P6, F5, A4)	8.2 days(P6, K6)	1.2(e^-)(F5) abs.	1.06, 0.69(E6) spect.; 1.63, 1.06, 0.72(?) (D19) spect.
	Ag	107	...	51.9(P44)				
	Ag	107*, 109*	C		I.T., e^-	40 sec.(A12)	....	0.093(V7, A12, H9) spect conv.
	Ag	108	A	.	β^-	2.3 min.(A1, B20)	2.8(N4) cl. ch.	
	Ag	109	...	48.1(P44)				
	Ag	110	A	.	β^-, γ(P6)	22 sec.(A1, P6)	2.8(G4) cl. ch. (K.U.)	
	Ag	108, 110	C		K, γ, e^-(K15, H59)	225 days(L14, R10)	....	0.650, 0.925, 1.51(D19) spect.; 0.6(K15) abs. Al
	Ag	111	A		β^-	7.5 days(K6, P6)	~ 0.8(B30) abs.	No γ(K6, P6)
	Ag	112	A		β^-, γ	3.2 hr.(P6)	2.2(P6) cl. ch.	
48	Cd	106	...	1.4(N34)				
	Cd	107, 109	C		K, γ(D4, V7, W11, A12)	6.7 hr.(D4, R5)	....	0.53(V7) abs. Pb
	Cd	107, 109	C	..	K	158 days(H34)		

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
48	Cd	108	...	1.0(N34)				
	Cd	109	*E*	...	β^+	33 min.(P2)		
	Cd	110	...	12.8(N34)				
	Cd	111	...	13.0(N34)				
	Cd	112	...	24.2(N34)				
	Cd	113	...	12.3(N34)				
	Cd	114	...	28.0(N34)				
	Cd	115	*A*	...	β^-, γ	2.5 days(G5)	1.11(C14) spect.	0.55(L57) cl. ch. recoil; 0.65(M34) spect.
	Cd		*E*	...	β^-, γ(C14)	40 days(C14)	0.95(C14) cl. ch.	
	Cd	116	...	7.3(N34)				
	Cd	117	*A*	..	β^-	3.75 hr.(C14)		
	Cd*		*D*	.	I.T., e	48.7 min.(W30)	...	0.195(W30) abs. of e^-
49	In	110	*D*	..	β^-	65 min.(B17)	1.6(B17) spect.	
	In	111	*D*	..	β^+, γ, e^-	20 min.(B17)	1.7(β^+)(L57) cl. ch.	0.16(B17) spect. conv.
	In	112	*D*	.	*K*, γ, e^-(L57)	2.7 days(B17, C14)	...	0.17, 0.25(B17, C14) spect. conv.
	In	112	*D*	...	I.T., γ, e^-	16.5 min.(S34)	...	0.120(S34) abs. of e^-
	In	112	*D*	...	β^+, β^-(?), γ, e^-(S34)	17.5 min.(S34)	1.3(β^+)(S34) abs.; 0.47(β^-?)(S34) abs.	0.095(S34) abs. of e^-
	In	113	...	4.5(S61)				
	In	113*	*A*	...	I.T., γ, e^-(B17)	105 min.(B17)	...	0.39(B17, L57) spect. conv.
	In	114	*A*	..	I.T., e^-(L57, L48)	48 days(B17)	...	0.19(B17, L57) spect. conv.
	In	114	*A*	...	β^-	72 sec.(L15, B17)	1.98(L32) cl. ch.	
	In	115	.	95.5(S61)				
	In	115*	*A*		I.T., e^-, γ(L57)	4.1 hr.(G5, B18)	...	0.34(O57) spect. conv.
	In	116	*A*	...	β^-	13 sec.(A1, C14)	2.8(C14) cl. ch.	No γ(M11)

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
49	In	116	A	....	β^-, γ	54 min.(A1, L15)	0.85(C14, C44) spect., cl. ch.	1.8, 1.4, 1.0, 0.6, 0.4, 0.2(C44) cl. ch. recoil; 2.32, 1.31, 1.12, 0 428(D19) spect.
	In	117	A	....	β^-, γ, e^-	117 min.(L32)	1.73(β^-)(C14) spect.	
50	Sn	112	...	1.1(A32)				
	Sn	113	A	....	K, e^-, γ	70–105 days(L17, B17)	....	0.085(B17) spect. conv.
	Sn	114	...	0.8(A32)				
	Sn	115	..	0.4(A32)				
	Sn	116	...	15.5(A32)				
	Sn	117	...	9.1(A32)				
	Sn	118	...	22.5(A32)				
	Sn	< 119	E	. ...	β^-	25 min.(L17)		
	Sn	< 119	E	. . ..	β^-	3 hr.(L17)		
	Sn	< 119	E	. . ...	β^-	13 days(L17)		
	Sn	119	...	9.8(A32)				
	Sn	120	...	28.5(A32)				
	Sn	122	...	5.5(A32)				
	Sn	124	...	6.8(A32)				
	Sn	125	B	. .. .. .	β^-	9 min.(L17)		
	Sn	< 126	D	. ...	β^-	40 min.(L17)		
	Sn	< 126	D	......	β^-	26 hr.(L17)		
	Sn	< 126	D	....	β^-	10 days(L17)		
	Sn	< 126	D	.. ...	....	~ 400 days(L17)		
	Sn	> 125	D	....	β^-	~ 20 min.(H55)		
	Sn	> 125	D	....	β^-	~ 80 hr.(H55); ~ 60 hr.(N15)		
	Sn	> 125	D	. .	β^-	~ 70 min (N15, H55)		
	Sn	> 125	D	. .... .	β^-	~ 11 days(H55)		
	Sn	> 125	F	... .	β^-	~ 4–5 hr.(H55)		

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
51	Sb		*E*		β^-	3.5 min.(D9)		
	Sb	116, 118	*E*		β^+	3.6 min.(R16)		
	Sb	120	*A*		β^+	17 min.(H10, L18)	1.53(A10) cl. ch.	
	Sb	121	...	56(A31)				
	Sb	122	*A*	....	β^-, γ	2.8 days(L28)	0.81, 1.64(A10, M35) cl. ch., abs.	0.96(M35) coincid. abs.; 0.80(M34) spect.
	Sb	123	...	44(A31)				
	Sb	124	*A*	....	β^-, γ	60 days(L18)	1.53(M35) abs.; 0.74, 2.45(H35, H49) spect.	1.82(M35) coincid. abs.; 1.75(K16) Be-γ-n reaction
	Sb	< 126	*D*		β^-	3 hr.(L18)		
	Sb	< 126	*D*			~ 45 days(L18)		
	Sb	< 126	*D*			~ 2 yr.(L18)		
	Sb	> 125	*D*		β^-	60 min.(N15)		
	Sb	127	*A*		β^-	80 hr.(A6)		
	Sb	129	*A*		β^-	4.2 hr.(A6)		
	Sb	> 131	*D*		β^-	< 10 min.(A6)		
	Sb	> 131	*D*		β^-	5 min.(A6)		
	Sb	133	*A*		β^-	< 10 min.(A6, W21)		
52	Te	120	...	< 1(A31)				
	Te	121	*A*		*K*, e^-(S15, O8)	125 days(S15)	...	Coincid.(Y3)
	Te	122	...	2.9(A31)				
	Te	122, 124	*E*	....	I.T., e^-(?)	30 days(K17)		0.0820, 0.0883, 0.136, 0.1573, 0.2108, 0.615(K17) spect. conv.
	Te	123	..	1.6(A31)				
	Te	124	...	4.5(A31)				

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
52	Te	125	...	6.0(A31)				
	Te	126	...	19.0(A31)				
	Te	127	*A*		I.T., e^-(S15)	90 days(S15)		0.086(H9) spect. conv.
	Te	127	*A*		β^-	9.3 hr.(S15)		
	Te	128		32.8(A31)				
	Te	129	*A*		I.T., e^-(S15)	32 days(S15)		0.102(H9) spect. conv.
	Te	129	*A*		β^-	72 min.(S15, A6)		
	Te	130		33.1(A31)				
	Te	131	*A*		I.T., e^-(S15)	30 hr.(S15, A6)		0.177(H9) spect. conv.
	Te	131	*A*		β^-	25 min.(S15)		
	Te	> 131	*D*		β^-	43 min.(A6)		
	Te	> 131	*D*		β^-	77 hr.(A6)	~ 0.3(B30) abs.	
	Te	133	*A*		β^-	60 min.(A6, W21)		
	Te	135	*A*		β^-	< 1 min.–15 min. (W21, S21)		
	Te		*D*		β^-	~ 1 min.(H55)		
53	I	124	*A*		β^+	4.0 days(L19, D9)		
	I	126	*A*		β^-, γ	13.0 days(L19, T4)	1.1(L19) abs.	0.5(L19) abs. Pb
	I	127		100(N30)				
	I	128	*A*		β^-, γ	24.99 min.(H36)	1.85(B14) cl. ch. or 1.05, 2.10(B14) cl. ch. (K.U.)	0.4(L19) abs. Pb
	I	130	*A*		β^-, γ	12.6 hr.(L19)	0.61, 1.03(R23) spect., coincid.	0.417, 0.537, 0.667, 0.744(R23) spect. conv., spect., coincid.
	I	131	*A*		β^-, γ	8.0 days(L19)	0.687(T7) cl. ch.; 0.595(D29, D30, D31) spect., coincid.	0.4(L19) abs. Pb; 0.367, 0.080(D30, D31) spect., spect. conv. coincid.

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
53	I	> 131	*D*		β^-, γ	2.4 hr.(A6)	~ 1.35(B30) abs.	0.85(B30) abs.
	I	> 131	*D*		β^-	54 min.(A6)		
	I	133	*A*		β^-	22 hr.(A6, W21)	1.1(P13) cl. ch.	
	I	135	*A*		β^-	6.6 hr.(S21, D27, W21)		
	I	137	*E*	...		30 sec.(S35)		
	I		*E*	...		1.8 min.(S35)		
54	Xe	124		0.094(N30)				
	Xe	126		0.088(N30)				
	Xe	127	*B*	...	I.T.(?), e^-, γ(C41)	75 sec.(C41)	...	0.175, 0.125(C41) spect. conv.
	Xe	127	*B*	...	e^-, γ(C41)	34 days(C41)		0.9(C41) abs. of e^-
	Xe	128		1.90(N30)				
	Xe	129		26.23(N30)				
	Xe	130		4.07(N30)				
	Xe	131		21.17(N30)				
	Xe	132		26.96(N30)				
	Xe	133	*A*	...	I.T., e^-(S27); β^-(S47)(?)	7.0 days(R22); 5.4 days(C22)	0.2–0.3(B30, S47) abs.	
	Xe	134		10.54(N30)				
	Xe	135	*A*	...	β^-, γ(B30)	9.4 hr.(S21, W21)	0.95(B30) abs. Al; 0.9(S47) abs. Al	
	Xe	135	*A*		β^-, γ(B30)	15.6 min.(R22)	0.7(B30) abs. Al; 0.6(S47) abs. Al	
	Xe	136		8.95(N30)				
	Xe	137	*D*		...	68 min.(C22)		
	Xe	137	*D*		β^-	3.4 min.(R22)	4(B30) abs. Al	
	Xe	138	*D*		β^-	17 min.(G21)		
	Xe	139	*A*		β^-	< 0.5 min.(H28)		
	Xe	140	*D*		β^-	< 0.5 min.(H28)		

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
55	Cs	133	...	100(N30)				
	Cs	134	A	....	β^-(K26)	3 hr.(K26)	1(K26) abs.	
	Cs	134	A	. .	β^-, γ(K26)	1.7 yr.(K26)	0.9(K26) abs.	
	Cs	138	D	.	β^-	33 min.(H28)	2.6(G21) abs.	
	Cs	139	A	. .	β^-	7 min.(H28)		
	Cs	140	D	. .	β^-	40 sec.(H28)		
56	Ba	130	...	0.101(N36)				
	Ba	132	...	0.097(N36)				
	Ba	133	A	....	I.T., e^-, γ(C30)	38.8 hr.(W28)	. .	0.30(D9) spect. conv.; 0.276(C30) spect. conv.
	Ba	134	..	2.42(N36)				
	Ba	135	...	6.59(N36)				
	Ba	136	..	7.81(N36)				
	Ba	137	...	11.32(N36)				
	Ba	138		71 66(N36)				
	Ba	139	A	...	β^-, γ	86 min.(P8, H28)	1(K26) abs.; 2.3(B30) abs.	0.6(K26) abs. Pb, Cu
	Ba		D		. .	3 min.(A1, P2)		
	Ba	140	A		β^-	~ 300 hr.(H28, G21)	1.2(B30) abs.	
	Ba	> 140	D	. .	β^-	6 min.(H48)		
	Ba	> 140	D		β^-	18 min.(H48)		
	Ba	> 140	E	.	β^-	< 1 min.(H14)		
57	La	137	B	. ...	K, γ(W23, M24)	17.5 hr.(W23)	. . .	0.88(W23) abs. Pb
	La	138	F	.	....	2.2 hr.(P2)		
	La	139		100(A31)				
	La	140	A	....	β^-, γ	40.0 hr.(W23)	1.41(W23) abs. Al spect.	2.00(W23, M24) abs. Pb; 2.04(M27) spect.

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
57	La	> 140	*D*		β^-	74 min.(H48)		
	La	> 140	*D*		β^-	3.5 hr.(H48)		
	La	> 140	*E*		β^-	< 30 min.(H14, H15)		
	La	> 140	*F*		β^-	15 min.(H55)		
	La	> 140	*F*		β^-	13 days(H55)		
58	Ce	136		< 1(D41)				
	Ce	138		< 1(D41)				
	Ce	139	*F*		β^+	2 1 min.(P9)		
	Ce	140		89(A31)				
	Ce	140*	*B*		I.T., γ(P14)	140 days(P14)		0.21(P14)
	Ce	141	*A*		β^-, γ	30 days(P14)	0 65(P14)	0.2(P14)
	Ce	141, 143	*C*			15 days(R11)	0.12(R11) spect.	
	Ce	142		11(A31)				
	Ce	143	*B*		β^-	36 hr.(P14)		
	Ce		*D*		β^-	310 days(B30, H55)		
	Ce		*D*		β^-	≦ 20 days(H55)		
	Ce		*D*		β^-	~ 15 min.(G19)		
	Ce		*D*		β^-	~ 4–5 hr.(H55)		
	Ce		*D*		β^-	~ 40 hr.(H55)		
59	Pr	140	*A*		β^+	3.5 min.(P9)	2.40(D32) cl. ch.	
	Pr	141		100(A31)				
	Pr	142	*A*		β^-, γ	19.3 hr.(D32)	2.14(D32) spect.	1.9(D32) abs. Pb
	Pr	143	*B*		β^-	13.5 days(P14)	0.95(P14)	
	Pr		*B*		β^-	25 min.(G19)		
	Pr		*D*		β^-	17 min.(H55)	3.1(B30, H55) abs.	
60	Nd	141	*E*		β^+	2.5 hr.(K19)	0.78(K19)	
	Nd	142		25.95(M53)				

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev	
							Particles	γ-rays
60	Nd	143		13.0(M53)				
	Nd	144		22.6(M53)				
	Nd	145		9.2(M53)				
	Nd	146		16.5(M53)				
	Nd	147, 149	*E*		β^-	47 hr.(W25, L25)	0.95(W25) abs.	
	Nd	148		6.8(M53)				
	Nd	150		5.95(M53)				
	Nd	151	*E*		β^-	21 min.(P9)		
61	61		*F*		β^-	12.5 hr.(P9)		
	61		*E*		*K* or I.T., γ(W25)	$\sim$ 200 days(W25)	. . . .	0.67(W25) abs.
	61		*E*		β^-, γ	5.3 days(K20)	2(K20)	
	61		*E*		β^-, γ	2.7 hr.(K20)	2(K20)	
	61		*E*		β^-, γ	16 days(K20)	1.7(K20)	
62	Sm	144		3(A33)				
	Sm	147		17(A33)				
	Sm	148 (W40)	*A*	14(A33)	α(H85, L74)	1.4×10^{11} yr.(H86); 1.7×10^{11} yr. (W40)	2.0(H86) cl. ch.	
	Sm	149		15(A33)				
	Sm	150		5(A33)				
	Sm	152		26(A33)				
	Sm	154		20(A33)				
	Sm		*D*		β^-	21 min.(P9)	1.8(K19)	
	Sm		*D*		I.T.(W25)	46 hr.(P9)	. . . .	$\sim$ 0.6(M31) abs. of e^-
	Sm		*E*		. . . .	60 days(K19)		
63	Eu	150	*E*		β^+	27 hr.(P9)		
	Eu	151		49.1(L60)				

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
63	Eu	152	*B*		β^-, γ, e^-(T6); *K*(?)(R2)	9.2 hr.(P9)	1.88(β^-)(T6) spect.	0.123, 0.163, 0.725(T6) spect. conv.
	Eu	153		50.9(L60)				
	Eu	154	*B*		β^-, γ(R11, F7)	5–8 yr.(F11)	0.9(R11) spect.	
	Eu		*E*		...	40 days(K20)		
64	Gd	152		0.2(W41)				
	Gd	154		2.86(W41)				
	Gd	155		15.61(W41)				
	Gd	156		20.59(W41)				
	Gd	157		16.42(W41)				
	Gd	158		23.45(W41)				
	Gd	159, 161	*E*		...	8 hr.(A1, H17)		
	Gd	160		20 87(W41)				
	Gd		*F*		β^-, γ(F11)	155–170 days(F11)		
65	Tb	159		100(A33)				
	Tb	160	*A*		β^-	3.9 hr.(H16, M13)		
	Tb	160	*A*		β^-, γ(B33)	72 days(B33)	0.70(B33) abs. A1	
66	Dy	158		0.1(D42)				
	Dy	160		1.5(D42)				
	Dy	161		22(A31)				
	Dy	162		24(A31)				
	Dy	163		24(A31)				
	Dy	164		28(A31)				
	Dy	165	*A*		β^-, γ	2.5 hr.(H17, P9, M13)	1.20(C31) abs., coincid.; 1.18(D33) spect.; 1.40(E11) cl. ch.	1.1(C31) abs., coincid.
	Dy	(?)	*F*		β^+	2.2 min.(P9)		

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
67	Ho	164	*F*	.....	β^-	47 min.(P9)		
	Ho	165	.	100(A33)				
	Ho	166	*B*	...	β^-	35 hr.(H17)	1.6(H20) abs.; 1.9(M31) abs.	
68	Er	162	..	0.1(W42)				
	Er	164	.	1.5(W42)				
	Er	165	*F*	....	β^+	1.1 min.(P9)		
	Er	166	..	32.9(W42)				
	Er	167	.	24.4(W42)				
	Er	168	..	26.9(W42)				
	Er	169, 171	*C*	....		7 min.(M13)		
	Er	169, 171	*C*	...	β^-	12 hr.(H17, P9)		
	Er	170	.	14.2(W42)				
69	Tm	169	.	100(A33)				
	Tm	170	*A*	....		105 days(H20)		
70	Yb	168	...	0.06(W43)				
	Yb	170		4.21(W43)				
	Yb	171	.	14.26(W43)				
	Yb	172		21.49(W43)				
	Yb	173	..	17.02(W43)				
	Yb	174		29.58(W43)				
	Yb	175, 177	*C*	....		3.5 hr.(H17, M13)		
	Yb	176	...	13.38(W43)				
	Yb	(?)	*G*	......	...	41 hr.(P9)		
71	Lu	175	.	97.5(M54)				
	Lu (H80, M54)	176	*A*	2.5(M54)	β^-(H80, L70), γ(F16)	7.3 × 10^{10} yr.(L70)	0.215(L70) abs. Al, spect.; 0.40(F16)	0.260(F16)

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
71	Lu	176, 177	C	. . . .	β^-	3.4 hr.(F16)	1.150(F16) abs.	
	Lu	176, 177	C	. .	β^-	6.6 days(F16)	0.440(F16) abs.	
72	Hf	174	...	0.18(M55)				
	Hf	176	...	5.30(M55)				
	Hf	177	...	18.47(M55)				
	Hf	178	...	27.13(M55)				
	Hf	179	...	13.85(M55)				
	Hf	180	..	35.14(M55)				
	Hf	181	A	....	β^-	55 days(H19)		
73	Ta	180	A	....	....	14–21 min.(B11, O1)		
	Ta	180	A	....	K, e^-, γ(O1); β^-(?)	8.2 hr.(O1)	< 0.5(e^-)(?)(O1) abs.	
	Ta	181	...	100(D40)				
	Ta	182	A	....	β^-, γ	97 days(O1)	1.0(H37) abs.; 0.98, 0.32, 0.050(Z2)	1.6(Z2)
74	W	180	...	~ 0.2(D43)				
	W	182	..	22.6(A31)				
	W	183	...	17.3(A31)				
	W	184	...	30.1(A31)				
	W	185	B	. . . . .	β^-, γ(M36)	77 days(M36)	0.55–0.65(F12) abs. A1; 0.64–0.72(F12) cl. ch.	
	W	186	...	29 8(A31)				
	W	187	B	....	β^-, γ(M36)	24.1 hr.(F12)	1.4(F12) abs. A1, cl. ch. (C31) abs., coincid.	0.87(F12) abs. Pb; 0.90(C31) coincid. abs., coincid.; 0.94(M30) spect.; 0.135, 0.101, 0.086(V6) spect. conv.

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
75	Re		*E*		β^+(C42)	30–55 min.(C32, D9)		
	Re		*E*			13 min.(C42)		
	Re	184	*B*		*K*(?), γ	52 days(F12)	....	0.85(F12)
	Re	185		38.2(A31)				
	Re	186	*B*		β^-	90 hr.(S16)	1.05(Y4) cl. ch.	No γ(C42)
	Re	187		61.8(A31)				
	Re	188	*B*		β^-, γ	18 hr.(P2)	2.5(S16) cl. ch. (K.U.)	0.8(M34) spect.
76	Os	184		0.018(N37)				
	Os	186		1.59(N37)				
	Os	187		1.64(N37)				
	Os	188		13.3(N37)				
	Os	189		16.1(N37)				
	Os	190		26.4(N37)				
	Os	191	*B*		β^-, γ(S36)	32 hr.(S36)	1.5(S36) abs. Al	
	Os	192		41.0(N37)				
	Os	193	*B*		β^-, γ(S36)	17 days(S36)	0.35(S36) abs. Al	
77	Ir	191		38.5(S63)				
	Ir	192, 194	*C*		β^-	1.5 min.(M15)		
	Ir	192, 194	*C*		β^-, γ(M34, W29)	19 hr.(M15, A1)	2.2(A2) spect.; 2.18(W29) spect., 2.11(W29) abs. Al	1.35(M34) spect.
	Ir	192, 194	*C*		β^-, γ	60 days(M15, F6)	...	0.63(M34) spect.; 0.307, 0.467, 0.603(D34) spect.
	Ir	193		61.5(S63)				
78	Pt	192		0.8(S63)				
	Pt	194		30.2(S63)				
	Pt	195		35.3(S63)				
	Pt	196		26.6(S63)				

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
78	Pt	196*	*D*		I.T., e^-(?)(S37)	80 min.(S37)		
	Pt	197	*B*		β^-	18 hr.(M15)	0.65(S37) abs.; 0.72(K27) abs.	
	Pt	197	*B*		β^-, γ(K27)	3.3 days(M15)		
	Pt	198		7.2(S63)				
	Pt	199	*A*		β^-	31 min.(M15)	1.8(S37, K27) abs.	
79	Au	196	*B*		β^-	13 hr.(M15)		
	Au	196	*B*		β^-, γ, e^-(K27)	4–5 days(M15); 5.6 days(L29, K27)	0.36(C43)	0.41(C43)
	Au	197		100(D44)				
	Au	198	*A*		β^-, γ	2.7 days(M15, A1)	0.8(M15, R2) abs. and cl. ch.; 0.78(C31) abs., coincid.	0.28, 0.44, 2.5(R2, S17) cl. ch. recoil, (C31) coincid.
	Au	199	*A*		β^-, γ(K27)	3.3 days(M15)	1.01(K27) abs.	0.45(K27) abs.
	Au	200, 202	*D*		β^-	48 min.(S37, M32)	2.5(S37) abs.	
80	Hg	196		0.15(N30)				
	Hg	197	*A*		*K*, γ, e^-(F13)	23 hr.(F13)		~ 0.20(F13) abs. of e^-; 0.161, 0.130(H38) spect. conv.; 0.125, 0.157(V8) spect. conv.
	Hg	197	*A*		*K*, γ, e^-(F13)	64 hr.(F13)		~ 0.09(F13) abs. of e^-; 0.075(H38) spect. conv.
	Hg	198		10.1(N30)				
	Hg	199		17.0(N30)				
	Hg	199*, 201*, 204*	*D*		I.T., e^-, γ(F13)	43 min.(H10, M15)		~ 0.53(F13) abs. of e^-

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
80	Hg	200	..	23.3(N30)				
	Hg	201	...	13.2(N30)				
	Hg	202	...	29.6(N30)				
	Hg	203, 205	*C*	.... .	β^-, γ(F13)	51.5 days(F13)	0.46(F13) abs. A1	0.30(F13) abs. Pb
	Hg	204	...	6.7(N30)				
	Hg	205	*A*	..	β^-	5.5 min.(K29, M32)	1.62(K29) abs. A1	
81	Tl		*D*	. ..	*K*(?), e^-, γ(K29)	10.5 hr.(K29)	. . . . .	1.0(K29) abs. Pb
	Tl		*D*	.	*K*(?), e^-(K29)	44 hr.(K29)		
	Tl	200	*F*	...	... .	4 min.(K3)		
	Tl	200	*F*	... ..	.	3.8 hr.(K3)		
	Tl	202	*B*	.	*K*(?), γ, e^-(K29, M32)	11.8 days(F14); 13 days(M32)	....	0.40(M32)
	Tl	203	...	29.1(N36)				
	Tl	204	*B*		β^-	4.23 min.(F17)	1.6(F17) abs.; 1.77(K29) abs. A1	No γ(F17)
	Tl	205	...	70.9(N36)				
	Tl	206	*B*		β^-	3.5 yr.(F14)	0.87(F14) cl. ch.	No γ(F14)
	AcC″	207	*A*		β^-, γ(C60)	4.76 min.(C60, S70)	1.47(S71) abs. A1	
	ThC″	208	*A*		β^-, γ(C60)	3.1 min.(C60)	1.82(S72) abs. paper	2.62(R40)
	RaC″	210	*A*		β^-	1.32 min.(C60)	1.80(L71) cl. ch.	
82	Pb	203	*B*		β^+	10.25 min.(K29)	1.66(K29) abs. A1	
	Pb	203	*B*		I.T (?) or *K*(?), e^-, γ(F14, K29, L33, M32)	52 hr.(F17, F14)	. .....	~0.45(F17, F14, K29) abs. of e^-, (F14, M32, L33) abs. Pb, (L33) spect., (M32) spect. conv., 0.27(L33, M32) spect. conv., abs. Pb

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
82	Pb	204	...	1.5(N38)				
	Pb	204*, 205	C	...	I.T.(?), γ, e^-(F14, M32)	68 min.(M32); 65 min.(F14)	...	1.1(F14) abs. of e^-, abs. Pb; 0.90(M32)
	Pb	206	...	23.6(N38)				
	Pb	207	...	22.6(N38)				
	Pb	208	...	52.3(N38)				
	Pb	209	A	...	β^-	3.0 hr.(T5)	0.70(K29, F14) abs.; 0.750(M32)	
	RaD	210	A	...	β^-, γ(R40)	22 yr.(C60)	0.0255(L72) spect.	0.047(R40)
	AcB	211	A	...	β^-, γ(S71)	36.1 min.(S70)	0.5, 1.40(S71) abs. Al	0.8(S71) abs.
	ThB	212	A		β^-, γ(R40)	10.6 hr.(C60)	0.36(S72) spect.	
	RaB	214	A		β^-, γ(R40)	26.8 min.(C60)	0.65(S72) spect.	
	Pb*		D	...	I.T., e^-	1.6 min.(W27)	...	~0.3(W27) abs. of e^-
83	Bi	207	A	...	K(?), e^-, γ(L33)	6.4 days(K29)	...	0.74(K29) abs. of e^-; 0.93(F14) abs. of e^-; 1.1(F14) abs. Pb
	Bi	209		100(N36)				
	RaE	210	A	.	β^-	5.0 days(C60)	1.17(F30, N40, L76) spect.	
	AcC	211	A	.	α(99.68%)(C60), γ(R40); β^-(0.32%)(C60), γ(C60)	2.16 min.(C60)	6.619(α)(H81) spect.	
	ThC	212	A	.	α(33.7%)(K50), γ(R40); β^-(66.3%)(K50), γ(C60)	60.5 min.(C60)	6.054(α)(B70, H81) spect.; 2.20(β^-)(S72) spect.	
	RaC	214	A	...	α(0.04%)(C60); β^-(99.96%)(C60), γ(R40)	19.7 min.(C60)	5.502(α)(L73) spect.; 3.15(β^-)(S72) abs. Al, spect.	1.8(R40)

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
84	Po	210	*A*	....	α, γ(R40)	140 days(C60)	5.298(H81) spect.	
	AcC′	211	*A*	.....	α	5×10^{-3} sec.(C60)	7.434(L73) spect.	
	ThC′	212	*A*	....	α	3×10^{-7} sec.(D50)	8.776(B70, H81) spect.	
	RaC′	214	*A*	....	α	1.5×10^{-4} sec. (D50, R41, W50)	7.680(B70, H81) spect.	
	AcA	215	*A*	....	α	1.83×10^{-3} sec. (W50)	7.365(L73) spect.	
	ThA	216	*A*	....	α($\sim$ 100%); β^-(0.014%) (K33)	1.58×10^{-1} sec. (W50)	6.774(α)(B70, H81) spect.	
	RaA	218	*A*	.	α(99.96%); β^-(0.04%)(K51)	3.05 min.(C60)	5.998(α)(B70, H81) spect.	
85	85	211	*A*	.....	α(60%)(C46); *K*(40%)(C46)	7.5 hr.(C46, C23)	5.94(α)(C46) abs.	
	85	216	*F*	....	α(K33)	Short (< 54 sec.) (K33)	7.64(K33) ion. ch.	
	85	218	*F*	......	α(K51)	Several sec. (?)(K51)	6.63(K51) ion. ch.	
86	An	219	*A*	...	α	3.92 sec.(C60)	6.824(H81, L73) spect.	
	Tn	220	*A*	..	α	54.5 sec.(C60)	6.282(B70, H81) spect.	
	Rn	222	*A*	.....	α	3.825 days(C60)	5.486(B70, H81) spect.	
87	87 (AcK)	223	*E*		β^-, γ(P41, P43)	21 min.(P40, P43)	1.20(P42, P41) cl. ch.	> 3(P41) cl. ch. pair
88	AcX	223	*A*		α, γ(R40)	11.2 days(C60)	5.717(L73) spect.	
	ThX	224	*A*	.	α	3.64 days(L71)	5.681(B70) spect.	
	Ra	226	*A*	.	α, γ(C60)	1590 yr.(C60)	4.791(L73) spect.	0.19(R40)
	$MsTh_1$	228	*A*	.....	β^-	6.7 yr.(C60)	0.053(L72) spect., abs. A1	

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
89	Ac	227	A	.... . .	α(1 %)(P40); β^-(99 %)(P40)	13 5 yr.(C60)	5.0(α)(P40) abs air; 0.220(β^-)(H82) spect	No γ(P43)
	$MsTh_2$	228	A	... .	β^-, γ(C60); α(G40)	6 13 hr.(C60)	1.55(β^-)(L6) spect.; 4.5(α)(G40) abs. air	
90	RdAc	227	A	.. ....	α, γ(C60)	18.9 days(C60)	6.049(L73) spect	
	RdTh	228	A	..	α, γ(C60)	1.90 yr.(C60)	5 418(L73) spect.	
	Io	230	A	.. ....	α, γ(W53)	8 3 × 10^4 yr.(C60)	4.66(G41) abs air; 4 81(W51) calor.	
	UY	231	A	.. ....	β^-	24 6 hr.(C60), 24.0 hr.(G43)	~0 2(E30) abs	
	Th	232	A	100(D45)	α	1.39 × 10^{10} yr.(K50)	4 20(S73) ion ch	
	Th	233	A	. ....	β^-	23 min (G12)		
	UX_1	234	A	. . ....	β^-, γ(M60, F40)	24.5 days(C60), 24.1 days(S70)	0.130, 0.300(M61) cl. ch.; 0.11, 0 20(F40) abs A1; 0.13(S72) abs. A1, spect.	0.092(M60)(1 %)(F40)
91	Pa	231	A	.... .	α, γ(C60)	3.2 × 10^4 yr (G42)	5 049(R42) spect.	
	Pa	233	A	. . .	β^-, γ, e^-(H40)	27.4 days(G12)	0.4(S38) abs. A1; 0.23(H40) spect.	e^- lines at 0.063, 0.077, 0 192, 0.293(H40) spect.
	UZ	234	A	.... . .	β^-, γ(F40)	6.7 hr.(C60)	0.56, 1.55(F40) abs A1	0.70(F40) abs. Pb, W
	UX_2	234	A	..	β^-, γ(M61); I T.(0 15 %) (?)(F40)	1.14 min.(C60)	2.32(S72) abs. A1; 1.52(5 %), 2 32(95 %) (M61) spect.	0.802(5 %)(M61) spect conv.; 0 782, 0.822 (B32) spect conv.
92	U_{II}	234	A	0.066(N39)	α	2 69 × 10^5 yr.(N41)	4 71(R43) cl ch.; 4 78(S75) abs air; 4 76(S77) ion ch.	
	AcU	235	A	0.71(N39)	α	7.07 × 10^8 yr.(N41)	4.52(W52) cl ch.	

TABLE OF ISOTOPES (Continued)

Z	Isotope	A	Class	Percent abundance	Type of radiation	Half-life	Energy of radiation in Mev: Particles	Energy of radiation in Mev: γ-rays
92	U	237	A	....	β^-, γ(M37)	~7 days(M37, N8)	0.26(M37) abs.	
	UI	238	A	99.28(N39)	α	4.51×10^9 yr.(N41)	4.15(R43) cl. ch.; 4.23(S75) abs. air; 4.21(S77) ion. ch.	
	U	239	A	....	β^-	23 min.(I1, S4)		
93	*Np	237	A	....	α	2.25×10^6 yr.(M62)		
	Np	238	A	....	β^-	2.0 days(S78)		
	Np	239	A	....	β^-, γ	2.3 days(M28, M19)	0.47(M28) abs.	0.22, 0.27(H25) spect. conv., spect.
94	†Pu	238	A	....	α	50 yr.(S78)		
	Pu	239	A	....	α	24,000 yr.(C63)		

* Neptunium.
† Plutonium.

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Names and Symbols of Radioactive Elements

For convenience, the names, symbols, atomic numbers and mass numbers of radioactive elements and isotopes are arranged in alphabetical order. See also table of isotopes.

Name	Symbol	Atomic Number	Mass Number	Name	Symbol	Atomic Number	Mass Number
Actinium A	AcA	84	215	Radium D (Radiolead)	RaD	82	210
Actinium B	AcB	82	211	Radium E	RaE	83	210
Actinium C	AcC	83	211	Radon (Radium emanation, Niton)	Rn	86	222
Actinium C′	AcC′	84	211	Thorium A	ThA	84	216
Actinium C″	AcC″	81	207	Thorium B	ThB	82	212
Actinium K	AcK	87	223	Thorium C	ThC	83	212
Actinium U	AcU	92	235	Thorium C′	ThC′	84	212
Actinium X	AcX	88	223	Thorium C″	ThC″	81	208
Actinon (Actinium emanation)	An	86	219	Thorium X	ThX	88	224
Ionium	Io	90	230	Thoron (Thorium emanation)	Tn	86	220
Mesothorium 1	$MsTh_1$	88	228	Uranium I	UI	92	238
Mesothorium 2	$MsTh_2$	89	228	Uranium II (Brevium)	UII	92	234
Radioactinium	RdAc	90	227	Uranium X_1	UX_1	90	234
Radiothorium	RdTh	90	228	Uranium X_2	UX_2	91	234
Radium A	RaA	84	218	Uranium Y	UY	90	231
Radium B	RaB	82	214	Uranium Z	UZ	91	234
Radium C	RaC	83	214				
Radium C′	RaC′	84	214				
Radium C″	RaC″	81	210				

PHYSICAL CONSTANTS OF INORGANIC AND METAL-ORGANIC COMPOUNDS

PHYSICAL CONSTANTS OF INORGANIC AND METAL-ORGANIC COMPOUNDS

The names, formulas and order of entries for the inorganic compounds only have been in charge of

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EXPLANATION OF TABLE

The table presents data for about four thousand compounds. The first section includes inorganic compounds and the metallic salts of organic acids, and the second metal-organic compounds.

It is intended that the substances listed include the more important definite compounds for which data are available. Some are listed because of their theoretical importance, even when no constants can be given.

Nomenclature and Arrangement.—The names used for the compounds conform to the best current usage insofar as this could be ascertained, the Rules for Naming Inorganic Compounds adopted January 28–29, 1938, by the Committee for the Reform of Inorganic Chemical Nomenclature of the International Union for Chemistry being used as a guide to some extent. The compounds are listed under the names of the elements in alphabetical order, except that acids and a few other compounds (e.g. hydrazine, hydroxylamine, and sulfuryl, thionyl and uranyl compounds) have their own headings. Ferrous and ferric compounds are entered under iron, stannous and stannic, under tin, cuprous and cupric, under copper and aurous and auric, under gold. Acid salts (including hydrosulfides) and many basic salts are placed immediately after the normal salts. Names like bicarbonate and bisulfate have not been used for acid salts, but names like antimony oxychloride and uranyl nitrate have been used for some basic salts. Prefixes such as di-, tri-, ortho-, meta-, pyro-, hypo-, and per- are not alphabetized. Iso-, however, and prefixes like chloro- in chloroplatinic acid are alphabetized. For the naming of binary compounds of nonmetallic elements the order of decreasing electropositivity given in the Report of the German Commission for Nomenclature (Meyer, *Helvetica Chimica Acta* 20, 159–75 (1937)) has been followed: Sb, As, B, Si, C, P, Te, Se, S, I, Br, Cl, N, O, F, except in the case of fluorine oxides, nitrogen chlorides, nitrogen iodides, etc. Binary compounds of hydrogen (except ammonia and water) are listed under arsenic hydride (instead of arsine), hydrogen chloride, hydrogen phosphide (instead of phosphine), hydrogen sulfide and like names. Most ammino compounds are grouped under headings like **Cobalt complexes** following the other compounds of the element in question, while complexes that have reasonably well-established names like chloroplatinate, cobaltinitrite, cyanoplatinite and fluoborate are listed under these names just like simpler salts. Double salts (including alums) are entered only once: (1) those with two cations are given with the more electropositive cation first in the order of the electromotive force series: Li, Rb, K, Na, NH_4, Sr, Ba, Ca, Mg, Al, U, Mn, Zn, Cr, Ga, Fe^{++}, Cd, In, Tl, Co, Ni, Sn, Pb, Fe^{+++}, Sb, Bi, As, Cu, Ag, Hg, Pd, Pt, Au (e.g. sodium aluminum sulfate, ammonium magnesium phosphate); (2) those with two anions are given with the anions in alphabetical order (e.g., strontium chloride fluoride). The finding of compounds known also under names about as common as those listed is facilitated by a **Synonym Index,** which precedes the table. Organic names conform to those used in the Table of Physical Constants of Organic Compounds.

Molecular weights have been computed to the nearest hundredth, based on the **International Atomic Weights of 1938.**

The **Crystalline form and color** are stated in easily interpreted abbreviations. Other important characteristics are often added. **Indices of refraction** are given in the same column. For crystals with two or three indices, they are invariably given in the order ω, ϵ or α, β, γ. All indices are for sodium light ($\lambda = .5893\mu$) unless otherwise stated. The temperature is assumed to be normal room temperature unless otherwise indicated by a superior figure following the index. 1.536^{25} (Li) would be interpreted as giving the value for the index of refraction of a substance for the red line of lithium at 25°C.

Specific gravity at 20°C, referred to water at 4°C, is normally given. Other temperatures are indicated by superior and inferior figures. For example: 2.64^{25}_{15} indicates a specific gravity of 2.64 at 25°C, referred to water at 15°C. It should be noted that values of specific gravity referred to water at 4°C are numerically equivalent to density in grams per milliliter. The **density of gases** is given in grams per liter, indicated g/l.

Melting and boiling points are given in °C. The boiling point is stated at normal atmospheric pressure (760 mm of Hg) unless otherwise indicated by a superscript which is to be interpreted as the pressure in mm of Hg under which the compound boils at the temperature given. For example: 250^{732} indicates a boiling point of 250°C under a pressure of 732 mm Hg; $426^{2\ atm.}$ indicates a boiling point of 426°C under a pressure of 2 atmospheres. Decomposition on heating is indicated by the abbreviation d. in melting or boiling point column. If decomposition occurs without change of state, the form d. 120 is used indicating the occurrence of decomposition at 120°C.

EXPLANATION OF TABLE

The form 120 d. would indicate a melting or boiling point of 120°C with decomposition. Loss of water of crystallization or oxygen is indicated by the form $-2H_2O$ or $-O$. The figures $-5H_2O$, 350 indicate the loss of five molecules of water of crystallization at 350°C.

Solubilities are stated for normal room temperatures, 20°C, unless otherwise indicated by a superior figure. 6.8^{25} indicates a solubility of 6.8 grams of substance in 100 ml of the solvent at 25°C. The term insoluble (i.) must be usually understood to mean that a negligible quantity of the compound dissolves. A large proportion of salts commonly regarded as insoluble really dissolve to a very slight extent. The form s.d. indicates solubility with more or less decomposition. The abbreviation d. alone in the solubility column indicates that decomposition is the primary action occurring. Solubility in acids and alkalies is usually understood to be accompanied by decomposition.

ABBREVIATIONS

a	acid
abs	absolute
ac. a	acetic acid
acet	acetone
act	active
al	alcohol
alk	alkali
amm	ammonium
amor	amorphous
anh	anhydrous
appr	approximately
aq	aqua, water
aq. reg	aqua regia
asym	asymmetrical
atm	atmospheres
bipyr	bipyramidal
bl	blue
blk	black
boil	boiling
br., brn	brown
brnsh	brownish
bz	benzene
c	cold
calc	calculated
carb	carbon
caust	caustic
chl	chloroform
choc	chocolate
cit. a	citric acid
col	colorless
coll	colloidal
com'l	commercial
comp	compounds
compl	completely
conc	concentrated
const	constant
cont	contains
corros	corrosion
cr	crystalline
cub	cubic
d, dec	decomposes
deliq	deliquescent
deriv	derivative
dibas	dibasic
di-H	dihydrogen
dil	dilute
dimorph	dimorphous
disg	disagreeable
dk	dark
doubt	doubtful
duct	ductile
effl	efflorescent
em	emerald
eth	ether
ev	evolves
evln	evolution
ex	excess
exist	existence
exp	explodes
extr	extreme(ly)
f., fr	from
feath	feathery
fl	flakes
floc	floculent
fluo, fluores.	fluorescent
form	formic
fum	fuming
fus	fused
fxd	fixed
gel., gelat	gelatinous
gl	glass
glac	glacial
glit	glittering
glob	globular
glyc	glycerin
gran	granular
greas	greasy
grn	green
h	hot
hex	hexagonal
ht	heat
hyd	hydrolyzed
hydx	hydroxides
hyg.	hygroscopic
i	insoluble
ign	ignites
ind	indigo
indef	indefinite
infl., inflam.	inflammable
infus	infusible
irid	iridescent
leaf.	leaflets
lem	lemon
lgr	ligroin
lng	long
lq., liq	liquid
lt	light
lum	luminous
lust	lustrous
me., meth	methyl
met	metal or metallic
micr	microscopic
min	mineral
misc	miscible
mixt	mixture
mod	modifications
monbas	monobasic
mon-H	monohydrogen
monocl	monoclinic
near	nearly
need	needles
nit	nitrate
oct	octahedral
odorl	odorless
offen	offensive
olv	olive
opt	optical or optically
or	orange
ord	ordinary
org	organic
oxal	oxalate or oxalic
pa	pale
pet	petroleum
pl	plates
pois	poisonous
polymorph	polymorphous
powd	powder
ppt	precipitate
pr	prisms
press	pressure
prob.	probably
prop	properties
purp	purple
pyr	pyridine
quad	quadrilateral
quest	questioned
rect	rectangular
redsh	reddish
reg	regular
rhbdr	rhombohedral
rhomb	rhombic, orthorhombic
s	soluble
satd	saturated
sld.	solid
sensit	sensitive
sc	scales
sec	secondary
silv	silver
sl	slightly
sly	slowly
sm	small
sod	sodium
soln	solution
solv	solvents
spont	spontaneous
st	steel
stab	stable
subl	sublimes
suffoc	suffocating
sulfd	sulfides
sulf	sulfur
sym	symmetrical
tabl	tablets
tart. a	tartaric acid
tetr	tetragonal
tetrah	tetrahedral
tol	toluene
trac	trace, traces
trans	transparent
translu	translucent
tri., trig	trigonal
tribas	tribasic
tricl	triclinic
trim	trimetric
tr. pt	transition point
turp	turpentine
unpleas	unpleasant
unst	unstable
v	very
vac	vacuum
var	various
viol	violent, violence
visc	viscous
vitr	vitreous
vlt	violet
volt., volat	volatizes
wh	white
wh. lt	white light
yel	yellow
yelsh	yellowish
∞	soluble in all proportions
>	above
<	below

SYNONYM INDEX

Compound sought	Listed	Compound sought	Listed
Acanthite	Silver sulfide	Avogadrite	Potassium fluoborate
"Ajinomoto"	Sodium *d*-glutamate	Azoimide	Hydrazoic acid
Alabandite	Manganese sulfide (ous)	Azurite	Copper carbonate, basic (ic)
Alamosite	Lead *meta*silicate	Baddeleyite	Zirconium oxide, di-
Albite	Sodium aluminum silicate	Baking soda	Sodium carbonate, acid
Alum, ammonium	Ammonium aluminum sulfate	Barite	Barium sulfate
		Baryta	Barium oxide
Alum, cesium	Cesium aluminum sulfate	Benzylate	Benzyloxide
		Berlin green	Iron ferricyanide (ic)
Alum, ammonium chrome	Ammonium chromium sulfate	Bertrandite	Beryllium *ortho*silicate
Alum, ammonium gallium	Ammonium gallium sulfate	Beryl	Beryllium aluminum silicate
Alum, ammonium vanadium	Ammonium vanadium sulfate	Bieberite	Cobalt sulfate (ous)
		Binoxalate	Oxalate, acid
Alum, iron ammonium	Ammonium iron sulfate	Bischofite	Magnesium chloride
		Bismite	Bismuth oxide, tri-
Alum, iron potassium	Potassium iron sulfate	Bismuthic acid, meta-	Bismuthoxide, penta-
		Bismuthine	Bismuth hydride
Alum, manganese potassium	Potassium manganese sulfate	Bismuthinite	Bismuth sulfide, tri-
		Bismuthyl	Bismuth oxy-
Alum, potassium	Potassium aluminum sulfate	Bisulfate, -ite	Sulfate, -ite, acid
		Bleaching powder	Calcium chloride hypochlorite
Alum, potassium chrome	Potassium chromium sulfate	Bloedite	Sodium magnesium sulfate
Alum, rubidium	Rubidium aluminum sulfate		
		Blue verdigris	Copper acetate, basic
Alum, sodium	Sodium aluminum sulfate	Blue vitriol	Copper sulfate (ic)
		Bobierrite	Magnesium *ortho*-phosphate
Alum, thallium	Aluminum thallium sulfate		
		Boracic acid	Boric acid
Alumina	Aluminum oxide	Borax	Sodium *tetra*borate
Aluminic acid, meta-	Aluminum hydroxide, mono-	Boric anhydride	Boron oxide
		Borobutane	Boron hydride
Alunogenite	Aluminum sulfate	Boroethane	Boron hydride
		Borofluoric acid	Fluoboric acid
Amidophosphoric acid, tri-	Phosphoryl amide	Borofluoride	Fluoborate
Amidosulfonic acid	Sulfamic acid	Bossingaultite	Ammonium magnesium sulfate
Anatase	Titanium oxide, di-		
Anglesite	Lead sulfate	Bromellite	Beryllium oxide
Anhydrite	Calcium sulfate	Bromoazide	Bromine azide
Anhydrite, soluble	Calcium sulfate	Bromyrite	Silver bromide
Anorthite	Calcium aluminosilicate	Brookite	Titanium oxide, di-
		Brucite	Magnesium hydroxide
Aquopentamminecobalt (III) chloride	under Cobalt complexes		
		Bunsenite	Nickel oxide, mono-
Aragonite	Calcium carbonate	Butter of antimony	Antimony chloride, tri-
Arcanite	Potassium sulfate		
Argentite	Silver sulfide	Butylate	Butoxide
Arsenoferrite	Iron arsenide, di-	Calamine	Zinc silicate
Arsenolite	Arsenic oxide, tri-	Calcite	Calcium carbonate
Arsine	Arsenic hydride, tri-	Calomel	Mercury chloride (ous)
Artinite	Magnesium carbonate, basic		
		Carbon oxybromide	Carbonyl bromide
Ascharite	Magnesium *pyro*borate	Carbon oxychloride	Carbonyl chloride
		Carbon oxysulfide	Carbonyl sulfide
Atacamite	Copper oxychloride (ic)		
		Carnallite	Potassium magnesium chloride
Auricyanide	Cyanoaurate		
Auric salts	under Gold	Caro's acid	Sulfuric acid, peroxymono-
Aurocyanide	Cyanoaurite		
Aurous salts	under Gold	Cassel yellow	Lead oxychloride

Compound sought	Listed
Cassiopeum	Lutecium
Cassiterite	Tin oxide (ic)
Celestite	Strontium sulfate
Cerargyrite	Silver chloride
Cerussite	Lead carbonate
Cervantite	Antimony oxide, tetra-
Chalcanthite	Copper sulfate (ic)
Chalcocite	Copper sulfide (ous)
Chamber crystals	Nitrosylsulfuric acid
Chessylite	Copper carbonate, basic (ic)
Chloride of Millon's base	Chloride (ic) aquo-basic ammonobasic
Chlorinated lime	Calcium chloride hypochlorite
cis-Chloroaquotetrammine cobalt (III) chloride	under Cobalt complexes
Chlor(o)azide	Chlorine azide
Chlorocalcite	Potassium calcium chloride
Chloromanganokalite	Potassium manganese chloride (ous)
Chloropentammine chromium (III) chloride	under Chromium complexes
Chloropentamminecobalt (III) chloride	under Cobalt complexes
Chrome red	Lead chromate, basic
Chrome yellow	Lead chromate
Chromic anhydride	Chromium oxide, tri-
Chrysoberyl	Beryllium aluminate
Cinnabar	Mercury sulfide (ic) (α-)
Claudetite	Arsenic oxide, tri-
Clausthalite	Lead selenide
Clinoenstatite	Magnesium silicate
Columbic acid	Columbium oxide, pent-
Columbium hydroxide	Columbium oxide, pent-
Common salt	Sodium chloride
Coquimbite	Iron sulfate (ic)
Corundum	Aluminum oxide
Cotunnite	Lead chloride
Covellite	Copper sulfide (ic)
Cream of tartar, soluble	Potassium borotartrate
Cristobalite	Silicon oxide, di-
Crocoite	Lead chromate
Cryolite	Sodium aluminum fluoride
Cryolithionite	Lithium sodium aluminum fluoride
Cuprammonium	under Copper complexes
Cuprite	Copper oxide (ous)
Decaborane	Boron hydride
Dermatol	Bismuth gallate, basic
Deuterioammonia, tri-	Ammonia-d_3
Diamminecopper (II) acetate	under Copper complexes
Diamminepalladium (II) hydroxide	under Palladium complexes
Diaquotetramminenickel (II) nitrate	under Nickel complexes
Diborane	Boron hydride
Dichlorodiamminepalladium (II) *trans.*	under Palladium complexes
Digermane	Germanium hydride
Dihydropentaborane	Borane hydride
Dihydrotetraborane	Boron hydride
Disilicane	Silicon hydride
Disilicoethane	Silicon hydride
Disiloxane	Silicyl oxide
Domeykite	Copper (tri) arsenide
Dysprosia	Dyprosium oxide
Epsom salt	Magnesium sulfate
Erbia	Erbium oxide
Erythrite	Cobalt *ortho*arsenate (ous)
Erythrosiderite	Potassium iron chloride
Ethylate	Ethoxide
Ethylxanthate	Xanthate
Euclase	Beryllium aluminum silicate
Eunatrol	Sodium oleate
Europia	Europium oxide
Ferric salts	under Iron
Ferrous salts	under Iron
Fischer's salt	Potassium cobaltinitrite
Fluellite	Aluminum fluoride
Fluorite	Calcium fluoride
Gadolinia	Gadolinium oxide
Gahnite	Zinc aluminate
Galena	Lead sulfide
Germane	Germanium hydride, tetra-
Germanium bromoform	Germane, tribromo-
Germanium chloroform	Germane, trichloro-
Gibbsite	Aluminum hydroxide, tri-
Glauber's salt	Sodium sulfate
Glucinum	Beryllium
Goslarite	Zinc sulfate
Greenockite	Cadmium sulfide
Guanajuatite	Bismuth selenide tri-
Guanite	Ammonium magnesium phosphate
Gypsum	Calcium sulfate
Hafnia	Hafnium oxide
Halite	Sodium chloride
Hambergite	Beryllium *ortho*borate, basic
Hauerite	Manganese sulfide (ic)
Hausmannite	Manganese oxide (ous, ic)
Heavy hydrogen	Deuterium
Heavy water	Deuterium oxide
Hematite	Iron oxide (ic)

Compound sought	Listed
Hessite	Silver telluride
Hexamminechromium (III) chloride	under Chromium complexes
Hexamminecobalt (III) chloride	under Cobalt complexes
Hexamminecobalt (III) *per*rhenate	under Cobalt complexes
Hexaantipyrineyttrium *per*chlorate	under Yttrium complexes
Hexaantipyrineyttrium iodide	under Yttrium complexes
Hexaborane	Boron hydride
Hexabromodisilicoethane	Silicon (di-) bromide, hexa-
Hexabromoethane	Carbon bromide, tri-
Hexachlorodisilicoethane	Silicon (di-) chloride hexa-
Hexachloroethane	Carbon chloride, tri-
Hexaiododisilicoethane	Silicon (di-) iodide, hexa-
Hexaureachromium (III) fluosilicate	under Chromium complexes
Hexaureachromium (III) *per*rhenate	under Chromium complexes
Hieratite	Potassium fluosilicate
Hoernesite	Magnesium *ortho*arsenate
Hopeite, α-	Zinc *ortho*phosphate
Hopeite, β-	Zinc *ortho*phosphate
Hyacinth	Zinc *ortho*silicate
Hydriodic acid	Hydrogen iodide
Hydrobromic acid	Hydrogen bromide
Hydrocerussite	Lead carbonate, basic
Hydrochloric acid	Hydrogen chloride
Hydrocyanic acid	Hydrogen cyanide
Hydrocyanite	Copper sulfate (ic)
Hydrofluosilicic acid	Fluosilicic acid
Hydromagnesite	Magnesium carbonate, basic
Hydrosulfite	Hyposulfite
Hydroxyplatinic acid	Platinum oxide, di- (ic)
Hyposulfite	Thiosulfate
Iodide of Millon's base	Iodide (ic) aquobasic ammonobasic
Iodine hydroxide	Iodous acid, hypo-
Iod(o)azide	Iodine azide
Iodyrite	Silver iodide
Jaipurite	Cobalt sulfide, mono-
Kainite	Potassium magnesium chloride sulfate
Kalinite	Potassium aluminum sulfate
Kaluszite	Potassium calcium sulfate
Kieserite	Magnesium sulfate
Köttigite	Zinc *ortho*arsenate
Krausite	Potassium iron sulfate (ic)
Krugite	Potassium calcium magnesium sulfate
Lanarkite	Lead sulfate, basic
Langbeinite	Potassium magnesium sulfate
Lansfordite	Magnesium carbonate
Lanthana	Lanthanum oxide
Laurionite	Lead oxychloride
Laurite	Ruthenium sulfide
Lautarite	Calcium iodate
Lawrencite	Iron chloride (ous)
Lechatelierite	Silicon oxide, di-
Leonite	Potassium magnesium sulfate
Leukonin	Sodium *meta*antimonate
Lime	Calcium oxide
Litharge	Lead oxide, mono-
Luminal	Sodium phenobarbital
Magnesia	Magnesium oxide
Magnesite	Magnesium carbonate
Magnetite	Iron oxide, ferrosoferric
Malachite	Copper carbonate, basic (ic)
Manganite	Manganese hydroxide (ic)
Manganolangbeinite	Potassium manganese sulfate (ic)
Manganosite	Manganese oxide, mon- (uso)
Marcasite	Iron sulfide, di-
Marshite	Copper iodide (ous)
Mascagnite	Ammonium sulfate
Massicot	Lead oxide, mono-
Matlockite	Lead oxychloride
Medinal	Sodium barbital
Melanterite	Iron sulfate (ous)
Mendipite	Lead oxychloride
Mercallite	Potassium sulfate, acid
Mercuric bromide, ammonobasic	under Mercury-nitrogen compounds
Mercuric bromide, diammine	under Mercury-nitrogen compounds
Mercuric chloride, ammonobasic	under Mercury-nitrogen compounds
Mercuric chloride, aquobasic ammonobasic	under Mercury-nitrogen compounds
Mercuric chloride, diammine	under Mercury-nitrogen compounds
Mercuric iodide, ammonobasic	under Mercury-nitrogen compounds
Mercuric iodide, aquobasic ammonobasic	under Mercury-nitrogen compounds
Mercuric iodide, diammine	under Mercury-nitrogen compounds
Metabisulfite	*Pyro*sulfite
Metacinnabarite	Mercury sulfide (ic) (β-)
Metazirconic acid	Zirconyl hydroxide
Methylate	Methoxide

Compound sought	Listed	Compound sought	Listed
Millerite...	Nickel sulfide, mono-	Phosgene..........	Carbonyl chloride
Minium	Lead oxide, red	Phosphine	Hydrogen phosphide
Mirabilite.......	Sodium sulfate	Phosphoric anhydride	Phosphorus oxide pent-
Misenite	Potassium sulfate, acid	Phosphorus sulfobromide or thiobromide, etc	Thiophosphoryl bromide, etc.
Molybdenite.......	Molybdenum sulfide, di-		
Molybdenum blue .	Molybdenum oxide, pent-	Phosphoryl bromide, etc.	Phosphorus oxybromide, etc.
Molybdic anhydride	Molybdenum oxide, tri-	Picromerite.......	Potassium magnesium sulfate
Molybdite........	Molybdenum oxide, tri-	Pinnoite..........	Magnesium *meta*borate
Molysite . . .	Iron chloride (ic)	Platinichloride .	Chloroplatinate
Monazite.......	Cerium *ortho*phosphate	Platinic hydroxide	Platinum oxide, di- (ic)
Monodiaspore ...	Aluminum hydroxide	Platinochloride.....	Chloroplatinite
		Platinocyanide...	Cyanoplatinite
Montanite. ..	Bismuth tellurate	Platinonitrite....	Nitroplatinite
Montroydite	Mercury oxide (ic)	Plattnerite	Lead oxide, di-
Morenosite .	Nickel sulfate	Plumbic	under Lead
Mosaic gold	Tin sulfide (ic)	Plumbous .	under Lead
Mullite	Aluminum silicate	Polydymite.... .	Nickel sulfide (ous, ic)
Nantokite . . .	Copper chloride (ous)		
Nembutal.....	Sodium pentobarbital	Polyhalite	Potassium calcium magnesium sulfate
		Potassamide	Potassium amide
Neodymia	Neodymium oxide	Potassium diboranide	Potassium *di*borane
Nesquehonite . .	Magnesium carbonate	Potassium pentaboranide	Potassium *penta*borane
Neutral verdigris .	Copper acetate (ic)	Praseodymia.. . .	Praseodymium oxide, sequi-
Newberyite .	Magnesium *ortho*phosphate		
		Propylate..	Propoxide
Niccolite	Nickel arsenide	Proustite	Silver thioarsenite
Niobium . ..	Columbium	Prussian blue . . .	Iron ferrocyanide (ic)
Niton .	Radon		
Nitric anhydride. .	Nitrogen oxide, pent-	Prussian green .	Iron ferricyanide (ous, ic)
Nitrobarite	Barium nitrate		
Nitrogen sulfide .	Sulfur nitride	Prussiate of soda, yellow	Sodium ferrocyanide
Nitrosoferricyanide	Nitroprusside		
Nitrous anhydride..	Nitrogen (di-) oxide, tri-	Pseudocotunnite... .	Potassium lead chloride
Nitroxyl . .	Nitryl	Pseudowallastonite.	Calcium *meta*silicate (α)
Octahedrite	Titanium oxide, di-		
Oldhamite.	Calcium sulfide	Pyrargyrite .	Silver thioantimonite
Opal .	Silicon oxide, di-	Pyrite	Iron sulfide (di-)
Orpiment .	Arsenic sulfide, tri-	Pyroborate	*Tetra*borate
Parahopeite	Zinc *ortho*phosphate	Pyrochroite .	Manganese hydroxide (ous)
Paralaurionite . .	Lead oxychloride		
Paramelaconite . .	Copper oxide (ic)	Quartz	Silicon oxide, di-
Paris green .	Copper acetate arsenite (ic)	Racemate	*dl*-Tartrate
		Radium emanation..	Radon
Peligot's salt .. .	Potassium chlorochromate	Raspite	Lead tungstate
		Realgar	Arsenic sulfide, di-
Pentaborane .	Boron hydride	Reddingite	Manganese *ortho*phosphate
Periclase ...	Magnesium oxide		
Permonosulfuric acid.	Sulfuric acid, peroxymono-	Rhodanate, rhodanide	Thiocyanate
		Rhodochrosite .	Manganese carbonate (ous)
Perovskite	Calcium titanate		
Per (di) sulfuric acid .	Sulfuric acid, peroxydi-	Rhodonite ..	Manganese *meta*silicate (ous)
Phenacite.........	Beryllium *ortho*silicate	Rinneite. .	Potassium iron chloride
Phenolate	Phenoxide	Rochelle salt	Potassium sodium tartrate

Compound sought	Listed	Compound sought	Listed
Roesslerite	Magnesium *ortho*arsenate	Tantalic acid, meta-	Tantalum hydroxide
Rutile	Titanium oxide, di-	Tarapacaite	Potassium chromate
Sal ammoniac	Ammonium chloride	Tartar emetic	Potassium antimony tartrate
Saltpeter	Potassium nitrate	Tenorite	Copper oxide (ic)
Samaria	Samarium oxide	Tephroite	Manganese *ortho*silicate (ous)
Scacchite	Manganese chloride, di-	Terbia	Terbium oxide
Scandia	Scandium oxide	Tetrabromoethylene	Carbon bromide, di-
Scheele's green	Copper *ortho*arsenite, acid (?) (ic)	Tetrabromomethane	Carbon bromide, tetra-
Scheelite	Calcium tungstate	Tetrabromosilicane	Silicon bromide, tetra-
Schlippe's salt	Sodium thioantimonate	Tetrachlorodiammineplatinum (IV), *cis*-	under Platinum complexes
Schonite	Potassium magnesium sulfate	Tetrachlorodiammineplatinum (IV), *trans*-	under Platinum complexes
Scorodite	Iron *ortho*arsenate	Tetrachloroethylene	Carbon chloride, di-
Seignette salt	Potassium sodium tartrate	Tetrachloromethane	Carbon chloride, tetra-
Sellaite	Magnesium fluoride	Tetradymite	Bismuth telluride, tri-
Senarmontite	Antimony oxide, tri-	Tetrafluoromethane	Carbon fluoride, tetra-
Siderite	Iron carbonate (ous)	Tetrafluorosilicane	Silicon fluoride, tetra-
Silanes	Silicon hydrides	Tetraiododisilicoethylene	Silicon (di-) iodide, tetra-
Silica	Silicon oxide	Tetraiodomethane	Carbon iodide, tetra-
Silicane	Silicon hydride	Tetraiodosilicane	Silicon iodide, tetra-
Silicobromoform	Silicane, tribromo-	Tetramminecopper (II) sulfate	under Copper complexes
Silicochloroform	Silicane, trichloro-	Tetramminepalladium (II) chloride	under Palladium complexes
Silicofluoride	Fluosilicate	Tetrammine platinum (II) chloride	under Platinum complexes
Silicofluoroform	Silicane, trifluoro-	Tetrammine platinum (II) chloroplatinite	under Platinum complexes
Silicoiodoform	Silicane, triiodo-	Tetramminezinc *per*rhenate	under Zinc complexes
Smithsonite	Zinc carbonate	Tetrapyridinecopper (II) fluosilicate (ic)	under Copper complexes
Sodamide	Sodium amide	Tetrapyridinecopper *per*rhenate	under Copper complexes
Soda niter	Sodium nitrate	Tetrapyridinenickel (II) fluosilicate	under Nickel complexes
Sodium heptoate	Sodium enanthate	Tetrapyridinezinc fluosilicate	under Zinc complexes
Sodium phenolate	Sodium phenoxide	Tetrasilicane	Silicon hydride
Sperrylite	Platinum arsenide	Tetrasilicobutane	Silicon hydride
Sphalerite	Zinc sulfide (β-)	Thenard's blue	Cobalt aluminate
Spherocobaltite	Cobalt carbonate (ous)	Thenardite	Sodium sulfate
Spinel	Magnesium aluminate	Thermonatrite	Sodium carbonate
Stannane	Tin hydride	Thiophosgene	Thiocarbonyl chloride
Stercorite	Sodium ammonium phosphate	Thoria	Thorium oxide, di-
Stibine	Antimony hydride	Thorite	Thorium *ortho*silicate
Stibnite	Antimony sulfide, tri-	Thulia	Thulium oxide
Stolzite	Lead tungstate	Tiemannite	Mercury selenide (ic)
Struvite	Ammonium magnesium phosphate	Triamidophosphoric acid	Phosphoryl amide
Sulfocarbolate	Phenolsulfonate	Tridymite	Silicon oxide, di-
Sulfochloride	Chloride sulfide	Trigermane	Germanium hydride
Sulfocyanate, sulfocyanide	Thiocyanate	Trisilicane	Silicon hydride
Sulfur oxychlorides	Sulfuryl, pyro-, chloride, sulfuryl chloride, thionyl chloride		
Sulfuryl amide	Sulfamide		
Sylvite	Potassium chloride		
Syngenite	Potassium calcium sulfate		
Szmikite	Manganese sulfate (ous)		

Compound sought	Listed	Compound sought	Listed
Trisilicopropane	Silicon hydride	Water glass	Sodium *tetra*silicate
Troilite	Iron sulfide (ous)	White lead	Lead carbonate, basic
Uranium nitrate	Uranyl nitrate		
Uranyl oxide	Uranium oxide, tri-	Willemite	Zinc *ortho*silicate
Valentinite	Antimony oxide, tri-	Witherite	Barium carbonate
Vanadyl bromide, etc.	Vanadium oxybromide, etc.	Wulfenite	Lead molybdate
		Wurzite	Zinc sulfide (α)
Verdigris	Copper acetate	Xanthogenate	Xanthate
Vermilion	Mercury sulfide (ic) (α)	Ytterbia	Ytterbium oxide
		Yttria	Yttrium oxide
Villiaumite	Sodium fluoride	Zaratite	Nickel carbonate, basic
Vitriol blue	Copper sulfate (ic)		
Vivianite	Iron *ortho*phosphate (ous)	Zincite	Zinc oxide
		Zinkosite	Zinc sulfate
Wallastonite	Calcium *meta*silicate (β)	Zircon	Zirconium *ortho*silicate
		Zirconia	Zirconium oxide, di-
Washing soda	Sodium carbonate	Zirconic acid	Zirconium hydroxide

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	**Aluminum**	Al	26.97	cub. silv. wh. duct. met
2	acetate	$Al(C_2H_3O_2)_3$	204 10	known only in soln
3	acetate, basic	$Al(OH)(C_2H_3O_2)\cdot xH_2O$	.....	wh. powd
4	*ortho*arsenate	$AlAsO_4\cdot 8H_2O$	310 01	wh. powd
5	benzoate	$Al(C_7H_5O_2)_3$	390 30	wh. cr. powd
6	benzyloxide	$Al(C_7H_7O)_3$	348.50	..
7	bromate	$Al(BrO_3)_3\cdot 9H_2O$	572 86	wh. cr. hyg
8	bromide	$AlBr_3$	266 72	col. rhomb. deliq. pl
9	"	$AlBr_3\cdot 6H_2O$	374.82	col.-yelsh need., deliq
10	"	$AlBr_3\cdot 15H_2O$	536.96	need., col
11	butoxide	$[Al(C_4H_9O)_3]_4$	985 23	wh. cr
12	carbide	Al_4C_3	143.91	hex., yel-grn
13	chlorate	$Al(ClO_3)_3\cdot 6H_2O$	385 44	rhbdr. col., deliq
14	chloride	$AlCl_3$	133 34	hex., wh.-col., odor HCl, v. deliq
15	"	$AlCl_3\cdot 6H_2O$	241.44	col. rhomb., deliq.; near. odorl. 1 6
16	diethyl malonate deriv	$Al(C_7H_{11}O_4)_3$	504 45	.
17	ethoxide	$[Al(C_2H_5O)_3]_4$	648 61	wh. cr
18	α-ethylacetoacetate deriv	$Al(C_6H_9O_3)_3$	414 37	wh. cr
19	ferrocyanide	$Al_4[Fe(CN)_6]_3\cdot 17H_2O$	1050 00	br. powd
20	fluoride	AlF_3	83 97	col. trans. tricl
21	" (fluellite)	$AlF_3\cdot H_2O$	101 99	rhomb., 1.473, 1.490, 1.511
22	"	$AlF_3\cdot 3\frac{1}{2}H_2O$	147 03	wh. cr. powd
23	fluosilicate	$Al_2(SiF_6)_3$	480 12	wh. powd
24	hydroxide, mono- (diaspore)	$Al_2O_3\cdot H_2O$	59.98 (119 96)	col. rhomb., 1 702, 1 722, 1.750
25	hydroxide, di-	$Al_2O(OH)_4$ (or $Al_2O_3\cdot 2H_2O$)	137.97	amor
26	" tri-(gibbsite)	$Al(OH)_3$ (or $Al_2O_3\cdot 3H_2O$)	77 99 (155 99)	monocl. or amor. gelat. ppt., wh., 1.566, 1.566, 1.587
27	iodide	AlI_3	407 73	wh.-br. pl., cont. free I_2, deliq
28	"	$AlI_3\cdot 6H_2O$	515 83	wh.-yel. cr
29	isopropoxide	$[Al(C_3H_7O)_3]_4$	816 92	wh. cr
30	lactate	$Al(C_3H_5O_3)_3$	294 18	wh.-yelsh. powd
31	nitrate	$Al(NO_3)_3\cdot 9H_2O$	375.14	rhomb. col. deliq
32	nitride	AlN	40 98	rhomb. yel
33	oleate	$Al(C_{18}H_{33}O_2)_3$	871 31	wh powd; exist. doubted except as a basic salt
34	oxalate	$Al_2(C_2O_4)_3\cdot 4H_2O$	390 06	wh. powd
35	oxide	Al_2O_3	101 94	hex. col., 1.765
36	" (corundum)	Al_2O_3	101 94	trig. wh., 1.773
37	palmitate	$Al(C_{16}H_{31}O_2)_3\cdot H_2O$	811 22	gran. yel. mass
38	2,4-pentanedione deriv. (acetylacetonate)	$Al(C_5H_7O_2)_3$	324 29	monocl. pr.
39	1-phenol-4-sulfonate	$Al(C_6H_5O_4S)_3$	546 45	redsh. wh. powd
40	phenoxide	$Al(C_6H_5O)_3$	306 27	grayish wh. cr. mass
41	*ortho*phosphate	$AlPO_4$	121 99	rhomb. pl., 1.546, 1.556, 1.578
42	propoxide	$[Al(C_3H_7O)_3]_4$	816.92	wh. cr

INORGANIC COMPOUNDS
of Organic Acids

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc
1	2.702	659 7	1800	i.	i.	s. alk., HCl, H_2SO_4; i. HNO_3, ac. a.
2	. . .	d.	.	s.	d.	......
3	. . .	d.	.	i.	s.	s. a.; i. NH_4 salts
4	3.011	$-H_2O$		i.	i.	sl. s. a.
5			. .	v. sl. s.		. ...
6		59–60	283–4$^{9.5}$			.
7		62.3	d. 100	s.	s.	sl. s. a.
8	3.01^{25}	97.5	263.3^{747}	s. with viol.	d.	s. al., CS_2, acet.
9	2.54	93	d.>100	s.	d.	s. al., amyl. al. sl. s. CS_2
10		−7.5	d. 7	s.	s.	s. al.
11	1.0251$\frac{20}{0}$	101.5–102	284.5^{10}	d.	d.	s. al.
12	2.36	stab. to 1400	d. at high temp.	d. to CH_4	d.	d. dil. a.; i. acet.
13		d.		v.s.	v.s.	s. dil. HCl
14	2.44^{25}; lq. 1.31^{200}	190$^{2.5\ atm.}$	182.7^{752}; subl. 177.8	69.9^{15}; s. with viol.	s.d.	100$^{12.5}$ abs. al., 072^{25} chl.; s. CCl_4, eth.; sl. s. bz.
15	2.398–.440		d.	s.	v.s., ev. HCl	s. eth., 50 abs. al.
16	1.084^{100}	98		i.		s. org. solv.
17	1.142$\frac{20}{0}$	134	205^{11}	d.	s.	v. sl. s. al., eth.
18	1.101^{80}	78–9	190–200^{11}	d.		s. lgr.
19				sl. s.	sl. s.	s. dil. a.
20	3.07	1040		s.	s.	i. a., al., alk., acet.
21	2.17			sl. s.	.	..
22		$-2H_2O$, 100	$-3H_2O$, 250	i.	sl. s.	
23				i.	....	...
24	3.3–3.5	d. 360		0.00001^{20}	....	v. sl. s. a., alk.
25				i.	i.	i. a., alk.
26	2.423	$-2H_2O$, 300		0.00015^{20}	.	s. a., alk.; i. al.
27	3.98^{25}	191	360 (382)	s. d.	s.	s. al., eth., CS_2
28	2.63	185 d.	d.	v. s.	v. s.	s. al., CS_2
29	1.0346$\frac{20}{0}$	118.5	140.5^{3}	d.		s. bz.
30	. .... .			v. s.	.	....
31	. ..	70	d. 150	63.7^{25}	v. s. d.	100 al.; s. alk., acet., HNO_3
32	3.05	2200$^{4\ atm}$	d.>2200	d. ev. NH_3	d.	d. a., al.
33				d.	d.	v. sl. s. bz.; i. al.
34		.	.	i.	i.	s. a.; i. al.
35	3.5–.9	2050	2250	.000098^{29}	i.	v. sl. s. a., alk.
36	4.00	2050	2250	.000098^{29}	i.	v. sl. s. a., alk.
37				i.		s. alk., pet., oil turp
38	1.007^{195}	194	314–50	sl. s.	......	s. al., eth., bz.
39		.	......	s.	. .	s. al., glyc.
40	1.23	265 d.	.	d.	.	s. al., chl., eth.
41	2.566	>1500	..	i.	i.	s. a., alk.; i. al.
42	1.0578$\frac{20}{0}$	106	248^{11}	d.	d.	s. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Aluminum			
1	salicylate	$Al(C_7H_5O_3)_3$	438 30	redsh -wh. powd
2	silicate (mullite)	$3Al_2O_3\ 2SiO_2$	425 94	col. rhomb
3	stearate	$Al(C_{18}H_{35}O_2)_3$	877 36	wh.-yelsh. powd., exist. doubted except as basic salt
4	sulfate	$Al_2(SO_4)_3$	342 12	wh. powd
5	"	$Al_2(SO_4)_3\ 9H_2O$	504 27	monocl wh., 1 459
6	" (alunogenite)	$Al_2(SO_4)_3 \cdot 18H_2O$	666 41	monocl col., 1 474, 1 476, 1.483
7	sulfide	Al_2S_3	150 12	hex. yel., odor H_2S, d. moist air
8	thallium sulfate	$AlTl(SO_4)_2\ 12H_2O$.	639 67	cub. oct. col., 1.4976
9	**Ammonia**	NH_3	17 03	col gas., $1.325^{16.5}$ lq
	Ammonium			
10	acetate	$NH_4C_2H_3O_2$	77 08	wh. cr. hyg
11	aluminum chloride	$NH_4Cl \cdot AlCl_3$	186 84	wh. cr
12	" sulfate	$NH_4Al(SO_4)_2$	237 13	hex. col
13	" "	$NH_4Al(SO_4)_2$ $12H_2O$	453 32	cub. col., 1.459
14	aminosulfamate	$NH_4NH_2SO_3$	114 12	deliq
15	*meta*antimonate	$NH_4SbO_3\ 2H_2O$	223 83	wh. cr
16	antimony fluoride	$2NH_4F\ SbF_3$	252 84	rhomb. col
17	*ortho*arsenate	$(NH_4)_3AsO_4 \cdot 3H_2O$	247 08	rhomb cr
18	*ortho*arsenate, mono-H	$(NH_4)_2HAsO_4$	176 00	monocl. col., odor NH_3
19	*ortho*arsenate, di-H	$NH_4H_2AsO_4$	158 97	tetr. col
20	*meta*arsenite	NH_4AsO_2	124 95	rhomb pr , col
21	azide	NH_4N_3	60 06	col pl
22	benzenesulfonate	$NH_4C_6H_5O_3S$	175 20	rhomb
23	benzoate	$NH_4C_7H_5O_2$	139 15	rhomb. col
24	*per*borate	NH_4BO_3(or NH_4-$BO_3 \cdot \frac{1}{2}H_2O$)	76 86 (85 87)	wh. cr
25	*tetra*borate	$(NH_4)_2B_4O_7\ 4H_2O$.	263 43	
26	*penta*borate (*deca*borate)	$NH_4B_5O_8 \cdot 4H_2O$	271 21	
27	*penta*borate (*deca*borate)	$(NH_4)_2B_{10}O_{16} \cdot$ $5H_2O$	490 36	monocl
28	*tetra*borate, acid	$NH_4HB_4O_7\ 3H_2O$	228 38	col. cr., effl., $-NH_3$
29	bromate ..	NH_4BrO_3	145 96	hex. col
30	bromide	NH_4Br	97 96	cub. col.; sl. hyg.; 1.712^{25}
31	bromoplatinate	$(NH_4)_2PtBr_6$ ..	710 81	cub. red-br
32	bromoselenate	$(NH_4)_2SeBr_6$	594 54	red oct cr
33	bromostannate ..	$(NH_4)_2SnBr_6$	634 28	cub. col
34	calcium arsenate	$NH_4CaAsO_4 \cdot 6H_2O$	305 13	monocl col
35	" phosphate	$NH_4CaPO_4 \cdot 7H_2O$	279 25	monocl col
36	carbamate	$NH_4CO_2NH_2$	78 07	rhomb. col
37	carbamate acid carbonate	$NH_4CO_2NH_2 \cdot$ NH_4HCO_3	157 13	wh. cr
38	carbonate	$(NH_4)_2CO_3 \cdot H_2O$	114 11	cub. col
39	carbonate, acid (bicarbonate)	NH_4HCO_3	79 06	rhomb. or monocl. col., 1 423, 1 536, 1.555
40	carbonate, sesqui-	$(NH_4)_4H_2(CO_3)_3 \cdot$ H_2O	272 22	rhomb pr
41	cerium nitrate (ous)	$2NH_4NO_3$ $Ce(NO_3)_3 \cdot 4H_2O$	558 32	monocl
42	" " (ic) .	$2NH_4NO_3 \cdot$ $Ce(NO_3)_4$	548 26	monocl. yel.-red

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1				i.		s. dil. alk.; i. al.
2	3.15	d. 1810		v. sl. s.		
3				i.		s. oil. turp., pet., alk.; sl. s. al.
4	2.71	d. 770		31.3^{0}	98.1^{100}	s. dil. a.; sl. s. al.
5	1.705^{20}_{0}	d.		s.	s.	s. a., alk.
6	1.69^{17}	d. 86.5		s.	s.	i. al.
7	2.02^{13}	1100	subl. 1550 (N_2)	d.		s. a.; i. acet.
8	2.32	91		10^{20}	65.19^{60}	
9	$.7710^{0}$ g/l, lq. 0.817^{-79}	−77.7	−33.35	89.9^{0}; 52.0	7.4^{100}	13.2^{20} al.; s. eth., org. solv.
10	1.073	114	d.	148^{4}	d.	s. al.; sl. s. acet.
11		304		s.		
12	2.039			s.		s. glyc.; i. al.
13	1.64	93.5	$-10H_2O$, 120 $-12H_2O$, 200	15^{20}	∞	s. dil. a.; i. al.
14				s.		i. al
15		d.		i.		i. al.
16		subl., d.		108		
17		d-loses NH_3				
18	1.989	d.		s.	d.	
19	2.311^{9}	d., $-NH_3^{300}$		33.74	122.4^{90}	
20				v. s.	d.	sl. s. NH_4OH; i. al., acet.
21	1.346	160	subl. 134, exp.	20.16/100 cc soln.	27.07^{40}/ 100 cc soln.	1.06 al.; s. NH_3; i. eth.
22	1.342	271-5 d.		98	320	19 cold al, i. eth., bz.
23	1.260	198 d.	subl. 160	$19.6^{14.5}$	83.3^{100}	1.63^{25} al.; i. eth.
24		d.		1.55^{17}	d.	
25				7.27^{18}		
26				7.03^{15}		
27				9.6		
28	2.38-.95			s.		
29		exp.		v. s.	v. s.	sl. s. al.
30	2.429	subl. 542	235 vac.	59.8^{0}	145.6^{100}	s. al., acet., eth., NH_3
31	4.265^{24}	d. 145		0.40^{0}; 0.59^{20}	0.36^{100}	
32	3.326			d.	d.	sl. s. eth.
33	3.50	d.		v. s.		
34	1.905^{15}	d. 140		0.02	s.	s. NH_4Cl, i. NH_4OH
35	1.561^{15}	d.		i.	d.	s. a.
36		subl. 60		v. s.	d.	v. s. NH_4OH, sl. s. al.; i. acet.
37		subl.		25^{100}	67^{850}	....
38		d. 58		100^{15}	d.	i al., CS_2, NH_3
39	1.58	107.5, (d. 36-60)	subl.	11.9^{0}	d.	i. al., acet.
40		d.		20^{15}	d.	sl. s. al.
41		74		318^{20}	817.4^{85}	
42				142.6^{25}	$232.^{80}$	sl. s HNO_3; s al

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Ammonium			
1	cerium sulfate (ous)	$(NH_4)_2SO_4 \cdot Ce_2(SO_4)_3 \cdot 8H_2O$	844.71	monocl
2	chlorate	NH_4ClO_3	101.50	monocl. need. col
3	*per*chlorate	NH_4ClO_4	117.50	rhomb. col., 1.482
4	chloride (sal ammoniac)	NH_4Cl	53.50	cub. col. 1.642
5	chloroaurate	NH_4AuCl_4	357.07	rhomb. or monocl. yel
6	"	$(NH_4AuCl_4)_4 \cdot 5H_2O$	1518.35	monocl. yel
7	chlorogallate	NH_4GaCl_4	229.59	wh. cr
8	chloroiridate	$(NH_4)_2IrCl_6$	441.92	cub. red-blk
9	chloroiridite	$(NH_4)_3IrCl_6 \cdot 1\frac{1}{2}H_2O$	486.99	grn.-br
10	chloropalladate	$(NH_4)_2PdCl_6$	355.52	cub. red-br
11	chloropalladite	$(NH_4)_2PdCl_4$	284.61	tetr. olive grn
12	chloroplatinate	$(NH_4)_2PtCl_6$	444.05	cub. yel
13	chloroplatinite	$(NH_4)_2PtCl_4$	373.14	rhomb. red (tetr.)
14	chloroplumbate	$(NH_4)_2PbCl_6$	456.03	cub. yel
15	chlorostannate	$(NH_4)_2SnCl_6$	367.52	cub. wh
16	chromate	$(NH_4)_2CrO_4$	152.09	monocl. yel
17	*di*chromate	$(NH_4)_2Cr_2O_7$	252.10	monocl. or
18	*per*chromate	$(NH_4)_3CrO_8$	234.13	cub. red-br
19	chromium sulfate (ic)	$(NH_4)Cr(SO_4)_2 \cdot 12H_2O$	478.36	cub. grn. or vlt., 1.4842
20	citrate, tri- (tert.)	$(NH_4)_3C_6H_5O_7$	243.22	wh. cr., deliq
21	" , di- (sec.)	$(NH_4)_2HC_6H_5O_7$	226.19	wh. gran. or powd
22	cobalt chloride (ous)	$NH_4Cl \cdot CoCl_2 \cdot 6H_2O$	291.45	red., deliq
23	cobalt *ortho*phosphate (ous)	$NH_4CoPO_4 \cdot H_2O$	190.02	vlt. cr. powd
24	cobalt sulfate (ous)	$(NH_4)_2SO_4 \cdot CoSO_4 \cdot 6H_2O$	395.24	monocl. ruby-red, 1.490, 1.495, 1.503
25	copper chloride (ic)	$2NH_4Cl \cdot CuCl_2 \cdot 2H_2O$	277.51	tetr. blue, 1.744, 1.724
26	" iodide (ous)	$NH_4I \cdot CuI \cdot H_2O$	353.47	rhomb. pl
27	cyanate	NH_4CNO	60.06	wh. cr
28	cyanide	NH_4CN	44.06	cub. col
29	cyanoaurate	$NH_4Au(CN)_4 \cdot H_2O$	337.33	col. pl
30	cyanoaurite	$NH_4Au(CN)_2$	267.28	cub. col
31	cyanoplatinite	$(NH_4)_2Pt(CN)_4 \cdot H_2O$	353.40	yel. cr
32	ethyl sulfate	$NH_4C_2H_5SO_4$	143.16	col. to sl. yelsh. hyg. cr
33	ferricyanide	$(NH_4)_3Fe(CN)_6$	266.07	red. cr
34	ferrocyanide	$(NH_4)_4Fe(CN)_6 \cdot 3H_2O$	338.16	monocl. yel., turns bl. in air
35	fluoborate	NH_4BF_4	104.86	rhomb. pr
36	fluogallate	$(NH_4)_3GaF_6$	237.84	wh. oct. cr
37	fluogermanate	$(NH_4)_2GeF_6$	222.14	col. hex. pr. and bipyr.; 1.428, 1.425
38	fluo*meta*phosphate	NH_4PF_6	163.06	col. pl
39	" , di-	$NH_4PO_2F_2$	119.06	col., rhomb
40	fluoride	NH_4F	37.04	hex. col., deliq., 1.315[25]
41	fluoride, acid	NH_4HF_2	57.05	rhomb. or tetr., deliq
42	fluosilicate (cryptohalite)	$(NH_4)_2SiF_6$	178.14	cub. or hex., col., 1.370
43	fluotitanate	$(NH_4)_2TiF_6$	197.98	hex. pr
44	fluozirconate	$(NH_4)_2ZrF_6$	241.30	rhomb., hex
45	"	$(NH_4)_3ZrF_7$	278.34	col. cub., 1.433
46	formate	NH_4CHO_2	63.06	monocl. wh., deliq

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.523	$-6H_2O$, 100, $-8H_2O$, 150		anh. 5.33^{22}; 3.29^{40}	1.05^{90}	
2		exp. 102		v. s.	v. s.	sl. s. al.
3	1.95	d.	......	10.74^{0}	42.54^{85}	s. acet.; sl. s. al.
4	1.527	subl. 335	......	29.7^{0}	75.8^{100}	0.6^{19} al.; s. NH_3
5				s.		sl. s. al.
6		$-5H_2O$, 100		s.		s. al.
7		275		v. s.	v. s.	s. al.; i. pet. eth.
8	2.856	d.		$.556^{0}$; $.69^{14}$	4.38^{80}	s. HCl; i. al.
9				s.		
10	2.418	d.		sl. s.		
11	2.17	d.		s.		i. al.
12	3.065	d.		$.29^{0}$; 67^{20}	3.37^{100}	.005 al.; i. eth., c. HCl
13	2.936	d.		s.	s.	i. al.
14	2.925	d. 120		sl. s.	d.	s. a.
15	2.4	d.		$33^{14.5}$	v. s.	
16	1.91^{12}	d.		40.5^{30}	d.	sl. s. NH_3, acet.; i. al.
17	2.15^{25}	d.		30.8^{15}	89^{30}	s. al.; i. acet.
18		d. 40	exp. 50	sl. s.	d.	sl. s. NH_3; i. al., eth.
19	1.72	94; $-9H_2O$, 100		21.2^{25}	32.8^{40}; grn. at 70	s. al., dil. a.
20		d.		v. s.	d.	i. al., eth., acet.
21				v. s.		sl. s. al.
22				v. s.	v. s.	
23				i.		s. a.
24	1.902			20.5^{20}	45.4^{80}	i. al.
25	1.993	d. 110		33.8^{0}	99.3^{80}	s. a., al.; sl. s. NH_3
26				d.	d.	s. NH_4I
27		d. 60		v. s.	d.	sl. s. al.; i. eth.
28	1.02^{100} g/l	d. 36	subl. 40	v. s.	d.	v. s. al.
29		d. 200		v. s.		v. s. al.; i. eth.
30		d. 100		v. s.	v. s.	s. al.; i. eth.
31				s.		
32		99		s.		
33		d		v. s.		
34		d.		s.	d.	i. al.
35	1.851^{17}	subl.		25^{16}	95^{100}	s. al.
36			d.>250−GaF_3	sl. s.		
37	$2.564\frac{25}{25}$			s.		i. al., meth. al.
38	2.180^{18}	d.		s.	s.	s. al., acet.
39		213		s.	s.	s. al., acet.
40	1.315	subl.		v. s.	d.	s. al.; i. NH_3
41	liq. $1.21\frac{12}{12}$	subl.		v. s.	v. s.	sl. s. al.
42	2.01	subl.		18.6^{17}	55.5^{100}	sl. s. al.; i. acet.
43		d.		s.	s.	i. al., eth.
44	1.154					
45				sl. s.		
46	1.266	116	d. 180	102^{9}	531^{80}	s. al., NH_3

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Ammonium			
1	gallium sulfate..	$NH_4Ga(SO_4)_2\cdot 12H_2O$	496.07	cub. oct. col., 1.4684
2	hydroxide	NH_4OH	35.05	in soln. only at ord. temp
3	iodate	NH_4IO_3	192.96	rhomb. or monocl
4	*meta*periodate	NH_4IO_4	208.96	tetr. col
5	iodide	NH_4I	144.96	cub. col. hyg., 1.701^{25}
6	iridium sulfate	$NH_4Ir(SO_4)_2\cdot 12H_2O$	619.46	yel. red
7	iron oxalate (ic)	$(NH_4)_3Fe(C_2O_4)_3\cdot xH_2O$		monocl. grn
8	" sulfate (ous)	$(NH_4)_2Fe(SO_4)_2\cdot 6H_2O$	392.14	monocl. grn., 1.487, 1.492, 1.499
9	" " (ic)	$NH_4Fe(SO_4)_2\cdot 12H_2O$	482.19	cub. oct., vlt; effl., 1.4854
10	lactate	$NH_4C_3H_5O_3$	107.11	col.-yelsh. syrupy liq
11	laurate, acid	$NH_4C_{12}H_{23}O_2\cdot C_{12}H_{24}O_2$	417.66	wh. sld
12	magnesium arsenate	$NH_4MgAsO_4\cdot 6H_2O$	289.37	tetr. col., 1.608
13	" carbonate	$(NH_4)_2CO_3\cdot MgCO_3\cdot 4H_2O$	252.49	wh
14	" chloride	$NH_4Cl\cdot MgCl_2\cdot 6H_2O$	256.83	rhomb., doub. pyram. deliq
15	" chromate	$(NH_4)_2CrO_4\cdot MgCrO_4\cdot 6H_2O$	400.52	monocl. yel., 1.636, 1.637, 1.653
16	" phosphate (guanite, struvite)	$NH_4MgPO_4\cdot 6H_2O$	245.48	rhomb. col., 1.495, 1.496, 1.504, NH_3 on exposure
17	magnesium sulfate (boussingaultite)	$(NH_4)_2SO_4\cdot MgSO_4\cdot 6H_2O$	360.62	monocl. col., 1.472, 1.473, 1.479
18	*l*-malate, acid	$NH_4HC_4H_4O_5$	151.12	rhomb. col
19	*per*manganate	NH_4MnO_4	136.97	rhomb
20	manganese phosphate (ic)	$NH_4MnPO_4\cdot H_2O$	186.01	wh. cr
21	" sulfate (ous)	$(NH_4)_2SO_4\cdot MnSO_4\cdot 6H_2O$	391.23	monocl. pa. red, 1.480, 1.484, 1.491
22	molybdate	$(NH_4)_2MoO_4$	196.03	monocl. pr. col
23	molybdate (com'l)	variable		monocl. col.-yelsh
24	molybdenum oxychloride	$(NH_4)_2MoOCl_5$	325.32	rhomb. br.-red
25	molybdotellurate	$3(NH_4)_2O\cdot TeO_3\cdot 6MoO_3\cdot 7H_2O$	1321.67	col. rhomb
26	"	$3(NH_4)_2O\cdot 2TeO_3\cdot 6MoO_3\cdot 10H_2O$	1551.32	col. monocl
27	myristate, acid	$NH_4C_{14}H_{27}O_2\cdot C_{14}H_{28}O_2$	473.77	wh. sld
28	nickel chloride	$NH_4Cl\cdot NiCl_2\cdot 6H_2O$	291.20	monocl. grn., deliq
29	nickel sulfate	$(NH_4)_2SO_4\cdot NiSO_4\cdot 6H_2O$	394.99	monocl. dk. bl.-grn., 1.495, 1.501, 1.508
30	nitrate	NH_4NO_3	80.05	rhomb. col. (monocl. > 32.1°)
31	nitrite	NH_4NO_2	64.05	wh.-yelsh. cr
32	oleate, acid	$NH_4C_{18}H_{33}O_2\cdot C_{18}H_{34}O_2$	581.94	wh. powd
33	oxalate	$(NH_4)_2C_2O_4\cdot H_2O$	142.12	rhomb. col., 1.439, 1.546, 1.594
34	oxalate, acid (binoxalate)	$NH_4HC_2O_4\cdot H_2O$	125.08	rhomb. col
35	palmitate, acid	$NH_4C_{16}H_{31}O_2\cdot C_{16}H_{32}O_2$	529.87	yelsh. soapy mass or yel. powd
36	*hypo*phosphate	$(NH_4)_2H_2P_2O_6$	196.14	
37	*ortho*phosphate, mono-H	$(NH_4)_2HPO_4$	132.11	monocl. col
38	" , di-H	$NH_4H_2PO_4$	115.08	tetr. col., 1.525, 1.479

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	1.777			30.9^{25}		.00864 70% al.
2		−77		s.		
3	3.309^{21}	d. 150		2.6^{15}	14.5^{100}	
4	3.056^{18}	exp.		2.7^{18}		
5	2.514	subl. 551	220 vac.	154.2^{0}	250.3^{100}	v. s. al., acet., NH_3; sl. s. eth.
6		106		s.		
7	1.78	d. 165		42.7^{0}	345^{100}	
8	1.864	d.		26.9^{20}	73.0^{80}	i. al.
9	1.71	230	$-12H_2O$, 230	124^{25}	400^{100}	s. dil. a.; i. al.
10	$1.19\text{-}.21^{15}$			∞		∞ al.
11		75	d.	s.	s.	4.8^{7} al., sl. s. eth., acet.
12	1.932^{15}	d.		0.038^{20}	0.024^{80}	s. a.; i. al.
13				s.	v. s.	s. a.; i. al.
14	1.456	d.		16.7		
15	1.84	d.		v. s.	v. s.	
16	1.711-.715	d.		0.0231^{0}; 0.052^{20}	0.0195^{90}	v. s. dil. a.; s. a.; i. al.
17	1.723	>120		17.68^{0}	130.58^{100}	
18	1.5	161	d	$32.2^{15.7}$		
19	2.208	exp.		7.9^{15}	d.	
20				0.0031	0.05	i. al., NH_4 salts
21	1.83			51.3^{25}	v. s.	
22	2.27	d.		s (d.)	d.	s. a.; i. al., NH_3, SO_2, acet.
23	2.498	d.		40	d.	s. a., alk.
24	2.175^{118}			s. d.		
25	2.78	550 d	d.	s.	s.	
26		550 d.	d	s.	s.	
27		75–90	d	sl. s.	s.	s. al.; i. eth.
28	1.645			v. s.	v. s.	
29	1.923			10.4^{20}	30^{80}	s. $(NH_4)_2SO_4$; i. al.
30	1.725^{25}	169.6	d. 210	118.3^{0}	871^{100}	3.8^{20} al., 17.1^{20} meth. al., s. acet., NH_3
31	1.69	d.		v. s.	d.	s. al.; i. eth.
32		78 d.		s.	s.	31^{0}, 80^{50}, 47^{10} al., 13.3^{15} eth.
33	1.50	d.		2.54^{0}; $4.0^{16.8}$	11.8^{50}, 34.8	i. NH_3
34	1.556	d.		s.		i. eth., bz.
35		$>100^{0}$	d.	sl. s.	s.	5.0^{0}, 8.80^{80} al.; 0.23^{13} eth.
36		170				
37	1.619	d.	d.	42.9^{0}, 57.5^{10}	106.0^{70}	i. al., acet.
38	1.803^{19}			22.7^{0}	173.2^{100}	i. acet.

No.	Name	Formula	Mol. wt	Crystalline form, color and index of refraction
	Ammonium			
1	*hypo*phosphite	$NH_4H_2PO_2$	83 08	rhomb. tabl
2	*ortho*phosphite, di-H	$NH_4H_2PO_3$	99 08	monocl. col. pr.
3	phosphomolybdate (molybdiphosphate)	$(NH_4)_3[P(Mo_3O_{10})_4]$	1876 50	yel. powd
4	phosphotungstate	$(NH_4)_3PW_{12}O_{40}\cdot5H_2O$	3022 26	white
5	picramate	$NH_4C_6H_4N_3O_5$	216 16	redsh -br. cr. powd
6	picrate	$NH_4C_6H_2N_3O_7$	246 14	rhomb. red or yel
7	praseodymium sulfate	$(NH_4)_2SO_4\cdot Pr_2(SO_4)_3\cdot8H_2O$	846 29	cr
8	propionate	$NH_4C_3H_5O_2$	91 11	pr. deliq
9	*d*-saccharate, acid	$NH_4HC_6H_8O_8$	227 17	need or monocl pr
10	salicylate	$NH_4C_7H_5O_3$	155 15	monocl. col
11	selenate	$(NH_4)_2SeO_4$	179 04	monocl. col., 1.561, 1.563, 1.585
12	selenide	$(NH_4)_2Se$	115 04	br
13	stearate, acid	$NH_4C_{18}H_{35}O_2\cdot C_{18}H_{36}O_2$	585 98	wh. cr
14	succinate	$(NH_4)_2C_4H_4O_4$	152 15	col cr
15	sulfate (mascagnite)	$(NH_4)_2SO_4$	132 14	rhomb. col., 1.521, 1.523, 1.533
16	*peroxydi*sulfate	$(NH_4)_2S_2O_8$	228 20	monocl. col., 1.498, 1.502, 1.587
17	sulfate, acid (bisulfate)	NH_4HSO_4	115 11	rhomb
18	sulfide, mono-	$(NH_4)_2S$	68 14	col.-yel. cr., hyg
19	sulfide, hydro-	NH_4HS	51 11	rhomb. wh
20	sulfite	$(NH_4)_2SO_3\cdot H_2O$.	134 16	monocl. col
21	sulfite, acid (bisulfite).	NH_4HSO_3.	99 11	hex. pr
22	*dl*-tartrate	$(NH_4)_2C_4H_4O_6$	184 15	monocl. col.; *d*, α 1.55, β 1.581
23	*dl*-tartrate, acid	$NH_4HC_4H_4O_6$	167 12	monocl. pr. col., 1.519, 1.561, 1.591
24	tellurate	$(NH_4)_2TeO_4$	227 69	wh powd
25	tellurite	$(NH_4)_2TeO_3$	211 69	need. in clusters
26	thallium chloride	$3NH_4Cl\cdot TlCl_3\cdot2H_2O$	507 29	col
27	thioantimonate	$(NH_4)_3SbS_4\cdot4H_2O$	376 19	yel pr
28	thiocarbonate	$(NH_4)_2CS_3$	144 27	yel. cr
29	thiocyanate	NH_4SCN	76 12	monocl col, deliq
30	*di*thionate	$(NH_4)_2S_2O_6\cdot\frac{1}{2}H_2O$	205 21	monocl
31	thiosulfate	$(NH_4)_2S_2O_3$	148 20	monocl col
32	titanium oxalate, basic	$(NH_4)_2TiO(C_2O_4)_2\cdot H_2O$	294 04	wh. cr mass
33	uranyl carbonate	$2(NH_4)_2CO_3\cdot UO_2CO_3\cdot2H_2O$	558 29	monocl yel
34	valerate	$NH_4C_5H_9O_2$	119 16	col or wh cr., disg. odor
35	*meta*vanadate	NH_4VO_3	116 99	col. cr, wh-yelsh
36	vanadium sulfate	$NH_4V(SO_4)_2\cdot12H_2O$	477 30	red to blue
37	zinc sulfate	$(NH_4)_2SO_4\cdot ZnSO_4\cdot6H_2O$	401 68	monocl. wh., 1 489, 1 493, 1 499
38	**Antimonic acid**, ortho-	H_3SbO_4	188 78	wh powd
39	" " , pyro-	$H_4Sb_2O_7$	359 55	powd
40	" " , meta-	$HSbO_3$	170 77	wh. powd
41	**Antimonious acid**, ortho-	H_3SbO_3	172 78	wh amor
42	" " , meta-	$HSbO_2$	154 77	
43	**Antimony**	Sb	121 76	hex silv. wh. met
44	bromide, tri-	$SbBr_3$	361 51	rhomb col
45	chloride, tri- (butter of Sb)	$SbCl_3$	228 13	rhomb col., deliq
46	chloride, penta-	$SbCl_5$	299 05	liq. or monocl. wh., 1.601^{14}
47	fluoride, tri-	SbF_3	178 76	oct
48	" , penta-	SbF_5	216 76	oily, col. liq

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.515	200	d 240	s.	s.	s. al., NH_3; i. acet.
2	...	123	d. 145	171^{0}	v. s.	i. al.
3		d.	.	sl. s.	sl. s.	s. alk.; i. al., HNO_3
4	...	...	...	sl. s.	sl. s.	...
5	.	...	..	s.	...	s. al.
6	1.719	d.	exp. 423	1.1^{20}	s.	sl. s. al.
7	$2.531^{16.5}$	$-8H_2O$, 170		sl. s.		...
8	1.108^{25}	45	..	v. s.		s. al., ac. a.
9		...	.	1.22^{15}	24.35^{100}	i. c. al.; s. h. al.
10		...	subl.	111^{25}	v. s.	28.8^{25} al.
11	2.194	d.	.	117^{7}	197^{100}	i. al., NH_3, acet.
12	.	.	d.	s.	.	..
13	.	110 d.	s.	v. s.		0.3^{25} al., 0.19^{25} eth., 0.08^{25} acet.
14	.	.	..	s.	..	s. al.
15	1.769	d. 100		70.6^{0}; 76	103.8^{100}	i. al., NH_3, acet.
16	1.982	d. 120		58.2^{0}	v. s.	...
17	1.78	146.9	.	100	v. s.	sl. s. al.; i. acet.
18		d.	..	v. s.	d.	v. s. NH_3; s. al.
19		118^{0} d.	subl.	128.1^{0}	d.	s. al.
20	1.41^{25}	d.	subl. 150	32.4^{0}	60.4^{100} d.	sl. s. al.; i. acet.
21	..	d.		267^{0}	620^{60}	...
22	1.601	d.		6.3^{15}	d.	sl. s. al.
23	1.636	d.		1^{20}	s.	s. a., alk.; i. al.
24	3.01^{25}; $3.024^{24.5}$	d.		s.	s.	i. al.; s. dil. a.
25		.	.	i.	i.	s. alk., acids, al.
26	2.39	..		s.	.	...
27		d.		71.2^{0}	d	i. al.
28		subl.		v. s.	d.	sl. s. al., eth.
29	1.305	149.6	d. 170	128^{0}; 165^{19}	v. s.	s. al., NH_3, acet.
30	1.704	d. 130		135^{0}	v. s.	i. al.
31		d. 150		v. s.	.	sl. s. acet.; i. al.
32	. .	.	.	v. s.	...	...
33	2.773	d. 100		5.8^{19}	d.	s. $(NH_4)_2CO_3$, aq. SO_2
34		d.		s.	.	s. al., eth.
35	2.326	d.		0.52^{15}	6.95^{96} d.	i. al., eth., NH_4Cl
36	1.687	49		28.45^{20}		...
37	1.931	d.		anh. 7^{0}	anh. 42^{80}	...
38	6.6	d. 100		sl. s.	sl. s.	s. KOH
39	.	$-H_2O$, 200		sl. s.	sl. s.	s. alk.
40	6.6	d.		sl. s.	sl. s.	s. a., KOH; i. acet.
41		d.	.	i.	i.	i. al.
42	.	d.		i.	i.	i. al.
43	6.684^{25}	630	1380	i.	i.	s. h. conc. H_2SO_4, aq. reg.
44	4.148^{23}	96.6	280	d.	d.	s. HCl, HBr, CS_2, NH_3, al., acet.
45	3.140^{25}	73.4	223	601.6^{0}	∞^{80}	s. al., HCl, tart. a., CS_2
46	liq. 2.336	2.8	140; 92^{30}	d.	d.	s. HCl, tart. a.
47	$4.379^{20.9}$	292	subl.	384.7^{0}	563.6^{30}	i. NH_3
48	liq. 2.99^{23}	7.0	149.5	s.		s. KF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Antimony			
1	hydride (stibine)	SbH_3	124 78	col. gas
2	iodide, tri-	SbI_3	502 52	trig., monocl red, rhomb. yel
3	" , penta-	SbI_5	756 36	br
4	α-mercaptoacetamide (thioglycolamide)	$Sb(C_2H_4NOS)_3$	392 12	wh cr
5	oxide, tri- (senarmontite)	Sb_2O_3	291 52	cub. wh , 2 087
6	" , tri-(valentinite)	Sb_2O_3	291 52	rhomb. col., 2.18, 2.35, 2 35
7	" , tetra- (cervantite)	Sb_2O_4	307 52	wh powd. n_D - 2 00
8	" , penta-	Sb_2O_5	323 52	yel powd
9	oxychloride (ous)	SbOCl	173 22	monocl. wh
10	" (ous)	$Sb_4O_5Cl_2$	637 95	col. mixt. SbOCl & Sb_2O_3
11	" (ic)	$SbOCl_3$	244 13	yel., exist doubtful
12	selenide, tri-	Sb_2Se_3	480 40	gray cr
13	sulfate (ous)	$Sb_2(SO_4)_3$	531 70	wh powd., deliq
14	sulfide, tri (stibnite)	Sb_2S_3	339 70	rhomb blk.-or. red, 3.194, 4 046, 4.303
15	" , penta-	Sb_2S_5	403 82	or.-yel. powd
16	*d*-tartrate	$Sb_2(C_4H_4O_6)_3\ 6H_2O$	795 83	wh. cr. powd
17	telluride, tri-	Sb_2Te_3	626 35	gray
18	**Antimonyl** sulfate	$(SbO)_2SO_4$	371 58	wh
19	" " , basic	$(SbO)_2SO_4\ Sb_2(OH)_4$	683 13	wh
20	**Argon**	A	39 944	col inert gas
21	**Arsenic** (black cryst.)	As_4	299 64	hex. silv. gray-blk. met
22	" (black amor.)	As_4	299 64	amor. blk
23	" (yellow)	As_4	299 64	cub yel
24	**Arsenic acid,** ortho-	$H_3AsO_4\ \frac{1}{2}H_2O$	150 94	wh translu. cr., hyg
25	" " , pyro-	$H_4As_2O_7$	265 85	col cr
26	" " , meta-	$HAsO_3$	123 92	wh. cr
	Arsenic			
27	bromide, tri-	$AsBr_3$	314 66	pr , col.-yelsh.; hyg
28	chloride, tri-	$AsCl_3$	181 28	oily liq or need. n_F = 1.621[14]
29	chloride, penta-	$AsCl_5$	252 20	col. exist quest
30	fluoride, tri-	AsF_3	131 91	oily liq
31	" , penta-	AsF_5	169 91	gas, col
32	hydride (solid)	As_2H_2	151 84	brown powd
33	" , tri- (arsine)	AsH_3	77 93	gas, col
34	iodide, di-	AsI_2	328 75	red pr
35	" , tri-	AsI_3	455 67	hex., red
36	" , penta-	AsI_5	709 51	exist. quest.
37	oxide, tri- (arsenolite)	As_2O_3	197 82	col cub or fibrous, 1 755
38	" , tri- (claudetite)	As_2O_3	197 82	monocl. col., 1.871, 1.92, 2 01
39	" , tri- (amor. or vitreous)	As_2O_3	197 82	amor. or vitreous
40	oxide, penta-	As_2O_5	229 82	amor. wh
41	oxychloride (ous)	AsOCl	126 37	brownish
42	phosphide, mono-	AsP	105 93	br. red powd
43	selenide, tri-	As_2Se_3	386 70	br. cr
44	sulfide, di- (or mono-) (realgar)	As_2S_2 (or AsS)	213 94 (106 97)	monocl. red-br., 2.46, 2.59, 2.61

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1	liq. 2.26^{-25}, 5.30^{0} g/l	−88	−17	20 cm^3	4 cm^3	1500 cm^3 al., 2500 cm^3 CS_2
2	mon. 4.768^{22}	167	401	d	d.	s. HI, HCl, KI, al., acet., CS_2
3	....	. .	79			
4		139		200		sl. s. al.; i. eth.
5	5.2	656	1550, subl.	v. sl. s.	sl. s.	s. HCl, KOH, tart. a., ac. a.
6	5.67	656	1550	v. sl. s.	sl. s.	s. HCl, KOH, tart. a., ac. a.
7	4.07	−O, 930		i.	i.	s. HCl, HI, KOH
8	3.78	−O, 380	−2 O, 930	i.	i.	s. HCl, HI, KOH
9		170 d.		i	d.	s. HCl, acet., CS_2; i. al., NH_3, chl.
10	5.01			v. sl s.		
11		d.		i.	d.	s. al.
12		611		v sl. s		
13	3.625^{4}	d.		i.	d.	s. a.
14	4.64	550		0.000175^{18}	d.	s. alk., NH_4HS, K_2S, HCl; i. ac. a.
15	4.120	d.		i.	i.	s. alk., NH_4HS, HCl; i. al.
16				s.		
17		629				
18	4.89			d	d.	
19				i	d.	5.15^{15} glyc.
20	1.784^{0} g/l; lq. 1.40^{-186}, cr. 1.65^{-233}	−189.2	−185.7	5.6^{0} cm^3	3.01^{50} cm^3	
21	5.727^{14}	$814^{36\ atm}$	subl 615	i	i.	s. HNO_3
22	4.7			i	i.	s. HNO_3, aq. Cl_2, aq. reg., h. alk
23	2.0^{20}			i.		s CS_2
24	2.0–2.5	35.5	$-H_2O$, 160	16.7	50	s. alk., al, glyc.
25		d. 206		Forms orthoarsenic acid		
26		d.		Forms orthoarsenic acid		
27	3.54^{25}	32.8	221	d.	d.	s. HCl, HBr, CS_2
28	liq. 2.163	−18	130.2 (122)	d	d	s. HBr, HCl, PCl_3, al., eth.
29		ca. −40		hydr.		
30	liq. 2.666	−8.5	63^{752}	d.	d.	s. al., eth., bz., NH_4OH
31	7.71 g/l	−80	−53	s.		s. alk., al., eth., bz.
32		d. 200		i.	i.	s. KOH; i. al., eth., CS_2
33	3.484 g/l	−113.5	−55; d. 230	20 cm^3	sl. s.	sl. s. al., alk.
34		d. 136		d.		s. al., eth., chl., CS_2
35	4.39^{13}	146	403	sl. s. d.	30 d.	s. al., eth., chl., bz., CS_2
36	3.93	76				
37	3.865^{25}	subl. 193		1.2^{2}; 2.04^{25}	11.46^{100}	s. al., alk., HCl
38	4.15	315; subl. 193		1.2^{2}; 2.04^{25}	11.46^{100}	s. al., alk., HCl
39	3.738	.		3.7^{20}	10.14^{100}	s. alk., alk. carb., HCl
40	4.086	d. 315		150^{16}	v. s.	s. al., a., alk.
41			d.	d.	d.	
42		subl. d.		d.	d.	s. H_2SO_4, HCl; sl. s. CS_2; i. al., eth., chl.
43	4.75	360		i.	d.	s. alk.
44	α 3.506^{19}; β 3.254^{19}	tr. 267; β 307	565	i.	i.	s. K_2S, $NaHCO_3$

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Arsenic			
1	sulfide, tri- (orpiment)	As_2S_3	246 00	monocl., yel or red $\beta > 2.72$ (Li)
2	" , penta-	As_2S_5	310 12	yellow
3	**Auric or Aurous**	See *Gold*		
4	**Barium**	Ba	137 36	yelsh.-silv met
5	acetate	$Ba(C_2H_3O_2)_2 \cdot H_2O$	273 46	tricl. col., 1.500, 1.517, 1.525
6	arsenate	$Ba_3(AsO_4)_2$	689 90	blk
7	" , acid	$BaHAsO_4 \cdot H_2O$	295 29	rhomb. or monocl. col
8	azide	$Ba(N_3)_2$	221 41	monocl. pr
9	"	$Ba(N_3)_2 \cdot H_2O$	239 42	cr. tricl., av. 1.7
10	benzoate	$Ba(C_7H_5O_2)_2 \cdot 2H_2O$	415 61	col nacreous leaf
11	boride	BaB_6	202 28	cub blk
12	bromate	$Ba(BrO_3)_2 \cdot H_2O$	411 21	monocl. col
13	bromide	$BaBr_2$	297 19	col. cr
14	"	$BaBr_2 \cdot 2H_2O$	333 22	monocl. col., 1.713, 1.727, 1.744
15	" fluoride	$BaBr_2 \cdot BaF_2$	472 55	pl
16	butyrate	$Ba(C_4H_7O_2)_2 \cdot 2H_2O$	347 59	
17	carbide	BaC_2	161 38	tetr. gray
18	carbonate (witherite)	$BaCO_3$	197 37	rhomb. wh., 1.529, 1.676, 1.677
19	" (α)	$BaCO_3$	197 37	hex wh
20	" (β)	$BaCO_3$	197 37	white
21	chlorate	$Ba(ClO_3)_2 \cdot H_2O$	322 29	monocl. col., 1.562, 1.577, 1.635
22	*per*chlorate	$Ba(ClO_4)_2$	336 27	hex. col
23	chloride	$BaCl_2$	208 27	monocl. col
24	"	$BaCl_2$	208 27	cub col
25	"	$BaCl_2 \cdot 2H_2O$	244 31	rhomb. col., 1.635, 1.646, 1 660
26	" fluoride	$BaCl_2 \cdot BaF_2$	383 63	tetr
27	chloroplatinate	$BaPtCl_6 \cdot 6H_2O$	653 43	rhomb. orange-yel
28	chloroplatinite	$BaPtCl_4 \cdot 3H_2O$	528 47	
29	chromate	$BaCrO_4$	253 37	rhomb. yel
30	*di*chromate	$BaCr_2O_7$	353 38	monocl red
31	"	$BaCr_2O_7 \cdot 2H_2O$	389 41	br red-yel. need
32	citrate	$Ba_3(C_6H_5O_7)_2 \cdot 7H_2O$	916 39	wh. powd
33	cyanide	$Ba(CN)_2$	189 40	wh. cr powd
34	cyanoplatinite	$BaPt(CN)_4 \cdot 4H_2O$	508 73	(a) monocl. yel., α 1.6704 (b) rhomb grn
35	ethylsulfate.	$Ba(C_2H_5SO_4)_2 \cdot 2H_2O$	423 63	wh. lust leaf
36	ferrocyanide	$Ba_2Fe(CN)_6 \cdot 6H_2O$	594 77	monocl. yel
37	fluoride	BaF_2	175 36	cub. col
38	" iodide	$BaF_2 \cdot BaI_2$	566 56	pl
39	fluosilicate	$BaSiF_6$	279 42	rhomb. need
40	formate	$Ba(CHO_2)_2$	227 40	rhomb. col., 1.573, 1.597, 1.636
41	*d*-gluconate.	$Ba(C_6H_{11}O_7)_2 \cdot 3H_2O$	581 71	pr. or rhomb. leaf
42	hydride	BaH_2	139 38	gray cr
43	hydroxide	$Ba(OH)_2 \cdot 8H_2O$	315 51	monocl. col., 1.471, 1.502, 1.50
44	iodate	$Ba(IO_3)_2$	487 20	monocl
45	"	$Ba(IO_3)_2 \cdot H_2O$	505 22	monocl. col
46	iodide	$BaI_2 \cdot 2H_2O$	427 23	rhomb. col., deliq
47	laurate	$Ba(C_{12}H_{23}O_2)_2$	535 97	wh. leaf cr
48	malate	$BaC_4H_4O_5$	269 43	
49	malonate.	$BaC_3H_2O_4 \cdot H_2O$	257 42	
50	manganate	$BaMnO_4$	256 29	hex. gray-grn
51	*per*manganate	$Ba(MnO_4)_2$	375 22	br.-vlt. cr
52	methylsulfate.	$Ba(CH_3SO_4)_2 \cdot 2H_2O$	395 58	col effl. cr
53	molybdate	$BaMoO_4$	297 31	wh powd

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc
1	3.43	300	707	0.00005^{18}	sl. s.	s. al., alk., alk. carb.
2	.		subl.	i.	i.	s. alk., HNO_3, alk. sulf
3						
4	3.5^{20}	850	1140	d. ev. H_2	d.	s. al., a.; i. bz.
5	2.19, anh. 2.47	d.		76.4^{26}	74^{70}	sl. s. al.
6	. . .			0.055		s. a., NH_4Cl
7	3.93^{15}	$-H_2O$, 150		sl. s.	d.	
8	2.936					
9		exp.		v. s.	v. s.	sl. s. al.; i. eth.
10		$-2H_2O$, 100		s.		sl. s. al.
11	4.36^{15}			i.	i.	s. HNO_3
12	3.99^{18}	d. 260		0.8	5.67^{100}	i. al., acet.
13	4.781^{24}	847		98^{0}	149^{100}	v. s. meth. al.
14	3.58^{24}	$-H_2O$, 75	$-2H_2O$, 120	151^{20}	204^{100}	v. s. meth. al.; s. al.
15	4.96^{18}			d.	d.	s. conc. HCl, HNO_3, i. al.
16		. .		37.42^{0}	42.12^{80}	
17	3.75	. .		d. to C_2H_2		d. a.
18	4.43	tr. 811 to α	d. 1450	0.0022^{18}	0.0065^{100}	s. a., NH_4Cl; i. al.
19	4.43	tr. 982 to β	d.	0.002^{20}	0.006^{100}	s. a., NH_4Cl; i. al.
20		$1740^{90\ \mathrm{atm.}}$	d.	0.0022^{18}	0.0065^{100}	s. a., NH_4Cl; i. al.
21	3.18	anh. 414	$-H_2O$, 120	27.4^{26}	111.2^{100}	sl. s. al., acet., HCl
22	($3H_2O$) 2.74	505		198.5^{25}	v. s.	v. s. al.
23	3.856^{21}	tr. 925 to cub.	1560	31^{0}	59^{100}	sl. s. HCl, HNO_3; i. al.
24		962	1560			
25	3.097^{24}	$-2H_2O$, 113		35.7^{20}	58.7^{100}	sl. s. HCl, HNO_3; i. al.
26	4.51^{18}			d.	d.	s. conc. HCl, HNO_3; i. al.
27	2.868	$-5H_2O$, 70		s.		d. a.; i. eth., meth. al.
28	2.868			s.		v. s. al.
29	4.498^{15}			$.00034^{16}$	$.00044^{28}$	s. min. a.
30				sl. s.		s. h. conc. H_2SO_4
31				d.		s. conc. soln. CrO_3
32				0.0406^{18}		sl. s. al.
33				80^{14}		18^{14} 70% al.
34	(a) 2.076 (b) 2.085	$-2H_2O$, 100		sl. s.	s.	i. al.
35				s.		sl. s. al.
36				0.17^{15}	0.9^{100}	
37	4.83	1280	2137	0.17^{10}	sl. s.	s. a., NH_4Cl
38	5.21^{18}			d.	d.	s. conc. HCl, HNO_3; i. al.
39	4.29^{21}			0.026^{17}	0.09^{100}	sl. s. a., NH_4Cl; i. al.
40	3.21			27.76^{0}	39.71^{80}	i. al., eth.
41		$-3H_2O$, 100; 120 d.		$3.3^{15.5}$	.	i. al.
42	4.21^{0}	d. 675	1400	d. to Ba(	$OH)_2+H_2$	d. a.
43	2.18^{16}, anh. 4.50	78	$-8H_2O$, 780	5.6^{15}	94.7^{78}	sl. s. al.
44	4.998	d.		0.022	0.197	s. HNO_3, HCl
45	5.23	$-H_2O$, 130		v. sl. s.	sl. s.	s. HCl, HNO_3; i. al., acet., H_2SO_4
46	515; anh. 4.917	740 d.	$-2H_2O$, 539	200^{15}	269^{100}	1.07^{15} al.; s. acet.
47		260		$0.008^{15.3}$	0.011^{50}	0.008^{25} al., 0.006^{25} eth.
48				0.883^{20}	1.044^{80}	
49				0.143^{0}	0.326^{80}	
50	4.85			v. sl. s.	. .	s. a.
51				62.5^{11}	75.4^{25}	
52	.			s.		s. al.
53	.			0.0058^{23}		sl. s. a.

No.	Name	Formula	Mol wt	Crystalline form, color and index of refraction
	Barium			
1	myristate	$Ba(C_{14}H_{27}O_2)_2$	592 08	wh. cr. powd
2	nitrate (nitrobarite)	$Ba(NO_3)_2$	261 38	cub. col., 1.572
3	nitrite	$Ba(NO_2)_2 \cdot H_2O$	247 39	hex. col.-yelsh
4	oxalate	BaC_2O_4	225 38	cr
5	oxide	BaO	153 36	cub. or hex , col ; wh -yelsh. powd
6	" , per-	BaO_2	169 36	wh.-gray powd
7	" , "	$BaO_2\ 8H_2O$	313 49	hex. col
8	palmitate	$Ba(C_{16}H_{31}O_2)_2$	648 18	wh. cr. powd
9	*hypo*phosphate	$BaPO_3$	216 38	need
10	*ortho*phosphate, tri-	$Ba_3(PO_4)_2$	602 12	cub. wh
11	" , di-	$BaHPO_4$	233 39	rhomb. wh
12	" , mono-	$BaH_4(PO_4)_2$	331 43	tricl
13	*pyro*phosphate	$Ba_2P_2O_7$	448 76	rhomb. wh
14	*hypo*phosphite	$Ba(H_2PO_2)_2\ H_2O$.	285 45	monocl. wh
15	propionate	$Ba(C_3H_5O_2)_2\ H_2O$	301 52	rhomb., β1.518
16	salicylate	$Ba(C_7H_5O_3)_2\ H_2O$	429 60	wh need
17	selenate	$BaSeO_4$	280 32	rhomb
18	*meta*silicate	$BaSiO_3$	213 42	rhomb. col., 1.673, 1 674, 1.678
19	"	$BaSiO_3\ 6H_2O$	321 52	rhomb., 1.542, 1 548, 1.548
20	stearate	$Ba(C_{18}H_{35}O_2)_2$	704 29	wh. powd.
21	succinate	$BaC_4H_4O_4$	253 43	
22	sulfate (barite)	$BaSO_4$	233 42	rhomb. wh. (monocl), 1 637, 1 638, 1.649
23	*peroxydi*sulfate	$BaS_2O_8\ 4H_2O$	401 54	monocl. wh
24	sulfide, mono-	BaS	169 42	cub. col
25	" , tri-	BaS_3	233 54	yel -grn
26	" , tetra-	$BaS_4 \cdot 2H_2O$	301 63	rhomb
27	" , hydro-	$Ba(HS)_2 \cdot 4H_2O$	275 56	rhomb yel
28	sulfite	$BaSO_3$	217 42	cub. (hex.) col
29	tartrate	$BaC_4H_4O_6\ H_2O$	303 45	
30	tellurate	$BaTeO_4\ 3H_2O$	383 02	voluminous wh
31	*pyro*tellurate, acid	$Ba(HTe_2O_7)_2 \cdot H_2O$.	891 83	voluminous ppt , yel.-hot, wh.-cold
32	thiocyanate	$Ba(SCN)_2 \cdot 2H_2O$	289 55	need
33	*di*thionate	$BaS_2O_6\ 2H_2O$.	333 51	rhomb., or monocl. col , 1 586, 1 595, 1.607
34	thiosulfate	BaS_2O_3	249 48	rhomb wh
35	"	$BaS_2O_3 \cdot H_2O$	267 50	wh. cr powd
36	thiotellurite	Ba_3TeS_5	699 99	rect. pr. pa. yel
37	tungstate	$BaWO_4$	385 28	tetr col
38	*meta*tungstate	$BaW_4O_{13}\ 9H_2O$	1243 19	rhomb
39	**Beryllium** (glucinum)	Be (Gl)	9 02	hex. gray met
40	acetate	$Be(C_2H_3O_2)_2$	127 11	pl
41	" basic	$BeO \cdot 3Be(C_2H_3O_2)_2$	406 35	oct
42	" propionate, basic	$BeO\ 3Be(C_2H_3O_2)(C_3H_5O_2)$	448 42	
43	aluminate (chrysoberyl)	$Be(AlO_2)_2$	126 96	rhomb., 1 747, 1.748, 1.757
44	aluminum silicate (euclase)	$2BeO\ Al_2O_3\ 2SiO_2 \cdot H_2O$	290 12	monocl., 1.652, 1 655, 1.671
45	" " (beryl)	$3BeO \cdot Al_2O_3\ 6SiO_2$	537 36	hex. col., transp., 1.580, 1.574
46	benzenesulfonate	$Be(C_6H_5O_3S)_2$	323 34	monocl.
47	*ortho*borate, basic (hambergite)	$Be_2(OH)BO_3$	93 87	rhomb., 1.560, 1.591, 1 631
48	bromide	$BeBr_2$	168 85	wh. need , deliq.
49	butyrate, basic	$BeO \cdot 3Be(C_4H_7O_2)_2$	574 66	
50	carbide	Be_2C	30 05	hex yel

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1				0.007^{25}	0.010^{50}	0.009^{25} al.; 0.003^{25} eth.; 0.046^{15} meth. al.
2	3.24^{23}	592	d.	8.7^{20}	34.2^{100}	sl. s. a.; i. al.
3	3.173^{29}	d. 115		63^{20}	109.6^{80}	v. s. HCl; 1.6 al.; i. acet.
4	2.658			0.0093^{18}	0.0228^{100}	s. a., NH_4Cl; i. al.
5	5.72; hex. 5.32	1923	*ca.* 2000	1.5^{0} d.	90.8^{80}	s. dil. a., al.; i. NH_3, acet.
6	4.96	450	−O, 800	v. sl. s.	d.	s. dil. a.; i. acet.
7		$-8H_2O$, 100		0.168	d.	s. dil. a.; i. al., eth., acet
8		d.		0.004^{15}	0.007^{50}	0.001^{25} eth.; $0.008^{16.5}$ al.
9				sl. s.		s. al.; v. sl. s. ac. a.
10	4.1^{16}			i.	i.	s. a.
11	4.165^{15}			0.01-.02		s. a., NH_4Cl
12	2.9^{4}			d.	d.	s. a.
13	3.9^{20}			0.01	sl. s.	s. a., NH_4 salts
14	2.90^{17}	d.		30^{15}	33^{100}	i. al.
15		300 d.		48^{0}	67.9^{80}	.08 al.
16				s.		
17	4.75	d.		0.0118	0.0138^{100}	s. HCl; i. HNO_3
18	4.399	1604		s.	d.	s. HCl
19	2.59					
20				0.004^{15}	0.006^{50}	$0.005^{16.5}$, 0.008^{25} al.; 0.001^{25} eth.
21				0.421^{0}	0.237^{80}	sl. s. al.
22	4.50^{15}	1580	tr. 1149-monocl.	$.00023^{18}$	$.00039^{100}$	.006 3% HCl; sl. s. H_2SO_4
23		d.		52.2^{0}	d.	i. al.
24	4.25^{15}			d.	d.	i. al.
25				s.	s.	
26	2.988	d. 300		41^{15}	v. s.	i. al., CS_2
27		d. 50		s.		i. al.
28			d.	0.02^{20}	0.002^{80}	v. s. HCl
29	$2.980^{20.5}$			0.026^{18}	0.058^{90}	0.032^{18} al.
30	4.2, dried at 200	d.>200		sl. s.	sl. s.	s. HCl, HNO_3
31				s.	s.	acids
32				43^{20}	s.	35^{20} al.
33	$4.536^{13.0}$	d.		24.75^{18}	90.9^{100}	sl. s. al.
34		d.		0.2		
35	3.5			v. sl. s.		
36				sl. s.	sl. s.	
37	5.04			sl. s.	sl. s.	d. a.
38	4.30			d.	v. s.	
39	1.85	1350	1530^{5}	i.	sl. s. d.	s. dil. a., alk.; i. Hg
40		d. 300		i.		i. al., eth., CCl_4
41	1.36^{4}	284	331	sl. d.	d.	s. chl., ac. a ; sl. s. al., eth.
42		127	330			
43	3.76					i. a.
44	3.1					
45	2.66	1410 ± 100				i. a.
46				v. s.	v. s.	v. s. ac. a., al., acet.; i. CS_2, eth., bz., CCl_4
47	2.35					
48	3.465^{25}	490 ± 10 subl.	520	s.	v. s.	s. al., eth.; i. bz.
49			239^{18}			
50	1.90^{15}	>2100 d.		d.	d.	s. a.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Beryllium			
1	carbonate	$BeCO_3 \cdot 4H_2O$	141.09	col
2	chloride	$BeCl_2$	79.93	col. need., deliq
3	"	$BeCl_2 \cdot 4H_2O$	152.00	monocl. wh., deliq
4	fluoride	BeF_2	47.02	amor. col
5	hydroxide	$Be(OH)_2$	43.04	wh. amor. powd. or cr
6	iodide	BeI_2	262.86	col. need
7	nitrate	$Be(NO_3)_2 \cdot 3H_2O$	187.08	wh.-yelsh. cr., deliq
8	nitride	Be_3N_2	55.08	cub., col
9	oxalate	$BeC_2O_4 \cdot 3H_2O$	151.09	rhomb., β 1.487
10	oxide (bromellite)	BeO	25.02	hex. wh. or amor. powd., 1.719, 1.733
11	2,4-pentanedione deriv. (acetylacetonate)	$Be(C_5H_7O_2)_2$	207.23	monocl. wh
12	*ortho*phosphate	$Be_3(PO_4)_2 \cdot 3H_2O$	271.15	
13	propionate, basic	$BeO \cdot 3Be(C_3H_5O_2)_2$	490.50	monocl.
14	selenate	$BeSeO_4 \cdot 4H_2O$	224.04	rhomb., 1.466, 1.501, 1.503
15	*ortho*silicate (phenacite)	Be_2SiO_4	110.10	tricl., 1.654, 1.670
16	" (bertrandite)	$2Be_2SiO_4 \cdot H_2O$	238.22	rhomb., 1.591, 1.605, 1.614
17	sulfate	$BeSO_4$	105.08	
18	"	$BeSO_4 \cdot 4H_2O$	177.14	tetr. col., 1.472, 1.440
19	sulfide	BeS	41.08	
20	**Bismuth**	Bi	209.00	hex. silv. wh. or redsh. met
21	acetate	$Bi(C_2H_3O_2)_3$	386.13	wh. cr
22	*ortho*arsenate	$BiAsO_4$	347.91	monocl., 2.14, 2.15, 2.18
23	benzoate	$Bi(C_7H_5O_2)_3$	572.33	wh. powd
24	bromide, mono-	$BiBr$	288.92	
25	" , tri-	$BiBr_3$	448.75	yel. cr. powd., deliq
26	carbonate, basic (oxycarbonate, subcarbonate)	$Bi_2O \cdot CO_3$	510.01	wh. powd
27	chloride, mono-	$BiCl$	244.46	
28	" , di-	$BiCl_2$	279.91	blk need (exist quest)
29	" , tri-	$BiCl_3$	315.37	wh. cr., deliq
30	" , tetra-	$BiCl_4$	350.83	col. cr
31	*di*chromate, basic	$(BiO)_2Cr_2O_7$	666.02	yel.-or red
32	citrate	$BiC_6H_5O_7$	398.10	wh. cr
33	fluoride, tri-	BiF_3	266.00	cub. gray cr
34	gallate, basic (dermatol)	$Bi(OH)_2C_7H_5O_5$ (approx.)	412.13	yel. cr
35	hydride (bismuthine)	BiH_3	212.02	liq
36	hydroxide	$Bi(OH)_3$	260.02	wh. amor. powd
37	iodate	$Bi(IO_3)_3$	733.76	wh
38	iodide, tri-	BiI_3	589.76	hex. redsh. br.-gray bl
39	*dl*-lactate	$Bi(C_6H_9O_6) \cdot 7H_2O$	512.25	pr. need.
40	nitrate	$Bi(NO_3)_3 \cdot 5H_2O$	485.11	tricl. col., sl. hyg
41	" , basic (oxynitrate, subnitrate)	$BiONO_3 \cdot H_2O$	305.02	hex. pl. or wh. powd
42	oxalate	$Bi_2(C_2O_4)_3$	682.06	
43	oxide, di-	BiO_2	241.00	
44	" "	$BiO_2 \cdot 2H_2O$	277.03	br.-yel

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		$-4H_2O$, 100		0.36^{0}		i. NH_3
2	1.899^{25}	440 ± 10	520	v. s.	v. s. d.	v. s. al., eth., bz., pyr.; sl. s. chl., CS_2; i. acet., NH_3
3				v. s.	v. s.	s. al.
4	1.986^{25}	800		∞	∞	s. al., H_2SO_4
5	1.909 (cr.)	d.		i.	i.	s. a., alk., $(NH_4)_2CO_3$
6	4.325^{25}	510 ± 10	590	d.	d.	s. al., eth., CS_2
7		60	d. 100–200	v. s.	v. s.	v. s. al.
8		2200 ± 100	d. 2240	d.	d.	d. a., conc. alk.; i. al.
9		$-2H_2O$, 100; $-3H_2O$, 220	d. 350	38.22^{25}		
10	3.025	2570	*ca.* 3900	$.00002^{20}$		s. conc. H_2SO_4, fus. KOH; i. dil. a., alk.
11	1.168^{4}	108	270	sl. s.	d.	s. a., al., eth.
12		$-H_2O$, 100		s.	s.	s. ac. a.
13		120				
14	2.03	$-2H_2O$, 100; $-4H_2O$, 300				
15	3.0					
16	2.6					
17	2.443	d. 540		i.	d. to $BeSO_4.4H_2O$	
18	$1.713^{10.5}$	$-2H_2O$, 100	$-4H_2O$, 250	42.5^{25}	100^{100}	sl. s. conc. H_2SO_4
19	2.36			d.	d.	
20	9.80	271	1470 (1420–1560)	i.	i.	s. HNO_3, h. H_2SO_4, aq. reg.; sl. s. h. HCl
21		d.		i.	i.	s. ac. a.
22	7.14					
23				i.		s. a.; i. eth.
24		287				
25	5.7	218	453	d. to BiOBr	d.	s HCl, HBr, eth.; i. al.
26	6.86	d.		i.	i.	s. a.
27		320				
28	4.86	163	d. 300	d.		
29	4.75	230–2	447	d. to BiOCl	d.	s. a., al., eth., acet.
30		225		d.		
31				i.	i.	s. a.; i. alk.
32	3.458	d.		sl. s.	sl. s.	s. NH_4OH; sl. s. al.
33	8.75			i.		s. a., acet.; i. al.
34		d.		i.		i. al., eth.
35			22			
36	4.36	$-H_2O$, 100 d. 415	$-1\frac{1}{2}H_2O$, 400	0.00014	d.	s. a.; i. or sl. s. conc. alk.
37				i.	d	sl. s. HNO_3; s. HI, KI, 3.5 abs. al.
38	5.7	439 (408)	d. 500	i.	d.	s. HCl, HI, KI, 3.5 abs. al.
39				14.4^{25}		
40	2.83	d. 30	$-5H_2O$, 80	d.	d.	v. s. HNO_3; s. a., 42^{19} acet.
41	4.928^{15}	d. 260		i.	i.	s. a.; i. al.
42				i.	i.	s. a.
43	5.6					
44	5.6	$-H_2O$, 110	$-2H_2O$, 180; $-O$, 305	i.		s. a.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Bismuth			
1	oxide, tri-	Bi_2O_3	466 00	rhomb yel
2	" "	Bi_2O_3	466 00	cub. gray-blk
3	" "	Bi_2O_3	466 00	rhomb., 1.91, av., wh lt
4	" " (bismite)	$Bi_2O_3 \cdot 3H_2O$	520 05	rhomb., 2.01, 1 82
5	" pent-	Bi_2O_5	498 00	br. or dk. red
6	" "	$Bi_2O_5 \cdot H_2O$ (or $HBiO_3$)	516 02 (258 01)	red
7	oxybromide	$BiOBr$	304 92	col. cr. or wh. powd
8	oxychloride	$BiOCl$	260 46	cr or wh. powd
9	oxyfluoride	$BiOF$	244 00	wh. cr. or powd
10	oxyiodide	$BiOI$	351 92	rhomb red cr
11	*ortho*phosphate	$BiPO_4$	304 02	monocl. wh
12	propionate, basic	$BiOC_3H_5O_2$	298 07	wh. powd.; faint odor prop acid
13	salicylate	$Bi(C_7H_5O_3)\cdot 2H_2O$	382 14	wh. powd
14	" , basic (oxysalicylate)(subsalicylate)	$Bi(C_7H_5O_3)_3 Bi_2O_3$	1086 33	wh micro. cr
15	selenide, tri- (guanajuatite)	Bi_2Se_3	654 88	rhomb. blk
16	sulfate	$Bi_2(SO_4)_3$	706 18	wh need
17	sulfide, mono-	BiS	241 06	gray (exist. quest)
18	" , tri- (bismuthinite)	Bi_2S_3	514 18	rhomb. br.-blk, 1 315, 1 900, 1 670
19	tartrate	$Bi_2(C_4H_4O_6)_3 \cdot 6H_2O$	970 31	wh. powd
20	tellurate (montanite)	$Bi_2TeO_6 \cdot 2H_2O$	677 64	biaxial, β 2.09
21	telluride, tri- (tetradymite)	Bi_2Te_3	800 83	rhbdr., gray
22	**Boric acid,** ortho- (boracic acid)	H_3BO_3	61 84	tricl col., 1.340, 1 456 1 459
23	" " tetra- (pyro-)	$H_2B_4O_7$	157 30	vitr. or wh. powd
24	**Borinetriamine,** tri-	$B_3N_3H_6$	80 53	col liq
25	**Borinoaminoborine**	B_2H_7N	42 70	col. liq
26	**Boron**	B	10 82	monocl. yel or br amor powd., 2.5 lq (λ579μ)
27	bromide	BBr_3	250 57	col. fum. liq., $1.5531^{6.3}$ (F)
28	" (mono-) hydride, penta-	B_2H_5Br	106 60	col gas
29	" (mono-) iodide, di-	$BBrI_2$	344 58	col liq
30	" (di-) iodide	BBr_2I	297 57	col liq
31	carbide	B_4C	55 29	blk cr
32	chloride	BCl_3	117 19	col fum liq., $1\ 420^{9.7}$ (F)
33	chloride (mono-) hydride, penta-	B_2H_5Cl	62 14	col gas, highly unstable
34	fluoride	BF_3	67 82	col gas
35	hydride (diborane, boroethane)	B_2H_6	27 69	col. gas, sickly sweet odor in low conc.
36	hydride (dihydrotetraborane, borobutane)	B_4H_{10}	53 36	col. pois. gas, disg odor
37	hydride (pentaborane, stable)	B_5H_9	63 17	col liq., pois, bad odor, spont inflam
38	hydride (pentaborane, unstable; dihydropentaborane)	B_5H_{11}	65 19	col. liq., turns yel on standing
39	hydride (hexaborane)	B_6H_{10}	75 00	col liq turns yel on standing
40	" (decaborane)	$B_{10}H_{14}$	122 31	col. need. rhomb
41	iodide	BI_3	391 58	col pl., hyg
42	iodide (mono-) hydride, penta-	B_2H_5I	153 60	col. mobile liq.
43	nitride, mono-	BN	24 83	amor. wh
44	" , di-	BN_2	38 84	
45	oxide (boric anhydride)	B_2O_3	69 64	vitr. col., 1.464
46	phosphide	BP	41 84	maroon powd
47	selenide, tri-	B_2Se_3	258 52	yel. gray powd

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	8.9	820	1890 (?)	i.	i.	s a.
2	8.20	tr. 704		i.	i.	s. a.
3	8.5	860				sl. s. a.
4	4.36	d. 415				
5	5.10	O, 150	−2 O, 357	i.	i.	s. a., KOH
6	5.75	$-H_2O$, 120	−2 O, 300 (357)	i.	i.	s. a., KOH
7	8.08			i.		s a., i. al.
8	7.72	red ht.		i.	i.	s. a.; i. acet., tart. a., NH_3
9	7.5	d.		i.		s. a.
10	7.92	d.		i.		s. a.; i. al., chl., KI
11	6.323^{16}	d.		i.	i.	s. HCl; i. dil. HNO_3, al.
12				i.		v. s. dil. HCl; i. al.
13		135 d.		d.		
14				i.		s. a., alk.; i. al., eth.
15	6.82	710	d.	i.		i. alk.
16	5.08^{15}	d.		d.	d.	s. a.
17	7.7	685		v. sl. s.		
18	7.39	685 d.		0.000018^{18}		s. HNO_3; i. dil. a.
19	2.595^{25}	$-3H_2O$, 105		i.	i.	s. a., alk.; i. al.
20	3.79					
21	7.7	573				
22	1.435^{15}	185 d.	$-1\frac{1}{2}H_2O$, 300	1.95^0 5.15^{21}	39.1^{100}	28^{20} glyc., .0078 eth., 5.56 al.; sl. s. acet.
23				s.	s.	s. al.
24	0.824^0; 0.898^{57}	−58	53	hyd.	hyd.	
25		−66.5	76.2			s. in triborine triamine
26	2.3; 1.73 (am.)	2300	2550	i.	i.	s. HNO_3, H_2SO_4; i. al., eth., alk.
27	2.650^0	−46	90.1^{740}	d.		s. al., CCl_4
28		−104	ca. 10	hyd. to H	BO_2 + HBr + H_2	
29			180	d.	d.	
30			125	d.	d.	
31	2.508 .522	2350	>3500	i.	i.	s. fus. alk.; i. a.
32	1.434^0	−107	12.5	d. to HCl	+ H_3BO_3	d. al.
33			-78^{18}	hyd.		
34	2.99 g/l	−127	−101	106 cm^3	d.	d. al.; s. conc. H_2SO_4
35	lq. 0.447^{-112}; sld. 0.577^{183}	−165.5	−92.5	sl. s. d. to H_3BO	$_3$ + H_2	s. NH_4OH
36	lq. 0.59^{-70}, 0.56^{16}	−120 (−112)	17.6–18.0	sl. s., hyd.		d. al.; s. bz.
37	0.61^0	−46.6	0^{66}	hyd.		
38		−123.4	65	hyd.		
39		−65.1	$0^{7\,2}$	hyd.		
40	0.94; liq. 0.78^{100}	99.7	100^{19}; $156^{102\,4}$; 213 extrap.	sl. s.	d.	v. s. CS_2; s. al., eth., bz.
41	3.35^{50}	43	210	d.	d.	d. al.; v. s. CS_2, CCl_4, bz.
42	liq. 1.8^{-108}; sld. 2.0^{-112}	−110	0^{78}	hyd. to H	BO_2 + HI	+ H_2
43	2.25	ca. 2730	subl.	i.	i.	d. HCl, HF, H_2SO_4
44			$1230^{0.4}$			
45	1.844	ca. 577		d. 1.1^0	15.7^{100}	s. a., al.
46		ign. 200		i.	i.	i all solv.
47				d.	d.	

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Boron			
1	(tri-) silicide	B_3Si	60.52	rhomb. blk
2	(hexa-) silicide	B_6Si	92.98	blk. cr....
3	sulfide, tri-	B_2S_3	117.82	wh. cr. or vitr
4	" , penta-	B_2S_5	181.94	wh. cr. (exist quest.)
5	**Borotungstic acid**	$H_5BW_{12}O_{40}\cdot 30H_2O$	3403.39	tetrag. col
6	**Bromic acid**	$HBrO_3$	128.92	known in soln. only, col. or yelsh
7	**Bromine**	Br_2	159.83	rhomb. or dk. red liq., 1.661
8	azide (bromoazide)	BrN_3	121.94	or. red liq
9	chloride	$BrCl$	115.37	red-yel. liq. or gas
10	fluoride, tri-	BrF_3	136.92	col.-gray yel. liq
11	" , penta-	BrF_5	174.92	col. liq
12	hydrate	$Br_2\cdot 10H_2O$	339.99	oct. red
13	**Bromoauric acid**	$HAuBr_4\cdot 5H_2O$	607.95	red-br. cr
14	**Bromoplatinic acid**	$H_2PtBr_6\cdot 9H_2O$	838.89	monocl. red, deliq
15	**Bromous acid,** hypo-	$HBrO$	96.92	col.-yel
16	**Cadmium**...	Cd	112.41	hex. silv.-wh. malleable met., 1.13
17	acetate	$Cd(C_2H_3O_2)_2\cdot 3H_2O$	284.55	monocl. col., odor ac. a
18	amide	$Cd(NH_2)_2$	144.46	
19	benzoate	$Cd(C_7H_5O_2)_2\cdot 2H_2O$	390.66	
20	borotungstate	$Cd_5(BW_{12}O_{40})_2\cdot xH_2O$		yel. cr. tricl
21	bromate	$Cd(BrO_3)_2\cdot H_2O$	386.26	rhomb. wh
22	bromide	$CdBr_2$	272.24	yel. cr
23	"	$CdBr_2\cdot 4H_2O$	344.31	sm. wh. need. effl
24	carbonate	$CdCO_3$	172.42	trig. wh
25	chlorate	$Cd(ClO_3)_2\cdot 2H_2O$	315.36	col. pr., deliq
26	chloride	$CdCl_2$	183.32	hex. col
27	"	$CdCl_2\cdot 2\frac{1}{2}H_2O$	228.36	monocl. col., 1.6513
28	chloroacetate, tri-	$Cd(C_2Cl_3O_2)_2\cdot 1\frac{1}{2}H_2O$	464.22	rhomb
29	" , di-	$Cd(C_2HCl_2O_2)_2\cdot H_2O$	386.31	need
30	" , mono-	$Cd(C_2H_2ClO_2)_2\cdot 6H_2O$	407.49	
31	cinnamate	$Cd(C_9H_7O_2)_2$	406.70	
32	cobaltinitrite	$Cd_3[Co(NO_2)_6]_2$	1007.21	yellow
33	cyanide	$Cd(CN)_2$	164.45	cr
34	ferrocyanide	$Cd_2Fe(CN)_6\cdot xH_2O$		
35	fluoride	CdF_2	150.41	cub. wh
36	fluosilicate	$CdSiF_6\cdot 6H_2O$	362.57	hex. col
37	formate	$Cd(CHO_2)_2\cdot 2H_2O$	238.48	monocl
38	fumarate	$CdC_4H_2O_4$	226.47	
39	hydroxide	$Cd(OH)_2$	146.43	trig. or amor. wh
40	iodate	$Cd(IO_3)_2$	462.25	wh. cr
41	iodate	$Cd(IO_3)_2\cdot H_2O$	480.27	monocl., small cr
42	iodide (*α*)	CdI_2	366.25	hex. brnsh
43	" (*β*)	CdI_2	366.25	
44	lactate	$Cd(C_3H_5O_3)_2$	290.55	need
45	maleate	$CdC_4H_2O_4\cdot 2H_2O$	262.50	
46	*permanganate*	$Cd(MnO_4)_2\cdot 6H_2O$	458.37	
47	nitrate	$Cd(NO_3)_2\cdot 4H_2O$	308.49	prism. need. wh., hyg

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.52			i.		d. H_2SO_4, KOH; sl. s. HNO_3
2	2.47			i.		d. H_2SO_4; s. HNO_3; i. KOH
3	1.55	310		d.		d. al.; sl. s. PCl_3, SCl_2
4	1.85	390		d.	d.	d. al.
5	3.0	45–51		s.		s. al., eth.
6		d. 100		v. s.	s. d.	
7	2.928^{59} 3.12^{20}	−7.3	58.78	4.17^{0}; 3.58^{20}	3.52^{50}	v. s. al., chl., eth., CS_2
8		*ca.* 45	exp.			s. eth., KI; sl. s. bz., lgr.
9			d. 10	s. d.		s. CS_2, eth.
10	2.49^{135}	(−2) 8.8	135	d. viol to HF, HB	O_2,HOBr, rO_3	d. alk.
11	2.466^{25}	−61.3	40.5	d.	d.	
12		d. 6.8	...	s.		
13		27		v. s.		s. al.
14		<100 d.		v. s.	v. s.	
15		40 (vac.)		s.	s., d.	s. al., eth., chl.
16	8.642	320.9	767 ± 2	i.	i.	s. a., NH_4NO_3, h. H_2SO_4
17	2.01	$-H_2O$, 130		v. s.	v. s.	v. s. al.
18	3.05^{25}	d. 120				
19				3.34^{30}		sl. s. al.
20		75		1250^{19}	v. s.	
21	3.758	d.		125^{17}		i. al.
22	5.192^{25}	567	963	57^{10}	162^{104}	26.6^{15} al.; 0.4^{15} eth.; s HCl
23		tr. 36		121^{10}		25 al.; s. acet.; sl. s. eth.
24	4.258^{4}	d.<500		i.	i.	s. a., KCN, NH_4 salts; i. NH_3
25	2.28^{18}	80		298^{0}	487^{95}	s. a., acet., al.
26	4.047^{25}	568	960	140^{20}	150^{100}	1.52^{15} al.; i. acet., eth.
27	3.327	tr. 34		168^{20}	180^{100}	2.05^{15} meth. al.; sl. s. al.
28	2.093^{25}					
29	2.132^{25}					
30	1.942^{25}					
31				0.7^{26}		
32		d. 175		sl. s.	v. s.	d. a., alk., org. solv.
33		d.>200		1.7^{15}		s. a., KCN, NH_4OH
34				i.	i.	s. HCl
35	6.64	1100	1758	4.35^{20}		s. a., HF; i. al., NH_3
36				s.	s	s. 50 % al.
37	2.44	d.		v. s.		
38				0.9^{30}		
39	4.79^{15}	d. 300		0.00026^{25}		s. a., NH_4 salts; i. alk.
40	6.43	d.		sl. s.	sl. s.	s. HNO_3, NH_4OH
41		$-H_2O$, 160		sl. s.	sl. s.	s. HNO_3, NH_4OH
42	5.670^{30}	388	713	79.8^{0}; 85.2^{18}	127.6^{100}	s. a., eth., al., NH_4OH; sl. s. NH_3, acet.
43	5.305^{30}					
44				10	12.5	i. al.
45				0.66^{30}		
46	2.81	d. 95		v. s.	v. s.	
47	2.455^{17}	100 (60)	132	109.7^{0}; 140.4^{30}	$326^{99.5}$	s. al., NH_3; i. HNO_3

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Cadmium			
1	oxalate	$CdC_2O_4 \cdot 3H_2O$	254 48	wh
2	oxide, sub-	$Cd_2O(?)$	240 82	grn. amor
3	"	CdO	128 41	amor., br
4	"	CdO	128 41	cubic br
5	*ortho*phosphate	$Cd_3(PO_4)_2$	527 27	amor. col
6	salicylate	$Cd(C_7H_5O_3)_2 \cdot H_2O$	404 65	need. wh
7	selenate	$CdSeO_4 \cdot 2H_2O$	291 40	rhomb
8	*meta*silicate	$CdSiO_3$	188 47	col rhomb
9	sulfate	$CdSO_4$	208 47	rhomb. wh
10	"	$CdSO_4 \cdot 4H_2O$	280 53	
11	"	$3CdSO_4 \cdot xH_2O$	769 54	monocl. wh., effl , 1.565
12	sulfide (greenockite)	CdS	144 47	hex. yel.-or., 2.506, 2.529
13	sulfite	$CdSO_3$	192 47	cr
14	tartrate	$CdC_4H_4O_6$	260 48	wh. cr powd
15	telluride	$CdTe$	240 02	blk. cub
16	tungstate	$CdWO_4$	360 33	yel. cr
	Cadmium complexes:			
17	Tetramminecadmium *per*rhenate	$[Cd(NH_3)_4](ReO_4)_2$	681 16	
18	Tetrapyridinecadmium fluosilicate	$[Cd(C_5H_5N)_4]SiF_6$	570 86	tricl. wh
19	**Calcium**	Ca	40 08	cub. silv. wh soft met
20	acetate	$Ca(C_2H_3O_2)_2$	158 17	col., 1.55, 1.56, 1.57
21	"	$Ca(C_2H_3O_2)_2 \cdot H_2O$	176 18	col need
22	aluminate	$CaAl_2O_4$ (or $CaO \cdot Al_2O_3$)	158 02	rhomb or monocl col., 1.643, 1.655, 1.663
23	"	$Ca_3Al_2O_6$ (or $3CaO \cdot Al_2O_3$)	270 18	cub., 1.710
24	aluminosilicate (anorthite)	$CaAl_2Si_2O_8$	278 14	tricl
25	*ortho*arsenate	$Ca_3(AsO_4)_2$	398 06	wh. amor. powd
26	"	$Ca_3(AsO_4)_2 \cdot 3H_2O$	452 11	col or wh. powd
27	arsenide	Ca_3As_2	270 06	red cr
28	azide	$Ca(N_3)_2$	124 13	rhomb. col
29	benzoate	$Ca(C_7H_5O_2)_2 \cdot 3H_2O$	336 35	rhomb col
30	*meta*borate	$Ca(BO_2)_2$	125 72	col long flat pl. rhomb , 1.540, 1 656, 1.682
31	"	$Ca(BO_2)_2 \cdot 2H_2O$	161 75	cub
32	"	$Ca(BO_2)_2 \cdot 6H_2O$	233 82	col hex
33	*tetra*borate	CaB_4O_7	195 36	readily vitrified
34	boride	CaB_6	105 00	cub. blk
35	bromate	$Ca(BrO_3)_2 \cdot H_2O$	313 93	monocl
36	bromide	$CaBr_2$	199 91	need., deliq
37	"	$CaBr_2 \cdot 3H_2O$	253 96	rhomb
38	"	$CaBr_2 \cdot 6H_2O$	308 01	hex col
39	butyrate	$Ca(C_4H_7O_2)_2 \cdot H_2O$	232 29	col
40	cacodylate	$Ca[(CH_3)_2AsO_2]_2$	314 04	wh. gran., almost odorl powd
41	carbide	CaC_2	64 10	rhomb. gray
42	carbonate (aragonite)	$CaCO_3$	100 09	rhomb. col., 1.530, 1.681, 1.685
43	" (calcite)	$CaCO_3$	100 09	hex. col , 1.658, 1.486
44	"	$CaCO_3 \cdot 6H_2O$	208 19	monocl., 1.460, 1.535, 1.545
45	chlorate	$Ca(ClO_3)_2 \cdot 2H_2O$	243 03	monocl. wh.-yelsh., deliq
46	*per*chlorate	$Ca(ClO_4)_2 \cdot 2H_2O$	275 03	

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	anh 3.32^{18}	d.		0.00337^{0}	0.009	s. a., NH_4OH; i. al.
2	8.192^{18}	d.		...	...	d. a., alk.
3	6.95	>1426	d. 900–1000	i.	i.	s. a., NH_4 salts; i. alk.
4	8.15	d. 900	...	i.	i.	s. a., NH_4 salts; i. alk.
5	...	1500		i.		s. a., NH_4 salts
6	...	...		sl. s.	s	s. a., NH_4OH, al., eth., glycerol
7	3.632	−1 H_2O, 100		v. s.		...
8	4.93	1242	...	v. sl. s.	...	...
9	4.691	1000	...	75.5^{0}	60.8^{100}	i. al., acet., NH_3
10	3.05			140^{0}	135.5^{100}	i. al.
11	3.09	tr. 41.5		114.2^{0}	87^{100}	50 al.
12	4.82	$1750^{100\ atm.}$	subl. in N_2 980	0.00013^{18}	colloidal	v. sl. s NH_4OH; s. a
13	...	d.		sl. s.		s. a., NH_4OH; i. al.
14			...	sl. s.		s. a., NH_4OH
15	6.20^{15}	1041	...	i.		d. HNO_3; i. a.
16		...		0.05		s. NH_4OH
17	3.714^{25}_{4}	...				0.037 conc. NH_4OH
18	2.282	...		...		...
19	1.55	810	1240	d. to $Ca(OH)_2$ + H_2		s. a.; sl. s. al.; i. bz., liq. NH_3
20	...	d.	...	37.4^{0}	29.7^{100}	sl. s. al.
21	...	d.	...	43.6^{0}	34.3^{100}	sl. s. al.
22	3.67	1600	...	d.	...	s. HCl; i. HNO_3, H_2SO_4
23	...	1535 d.	...	i.		s. a.; not d. by KOH soln.
24	2.765	1551		...		...
25	...	...	...	0.0048; $.013^{25}$	...	...
26	...	...	...	i.	i.	s. a.
27	3.031^{25}	d.	...	d.	d.	d. a.; s. hot HNO_3
28	...	exp. 144–56	...	...		$.211^{16}$ al.; i. eth.
29	1.436	−3H_2O, 110	...	2.67^{0}	8.3^{80}	...
30		1154	...	sl. s.	...	s. a., NH_4 salts; sl. s. ac. a.
31	...	d.	...	$.310^{30}$	0.40^{90}	s. a., NH_4 salts
32			...	0.25^{30}	...	...
33		986			...	...
34	2.33^{16}, 2.3^{20}	...		i.	i.	s. HNO_3; sl. s. conc. H_2SO_4
35	3.329	−H_2O, 180	...	v. s.	v. s.	...
36	3.353^{25}	765	806–812	125^{0}	312^{105}	s. a., al., acet.; sl. s. NH_3
37		80.5	...	240^{0}	1850^{80}	s. a., al., acet.
38	...	38.2	149–50	594^{0}	1360^{25}	s. a., al, acet.
39	...	...	...	22.0^{0}	17.3^{100}	...
40	...	...	...	v. s.	...	...
41	2.22	2300	...	d. to $Ca(OH)_2$ + C_2H_2		not d. by conc. H_2SO_4
42	2.93	d. 825	...	$.00153^{25}$ ($.146^{0}$)*	$.00190^{75}$ ($.088^{35}$)*	s. a., NH_4Cl
43	2.711^{25} ?	$1339^{1025\ atm.}$	subl. 898.6	$.0014^{25}$ ($.13^{0}$)*	$.0018^{75}$ ($.077^{35}$)*	s. a., NH_4Cl
44	1.771^{0}		...	...	...	...
45	2.711	−H_2O, >100	...	177.7^{8}	v. s.	s. al., acet.
46	...	...	...	188.6^{25}	...	s. al., acet.

* Solubility in water containing CO_2 (?)

No	Name	Formula	Mol wt.	Crystalline form, color and index of refraction
	Calcium			
1	chloride	$CaCl_2$	110 99	cub. col., deliq., 1.52
2	"	$CaCl_2 H_2O$	129 01	col., deliq
3	"	$CaCl_2\cdot 2H_2O$	147 03	col
4	"	$CaCl_2 6H_2O$	219 09	trig. col., deliq., 1.417, 1393
5	" hypochlorite (bleaching powder, chlorinated lime)	$CaCl(OCl)$	126 99	wh. powd.; strong Cl odor, prob. a mixt.
6	chloride fluoride *ortho*-phosphate	$CaClF\ 3Ca_3(PO_4)_2$	1025 38	col , 1 634, 1.631
7	*hypo*chlorite .	$Ca(ClO)_2\cdot 4H_2O$	215 06	col cr., deliq
8	chromate	$CaCrO_4\ 2H_2O$	192 12	monocl. pr., yel
9	cinnamate	$Ca(C_9H_7O_2)_2\ 3H_2O$	388 42	col cr
10	citrate	$Ca_3(C_6H_5O_7)_2\cdot 4H_2O$	570 51	need. wh., 1.515, 1.530, 1.580
11	cyanamide	$CaCN_2$	80 11	hex. rhbdr. col
12	cyanide	$Ca(CN)_2$	92 12	rhbdr
13	cyanoplatinite	$CaPt(CN)_4\ 5H_2O$	429 46	rhomb , yel., grn fluores., 1.6226
14	ethylsulfate	$Ca(C_2H_5SO_4)_2\ 2H_2O$	326 35	wh. cr
15	ferricyanide	$Ca_3[Fe(CN)_6]_2\cdot 12H_2O$	760 33	red, need., deliq
16	ferrocyanide	$Ca_2Fe(CN)_6\cdot 12H_2O$	508 30	tricl. yel , 1 570, 1 582, 1 596
17	fluoride (fluorite)	CaF_2	78 08	cub. col., lum. with heat , 1 434
18	fluosilicate	$CaSiF_6$	182 14	wh. cr. powd. tetr
19	"	$CaSiF_6\ 2H_2O$	218 17	tetr. col
20	formate	$Ca(CHO_2)_2$	130 12	rhomb., col , 1.510, 1.514, 1.578
21	fumarate	$CaC_4H_2O_4\ 3H_2O$	208 18	rhomb. col
22	*d*-gluconate	$Ca(C_6H_{11}O_7)_2\ H_2O$	448 39	cr. powd., need
23	glycerophosphate	$CaC_3H_5(OH)_2PO_4$	210 19	wh. cr. hyg powd
24	hydride	CaH_2	42 10	gray-wh cr. powd
25	hydroxide	$Ca(OH)_2$	74 10	rhomb. trig col
26	iodate (lautarite)	$Ca(IO_3)_2$	389 92	tricl
27	"	$Ca(IO_3)_2\ 6H_2O$	498 02	rhomb., 1.686, 1.644, 1.604
28	iodide	CaI_2	293 92	yelsh.-wh. pl., deliq
29	"	$CaI_2\cdot 6H_2O$	402 02	
30	isobutyrate	$Ca(C_4H_7O_2)_2\ H_2O$	232 29	col
31	lactate	$Ca(C_3H_5O_3)_2\cdot 5H_2O$	308 30	wh powd
32	laurate	$Ca(C_{12}H_{23}O_2)_2\ H_2O$	456 71	wh. need , eff
33	linoleate	$Ca(C_{18}H_{31}O_2)_2$	598 94	wh. amor. powd
34	magnesium *ortho*silicate (merwinite)	$Ca_3Mg(SiO_4)_2$	328 68	monocl col. to pa. grn., 1.708, 1.711, 1.718
35	*dl*-malate	$CaC_4H_4O_5\cdot 3H_2O$	226 20	rhomb. col., 1.545, 1.555, 1.575
36	*l*-malate	$CaC_4H_4O_5\ 2H_2O$	208 18	col
37	malate, acid	$Ca(HC_4H_4O_5)_2\cdot 6H_2O$	414 34	rhomb. or wh. cr. powd., 1.493, 1.507, 1.545
38	maleate	$CaC_4H_2O_4\ H_2O$	172 15	rhomb. col., 1 495, 1 575, 1.640
39	malonate	$CaC_3H_2O_4\cdot 4H_2O$	214 19	
40	*per*manganate	$Ca(MnO_4)_2\cdot 5H_2O$	368 02	purp., pr
41	α-methylbutyrate (ethylmethylacetate)	$Ca(C_5H_9O_2)_2$	242 33	
42	molybdate	$CaMoO_4$	200 03	tetr. col., 1 967, 1.978
43	nitrate	$Ca(NO_3)_2$	164 10	cub. col., hyg
44	"	$Ca(NO_3)_2\ 3H_2O$	218 14	
45	"	$Ca(NO_3)_2\cdot 4H_2O$	236 16	monocl. col , deliq , 1 465, 1.498, 1.504

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.512^{25}	772	>1600	59.5^{0}	159^{100}	s. al., ac. a., acet.
2		260	....	76.8^{0}	249^{100}	s. al.; i. acet.
3				97.7^{0}	326^{60}	s. al.
4	1.68^{17}	29.92	$-4H_2O$, 30; $-6H_2O$, 200	279^{0}	536^{20}	s. al.
5		d.	...	d. evln. Cl		d. a.
6	3.14	1270		v. sl. s.		
7		d.		v. s.	d.	d. a.
8		$-2H_2O$, 200		22.4^{0}; 16.3^{20}	18.2^{45}	s. a., al.
9				0.22^{2}	1.34^{100}	
10		$-2H_2O$, 130	$-4H_2O$, 185	$.25^{30}$	$.210^{95}$	0.0065^{18} al.
11			1190	d. evln. NH_3	d.	
12				s.	d.	
13				s.		
14				s.		s. al.
15				v. s.	v. s	
16	1.68	d.		$86.8^{24.9}$	$115^{64.7}$	
17	3.180	1360		0.0016^{18}	0.0017^{26}	s. soln. NH_4 salts; sl. s. a.; i. acet.
18	$2.662^{17.5}$			sl. s.		s. HF, HCl, al.
19	2.254			sl. s. d.		s. HF, HCl; i. al.
20	2.015	d.		16.2^{0}	18.4^{100}	i. al.
21				2.11^{30}		
22		$-H_2O$, 120		3.3^{15}		v. sl. s. al.
23				2^{25}	less s.	i. al.
24	1.7	814-6		d. to $Ca(OH)_2 + H_2$		d. a., no known solv.
25	2.343	$-H_2O$, 580	d.	0.185^{0}	0.077^{100}	s. NH_4Cl soln., a., i. al.
26	4.519^{15}	d.		0.10^{0}	0.95^{100}	s. HNO_3
27		d.		0.13^{0}, 33^{25}	1.22^{100}	s. HNO_3
28	3.956^{25}	575	718	66^{10}	81^{100}	s. a., al., acet.
29		42	160	757^{0}	1680^{90}	s. a., acet., al.
30				28.8^{0}	37.6^{100}	
31		$-3H_2O$, 100		3.1^{0}	7.9^{30}	sl. s. a., i. al., eth.
32		182-3		0.004^{15}	0.055^{100}	0.059^{15} al., 1.72^{78} al.
33				i.		s. al., eth.
34	3.150					
35				0.321^{0}	$0.451^{37.5}$	i. al.
36				0.812^{0}	$1.224^{37.5}$	i. al.
37				sl. s.		
38				2.89^{25}	3.21^{40}	
39				0.44^{0}	0.72^{100}	
40	2.4	d.		331^{14}	338^{25}	s. NH_4OH
41				24.24^{0}	25.65^{70}	
42	4.35			i.		s. a.; i. al., eth.
43	2.36	561		102.0^{0}; 341^{25}	376^{150}	s. al., acet.
44		51.1				
45	1.82	α42.7; β39.7	d. 132	266^{0}	660^{30}	s. al., acet.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Calcium			
1	nitride	Ca_3N_2	148.26	br. cr
2	nitrite	$Ca(NO_2)_2 \cdot H_2O$	150.11	hex. col.-yelsh., deliq
3	"	$Ca(NO_2)_2 \cdot 4H_2O$	204.16	col
4	oleate	$Ca(C_{18}H_{33}O_2)_2$	602.97	wh. wax-like cr
5	oxalate	CaC_2O_4	128.10	cub. col
6	oxide (lime)	CaO	56.08	cub. col. 1.838
7	" , per-	CaO_2	72.08	wh
8	" "	$CaO_2 \cdot 8H_2O$	216.21	tetr., pearly
9	palmitate	$Ca(C_{16}H_{31}O_2)_2$	550.90	wh. or yelsh.-wh. fatty powd
10	1-phenol-4-sulfonate	$Ca(C_6H_5O_4S)_2 \cdot H_2O$	404.42	wh. to pinkish powd.
11	phenoxide	$Ca(OC_6H_5)_2$	226.28	redsh. powd
12	*hypo*phosphate	$Ca_2P_2O_6 \cdot 2H_2O$	274.23	gel
13	*ortho*phosphate, tri (tert.)	$Ca_3(PO_4)_2$	310.28	amor. wh. powd
14	" , di- (sec., brushite)	$CaHPO_4 \cdot 2H_2O$	172.14	monocl. wh., 1.5576, 1.5457, 1.5392
15	" , mono- (prim.)	$Ca(H_2PO_4)_2 \cdot H_2O$	252.17	tricl. col., deliq., 1.5292, 1.5176, 1.4932
16	*pyro*phosphate	$Ca_2P_2O_7$	254.20	biaxial, col
17	"	$Ca_2P_2O_7 \cdot 5H_2O$	344.28	monocl., 1.539, 1.545, 1.551
18	*meta*phosphate	$Ca(PO_3)_2$	198.12	col
19	phosphide	Ca_3P_2	182.28	red cr
20	*hypo*phosphite	$Ca(H_2PO_2)_2$	170.15	monocl. wh.-gray
21	*ortho*phosphite, di-	$2CaHPO_3 \cdot 3H_2O$	294.26	
22	*ortho*plumbate	Ca_2PbO_4	351.37	red-br. cr
23	plumbite	$CaPbO_2$	279.29	cr
24	propionate	$Ca(C_3H_5O_2)_2 \cdot H_2O$	204.24	col. monocl. tabl
25	*l*-quinate	$Ca(C_7H_{11}O_6)_2 \cdot 10H_2O$	602.56	rhomb. leaf
26	salicylate	$Ca(C_7H_5O_3)_2 \cdot 2H_2O$	350.33	oct
27	"	$Ca(C_7H_5O_3)_2 \cdot 3H_2O$	368.35	monocl. wh.; 2H₂O oct
28	selenate	$CaSeO_4$	183.04	col., (2H₂O, monocl.)
29	selenide	$CaSe$	119.04	simple cub., 2.274
30	*meta*silicate (α) (pseudo-wollastonite)	$CaSiO_3$	116.14	monocl. col., 1.610, 1.611, 1.664
31	*meta*silicate (β) (wollastonite)	$CaSiO_3$	116.14	monocl. col., 1.616, 1.629, 1.631
32	silicide	$CaSi_2$	96.20	
33	stearate	$Ca(C_{18}H_{35}O_2)_2$	607.01	cr. powd
34	succinate	$CaC_4H_4O_4 \cdot 3H_2O$	210.20	col., 1.460, 1.540, 1.610
35	sulfate (anhydrite)	$CaSO_4$	136.14	rhomb. or monocl. col., 1.569, 1.575, 1.613
36	" (soluble anhydrite)	$CaSO_4$	136.14	tricl. need
37	" (gypsum)	$CaSO_4 \cdot 2H_2O$	172.17	monocl. col., 1.521, 1.523, 1.530
38	sulfide (oldhamite)	CaS	72.14	cub. col., 2.137
39	" , hydro-	$Ca(HS)_2 \cdot 6H_2O$	214.31	pr. col
40	sulfite	$CaSO_3 \cdot 2H_2O$	156.17	hex. col
41	" , acid.	$Ca(HSO_3)_2$	202.22	yelsh. liq., strong SO_2 odor
42	*d*-tartrate	$CaC_4H_4O_6 \cdot 4H_2O$	260.22	rhomb., 1.525, 1.535, 1.550
43	*dl*-tartrate	$CaC_4H_4O_6 \cdot 4H_2O$	260.22	tricl., powd. or need
44	*meso*tartrate	$CaC_4H_4O_6 \cdot 3H_2O$	242.20	monocl. or tricl. pr
45	telluride	$CaTe$	167.69	simple cub., 2.51-.58
46	tellurite	$CaTeO_3$	215.69	wh. flecks

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.63^{17}	900		75.5 d.	247 d.	s. dil. a.; i. abs. al.
2	2.23^{34}; anh. 2.53^{30}	$-H_2O$, 100		45.9^{0}	89.6^{91}	sl. s. al.
3	1.674^{0}_{0}	$-2H_2O$, 44		74.9^{0}	106^{42}	s. al.
4		83-4		0.04^{25}	0.03^{50}	sl. s. eth.
5	2.2^{4}	d.		0.00067^{13}	0.0014^{95}	s. a.; i. ac. a.
6	3.40	2572	2850	$.131^{10}$ d.	$.07^{80}$ d.	s. a.
7		d. 275		sl. s.		s. a.
8		$-8H_2O$, 100	d. 275, exp.	sl. s. ev. O	d.	s. a., NH_4 salts; i. al., eth.
9				0.003^{25}		v. sl. s. al.; 0.008^{25} eth.
10				s.		s. al.
11				sl. s.		sl. s. al.
12				i.		s. HCl, $H_4P_2O_6$, $H_2P_2O_6$
13	3.14	1670		0.0023	d.	s. a.; i. al.
14	2.306^{16}	d. 25		0.02^{20}; 0.0316^{38}	0.075^{100}, d.	s. a.; i. al.
15	2.220^{16}	$-H_2O$, 109	d. 203	i.	d	s. a.
16	3.09	1230		i.		s. a.
17	2.25			sl. s.		s. a.; i. NH_4Cl
18	2.82	975		i.	i.	i. a.
19	2.238^{25}	>1600		d. ev. PH_3		s. a.; i. al., eth., bz.
20		d.		15.4^{25}	12.5^{100}	i. al.
21				sl. s.	d.	s. NH_4Cl
22	5.71	d.		i.	d.	s. a.
23		d.		sl. s.		
24				49.0^{0}	55.8^{100}	i. al.
25		50; $-10H_2O$, 120		16^{16}		i. al.
26				s.	s.	s. al.
27				2.70^{15}	44.7^{100}	s. al.
28	2.93; ($2H_2O$) 2.68			7.9^{6}	5.4^{67}	
29	7.593					
30	2.905	1540		0.0095^{17}		s. HCl
31	2.915	tr. 1200				
32	2.5			i.	d.	d. a., bases
33		179-80		0.004^{15}		i. al., eth.
34				1.52^{0}	0.89^{80}	
35	2.96	monocl. 1450	tr. to rhomb. 1193	0.298	0.1619^{100}	s. a., $Na_2S_2O_3$, NH_4 salts, glyc.
36	2.45					
37	2.32	$-1\frac{1}{2}H_2O$, 128	$-2H_2O$, 163	0.241^{0}	0.222^{100}	s. a., $Na_2S_2O_3$, NH_4 salts, glyc.
38	2.18^{15}		d.	$.0121^{15}$ d.	$.4614^{100}$ d.	d. a.
39		d. 15-18		v. s.		s. al.
40		$-2H_2O$, 100		0.0043^{18}	0.0011^{100}	s. H_2SO_3
41				s.		s. a.
42		d.		0.0266^{0}	$0.0689^{37.5}$	sl. s. al.
43		$-4H_2O$, 200		0.0032^{0}	$.0078^{37.5}$	s. HCl; i. acet. a.
44		$-3H_2O$< 170		i.	0.16^{100}	$.028^{18}$, $.085^{100}$ acet. a.
45	7.593					
46		>960		sl. s	s.	s. a.

No	Name	Formula	Mol wt.	Crystalline form, color and index of refraction
	Calcium			
1	thiocarbonate	$CaCS_3$	148 27	yel
2	thiocyanate	$Ca(SCN)_2 \cdot 3H_2O$	210 28	wh. cr., deliq
3	*di*thionate	$CaS_2O_6 \cdot 4H_2O$	272 26	trig col., 1 5496
4	thiosulfate	$CaS_2O_3 \cdot 6H_2O$	260 30	tricl
5	*meta*titanate (perovskite)	$CaTiO_3$	135 98	rhomb., β 2 34
6	tungstate (scheelite)	$CaWO_4$	288 00	tetr. col. or wh. sc, 1.918, 1.934
7	*meta*tungstate	$CaW_4O_{13} \cdot 10H_2O$	1163 92	col tricl
8	valerate	$Ca(C_5H_9O_2)_2$.	242 33	
9	*meta*zirconate	$CaZrO_3$	179.30	monocl
10	**Carbon** amorphous	C	12 01	amor. blk
11	" graphite	C	12 01	cub. blk
12	" diamond	C	12 01	cub. col., 2.4173
13	bromide, di- (tetrabromoethylene)	C_2Br_4	343 68	
14	bromide, tri- (hexabromoethane)	C_2Br_6	503.52	rhomb. pr. 1.740, 1 847, 1 863
15	bromide, tetra- (tetrabromoethane)	CBr_4	331 67	col. monocl. tab 1 59998$^{99.5}$ (He)
16	chloride, di-(tetrachloroethylene)	C_2Cl_4	165 85	col liq., eth odor, 1.5055
17	chloride, tri-(hexachloroethane)	C_2Cl_6	236 76	rhomb, tricl or cub, col
18	chloride, tetra- (tetrachloromethane)	CCl_4	153 84	col. liq, 1.46305^{15}...
19	fluoride, tetra- (tetrafluoromethane)	CF_4	88 01	col. gas
20	iodide, tetra- (tetraiodomethane)	CI_4	519 69	octahdr. red
21	oxide, sub-	C_3O_2	68 03	col gas or liq, 1.4538^0
22	" mon-	CO	28 01	col odor. **poisonous** gas
23	" di-	CO_2	44 01	col odorl gas or col liq
24	selenide sulfide	CSeS	123 03	yel. oily liq
25	sulfide, sub-	C_3S_2	100 15	red liq
26	" , mono-	CS (or $(CS)x$)	44 07	red powd
27	" , di-	CS_2	76 13	inflam col liq, 1 62950^{18}
28	" telluride	CSTe	171 68	yel-red
29	**Carbonic acid**	H_2CO_3	62 03	exists only in solution
30	**Carbonyl bromide** (carbon oxybromide)	$COBr_2$	187 84	
31	**Carbonyl chloride** (phosgene, carbon oxychloride)	$COCl_2$	98 92	col. pois. gas or col volat liq
32	**Carbonyl sulfide** (carbon oxysulfide)	COS	60 07	gas
33	**Cerium**	Ce	140 13	cub or hex steel gray met
34	acetate (ous)	$Ce(C_2H_3O_2)_3 \cdot 1\frac{1}{2}H_2O$	344 29	wh.-redsh. cr. powd
35	benzoate (ous)	$Ce(C_7H_5O_2)_3 \cdot 3H_2O$	557 51	wh. to redsh-wh. powd
36	bromate (ous)	$Ce(BrO_3)_3 \cdot 9H_2O$.	686 02	hex. redsh wh
37	bromide (ous)	$CeBr_3$	379.88	wh cr. powd., deliq
38	" "	$CeBr_3 \cdot H_2O$	397 89	need., deliq
39	carbide	CeC_2	164 15	hex. red....
40	carbonate (ous)	$Ce_2(CO_3)_3 \cdot 5H_2O$	550 37	micr. pr., wh.
41	chloride (ous)	$CeCl_3$	246 50	col. cr., deliq

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	...			s.		s. al.
2	...			v. s.	v. s.	v. s. al.
3	2.176			16^{0}	30^{30}	...
4	1.872	d.		100^{3}	d.	i. al.
5	4.10					
6	6.06			0.2		s. NH_4Cl; i. a., al.
7	...	d.	...			d. a.
8	..			8.28^{0}	7.39^{100}	
9	4.78	2550				
10	1.8–2.1	subl. 3537	4200 (?)	i.	i.	i. a., alk.
11	2.25	3527	4200 (?)	i.	i.	s. liq. Fe; i. a., alk.
12	3.51	>3500	4200 (?)	i.	i.	i. a., alk.
13	...	57.5	227			
14	3.823	148 – 9d	210	i.		s CS_2 v. sl. s. al., eth
15	3.42	α48 4; β90.1	189 5	0.024^{30}		s. al., eth., chl.
16	$1.6311\frac{15}{4}$	−22.4	120.8	i.		s. al , eth.
17	2 091	subl. 187		i.		s. al., eth., oils
18	1.595	−23 0	76.8	v. sl. s		s. al. bz., chl., eth.
19	1.96^{-184}	−184	−128	sl. s		
20	4.32	171 d.		i.	d.	s. d h al , CS_2, eth.
21	liq 1.114^{0}	−111.3	7	d.		
22	1.250^{0} g/l; lq. 0 793	−207	−190 (−192)	3.5^{0} cm^{3}	20^{20} cm^{3}	s al , Cu_2Cl_2, bz., ac a.
23	1.977^{0} g/l; lq 1.101^{-37} s 1 56^{-79}	−56.6$^{5\ 2atm}$	−78 5 subl.	171.3^{0} cm^{3}; $.348^{0}$g; $.145^{25}$g	90.1^{20} cm^{3}; $.097^{40}$ g; $.058^{60}$ g	31^{15} al. cm^{3}; s. acet.
24	1.9874	−85	84.5	i.	i	s CS_2; sl. s. al.
25	1.274	−0.5				
26	1.66	d.	200	i.		s CS_2, eth; i. al
27	$1.261\frac{22}{20}$	−108.6; frz. −111	46 3	0.22^{22}	$.014^{50}$	s al., eth.
28	2.9^{-50}	−54	d. > −54.0			s CS_2, bz.
29				s.		....
30	2.44		64.5			....
31	1.392	−104	8 3	d.		d. a., al.; v. s. bz., tol.; s. ac. a.
32	2.72 g/l; lq. 1.24^{-87}	−138	−48	133^{0} cm^{3}	40.3^{30} cm^{3}	v. s al., alk.
33	cub. 6.90; hex. 6.7	640	1400	i.	i.	s dil a.; i. al.
34		−1½H_2O, 115	d.	26.5^{15}	16.2^{75}	
35		−3H_2O, 100			sl. s.	sl s. hot al.
36		49		s.		
37				s		
38	.. ..	d.		s.		s. al.
39	5.23			d.	d.	s. a
40	..			v. sl. s.		s. dil a., $(NH_4)_2CO_3$
41	3.92^{0}	848 (794–812)	d.	100	d.	30 al.; s. acet.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Cerium			
1	citrate (ous)	$Ce(C_6H_5O_7)\cdot3\frac{1}{2}H_2O$	392 29	wh. powd
2	cyanoplatinite (ous)	$Ce_2[Pt(CN)_4]_3\cdot18H_2O$	1502 46	monocl. yel bl. lust
3	fluoride (ous)	CeF_3	197 13	hex. wh
4	" (ic)	$CeF_4\cdot H_2O$	234 15	wh. amor. powd
5	hexaantipyrine *perchlo*rate (ous)	$[Ce(C_{11}H_{12}N_2O)_6]\cdot(ClO_4)_3$	1567 84	col. hex. cr
6	hexaantipyrine iodide (ous)	$[Ce(C_{11}H_{12}N_2O)_6]I_3$	1650 23	large yel. cr
7	hydride (ous)	CeH_3	143 15	amor. powd., dk. bl
8	hydroxide (ous)	$Ce(OH)_3$	191 15	wh. gelat. ppt
9	" (ic)	$Ce(OH)_4$	208 16	yelsh gelat. ppt
10	iodate (ic)	$Ce(IO_3)_4$	839 81	col
11	iodide (ous)	$CeI_3\ 9H_2O$	683 04	redsh.-wh cr.
12	nitrate (ous)	$Ce(NO_3)_3\cdot6H_2O$	434 25	col. or redsh. (trac. La, Di) cr, deliq
13	" (ic), basic	$Ce(OH)(NO_3)_3\cdot3H_2O$	397 21	long red need
14	oxalate (ous)	$Ce_2(C_2O_4)_3\ 9H_2O$.	706 47	yel.-wh. cr
15	oxide (ous)	Ce_2O_3	328 26	gray-grn powd
16	" (ic)	CeO_2	172 13	cub wh -yel or amor
17	oxychloride (ous)	$CeOCl$	191 59	purp. leaf
18	2,4-pentanedione deriv (ous) (acetylacetonate)	$Ce(C_5H_7O_2)_3\ 3H_2O$	491 50	lt. yel cr. ppt
19	*ortho*phosphate (ous) (monazite)	$CePO_4$	235 15	monocl red or rhomb yel
20	*meta*phosphate (ous)	$Ce(PO_3)_3$	377 19	micr need
21	salicylate (ous)	$Ce(C_7H_5O_3)_3$	551 46	wh. to redsh.-wh. powd
22	silicide	$CeSi_2$	196 25	
23	sulfate (ous)	$Ce_2(SO_4)_3$	568 44	monocl. or rhomb col; grn. powd., hyg.
24	" "	$Ce_2(SO_4)_3\ 4H_2O$	640 50	rhomb. asbestos like need. ($5H_2O$ monocl.)
25	" "	$Ce_2(SO_4)_3\cdot8H_2O$	712 57	tricl. or monocl. sm. pink cr
26	" "	$Ce_2(SO_4)_3\ 9H_2O$	730 59	asbestos like need. hex. cr
27	" (ic)	$Ce(SO_4)_2$	332 25	deep yel. cr
28	" "	$Ce(SO_4)_2\ 4H_2O$	404 31	rhomb sulf. yel
29	sulfide (ous)	Ce_2S_3	376 44	red cr.; br -dk. purp. powd
30	**Cesium**	Cs	132 91	hex. silv.-wh. duct. met
31	acetate	$CsC_2H_3O_2$	191 95	deliq
32	aluminum sulfate	$CsAl(SO_4)_2\ 12H_2O$	568 19	cub col, 1 4587
33	benzoate.	$CsC_7H_5O_2$.	254 02	
34	bromate	$CsBrO_3$	260 83	
35	bromide, mono-	$CsBr$	212 83	cub. col, 1.6984
36	" tri-	$CsBr_3$	372 66	rhomb
37	bromoiodide, di-	$CsIBr_2$	419.66	rhomb
38	bromo*di*iodide	CsI_2Br	466 67	
39	carbonate	Cs_2CO_3	325 83	col. cr., deliq
40	" , acid	$CsHCO_3$	193 93	rhomb
41	chlorate	$CsClO_3$	216 37	
42	*per*chlorate	$CsClO_4$	232 37	rhomb. col
43	chloride	$CsCl$	168 37	cub col. deliq., 1.6418
44	chloroaurate	$CsAuCl_4$	471 94	monocl., yel
45	chloro*di*bromide	$CsBr_2Cl$	328 20	yellow
46	chlorobromide, di	$CsBrCl_2$	283 74	
47	chloroiodide, di-	$CsICl_2$	330.74	rhomb. pa. or

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1				i.		s. dil. min. a.
2	2.657					
3	6.16	1324		i.		
4		d.		i		s. a.
5		295–300 d.		1.08^{20}		
6		268–70		15.10^{20}		
7		ign.		d.		
8						s. a., $(NH_4)_2CO_3$; i. alk.
9						s. a.; sl. s. alk. carb.; i. alk.
10				0.015^{20}		
11			d. ev. I_2	v. s.		v. s. al.
12		$-3H_2O$, 150	d. 200	v. s.	v. s.	50 al.; s. acet.
13				s.		
14		d.		0.053^{25}		s. H_2SO_4, HCl; i. $H_2C_2O_4$, al., alk., eth.
15	6.9–7.0	ign. 200; 1692		i.	i.	s. H_2SO_4; i. HCl
16	7.3	1950		i	i.	s. H_2SO_4, HNO_3; i. dil. a.
17				i.		s. dil. a.
18		131–2		d.		v. s. al.
19	5.22			i.	i.	s. a.; i. al.
20	3.272					i. a
21				i.		
22	5.67^{17}			i.		
23	3.912			10.1^{0}	4.06^{80}; 2.25^{100}	
24	3.22 ($5H_2O$)			3.90^{50}	0.514^{100}	
25	2.886^{17}	$-8H_2O$, 630		23.8^{0}; 12^{20}	6^{60}	
26	2.831			11.87^{15}; 9.42^{30}		
27	3.91^{18}		d 195	sly. d. to	form basic	salt
28				v. s., d.		s. dil. H_2SO_4
29	5.020^{11}	d.		i.	d.	s. dil. a.
30	1.90	28.5	670	d.	d.	s. a., d. al.
31		194		$945.1^{-2.5}$	$1345.5^{98.5}$	
32	1.97	117		0.34^{0}	42.54^{100}	s. dil. a.; i. al.
33				294.5^{0}	398.5^{100}	
34				4.53^{30}		
35	4.44; lq. 3.04^{700}	636	1300	124.3^{25}		s. a.
36		180				
37		248	d. 320			
38		195.5		260.5^{15}d.		s. al.
39		d. 610		260.5^{15}	v. s.	11^{19} al.: s. eth.
40		$-\frac{1}{2}CO_2$, 175		209.3^{15}	v. s.	s. al.
41	3.57				37.9^{100}	s. al.
42	3.327	d.		0.8^{0}	30^{100}	i. abs. al.
43	3.97	646	1290 subl.	161.7^{0}; 185.7^{30}	270.5^{100}	v. s al.
44				0.5^{10}	27.5^{100}	s. al.
45		191				
46		205				
47	3.86	230	d. 290			

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Cesium			
1	chloroplatinate	Cs_2PtCl_6	673 79	cub. yel
2	chlorostannate	Cs_2SnCl_6	597 26	cub. wh
3	chromate	Cs_2CrO_4	381 83	α yel. pr.; β yel. rhomb
4	cyanide	CsCN	158 93	col. cr
5	fluogermanate	Cs_2GeF_6	452 42	isotropic cr., reg. octahedra
6	fluoride	CsF	151 91	cub. col
7	"	$CsF\ 1\frac{1}{2}H_2O$	178 93	
8	fluosilicate	Cs_2SiF_6	407 88	cub. wh
9	fluotellurite	$CsTeF_5$	355 52	col. need
10	formate	$CsCHO_2$	177 93	
11	"	$CsCHO_2{\cdot}H_2O$	195 94	
12	gallium selenate	$CsGa(SeO_4)_2\ 12H_2O$	704 74	col. cr
13	" sulfate	$CsGa(SO_4)_2{\cdot}12H_2O$	610 94	cub. col., 1.46495
14	hydride	CsH	133 92	wh. cr
15	hydroxide	CsOH	149 92	col -yelsh., v deliq
16	iodate	$CsIO_3$	307 83	monocl. wh
17	*metaper*iodate	$CsIO_4$	323 83	rhomb. wh. pl
18	iodide, mono-	CsI	259 83	cub. col , 1 7876
19	" , tri	CsI_3	513 67	rhomb. blk
20	" , penta-	CsI_5	767 51	tricl. blk
21	" , chlorobromo-	CsIBrCl	375 20	rhomb. yel.-red
22	*per*manganate	$CsMnO_4$	251 84	
23	mercury bromide (ic)	$CsBr{\cdot}2HgBr_2$	933 71	rhomb
24	mercury chloride (ic)	$CsCl\ HgCl_2$	439 89	cub. or rhomb. col., 1.792
25	nitrate	$CsNO_3$	194 92	col. hex or cub., glit
26	" , acid	$CsNO_3{\cdot}HNO_3$	257 93	oct
27	" "	$CsNO_3{\cdot}2HNO_3$	320 95	col pl
28	nitrite	$CsNO_2$	178 92	yel. cr
29	oxalate	$Cs_2C_2O_4$	353 84	
30	oxide, mon-	Cs_2O	281 82	or -red cr
31	" , di-	Cs_2O_2	297 82	pa. yel. need
32	" , tri-	Cs_2O_3	313 82	choc. br. cr
33	" , tetr-	Cs_2O_4	329 82	yel. cr
34	phthalate, acid	$CsHC_8H_4O_4$	298 03	rhomb
35	rhodium sulfate	$CsRh(SO_4)_2\ 12H_2O$	644 13	yel. oct
36	salicylate	$CsC_7H_5O_3$	270 02	
37	silicotungstate	$4Cs_2O\ SiO_2{\cdot}12WO_3{\cdot}xH_2O$		wh. cr
38	sulfate	Cs_2SO_4	361 88	rhomb. or hex. col , 1.560, 1.564, 1.566
39	" , acid	$CsHSO_4$	229 98	rhomb. col. pr
40	sulfide	$Cs_2S{\cdot}4H_2O$	369 94	wh. cr., deliq
41	" , di-	Cs_2S_2	329 94	amor., dk. red
42	" , "	$Cs_2S_2{\cdot}H_2O$	347 96	tetr
43	" , tri-	Cs_2S_3	362 00	yel. leaf
44	" , tetra-	Cs_2S_4	394 06	yel
45	" , penta-	Cs_2S_5	426 12	
46	" , hexa-	Cs_2S_6	458 18	brown-red
47	tartrate, acid	$CsHC_4H_4O_6$	281 99	wh. rhomb. cr
48	" dihydroxy-	$Cs_2C_4H_4O_8{\cdot}2H_2O$	481 92	
49	**Chloric acid**	$HClO_3{\cdot}7H_2O$ (?)	210 58	known only as col soln
50	" " per-	$HClO_4$	100 47	col. unst. liq
51	" " "	$HClO_4\ H_2O$	118 48	need., fairly stable
52	" " "	$HClO_4\ 2H_2O$	136 50	stable, liq
53	**Chlorine** ...	Cl_2	70 91	grnsh.-yel. gas or lq. or rhomb. cr.; gas 1.000768, lq. 1.367
54	azide (chlor(o)azide)	ClN_3	77 48	gas, exp

INORGANIC COMPOUNDS (Continued)

No	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		d.		$.024^{0}$; $.135^{20}$	0.377^{100}	i. al.
2	3.33					i. conc. HCl
3	4.237			71.4^{13}	95.5^{30}	
4				s.		i. al.
5	4.10			sl. s.	v. s.	sl. s. a.
6	3.586	684	1250	v. s.		i. al.
7				366.5^{18}		
8	3.372^{17}			60^{17}	less s.	i. al.
9				d.	d.	soln. HF
10		265			$2012^{95.4}$	
11		$-H_2O$, 41		369.9^{1}		
12				4.14^{25}		
13	2.113			1.51^{25}		$.0035^{25}$ 70% al.
14	2.7	d.		d.	d.	d. a.
15	3.675	272.3		395.5^{15}		s. al.
16	4.85			2.6^{24}		
17	4.259			2.15^{10}		
18	4.510	621	1280	44^{0}	160^{61}	s. al.
19		207.5		v. sl. s.		
20		73				
21		235	d. 290			
22	3.597	d.		0.097^{1}	1.27^{59}	
23				0.807^{17}		sl. s. al.
24				1.44^{17}		i. abs. al.
25	3.685, lq. 2.71^{500}	414	d.	9.16^{0}; 14.9^{10}	196.8^{100}	s. acet.; sl. s. al.
26		100				
27		32-36				
28				v. s.	v. s.	
29				282.9^{25}		
30	4.36	d. 360-400		v. s.	d.	s. abs. al.
31	4.25	400	$-O_2$, 650	s.	d.	s. a
32	4.25^{0}	400		d.		s. a.
33	3.77^{19}	600	d.	d. to CsOH	d.	s. a.
34	2.178					
35	2.238	110-111		sl. s.		
36				196.2^{0}	1522^{100}	
37				0.005^{20}	0.5^{100}	sl. s. NH_4OH; i. HCl, al.
38	4.243	1010	tr. hex. 660	167^{0}	220^{100}	i. al., acet.
39	3.352^{16}	d.		s.		
40				v. s.	v. s.	
41		460	>800	hyg.		
42				s.		
43		217	780			
44		160 d				
45	2.806^{16}	210				
46		186				
47				9.7^{25}	98^{100}	
48				22.5^{0}		
49	$1.282^{14.2}$	<−20	d. 40	v. s.		
50	1.764^{22}	−112	39^{56}	∞		
51	1.88; lq 1.776^{50}	50	exp. 110	v. s.	v. s.	
52	1.65	−17.8	200	v. s.	v. s.	s. al.
53	3.214^{0} g/l, lq. 1.557^{-34}; s. 1.9	−102	−33.7 (−34.6)	310^{10} cm³; 1.46^{0} g	177^{30} cm³, 0.57^{30} g	s. alk.
54				sl. s.		d. alk.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Chlorine			
1	fluoride, mono-	ClF	54.46	nearly col. gas
2	" tri-	ClF_3	92.46	col. gas
3	hydrate	$Cl_2 \cdot 6H_2O$ (?)	179.01	rhomb. lt. yel
4	oxide, mon-	Cl_2O.	86.91	yel.-red gas or red-br. lq
5	" di- (per-)	ClO_2	67.46	red-yel. gas or or.-red cr., exp
6	" tetr-	ClO_4.	99.46	. . . . .
7	oxide, hept-	Cl_2O_7	182.91	col. oil
8	**Chloroauric acid**	$HAuCl_4 \cdot 4H_2O$	412.10	brt. yel. need., deliq
9	**Chloroplatinic acid**	$H_2PtCl_6 \cdot 6H_2O$	518.09	red-br. pr., deliq
10	**Chlorostannic acid**	$H_2SnCl_6 \cdot 6H_2O$	441.56	col. leaf
11	**Chlorosulfonic acid**	$ClSO_3H$	116.53	col. fum. liq., 1.437^{14}
12	**Chromium**	Cr	52.01	cub. steel gray, v. hard met
13	acetate (ous)	$Cr(C_2H_3O_2)_2$	170.10	red cr
14	" (ic)	$Cr(C_2H_3O_2)_3 \cdot H_2O$	247.16	gray-grn. powd. or bluish-grn., pasty mass
15	arsenide, mon-	$CrAs$	126.92	gray, hex
16	boride, mono-	CrB	62.83	silv. cr
17	bromide (ous)	$CrBr_2$	211.84	wh. cr
18	" (ic)	$CrBr_3$	291.76	hex. olv. grn
19	" "	$CrBr_3 \cdot 6H_2O$	399.86	hex. pl., grn., deliq
20	(tri-) carbide, di-	Cr_3C_2	180.05	gray cr
21	(penta-) carbide, di-	Cr_5C_2	284.07	silv. cr
22	carbonate (ous)	$CrCO_3$	112.02	amor. gray bl
23	chloride (ous)	$CrCl_2$	122.92	wh. need., deliq
24	" (ic)	$CrCl_3$	158.38	l. vlt. pl. (or deliq. s. cr.)
25	" "	$[Cr(H_2O)_6]Cl_3$	266.48	monocl. vlt
26	" "	$[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$	266.48	grn. cr. powd
27	" "	$[Cr(H_2O)_4Cl_2]Cl \cdot 2H_2O$	266.48	rhomb. grn
28	" "	$CrCl_3 \cdot 10H_2O$	338.54	grn. cr. powd
29	fluoride (ous)	CrF_2	90.01	grn. cr
30	" (ic)	CrF_3	109.01	rhomb. grn
31	" "	$CrF_3 \cdot 4H_2O$	181.07	cub. oct. grn
32	" "	$CrF_3 \cdot 9H_2O$	271.16	vlt. bl. gelat
33	hydroxide (ous)	$Cr(OH)_2$	86.03	yel. br
34	" (ic)	$Cr(OH)_3$ (or $Cr_2O_3 \cdot xH_2O$)	103.03	bl.-gray grn. gel. or vlt. amor
35	iodide (ous)	CrI_2	305.85	grayish powd. . . . . .
36	nitrate (ic)	$Cr(NO_3)_3 \cdot 7\frac{1}{2}H_2O$	373.16	monocl. br . . . . .
37	" "	$Cr(NO_3)_3 \cdot 9H_2O$	400.18	monocl. purp .
38	nitride, mono-	CrN	66.02	amor . .
39	oxalate (ous)	$CrC_2O_4 \cdot H_2O$	158.05	yel. cr. powd .
40	oxide, mon- (ous)	CrO	68.01	black
41	" sesqui- (ic)	Cr_2O_3	152.02	hex., grn . .
42	" di-	CrO_2.	84.01	br.-blk. powd
43	" tri- (chromic anhydride)	CrO_3.	100.01	rhomb. red., deliq
44	oxychloride	CrO_2Cl_2	154.92	dk. red liq. . .
45	2,4-pentanedione deriv (acetylacetonate)	$Cr(C_5H_7O_2)_3$	349.33	.
46	*ortho*phosphate (ic)	$Cr(PO_4) \cdot 2H_2O$	183.06	violet cr
47	" "	$Cr(PO_4) \cdot 4H_2O$	219.09	grn. cr . . . .

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	1.62^{-100}	−154 + 0.5	−100.8	d.	d.	
2	1.77^{13}	−83	11.3	d.	d.	
3	1.23	d. 9.6		v. s.		s. alk.
4	3.89^{0} g/l	−20	3.8^{756}; exp.	200 cm³	d. to HOCl	exp. C. comp.; s. alk., H_2SO_4
5	3.09^{11} g/l	−59	9.9^{731}; exp. 100	2000^{4} cm³	d. $HClO_3$, Cl_2, O_2	exp. C. comp.; s. alk., H_2SO_4
6			82; exp.	s. d.		s. bz.
7		−91.5	82	s. d.		s. bz.
8		d		s.	v. s	s. al., eth.
9	2.431	60		v. s.	v. s.	s. al., eth.
10	1.93	9		s.		
11	1.766^{18}	−80	158	d. to H_2SO_4 + HCl		d. al., a.; i. CS_2
12	6.92	1615	2200	i.	i.	s. HCl, dil. H_2SO_4; i. HNO_3
13				sl. s.	s.	sl. s. al.
14				s.		i. al.
15	6.35^{16}			i	i.	i. a.
16	5.4^{17}			i.	i.	s. fus. Na_2O_2
17	4.356					s. al.
18	4.250		subl.	(1) 200* (2) i.	i.	v. s. al.; d. alk.
19	5.4^{17}			200		v. s. al.; s. fus. Na_2O_2; i. eth.
20	6.68	1890	3800	i	i.	s. dil HCl
21	6.915^{25}	1665				
22				v. sl. s.		s. min. a.; i. eth., al.
23	2.75			v. s.	v. s.	sl. s. al., i. eth.
24	2.76^{15}		1300 subl.	(1) i. (2) 233^{25}	i. s.	i. a., CS_2, acet., al.
25	2.76	95		58.7^{25}	s.	s. al.; i. eth.
26	1.760^{25}					
27	2.76	83		58.5^{15}	s	s al., i eth.
28				v. s.		v. s. al.
29	4.11	1100	>1300	sl. s		s h. HCl; i al
30	3.8	>1000	subl.	i.		sl. s. a.; i. al., NH_3
31	3.78			s	s.	s a.; i. al., NH_3
32				v. s.		s. a., HCl, KOH; i. al
33				d		s. a.
34				i.	i.	s. a., alk.; sl. s. NH_4OH
35	5.196			v. s.		
36		100		s.	s.	
37		37	d. 125.5	s.	s.	s. a., al., alk., acet.
38		d. 1500		i.		i. a., alk.
39					s.	
40				i	i.	i. dil. HNO_3
41	5.21	1990		i.	i.	i. a., al., alk.
42		−O, 300		i		s. HNO_3
43	2.70	196	d	166^{15}	206.7^{100}	s. eth., al., H_2SO_4
44	1.911	−96.5	117	d.	d.	d al.; s. eth., ac. a.
45		216	340	i		s. org. solvts. except lgr.
46	$2.42^{32.5}$			sl. s.		s. a., alk.; i. ac. a.
47	$2.10^{32.5}$			sl. s.		s. a

* Several chromic salts exist in two forms, a soluble and an insoluble modification

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Chromium			
1	*ortho*phosphate (ic)	$Cr(PO_4)\cdot 6H_2O$	255.13	tricl. vlt
2	phosphide, mono-	CrP	83.03	gray-blk. cr.
3	silicide	Cr_3Si_2	212.15	tetr. pr
4	sulfate (ous)	$CrSO_4\cdot 7H_2O$	274.18	blue cr
5	" (ic)	$Cr_2(SO_4)_3$	392.20	vlt. or red powd
6	" "	$Cr_2(SO_4)_3\cdot 5H_2O$	482.28	green amor
7	" "	$Cr_2(SO_4)_3\cdot 15H_2O$	662.44	violet amor. sc
8	" "	$Cr_2(SO_4)_3\cdot 18H_2O$	716.49	cub. oct., bl.-vlt
9	sulfide, mono- (ous)	CrS	84.07	blk. powd
10	" , sesqui- (ic)	Cr_2S_3	200.20	br. blk. powd
11	(tri-) sulfide, tetra-	Cr_3S_4	284.27	gray-blk. powd
12	**Chromium complexes:** Chloropentamminechromium (III) chloride	$[Cr(NH_3)_5Cl]Cl_2$	243.54	oct. red
13	Hexamminechromium (III) chloride	$[Cr(NH_3)_6]Cl_3\cdot H_2O$	278.59	yel. cr
14	Hexaureachromium (III) fluosilicate	$[Cr(CON_2H_4)_6]_2\text{-}[SiF_6]_3\ 3H_2O$	1304.95	leaves, lt grn
15	Hexaureachromium (III) *per*rhenate	$[Cr(CON_2H_4)_6]\text{-}(ReO_4)_3$	1163.29	grn. need
16	**Cobalt**	Co	58.94	cub. silv. gray metal
17	acetate (ous)	$Co(C_2H_3O_2)_2\ 4H_2O$	249.09	monocl. red-vlt., deliq
18	" (ic)	$Co(C_2H_3O_2)_3$	236.07	oct., green
19	aluminate (approx. Thenard's blue)	$Co(AlO_2)_2$	176.88	cub. blue
20	*ortho*arsenate (ous), (erythrite)	$Co_3(AsO_4)_2\cdot 8H_2O$	598.77	monocl. vlt.-red, 1.626, 1.661, 1.699
21	*ortho*arsenite, acid (ous)	$Co_3H_6(AsO_3)_4\cdot H_2O$	692.52	rose-red
22	benzoate (ous)	$Co(C_7H_5O_2)_2\cdot 4H_2O$	373.23	gray-red leaf
23	boride, mono-	CoB	69.76	pr
24	bromate (ous)	$Co(BrO_3)_2\cdot 6H_2O$	422.87	oct. red
25	bromide (ous)	$CoBr_2$	218.77	grn. cr., deliq
26	" "	$CoBr_2\ 6H_2O$	326.87	pr. red-vlt., deliq
27	carbonate (ous) (sphero-cobaltite)	$CoCO_3$	118.95	trig., red, 1.855, 1.60
28	" , basic (ous)	$2CoCO_3\cdot 3Co(OH)_2\ H_2O$	534.78	vlt.-red prisms
29	carbonyl, tri-.	$Co(CO)_3$ (or $[Co(CO)_3]_4$)	142.97 (571.88)	blk. cr
30	carbonyl, tetra-.	$Co(CO)_4$ (or $[Co(CO)_4]_2$)	170.98 (341.96)	or. cr
31	chlorate (ous)	$Co(ClO_3)_2\cdot 6H_2O$	333.95	cub. red, deliq
32	*per*chlorate (ous)	$Co(ClO_4)_2$	257.85	red need
33	*per*chlorate (ous)	$Co(ClO_4)_2\cdot 6H_2O$	365.95	hex., red 1.55
34	chloride (ous).	$CoCl_2$	129.85	bl. cr
35	chloride (ous)	$CoCl_2\ 2H_2O$	165.89	
36	chloride (ous)	$CoCl_2\cdot 6H_2O$	237.95	monocl. red

No.	Sp. gr. or density	Melting point °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.121	$-3\frac{1}{2}H_2O$, 100		sl. s.		s. a., alk.; i. ac. a.
2	5.7^{16}			i.	. . .	s. HNO_3, HF; i. a.
3	5.5			i.	i.	s. HCl, HF; i. HNO_3, H_2SO_4
4				12.35^{0}		sl. s. al.
5	3.012	. . . . .		i.; s.*		s. al.; i. a.
6				s.		s. al., H_2SO_4
7	1.867^{17}	100	$-10H_2O$, 100	s.	s., d.^{67}	i. al.
8	1.7^{20}	$-12H_2O$, 100		120^{20}	d.	s. al.
9	4.1			i.	. . . .	v. s. a.
10	3.77^{19}	. . . .		i. d.	d.	d. al.; s. HNO_3
11		. .		i.	. . . .	s. HNO_3; i. HCl, dil. H_2SO_4
12	1.696	. .	. .	.65 g. at 16	. . . .	i. HCl
13	1.585			s.	. .	. . . .
14				$.522^{20}$		i. al.
15	$2.652\frac{25}{4}$	. . .		1.786		.667 al.
16	8.9	1480	2900	i.	i.	s. a.
17	1.705^{19}		$-4H_2O$, 140	s.	s.	s. a., al.
18		. .		hyd. read	ily	s. glac. acet. a.
19				i.	i.	i. a.
20	2.948	d.		i.	i.	s. dil. a., NH_4OH
21		$-H_2O$, 100		i.	. .	s. a., NH_4OH
22		$-4H_2O$, 115		v. s.		. . .
23	7.25^{18}	. .		d.	d.	s. HNO_3
24				45.5^{17}		s NH_4OH
25	4.909^{25}	d.		66.7^{59}	68.1^{97}	77.1^{20} al.; s. eth.
26	2.46	47-8; $-4H_2O$, 100	$-6H_2O$, 130	s. red color	153 2^{97}	s. a., eth., al. bl. color
27	4.13	d.		i.	i.	s. a.; i. NH_3
28				i.	d.	s. a., $(NH_4)_2CO_3$
29				sl. s.		d. with Br
30	1.73^{18}	51	d. 52	i.	i.	s. al., CS_2, eth.
31	1.92	61	d 100	558.3^{0}	v. s.	s. al.
32	3.327			100^{0}	115^{45}	s. al., acet.
33		143 ($5H_2O$)		$5H_2O$: 100^{0}	115^{45}	s. al., acet.
34	3.356	subl.	1049	45^{7}	105^{98}	54.4 al.; 8.6 acet.; 38.5 meth. al.
35	$2.477\frac{2\text{[illegible]}}{25}$					
36	$1.924\frac{25}{25}$	86	$-6H_2O$, 110	76.7^{0} (red); 49.9^{20}	190.7^{100}	v. s. al. bl. color; 0.29 eth.; s. acet.

* Several chromic salts exist in two forms, a soluble and an insoluble modification.

No.	Name	Formula	Mol wt.	Crystalline form, color and index of refraction
	Cobalt			
1	chloride (ous), diammine (α-)	$CoCl_2 \cdot 2NH_3$	163.92	rose
2	chloride (ous), diammine (β-)	$CoCl_2 \cdot 2NH_3$	163.92	blue-violet
3	chloride (ous), hexammine	$CoCl_2 \cdot 6NH_3$	232.05	rose-red oct
4	chromate (ous)	$CoCrO_4$	174.95	gray-blk. cr
5	citrate (ous)	$Co_3(C_6H_5O_7)_2 \cdot 2H_2O$	591.05	rose-red.
6	cyanide (ous)	$Co(CN)_2 \cdot 2H_2O$	147.01	buff, anh. bl.-vlt. powd
7	" "	$Co(CN)_2 \cdot 3H_2O$	165.02	amor. red-gray powd
8	ferricyanide (ous)	$Co_3[Fe(CN)_6]_2$	600.72	red. need
9	ferrocyanide (ous)	$Co_2Fe(CN)_6 \cdot 7H_2O$	455.94	gray-grn
10	fluoride (ous)	$CoF_2 \cdot 2H_2O$	132.97	monocl. rose-red
11	" "	$CoF_2 \cdot 4H_2O$	169.00	α rhomb. oct. red; β cr powd rose
12	" (ic)	$Co_2F_6 \cdot 7H_2O$	357.99	grn. powd
13	" , acid (ous).	$CoF_2 \cdot 5HF \cdot 6H_2O$	305.08	trig., orange-red
14	" (ic)	CoF_3(or Co_2F_6)	115.94	hex. brown
15	fluosilicate (ous)	$CoSiF_6 \cdot 6H_2O$	309.10	trig. pink, 1.382, 1.387
16	formate (ous)	$Co(CHO_2)_2 \cdot 2H_2O$	185.01	red cr
17	hydroxide (ous)	$Co(OH)_2$	92.96	rhomb. rose-red
18	" (ic)	$Co(OH)_3$	109.96	blk.-br. powd
19	iodate (ous).	$Co(IO_3)_2$	408.78	bl.-vlt. need
20	" "	$Co(IO_3)_2 \cdot 6H_2O$	516.88	red oct
21	iodide (ous), (α-)(stable)	CoI_2	312.78	hexag. black
22	" " (β-)	CoI_2	312.78	yel. need., unst
23	" "	$CoI_2 \cdot 2H_2O$	348.81	grn., deliq
24	" "	$CoI_2 \cdot 6H_2O$	420.88	hex br.-red
25	linoleate (ous)	$Co(C_{18}H_{31}O_2)_2$	617.80	brown amor
26	nitrate (ous)	$Co(NO_3)_2 \cdot 6H_2O$	291.05	monocl. red, deliq
27	oleate (ous)	$Co(C_{18}H_{33}O_2)_2$	621.83	br. amor. powd
28	oxalate (ous)	CoC_2O_4	146.96	redsh. wh
29	oxide (ous)	CoO	74.94	cub. grn.-br
30	" (" , ic)	Co_3O_4	240.82	cub. blk
31	" (ic)	Co_2O_3	165.88	blk.-gray powd
32	palmitate	$Co(C_{16}H_{31}O_2)_2$	569.76	
33	*ortho*phosphate (ous)	$Co_3(PO_4)_2$	366.86	redsh. cr
34	" "	$Co_3(PO_4)_2 \cdot 2H_2O$	402.89	pink powd
35	" "	$Co_3(PO_4)_2 \cdot 8H_2O$	510.99	redsh. powd
36	phosphide	Co_2P	148.90	sm. need gray
37	*ortho*phosphite, di- (ous)	$CoHPO_3 \cdot 2H_2O$	175.00	redsh need
38	propionate (ous)	$Co(C_3H_5O_2)_2 \cdot 3H_2O$	259.13	dk red. cr
39	*per*rhenate (ous)	$Co(ReO_4)_2 \cdot 5H_2O$	649.64	dk. pink
40	selenate (ous)	$CoSeO_4 \cdot 5H_2O$	291.98	tricl. ruby red
41	" "	$CoSeO_4 \cdot 7H_2O$.	328.01	monocl
42	selenide, mono-	$CoSe$	137.90	hex. yel
43	*ortho*silicate (ous)	Co_2SiO_4	209.94	vlt. cr
44	silicide	$CoSi$	87.00	rhomb
45	"	$CoSi_2$	115.06	cub dk bluish
46	"	Co_2Si	145.94	gray cr
47	sulfate (ous)	$CoSO_4$	155.00	hex and oct red powd
48	" "	$CoSO_4 \cdot H_2O$	173.02	red cr

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.097	273	...	...	...	...
2	2.073	210→α	form	...	..	...
3	1.497	...	...	...	...	s. NH_4OH; i. al.
4	...	d.	...	i.	...	s. a., NH_4OH
5	...	$-2H_2O$, 150	...	0.8	...	...
6	anh. 1.872^{25}	$-2H_2O$, 280	...	i.	...	s. KCN, HCl, NH_4OH
7	...	$-3H_2O$, 250	...	i.	...	s. KCN soln.
8	...		...	i.	...	s. NH_4OH; i. HCl
9	...	...	...	i.	...	s. KCN; i. HCl
10	4.46	...	...	s.	d.	s. HF
11	2.192^{25}	...	...			...
12	2.314^{25}	...	...		...	...
13	2.045	...				
14	3.88	...	...	d. to $Co(OH)_3$		...
15	2.113^{19}	...	...	$118.1^{21.5}$	s.	...
16	2.129^{22}	$-2H_2O$, 140	anh. d. 175	5.03^{20}	...	...
17	3.597^{15}	d.	...	.00032	...	s. a., NH_4 salts; i. alk.
18	...	d.	$-1\frac{1}{2}H_2O$, 100	0.00032	...	s. a.; i. al.
19	5.008^{18}	...	...	0.4^{15}	1.33^{100}	s. HCl, HNO_3
20	3.689^{21}	61 d.; $-4H_2O$, 135		s.		...
21	5.68	...	...	159^{9}	420^{100}	v. s. al., acet.
22	5.45^{25}		...		...	...
23	...		...	376.2^{46}	s.	...
24	2.90	$-6H_2O$, 130	...	s.	s.	s. al., eth., chl.
25	...			i.	...	s. al., eth., acet.
26	1.87	<100	$-3H_2O$, 55	133.8^{0}	v. s.	$100^{12.5}$ al.; s. acet.; sl. s. NH_3
27	...	...	...	i.	...	s. al., eth., oils, bz.
28	3.021^{25}		...	i.	...	s. a., NH_4OH
29	6.47^{18}	1935		i.	i.	s. a., NH_4OH; i. al.
30	6.07	...	...	i.	i.	s. H_2SO_4; i. HCl, HNO_3, aq. reg.
31	5.18	d. 895	...	i.	i.	s. a.; i. al.
32	...	70.5				s. pyridine, hot CS_2, CCl_4; sl. s. eth., CS_2; i. meth. al., acet.
33	2.587^{25}	...		i.	i.	s. H_3PO_4, NH_4OH
34	...			i.	...	s. H_3PO_4
35	2.769^{25}	$-8H_2O$, 200		sl. s.	...	s. min. a., H_3PO_4; i. al.
36	6.4^{15}	1386	...	i.	i.	s. HNO_3
37	...	bl. at 250		sl. s.	...	...
38	...	*ca.* 250		anh. 33.5^{11}	...	v.s. al.
39	...	d.		d.		...
40	2.512	d.		v. s.	...	...
41	2.135	...			...	...
42	7.65	red ht.				...
43	4.63	...	...	i.	...	s. dil. HCl
44	6.30^{20}	1395				...
45	5.3	1277				...
46	7.28	1327	...	...	...	d. a.
47	3.71_{25}^{25}	989		36.2^{20}	83^{100}	1.04^{18} meth. al.; i. NH_3
48	3.075^{25}	d.		s.	s.	...

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Cobalt			
1	sulfate (ous)	$CoSO_4 \cdot 6H_2O$	263 10	monocl.
2	" " (bieberite).	$CoSO_4 \cdot 7H_2O$	281 11	monocl. red-pink, 1.477, 1.483, 1.489
3	" (ic)	$Co_2(SO_4)_3 \cdot 18H_2O$.	730 35	bl.-green cr. powd...
4	sulfide, mono- (jaipurite)	CoS	91 00	oct. reddish, silver-white
5	(tri-) sulfide, tetra- (ous, ic)	Co_3S_4 ..	305 06	cub., dk. gray
6	sulfide, sesqui- (ic)	Co_2S_3....	214.06	blk. cryst....
7	" di-	CoS_2	123 06	cub. blk. ..
8	sulfite (ous)	$CoSO_3 \cdot 5H_2O$	229 08	red
9	tartrate (ous)	$CoC_4H_4O_6$	207 01	monocl. redsh ...
10	thiocyanate (ous)	$Co(SCN)_2 \cdot 3H_2O$	229 14	rhomb. violet
11	*ortho*titanate	Co_2TiO_4	229 78	cub. grnsh. blk.
12	tungstate (ous)	$CoWO_4$	306 86	monocl., bl.-grn.
	Cobalt complexes:			
13	Aquopentamminecobalt (III) chloride (roseo)	$[Co(NH_3)_5H_2O]Cl_3$.	268 49	brick-red cr ..
14	*cis*-Chloroaquotetramminecobalt (III) chloride	$[Co(NH_3)_4(H_2O)Cl]Cl_2$	251.46	rhomb. violet.
15	Chloropentamminecobalt (III) chloride (purpureo)	$[Co(NH_3)_5Cl]Cl_2$	250.47	rhomb. dk. red-violet
16	Hexamminecobalt (III) chloride (luteo)	$[Co(NH_3)_6]Cl_3$..	267.50	monocl. or
17	Hexamminecobalt (III) *per*rhenate	$[Co(NH_3)_6](ReO_4)_3 \cdot 2H_2O$	948 10	or.-yel. doubly refracting pr.
18	**Cobalticyanic acid**..	$[H_3Co(CN)_6]_2 \cdot H_2O$ (or $\frac{1}{2}H_2O$)	454 16	col. need., deliq.
19	**Cobaltocyanic acid** .	$H_4Co(CN)_6$	159 03	col.
20	**Columbium** (niobium)	Cb (Nb).	92 91	rhomb. steel gray lust. met., 1.80
21	bromide, penta-	$CbBr_5$	492 49	purp. red
22	chloride, penta- . .	$CbCl_5$.	270 20	yel.-wh., deliq.
23	fluoride, penta-....	CbF_5 .	187 91	monocl. pr., col..
24	hydride	CbH .. .	93 92	gray powd..........
25	nitride, mono-	CbN	106 92	black
26	oxalate, acid ..	$Cb(HC_2O_4)_5$	583 05	monocl. col
27	oxide, mon- (or di-) .. .	CbO (or Cb_2O_2)	108 91	cubic blk.
28	" di- (or tetr-). .	CbO_2 (or Cb_2O_4)	124 91	black .
29	" pent-.. . .	Cb_2O_5.	265.82	rhomb. wh
30	" " (columbic acid, columbium hydroxide)	$Cb_2O_5 \cdot xH_2O$		wh. amor
31	oxybromide ...	$CbOBr_3$	348 66	yel. cryst
32	oxychloride ...	$CbOCl_3$	215 28	need. col
33	oxysulfide....	Cb_2OS_3 (?)	298.00	black
34	**Copper**...	Cu.. ..	63 57	cub. redsh. metal
35	acetate (ic) (neutral verdigris)	$Cu(C_2H_3O_2)_2 \cdot H_2O$.	199 67	dk. grn. powd., 1.545, 1.550 .
36	acetate, basic (blue verdigris)	$Cu(C_2H_3O_2)_2 \cdot CuO \cdot 6H_2O$	369 33	grnsh.-bl. powd.
37	acetate arsenite (ic) (Paris green)	Approx. $Cu(C_2H_3O_2)_2 \cdot 3CuO \cdot As_2O_3$	1013.83	em. grn. powd . ..
38	acetylide (ous). ..	Cu_2C_2 . .	151 16	amor. red exp .. . .

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$2.019\frac{15}{15}$		.	. ..	.	. .. .
2	$1.948\frac{25}{25}$	96.8	$-7H_2O$, 420	60.4^{3}	67^{70}	2.5^{8} al.; s. meth. al.
3	.		.	s. d.		s. H_2SO_4; i. pyr.
4	5.45	>1116	.	0.00038^{18}	.	s. a., al.
5	4.86	.	.			. .. . ..
6	4.8	...		i.	.	d. a.
7	4.269			i		s. HNO_3, aq. reg.
8	. .	...	.	i.	.	s. H_2SO_3
9	.			sl. s.		s. dil. a.
10		$-3H_2O$, 105		s.		
11	5.07-.12	. . ..				s. conc. HCl; sl. s. dil. HCl
12	8.42			i.		s. hot conc. acids; sl. s. cold dil. acids
13	1.7^{25}	d. 100		16.12^{0}; 24.87^{25}	24.87^{16}	sl. s. HCl; i. al.
14	1.847	d.	.	1.4^{0}; 2.76^{20}		s. a.; i. al.
15	$1.819\frac{25}{25}$	d.		0.232^{0}; 0.4^{25}	$1.031^{46\,6}$	s. conc. H_2SO_4; i. al.
16	1.702			4.26^{0}	$12.74^{46\,5}$	s. conc. HCl; i. al., NH_4OH
17	3.329^{25}			0.0469	.	... . .
18		d <100		s.		s. al., HCl, dil. HNO_3, dil. H_2SO_4
19		....		s.		i. abs. al., eth., chl.
20	8.55	2500	3700	i.	i.	s. h. H_2SO_4; sl. s. HF; i. HCl, HNO_3
21	.	150	270	d.		s. al., ethyl bromide
22	2.75	194	240.5	d.		s. HCl, CCl_4, al.
23	3.293^{18}	75.5	229	s. d.		s. al.; sl. s. CS_2, chl., H_2SO_4
24	6.6	infus				s. HF, conc. H_2SO_4; i. HCl, HNO_3, alk.
25	8.4	2050 d.				s. HF+HNO_3; i. HNO_3
26				d.	d.	s. $H_2C_2O_4$; d. al.
27	6.27			i.	i.	s. a., alk.; i. al., HNO_3
28				i.	i.	sl. s. alk.; i. a.
29	4.47	1520		i	i.	s. H_2SO_4, HF, alk.
30	4.3 ?			i.	.	s. KOH, HF, H_2SO_4; i. NH_3
31		subl.		d.		s. a.
32	10.19^{400} g/l	subl. 400	.	s. d.	d.	s. H_2SO_4, al.; i. HCl
33			.	i.	.	s. H_2SO_4; sl. s. HF; i. HCl
34	8.92	1083	2310	i.	i.	s. HNO_3, h. H_2SO_4; v. sl. s. HCl, NH_4OH
35	1.882	115	240 d.	7.2	20	7.14 al.; s. eth.
36				sl. s.	.	s. dil. a., NH_4OH; sl. s. s. al.
37			..	i.		s. a., NH_4OH; i. al.
38	......	exp.	. ..	v. sl. s.	.	s. a., KCN

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Copper			
1	*ortho*arsenate (ic)	$Cu_3(AsO_4)_2 \cdot 4H_2O$	540.59	bluish-grn
2	" , acid (ic).	$Cu_5H_2(AsO_4)_4 \cdot 2H_2O$	911.54	blue
3	(tri-) arsenide (domeykite)	Cu_3As	265.62	hex
4	arsenide	Cu_5As_2	467.67	oct. bl.
5	*ortho*arsenite, acid (?) (ic) (Scheele's green)	$CuHAsO_3$ (?)	187.49	green powd
6	benzoate (ic)	$Cu(C_7H_5O_2)_2 \cdot 2H_2O$	341.82	lt.-bl. cr. powd
7	*meta*borate (ic)	$Cu(BO_2)_2$	149.21	bluish-grn. cr. powd.
8	boride	Cu_3B_2	212.35	yellow
9	bromate (ic)	$Cu(BrO_3)_2 \cdot 6H_2O$	427.50	cub. bl.-grn
10	bromide (ous)	$CuBr$ (or Cu_2Br_2)	143.49 (286.97)	cub., tetrah. wh
11	" (ic)	$CuBr_2$	223.40	monocl. blk., deliq
12	butyrate (ic)	$Cu(C_4H_7O_2)_2 \cdot 2H_2O$	273.80	dk.-grn. cr.; odor butyric a.
13	carbonate (ous)	Cu_2CO_3	187.15	yellow (exist. quest.)
14	" , basic (ic) (malachite)	$CuCO_3 \cdot Cu(OH)_2$	221.17	monocl. dk. grn., 1.655, 1.875, 1.909
15	" , basic (ic) (azurite, chessylite)	$2CuCO_3 \cdot Cu(OH)_2$	344.75	monocl. bl., 1.730, 1.758, 1.838
16	chlorate (ic)	$Cu(ClO_3)_2 \cdot 6H_2O$	338.58	cub. green, deliq
17	chloride (ous) (nantokite)	$CuCl$ (or Cu_2Cl_2)	99.03 (198.05)	cub. wh., 1.93
18	chloride (ic)	$CuCl_2$	134.48	br. yel. powd. hyg
19	" "	$CuCl_2 \cdot 2H_2O$	170.52	rhomb. grn., deliq., β 1.685
20	chromate, basic (ic)	$CuCrO_4 \cdot 2CuO \cdot 2H_2O$	374.75	yel.-br
21	dichromate (ic)	$CuCr_2O_7 \cdot 2H_2O$	315.62	blk. cryst., deliq
22	citrate (ic)	$2Cu_2C_6H_4O_7 \cdot 5H_2O$	720.56	bluish-grn. powd
23	cyanide (ous)	$CuCN$ (or $Cu_2(CN)_2$)	89.59	monocl. wh
24	" (ic)	$Cu(CN)_2$	115.61	yel. grn. powd.
25	ethylacetoacetate (ic)	$Cu(C_6H_9O_3)_2$	321.84	grn. need
26	ferricyanide (ous)	$Cu_3Fe(CN)_6$	402.66	br.-red
27	" (ic)	$Cu_3[Fe(CN)_6]_2$	614.61	yel.-grn
28	ferrocyanide (ous)	$Cu_4Fe(CN)_6$	466.23	br.-red
29	" (ic)	$Cu_2Fe(CN)_6 \cdot 7H_2O$	465.20	red.-br
30	fluoride (ous)	CuF (or Cu_2F_2)	82.57	red cryst
31	" (ic)	$CuF_2 \cdot 2H_2O$	137.60	monocl. bl
32	fluosilicate (ous)	Cu_2SiF_6	269.20	red powd
33	" (ic)	$CuSiF_6 \cdot 4H_2O$	277.69	monocl. pr
34	" (ic).	$CuSiF_6 \cdot 6H_2O$	313.73	rhomb. bl., deliq., 1.409, 1.408
35	formate (ic)	$Cu(CHO_2)_2$	153.61	monocl. bl.
36	" "	$Cu(CHO_2)_2 \cdot 4H_2O$	225.67	blue cr
37	glycine deriv. (ic)	$Cu(C_2H_4NO_2)_2 \cdot H_2O$	229.71	bl. need
38	hydride	CuH (or Cu_2H_2)	64.58	red-br. (exist. quest.)
39	hydroxide (ous)	$CuOH$	80.58	yellow (exist. quest.)
40	" (ic)	$Cu(OH)_2$	97.59	bl. gel. or amor. bl. powd
41	iodate (ic)	$Cu(IO_3)_2$	413.41	monocl. grn
42	" "	$Cu(IO_3)_2 \cdot H_2O$	431.43	tricl. blue
43	" , basic (ic)	$Cu(OH)IO_3$	255.50	rhomb. grn
44	*para*periodate (ic)	Cu_2HIO_6	351.07	grn. powd. cr
45	iodide (ous) (marshite)	CuI (or Cu_2I_2)	190.49	cub. wh., 2.346

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1				i.	i.	s. a., NH_4OH
2				i.		s. a., NH_4OH
3	8.0	830				
4	7.56	d.		i.	i.	s. a., NH_4OH
5		d.		i.	i.	s. a., al., NH_4OH
6		$-2H_2O$, 110		sl. s.		s. dil. a.; sl. s. al.
7	3.859			s.		
8	8.116					
9	2.583	d. 180	$-6H_2O$, 200	v. s.		s. NH_4OH
10	4.718	504	1345	v. sl. s.	d.	s. HBr, HCl, HNO_3, NH_4OH; i. acet.
11		498		v. s.		s. al., acet., NH_3, pyr.; i. bz.
12				v. sl. s.		s. al., eth., NH_4OH, dil. a.
13	4.40	d.		i.	i.	s. a., NH_4OH
14	4.0	d. 200		i.	d.	0.026 aq. CO_2; s. a., NH_4OH, KCN; i. al.
15	3.88	d. 220		i.	d.	s. NH_4OH, h. aq. $NaHCO_3$
16		65	d. 100	207^{0}	v. s.	s. al., acet.
17	3.53	422	1366	0.0062		s. HCl, NH_4OH
18	3.054	498	d. to CuCl, 993	70.6^{0}	107.9^{100}	53^{15} al.; 68^{15} meth. al.
19	2.38	$-2H_2O$, 110	d.	110.4^{0}	192.4^{100}	s. al., NH_4Cl
20		$-2H_2O$, 260		i.		s. HNO_3, dil. a., NH_4OH; i. al.
21	2.283	$-2H_2O$, 100		v. s.	d.	s. a., al., NH_4OH
22				i.		s. a., NH_4OH
23	2.92	474.5	d.	i.	i.	s. HCl, NH_4OH, KCN; sl. s. NH_3
24		d.		i.		s. a., alk., KCN, C_5H_5N, pyr.
25		192-3	subl.	i.		v. s. al., eth.; 10^{80} bz.
26				i.		s. NH_4OH; i. HCl
27				i.		s. NH_4OH; i. HCl
28				i.		s. NH_4OH; i. NH_4Cl
29				i.	i.	s. NH_4OH; i. a., NH_3
30		908	subl. 1100	i.		s. HCl, HF, HNO_3; i. al.
31	2.93			sl. s.	d.	s. al., HCl, HNO_3, HF; i. acet., NH_3
32			d.→SiF_4		d., 100	
33	2.158			42.8		
34	2.207			232^{17}		0.16^{20}, 92% al.
35	1.831			12.5	d.	0.25 al.
36	1.81			6.2		
37		$-H_2O$, 130		0.57^{15}		s. alk.
38		d. 60		d.		s. HCl d.
39	3.37	$-\frac{1}{2}H_2O$, 360		i.	i.	s. a., NH_4OH
40	3.368	d. $-H_2O$		i.	d.	s. a., NH_4OH, KCN
41	5.241^{15}	d.		0.1364^{25}	i.	s. dil. HNO_3, H_2SO_4
42	4.872	$-H_2O$, 240	d. 290	0.33^{15}	0.65^{100}	s. NH_4OH, dil. H_2SO_4; i. al., dil. HNO_3
43	4.873	d. 290		i.	i.	s. dil. H_2SO_4
44		d. 110		i.	i.	s. dil. HNO_3
45	5.62	605	1290	0.0008^{18}		s. KI, KCN, NH_4OH; i. a., al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Copper			
1	lactate (ic)	$Cu(C_3H_5O_3)_2 \cdot 2H_2O$	277.74	monocl. dk. bl
2	laurate (ic)	$Cu(C_{12}H_{23}O_2)_2$	462.18	lt. blue powd
3	nitrate (ic)	$Cu(NO_3)_2 \cdot 3H_2O$	241.63	blue, deliq
4	" "	$Cu(NO_3)_2 \cdot 6H_2O$	295.68	bl. cr. deliq
5	nitride	Cu_3N	204.72	dk. gr. powd
6	nitrite, basic (ic)	$Cu(NO_2)_2 \cdot 3Cu(OH)_2$	448.34	grn. powd
7	nitroprusside (ic)	$CuFe(CN)_5NO \cdot 2H_2O$	315.54	wh.-grnsh. powd
8	oleate (ic)	$Cu(C_{18}H_{33}O_2)_2$	626.46	br. powd. or grn bl mass pois.
9	oxalate (ic)	$CuC_2O_4 \cdot \frac{1}{2}H_2O$	160.60	bl. wh
10	oxide, sub-	Cu_4O	270.28	olive grn
11	" (ous) (cuprite)	Cu_2O	143.14	oct., cub. red
12	oxide (ic) (paramelaconite)	CuO	79.57	tetr. cub. blk. hyg
13	" " (tenorite)	CuO	79.57	tricl. black, β 2.63
14	" , per-	$CuO_2 \cdot H_2O$	113.59	br. or brownish-blk. cr
15	oxychloride (ic)	$CuCl_2 \cdot 2CuO \cdot 4H_2O$	365.69	pa. bl.-grn
16	" (atacamite)	$CuCl_2 \cdot 3CuO \cdot 3H_2O$	427.24	orthorhomb grn
17	palmitate (ic)	$Cu(C_{16}H_{31}O_2)_2$	574.39	grn.-bl. powd
18	2,4-pentanedione deriv. (acetylacetonate)	$Cu(C_5H_7O_2)_2$	261.78	bl. cr
19	phenolsulfonate	$Cu(C_6H_5O_4S)_2 \cdot 6H_2O$	517.99	bl.-grn. cr
20	*ortho*phosphate (ic)	$Cu_3(PO_4)_2 \cdot 3H_2O$	434.80	rhomb. bl
21	(tri-) phosphide	Cu_3P	221.73	gray blk.
22	(tri-) phosphide, di-	Cu_3P_2	252.75	gray-blk. met. powd
23	*ortho*phosphite, di- (ic)	$CuHPO_3 \cdot 2H_2O$	179.63	blue cr
24	salicylate (ic)	$Cu(C_7H_5O_3)_2 \cdot 4H_2O$	409.86	bl.-grn. need
25	selenate (ic)	$CuSeO_4 \cdot 5H_2O$	296.61	tricl. bl
26	stearate (ic)	$Cu(C_{18}H_{35}O_2)_2$	630.50	lt. grn -bl. amor. powd
27	sulfate (ous)	Cu_2SO_4	223.20	gray powd
28	" (ic) (hydrocyanite)	$CuSO_4$	159.63	grn.-wh. rhomb
29	" (ic) (blue vitriol or chalcanthite)	$CuSO_4 \cdot 5H_2O$	249.71	tricl. blue, 1.514, 1.537, 1.543
30	sulfide (ous) (chalcocite)	Cu_2S	159.20	rhomb. blk
31	" "	Cu_2S	159.20	cub. blk
32	sulfide (ic) (covellite)	CuS	95.63	hex. or monocl. blk
33	sulfite (ous)	$Cu_2SO_3 \cdot H_2O$	225.22	red pr
34	" "	$Cu_2SO_3 \cdot H_2O$	225.22	hex. wh
35	tartrate (ic)	$CuC_4H_4O_6$	211.64	lt.-bl. powd
36	" "	$CuC_4H_4O_6 \cdot 3H_2O$	265.69	lt. gray bl. powd
37	tellurite	$CuTeO_3$	239.18	ppt. siskin grn
38	thiocyanate (ous)	$CuSCN$	121.65	wh
39	" (ic)	$Cu(SCN)_2$	179.73	black
40	tungstate (ic)	$CuWO_4 \cdot 2H_2O$	347.52	oct. lt. grn

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1				16.7	45^{100}	s. NH_4OH; sl. s. al.
2		111-13		sl. s.	sl. s.	
3	2.047^{39}	114.5	$-HNO_3$, 170	137.8^{0}; 381^{40}	666^{80}; 1270^{100}	$100^{12.5}$ al.
4	2.074	$-3H_2O$, 26.4		243.7^{0}	∞	s. al.
5		d. 300		d.		d. a.
6				sl. s.		s. NH_4OH; sl. s. al.; d. dil. a.
7				i.		s. alk.; i. al.
8				i.	i.	s. eth.
9				$.00253^{25}$		s. NH_4OH; i. ac. a.
10		d.		i.		d. a.
11	6.0	1235	$-O$, 1800	i.	i.	s. HCl, NH_4Cl, NH_4OH; sl. s. HNO_3; i. al.
12	6.40	d. 1026		i.	i.	s. a., NH_4Cl, KCN
13	6.45	d. 1026		i.	i.	s. a., NH_4Cl, KCN
14				i.		s. a. d.; i. al.
15		$-3H_2O$, 140		i.		s. a.
16	3.76–3.78					
17		120		i.		s. h. bz., CS_2, CCl_4; sl. s. al., eth., chl., pyr., i. meth. al., acet.
18		>230	subl.	i.		sl. s. al., s. chl.
19				s.		s. al.
20				i.	sl. s.	s. a., NH_4OH, H_3PO_4; i. NH_3
21	6.4–6.8			i.		s. HNO_3; i. HCl
22	6.67	d.		i.		s. HNO_3; i. HCl
23		d.		i.	i.	
24				v. s.		v. s. al., NH_4OH
25	2.559			25.7^{16}	d.	s. a., NH_4OH; i. al.
26		125		i.		s. eth., h. bz., chl., turp.; sl. s. pyr.; i. meth. al., acet., c. bz.
27		+O, 200		d.		s. conc. HCl, NH_3, glac. acet. a.
28	3.603	200	d. 650 to CuO	14.3^{0}	75.4^{100}	1.04^{18} meth. al.; i. al.
29	2.284	$-4H_2O$, 110	$-5H_2O$, 150	31.6^{0}	203.3^{100}	15.6^{18} meth. al.; i. al.
30	5.6	1100		1×10^{-14}		s. HNO_3, NH_4OH; i. acet.
31	5.78	1130		1×10^{-14}		s. HNO_3, NH_4OH; i. acet.
32	4.6	tr. 103	d. 220	0.000033^{18}		s. HNO_3, KCN, h. conc. HCl, H_2SO_4; i. al., alk.
33	4.46^{15}					
34	3.83^{15}	d.		sl. s.		s. NH_4OH, HCl; i. al., eth.
35				v. sl. s.		s. a., alk.
36		d.		0.02^{15}	0.14^{85}	s. a., alk.
37				i.	i.	
38	2.843	1084		0.0005^{18}		s. NH_4OH, conc. a., eth.; i. al.
39		d. 100		d.	d.	s. a., NH_4OH
40		red ht.		0.1^{15}		s. NH_4OH; sl. s. ac. a.; i. al.; d. min. a.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Copper			
1	**xanthate** (ethylxanthogenate)	$Cu(C_3H_5OS_2)_2$	305.95	yellow ppt
	Copper complexes:			
2	Diamminecopper (II) acetate	$Cu(C_2H_3O_2)_2 \cdot 2NH_3$	215.72	vlt.-bl. cr
3	Tetramminecopper (II) sulfate	$[Cu(NH_3)_4]SO_4 \cdot H_2O$	245.77	rhomb. bl.
4	Tetrapyridinecopper (II) fluosilicate	$[Cu(C_5H_5N)_4]SiF_6$	522.02	rhomb. purplish-blue.
5	Tetrapyridinecopper (II) *per*rhenate	$[Cu(C_5H_5N)_4]$-$(ReO_4)_2$	880.58	bl. monocl. cr
6	**Cyanic acid**	HOCN	43.03	
7	**Cyanoauric acid**	$HAu(CN)_4 \cdot 3H_2O$.	356.33	tab
8	**Cyanogen**	C_2N_2	52.04	col. gas. pungent odor. v. pois
9	**Cyanogen compounds**	See *Organic Tables.*		
10	**Dysprosium**	Dy	162.46	
11	acetate	$Dy(C_2H_3O_2)_3 \cdot 4H_2O$	411.66	yel. need.
12	bromate	$Dy(BrO_3)_3 \cdot 9H_2O$	708.35	yel. hex. need
13	carbonate	$Dy_2(CO_3)_3 \cdot 4H_2O$	577.01	
14	chloride	$DyCl_3$	268.83	shining yel. pl.
15	chromate	$Dy_2(CrO_4)_3 \cdot 10H_2O$	853.11	yel. cr.
16	nitrate	$Dy(NO_3)_3 \cdot 5H_2O$	438.57	yel. cryst.
17	oxalate	$Dy_2(C_2O_4)_3 \cdot 10H_2O$	769.14	pr
18	oxide (dysprosia)	Dy_2O_3	372.92	wh. powd
19	*ortho*phosphate	$DyPO_4 \cdot 5H_2O$	347.56	yellowish-white powd
20	selenate	$Dy_2(SeO_4)_3 \cdot 8H_2O$	897.93	yel. need
21	sulfate	$Dy_2(SO_4)_3 \cdot 8H_2O$.	757.23	brill. yel. cr
22	**Erbium**	Er	167.20	dk. gray powd
23	acetate	$Er(C_2H_3O_2)_3 \cdot 4H_2O$	416.40	triclinic
24	chloride	$ErCl_3 \cdot 6H_2O$	381.67	deliq
25	nitrate	$Er(NO_3)_3 \cdot 5H_2O$	443.31	redsh. cr
26	oxalate	$Er_2(C_2O_4)_3 \cdot 10H_2O$.	778.62	redsh. micr powd
27	oxide (erbia)	Er_2O_3	382.40	rose-red powd
28	sulfate	$Er_2(SO_4)_3$	622.58	
29	"	$Er_2(SO_4)_3 \cdot 8H_2O$	766.71	monocl. rose-red
30	**Europium**	Eu	152.00	st. gray
31	chloride	$EuCl_3$	258.37	fine yel. need
32	oxide (europia)	Eu_2O_3	352.00	pa. rose powd
33	sulfate	$Eu_2(SO_4)_3 \cdot 8H_2O$	736.31	pa. rose cr
	Ferric or Ferrous See	*Iron*		
34	**Ferricyanic acid**	$H_3Fe(CN)_6$	214.97	grn.-br. need., deliq
35	**Ferrocyanic acid**	$H_4Fe(CN)_6$	215.98	wh. need., bl. in moist air
36	**Fluoboric acid**	HBF_4	87.83	col. liq
37	**Fluorine**	F_2	38.00	grn. yel. gas, pois., 1.000195
38	oxide	F_2O	54.00	col. gas unst
39	**Fluosilicic acid**	H_2SiF_6	144.08	col. liq. fum. corros
40	**Gadolinium**	Gd	156.90	
41	acetate	$Gd(C_2H_3O_2)_3 \cdot 4H_2O$	406.10	tricl
42	bromide	$GdBr_3 \cdot 6H_2O$	504.75	rhomb. pl
43	chloride	$GdCl_3$	263.27	monocl. pr. sol.
44	chloride	$GdCl_3 \cdot 6H_2O$	371.37	wh. pr., deliq
45	cyanoplatinite	$Gd_2Pt_3(CN)_{12} \cdot 21H_2O$	1590.05	rhomb.
46	fluoride	GdF_3	213.90	wh. gelat
47	nitrate	$Gd(NO_3)_3 \cdot 5H_2O$	433.01	prisms

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		d.		i.		s. NH_4OH; v. sl. s. al.; i. CS_2
2		d. *ca.* 175		s., d.		s. ac. a., NH_4OH; i. al.
3	1.81	d. 150		$18.5^{21.5}$	d.	i. al.
4	2.108					
5	2.338			.5555		
6	1.140_0^0			d.		
7		50	d.	s.		s. al., eth.
8	2.335 g/l; 0.87	−34.4	−20.7	450^{20} cm³		230 cm³ al.; 500 cm³ eth.
9						
10						
11		d. 120		s.		v. sl. s. al.
12		78	$-6H_2O$, 110	v. s.		sl. s. al.
13		$-3H_2O$, 15		i.		
14	3.67^0	680		s.		
15		$-3\frac{1}{2}H_2O$, 150	d.	1.002^{25}		
16		88.6		s.		
17				i.		s. dil. a.
18	7.81^{27}					s. a. grn. soln.
19		$-5H_2O$, >200		i.		s. dil. a., ac. a.
20		$-8H_2O$, 200		v. s.		i. al.
21		stab. 110	$-8H_2O$, 360	s.		
22	4.77^{15} (?)					
23	2.114					
24				s.	s.	s. al.
25				s.		s. al., eth., acet.
26	2.64 (?)	d. 575				
27	8.640	infus.		0.00049^{29}		sly. s. min. a.
28	3.678	d. 630		43^0		
29	3.217	$-8H_2O$, 400		16^{20}	$6\ 53^{40}$	
30				i.	i.	
31		623 + 2				
32	7.42 fr. oxal.; 6.55 fr. nit.					
33		$-8H_2O$, 375		2.563^{20}	1.93^{40}	
34		d.		s.	s.	s. al.
35		d.		s.	s.	s. al.; i. eth.
36			d. 130	∞	s.	∞ al.
37	1.69^{15} g/l, lq. 1.108^{-187}	−223	−187	d. to O_3 + HF	d.	
38	lq. $1.90^{-223.8}$	−223.8	−144.8	sl. s., d.	i.	sl. s. a., alk.
39	$1.29\text{–}.31^{15}$		d.	s.	s.	sl. s. alk.
40						
41	1.611			11.6^{25}		
42	2.844^{15}			s.	s.	s. HBr
43	4.52^0	628		s.	s.	
44	2.424^0			s.	s.	
45	2.563					
46				i		sl. s. hot HF
47	2.406^{15}	92		v. s.	v. s.	v. sl. s. conc. HNO_3

No.	Name	Formula	Mol wt.	Crystalline form, color and index of refraction
	Gadolinium			
1	nitrate	$Gd(NO_3)_3 \cdot 6H_2O$	451.02	tricl.
2	oxalate	$Gd_2(C_2O_4)_3 \cdot 10H_2O$	758.02	monocl.
3	oxide (gadolinia)	Gd_2O_3	361 80	wh. amor. powd., hyg
4	selenate	$Gd_2(SeO_4)_3 \cdot 8H_2O$	886 81	monocl. pearly
5	sulfate	$Gd_2(SO_4)_3$	601.98	col.
6	"	$Gd_2(SO_4)_3 \cdot 8H_2O$	746 11	monocl.
7	sulfide	Gd_2S_3	409 98	yel. hyg. mass
8	**Gallium**	Ga	69 72	rhomb. pseudotetr. gray-bl
9	acetate, basic	$4Ga(C_2H_3O_2)_3 \cdot 2Ga_2O_3 \cdot 5H_2O$	1452 37	micr. cr., wh.
10	bomide, tri-	$GaBr_3$	309 47	col. cr., deliq
11	" tri-, mon-ammine	$GaBr_3 \cdot NH_3$	326 50	wh. powd.
12	" " , hexammine	$GaBr_3 \cdot 6NH_3$	411 66	wh. powd.
13	chloride, di-	$GaCl_2$	140 63	col. cr., deliq.
14	" , tri-	$GaCl_3$	176.09	col. cryst., deliq.
15	" ", monammine	$GaCl_3 \cdot NH_3$	193.12	wh. powd.
16	" ", hexammine	$GaCl_3 \cdot 6NH_3$	278.28	wh. powd.
17	ferrocyanide	$Ga_4[Fe(CN)_6]_3$	914 72	gel. wh. ppt.
18	fluoride, tri-	GaF_3	126 72	white powd.
19	" "	$GaF_3 \cdot 3H_2O$	180 77	wh. powd.
20	hydroxide	$Ga(OH)_3$	120 74	amor. wh.
21	" (hydrated gallium oxide)	$Ga_2O_3 \cdot xH_2O$	.	gel. ppt., indef. composition
22	hydroxyquinoline deriv.	$Ga(C_9H_6NO)_3$	502.16	grn.-yel. cr.
23	iodide, tri-	GaI_3	450 48	col.-lem. yel. (need.) hyg.
24	" " , monammine	$GaI_3 \cdot NH_3$	467 51	wh. powd.
25	" " , hexammine.	$GaI_3 \cdot 6NH_3$	552 67	wh. powd.
26	nitrate	$Ga(NO_3)_3 \cdot xH_2O$	..	wh. cr., deliq
27	nitride	GaN	83.73	dk. gray powd. hex.
28	oxalate	$Ga_2(C_2O_4)_3$	403.50	white powder
29	"	$Ga_2(C_2O_4)_3 \cdot 4H_2O$	475.56	micr. powd. wh., hyg.
30	oxide, sub-	Ga_2O	155 44	br.-blk. powd.
31	" , sesqui-	Ga_2O_3	187.44	wh. powd.; α trig., β monocl
32	" "	$Ga_2O_3 \cdot H_2O$.	205 46	white powd.
33	oxychloride	$6GaOCl \cdot 14H_2O$	979 29	oct.
34	2,4-pentanedione deriv. (acetylacetonate)	$Ga(C_5H_7O_2)_3$.	367.04	α monocl. or. plates, β rhomb. or. pyramids, γ rhomb. pyramids
35	selenate	$Ga_2(SeO_4)_3 \cdot 16H_2O$	856 58	col. cr.
36	"	$Ga_2(SeO_4)_3 \cdot 22H_2O$	964.68	cr. monocl. or tricl., col.
37	selenide, sub-	Ga_2Se	218 40	. . . . .
38	" mono-	GaSe	148 68	dk. red-br. greas. leaf
39	" sesqui-.	Ga_2Se_3	376 32	rdsh. blk., hard, brittle
40	sulfate	$Ga_2(SO_4)_3$	427 62	wh. powd.
41	"	$Ga_2(SO_4)_3 \cdot 18H_2O$	751 91	col. cr.
42	sulfide, sub-	Ga_2S	171.50	grn. cr. or blk. powd.
43	" , mono-	GaS	101.78	sublimate, lt. yel.
44	" , sesqui-	Ga_2S_3	235 62	yel. cr. or wh. amor.
45	telluride, mono-	GaTe	197.33	soft, blk. greasy leaves
46	" , sesqui-	Ga_2Te_3.	522.27	hard, blk., brittle cr.
	Germane			
47	bromo-	GeH_3Br	155 54	col. liq.
48	chloro-	GeH_3Cl	111 08	col. liq.
49	chlorotrifluoro-	GeF_3Cl	165.06	colorless gas.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.332	91	......	v. s.	v. s.	....
2	....	$-6H_2O$, 110	..	i.		s. HNO_3; sl. s. a.; 0.11 $n-H_2SO_4$
3	7.407^{15}	....	. ..	v. sl. s.		s. a.
4	3.309	$-8H_2O$, 130	.... ..	s.	s.	....
5	$4.139^{14.6}$	..	.	3.98^{0}	$2.26^{34.4}$	....
6	$3.010^{14.6}$		....	3.28^{20}	2.54^{40}	....
7	3.8		.. ..	d.		d. a.
8	5.903^{25}; $6.093^{32.38}$	29.78	2000 ± 150	i.	i.	s. a., alk.; sl. s. Hg
9	.	d.>160		s.	d.	i. ac. a.
10	3.69^{25}	121.5 ± 0.6	278.8	s.	s.	sl. s. NH_3
11	3.112^{25}	124	.	d.	d.	sl. s. NH_3
12			...	d.	d.	sl. s. NH_3
13		164(175)	535	v. s.	d.	
14	2.47^{25}; lq. 2.36^{80}_{80}	77.9 ± 0.2	201.2	v. s.	v. s.	s. NH_3; sl. s. pet. eth
15	2.189^{25}	124		d.	d.	s. NH_3
16	.		....	d.	d.	s. NH_3
17			d.	s.	s.	i. conc. HCl
18	4.47	>1000	subl. ca. 950	.002		s. H_2F_2; i. dil. HCl
19		>140	d.	i.	sl. s.	s. dil. HCl; sl. s. 50% HF
20		d. to Ga_2O_3 + H_2O		i.	i	s. a., alk.
21		.		.00010		.0032 4.6% NH_4OH; s. a., NaOH
22	.	>150	subl. vac.	.0001	.0012	s. a., alk; sl. s. al.
23	4.15^{25}	212 ± 1	345, subl.		d.	
24	3.635^{25}	140	..	d.	d.	
25	.			d.	d.	
26		d. 110	→Ga_2O_3, 200	v. s.	v. s.	s. abs. al.; i. eth.
27			subl.>800	i.	i.	d. h. a., alk.
28			d. 195-CO_2			
29	.	d. 195	d.>160-H_2O	0.4		
30	4.77	>660	subl.>500 d.>800	i.	i.	s. a., alk.
31	α6.44; β5.88	1900	... ..	i.	i.	s. h. a., alk.
32			.	sl. s.		
33	.			i.		v. s. KOH; i. dil. HNO_3
34	α1.42; β1.41	194-5	subl. 140^{10}	s.	s.	s. acet.
35	.	.	.	v. s.	v. s.	
36			.	57.4^{25}	v. s.	
37	5.02	.....	..			
38	5.03	960	..			
39	4.92	1020				
40		d.>600	d.>520	v. s.	v. s.	s. al.; i. eth.
41			. ...	v. s.	v. s.	s. 60% al.; i. al., eth.
42	4.18^{25}	d.>800		d.	d.	s. a., alk.
43	3.86^{25}	965 ± 10		i.	d.	s. a., alk.
44	3.65^{25}	1255 ± 10		d.	d.	s. a., alk.
45	5.44	824	.	.		
46	5.57	790	..			.. . ..
47	$2.34^{29.5}$	−32.0	52.0	d.	d.	reacts like GeH_2Br_2; d. alk.; i. al.
48	1.75^{-52}	−52.0	28.0	d.	d.	d. alk.; i. al.
49	....	−66.2	−20.3	d.		s. abs. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Germane			
1	dibromo-	GeH_2Br_2	234 45	col. liq
2	dichloro-	GeH_2Cl_2	145 53	col. liq
3	dichlorodifluoro-	$GeCl_2F_2$	181 51	col. gas
4	tribromo- (germanium bromoform)	$GeHBr_3$	313 36	col. liq
5	trichloro- (germanium chloroform)	$GeHCl_3$	179 98	col. liq
6	trichlorofluoro-	$GeCl_3F$	197.97	col liq
7	**Germanium**	Ge	72 60	cub. gray-wh. met
7	bromide, di-	$GeBr_2$	232 43	col. need. or pl
9	" , tetra-	$GeBr_4$	392 26	gray-wh. oct
10	chloride, di-	$GeCl_2$.	143 51	wh. powd
11	" , tetra-	$GeCl_4$	214 43	col. liq., 1.464
12	fluoride, di-	GeF_2	110 60	wh. cr., hyg
13	" , tetra-	GeF_4	148 60	col. gas or solid, not liq. at atm. press.
14	" "	$GeF_4 \cdot 3H_2O$	202 65	wh. cr., deliq
15	hydride, mono-	GeH	73 61	br. powd
16	" , tetra- (germane)	GeH_4	76 63	col. gas
17	" (digermane)	Ge_2H_6	151 25	liq
18	" (trigermane)	Ge_3H_8	225 86	col. liq
19	hydroxide (ous)	$GeO \cdot xH_2O$		yel. to red
20	imide	$Ge(NH)_2$	102 63	wh. amor. powd
21	iodide, di-	GeI_2	326 44	yel. hex
22	" , tetra-	GeI_4	580 28	cub. yel
23	(tri-) nitride, di-	Ge_3N_2	245 82	blk. cr
24	" " , tetra-	Ge_3N_4	273 83	wh.-lt. br. powd
25	oxide, mono-	GeO	88 60	blk cr powd
26	" , di- (soluble)	GeO_2	104 60	hex., col
27	" " (insoluble)	GeO_2	104 60	tetr
28	oxychloride	$GeOCl_2$	159 51	col. liq
29	sulfide, mono-	GeS	104 66	yel.-red amor. or rhomb. bipyram. blk.
30	" , di-	GeS_2	136 72	wh. powd. orthorhombic, white
31	**Glucinum**	See *Beryllium*		
32	**Gold**	Au	197 20	cub. yel. duct. met., coll. bl. vlt
33	bromide (ous)	AuBr	277 12	yelsh.-gray mass or cr. powd
34	" (auroauric)	Au_2Br_4	714 06	blk. (exist. quest.)
35	" (ic)	$AuBr_3$ (or Au_2Br_6)	436 95	gray powd., cr. brown
36	chloride (ous)	AuCl	232 66	yel. cr
37	" (auroauric)	Au_2Cl_4	536 23	dk. red (exist. quest.)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1	2.80^{0}	−15.0	89.0	d	d	d. alk ; i. al.
2	1.90^{-68}	−68.0	69.5	d.	d.	d. alk.; i. al.
3		−51.8	−2.8	d.		s. abs. al.
4		−24.0	d.	d.	d	d alk.
5	1.93^{0}	−71.0	75 2	d	d	d alk.
6		−49.8	37.5	d.		s. abs. al.
7	5.35^{20}_{20}	958.5	(2700)	i.	i.	s. h. H_2SO_4, aq. reg.; i alk.
8		122.0	d.	d.	d	s. a., $GeBr_4$, al.; i. bz.
9	3.132^{29}_{29}	26.1	186.5	d.	d.	s. abs. al., eth., bz.; i. conc. H_2SO_4
10		d to Ge	$+GeCl_4$	d.	d.	s $GeCl_4$; i. al., chl.
11	1.879^{20}_{20}	−49.5	83.1	d.	d.	v s. dil. HCl; s. al., eth., i. conc. H_2SO_4, conc. HCl
12		d.>350	subl.	s.	v. s.	
13	6.65 g/l	subl.		s. d. to G	eO_2 + H_2	GeF_6
14		d		s	s	
15		d. 165	sl. exp.	i.	i.	s. HNO_3, H_2O_2; i. NaOH.
16	3.43 g/l, lq. 1.532 ^{142}	−165.0	−90.0 (−126)	i.	i.	s. NaOCl, sl. s. h. HCl
17	g. 6.74^{20} g/l, lq. 1.98^{-109}	−109	29	d		
18	2.2	−105.6	110.5	i		s. CCl_4
19		d.		i.		v. s. HCl, sl. s. NaOH
20		d. 150		d. to NH_3	$+GeO_2$	
21		subl , d		s.	d.	s. dil. a., conc. HI; sl. s. chl., CCl_4
22	4.322^{26}_{26}	144.0	d.	s., with slow hydrolysis	d	s. CS_2, CCl_4, bz , sl. s. conc. HCl, KOH
23			subl.>650			
24		d. 450		i.	i	i. a., alk.
25		subl. 710		i.	i.	s. Cl_2 water or H_2O_2 with NH_4OH; i. a., alk.
26	4.703^{18}	1115.0		0.447^{25}	1.0^{100}	s. a., alk.; one form i. H_2O, HCl, HF, NaOH, NH_4OH
27	6.239	1086 ± 5		i.		sl s. NaOH; i. HF, HCl
28		−56.0	d.>20	d	d.	i. all solv.
29	(am.) 3.31, rhomb. 4.01^{14}_{14}	530	subl.>430	i.	i.	s. HCl, alk., or alk. sulfd.; sl. s. NH_4OH
30	2.94^{14}	*ca.* 800	subl.>600	sl. s.; d. sly.	d. to GeO_2+ H_2S	s. alk., alk. sulfd.; i. a., al., eth., etc.
31						
32	19.3; lq 17.0^{1063}	1063	2600	i.	i.	s. KCN, aq. reg., h. H_2SeO_4; i. a.
33	7.9	d. 115	. .	i.	i.	d. a.
34	.	d. 115	. .	d.	. . . . .	. . . .
35		$-Br_2$, 160		sl. s.	.	s. eth.
36	7.4	d. to $AuCl_3$, 170	d. 289.5	d., v. sl. s.	d	s. HCl, HBr
37	5.1	d. 250	.	d.	. . . .	. . . .

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Gold			
1	chloride (ic)	$AuCl_3$	303 57	claret red, pr cr
2	" "	$AuCl_3 \cdot 2H_2O$	339 60	orange cr
3	cyanide (ous)	AuCN	223 22	lt. yel. cr. powd
4	" (ic)	$Au(CN)_3 \cdot 6H_2O$ (or $3H_2O$)	383 35 (329 30)	col hyg. pl
5	hydroxide (ous)	AuOH	214 21	dk. vlt
6	" (ic)	$Au(OH)_3$	248 22	yel -br. powd
7	iodide (ous)	AuI	324 12	grnsh.-yel. powd
8	" (ic)	AuI_3	577 96	dk. grn
9	nitrate, acid, (ic)	$AuH(NO_3)_4 \cdot 3H_2O$	500 29	tricl. oct. yel.
10	oxide (ous)	Au_2O	410.40	gray-violet
11	" (auroauric)	Au_2O_2	426 40	olive br. powd
12	" (ic)	Au_2O_3	442 40	br.-blk. powd
13	phosphide	Au_2P_3	487 46	gray
14	selenide	Au_2Se_3	631 28	
15	sulfate (ic)	$Au_2O_3 \cdot 2SO_3 \cdot H_2O$	620 54	yel. deliq. (exist. quest.)
16	sulfide (ous)	Au_2S	426.46	br.-blk. powd
17	" (auroauric)	Au_2S_2 (or AuS)	458 52	blk
18	" (ic)	Au_2S_3	490 58	br.-blk powd
19	telluride	Au_2Te	522 01	tricl. (exist. quest.)
20	"	$AuTe_2$	452 42	(1) rhomb. (2) monocl. (3) tricl. yel, earthy to massive.
21	**Hafnium**	Hf	178 60	gray
22	carbide	HfC	190 61	
23	oxide (hafnia)	HfO_2	210 60	wh. monocl
24	oxychloride	$HfOCl_2 \cdot 8H_2O$	409 64	col
25	**Helium**	He	4 003	col. gas, inert, odorl
26	**Holmium**	Ho	164 94	salts yellow
27	**Hydrazine**	NH_2NH_2	32 05	col. liq or wh. cr., 1.470[22]
28	azide	$N_2H_4 \cdot HN_3$	75.08	deliq
29	fluogermanate	$2N_2H_4 \cdot H_2GeF_6$	252.71	monocl. pr., 1.452, 1.460, 1.464
30	fluosilicate	$N_2H_4 \cdot H_2SiF_6$	176 12	cryst
31	formate	$N_2H_4 \cdot 2CH_2O_2$	124 10	cub
32	hydrate	$N_2H_4 \cdot H_2O$	50 06	col fum liq or cub cr
33	hydrochloride, mono-	$N_2H_4 \cdot HCl$	68 51	wh. need
34	" , di-	$N_2H_4 \cdot 2HCl$	104.98	cub col
35	nitrate, mono-	$N_2H_4 \cdot HNO_3$	95 06	col dimorph need
36	" , di-	$N_2H_4 \cdot 2HNO_3$	158 08	col cr
37	oxalate	$2N_2H_4 \cdot H_2C_2O_4$	154 13	wh need
38	*hypo*phosphate	$N_2H_4 \cdot 2H_2PO_3$	194 12	
39	*ortho*phosphate	$N_2H_4 \cdot H_3PO_4$	130 09	
40	*ortho*phosphite	$N_2H_4 \cdot H_3PO_3$	114 09	
41	*ortho*phosphite	$N_2H_4 \cdot 2H_3PO_3$	196 14	
42	picrate	$N_2H_4 \cdot HC_6H_2N_3O_7 \cdot \frac{1}{2}H_2O$	270 16	
43	selenate	$N_2H_4 \cdot H_2SeO_4$	177 02	col. cr. powd
44	sulfate	$2N_2H_4 \cdot H_2SO_4$	162 17	col. cr
45	"	$N_2H_4 \cdot H_2SO_4$	130 12	rhomb. col
46	**Hydrazoic acid** (azoimide)	HN_3	43 03	col. liq
47	**Hydrogen**	H_2	2 0162	col. gas, cub. solid
48	bromide (hydrobromic acid)	HBr	80.92	col. gas or pa. yel. liq., 1.325 lq.

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	3.9	254 d.	subl. 265	68	v. s.	s. al., eth.; sl. s. NH_3; i. CS_2
2	...	d.		s.	s.	s. HCl, al., eth.; sl. s. NH_3
3	7.12	d.		v. sl. s.	...	s. KCN, NH_4OH; i. al., eth.
4	...	d. 50		v. s.	d. v. s.	s. al., eth.
5	...	$-H_2O$, 200	...	s.	...	s. d. alk.
6	...	$-1\frac{1}{2}H_2O$, 250	...	5.7×10^{-11} at 25	...	s. HCl, NaCN, conc. HNO_3
7	8.25	d. 120	...	v. sl. s.	sl. s. d.	s. KI
8	...		...	i.	d.	s. iodides
9	2.84	72 d.		s. d.		s. HNO_3
10	3.6	−O, 205		i.	i.	s. HCl; sl. s. KOH; i. H_2SO_4, HNO_3, al.
11	...	d. 180		i.		...
12	...	−O, 160	−3 O, 250	i.	i.	s. HCl
13	6.67	d.	...	...	...	i. HCl, dil. HNO_3
14	4.65^{22}	...	...	...	...	...
15	...			s.	d.	s. HCl, H_2SO_4
16	...	d. 240	...	i.; fresh soln.	ppt. coll.	i. a.; s. KCN, aq reg
17	...	d. 140	...	i.	i.	s. $(NH_4)_2S$; i. a.
18	8.754	d. 197		i.	...	s. Na_2S; i. a., eth
19	9.04		...	...		...
20	8.2–9.3	472, d.	...	i.	i.	...
21	13.3	2207(1700?)	>3200	i.	...	...
22	...	4160	...	...	...	...
23	9.68	2812	...	i.	...	...
24	...			s.	...	...
25	0.1785^0 g/l; lq. $0.147^{-270.8}$	$-272.2^{26\ atm.}$	−268.9	0.94^0 cm³, 0.94^{25} cm³	1.05^{50} cm³, 1.21^{75} cm³	abs. by Pt; i. al.
26	...	...	...	...	...	...
27	lq. 1.011^{15}	1.4	113.5	v. s.	...	s. al.
28	...	75.4	...	v. s.	v. s.	v. s. al.
29	$2.406\frac{25}{25}$	...	...	s.	...	...
30	...	d. 186	...	v. s.	...	sl. s. al.
31	...	128		s.	...	...
32	1.03^{21}	<−40	118.5^{740}	∞	∞	s. al.; i. eth., chl.
33	...	89	...	v. s.	...	sl. s al.
34	1.42	198		270.4^{23}	v. s.	sl. s. al.
35	...	70.7	subl. 140	v. s.	...	sl. s. al.
36	...	104 d.	...	v. s.		...
37	...	148		200^{35}		$.0003^{22}$ al; i. eth.
38	...	152	...	...		...
39	...	82	...	...	...	...
40	...	36	...	...	...	...
41	...	82	...	...	...	...
42	...	201.3	...	s.	s.	...
43	...		...	v. sl. s.	v. s.	...
44	...	85	...	v. s.	...	i. al.
45	1.37	254	...	3.05^{32}	v. s.	i. al.
46	...	−80	37	∞	∞	s. al., alk.
47	.0899 g/l; lq. .070	−259.18	−252.8	2.14^0 cm³, 1.91^{25} cm³	0.85^{80} cm³, 1.89^{50} cm³	6.925^0 cm³ al.
48	3.50^0 g/l; lq. 2.77^{-67}	−88.5	−67.0	221^0	130^{100}	s. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Hydrogen			
1	bromide	$HBr \cdot H_2O$	98 94	col. liq
2	" (const.-boiling mixt.)	HBr (47%) + H_2O		col. liq
3	bromide	$HBr \cdot 2H_2O$	116 96	wh. cr. col. liq
4	chloride (hydrochloric acid)	HCl	36 47	col. gas or col. pois. fum liq.; 1 256 lq.
5	" (const.-boiling mixt.)	HCl(20 24%) + H_2O		col. liq
6	"	$HCl \cdot H_2O$	54 48	col. liq
7	"	$HCl \cdot 2H_2O$	72 50	col. liq
8	"	$HCl \cdot 3H_2O$	90 51	col. liq
9	cyanide (hydrocyanic acid)	HCN	27.03	col. liq. or gas, pois., 1.2675^{10} liq.
10	fluoride	HF (or H_xF_x)	20.01	col. fum. corros. liq. or gas
11	" (const.-boiling mixt.)	HF(35.35%) + H_2O		col. liq
12	iodide (hydriodic acid)	HI	127 93	col gas or pa. yel. liq., 1.466 liq
13	" (const.-boiling mixt.)	HI(57%) + H_2O		col. or pa. yel., fum. liq
14	"	$HI \cdot 2H_2O$	163 96	col. liq
15	"	$HI \cdot 3H_2O$	181 98	col. liq
16	"	$HI \cdot 4H_2O$	199 99	col. liq
17	oxide (water)	H_2O (or $(H_2O)_x$)	18 02	col. liq. or hex. col. cr., liq. 1.333, sld. 1.309, 1.313
18	" , per-	H_2O_2	34 02	col liq, 1.414^{22} liq
19	phosphide (phosphine)	H_3P	34 04	col pois spon infl gas or col liq, 1 317 liq.
20	"	H_4P_2	66 07	col. liq
21	"	$(H_2P_4)_3$	378 29	yel. solid
22	selenide	H_2Se	80 98	col. gas
23	sulfide	H_2S	34 08	col. infl. gas, offen odor 1 374 liq
24	" , di-	H_2S_2	66 14	yel. oil, 1.885
25	" , tri-	H_2S_3	98 20	bright yel liq
26	" , penta-	H_2S_5	162 32	clear yel. oil
27	telluride	H_2Te	129 63	col. gas or yel. need
28	**Hydroxylamine**	NH_2OH	33 03	wh. need. or col. liq., $1.440^{23.5}$ (lq.), deliq
29	fluogermanate	$2NH_2OH \cdot H_2GeF_6$	254 68	monocl pr. 1.418, 1.438, 1.433
30	fluosilicate	$2NH_2OH \cdot H_2SiF_6 \cdot 2H_2O$	246 17	scales
31	hydrochloride	$NH_2OH \cdot HCl$	69 50	monocl. col.
32	nitrate	$NH_2OH \cdot HNO_3$	96 05	wh
33	sulfate	$2NH_2OH \cdot H_2SO_4$	164 14	monocl. col
34	**Illinium**	Il	146?	
35	**Indium**	In	114 76	tetr. silv. wh. soft metal
36	bromide, mono-	$InBr$	194 68	red-br. solid
37	" , di-	$InBr_2$	274 59	pa. yel. solid
38	" , tri-	$InBr_3$	354 51	wh. to yel. need., deliq
39	perchlorate	$In(ClO_4)_3 \cdot 8H_2O$	557 26	col. deliq. cr.
40	chloride, mono-	$InCl$	150 22	(1) yel. or (2) dk. red, deliq

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	1.78	Stable	−3.3 to −15.5 bet. 1 and 2.5 atm.			
2	1.49	−11	126			
3	2.11^{-15}	−11		s.	s.	
4	1.639^{0} g/l; lq. 1.194^{-86}	−112	−83.7	$82\ 3^{0}$ g	$56\ 1^{60}$ g	327 cm³ al., s. eth., bz
5			110			
6	1.48	−15 35		∞	∞	s. al.
7	lq. $1.46^{18.3}$	−17 7	d	∞		s. al.
8		−24 4	d.	∞		s. al.
9	901 g/l, 699^{20}, 0.6884 lq	−14	26	∞	∞	∞ al., s. eth.
10	921 g/l, lq. .987	−92.3	19.4	∞	v. s	
11			120			
12	5.66^{0} g/l; lq. $2.85^{-4.7}$	−50 8	-35.38^{4} atm	$42\ 500^{10}$ cm³	v. s	s. al.
13	1.70^{15}		127^{774}			
14		−43		∞		
15		−48		∞		
16		−36.5		∞		
17	$1\ 000\frac{4}{4}$, s. $.9168^{0}$	0	100			∞ al.
18	$1\ 4649\frac{0}{4}$	− 89	152 1	∞		s. al., eth.; i. pet. eth.
19	$1\ 529^{0}$ g/l, lq. 746^{-90}	− 133 5	−87 4	26^{17} cm³	i	s. al., eth., Cu_2Cl_2
20	1 012	<−10	57.5^{735}	i.	i.	s. al., turp.
21	1.83^{19}	ign. 160	d.	i.	i.	i. al., s. P, P_2H_4
22	3.614 g/l, lq. $2\ 12^{-42}$	−64	−42	377^{4} cm³	$270^{22.5}$ cm³	s. CS_2, $COCl_2$
23	$1\ 539^{0}$ g/l, lq. 96	−82.9	−61.80	437^{0} cm³	186^{40} cm³	9.54^{20} cm³ al.; s. CS_2
24	1.376	−88	74.5	d.		s. bz., CS_2; i. al.
25	1.496^{15}	−52	d. 90			
26	$1\ 67^{16}$	d.				
27	5.81 g/l; lq. 2.57^{-20}	−51	−4; 0	s. (unst.)		s. al., alk.
28	1.204	33.05	56.5^{22}	s.	d	s. a., al., meth. al.; v. sl. s. eth., chl., bz., CS_2
29	$2\ 229\frac{25}{25}$			s.		s. abs. al.
30				v. s		i. al.
31	1.67^{17}	151	d.	83^{17}	v. s.	s. al., meth. al., glyc.; i. eth.
32		48	d.<100	v. s.	d.	v. s. al.
33		170	d.	32.9^{0}	68.5^{90}	s. eth.; sl. s. al.
34						
35	7.362	155	1450	i.	i.	s. a., v. sl. s. NaOH
36	4.96^{25}	220	662, subl.	d.		s. a.
37	4.22^{25}	235	632, subl.	d.		s. a
38	4.74^{25}	436 ± 2	subl. easily	v. s.		
39		*ca.* 80	d. 200	v. s.	d	s. abs. al.; sl. s. eth.
40	$4\ 19^{25}$ (yel.); $4\ 18^{25}$ (red)	225 ± 1	550 (608)	d.	d.	s. a.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Indium			
1	chloride, di-	$InCl_2$	185.67	wh. cr., deliq
2	" , tri-	$InCl_3$	221 13	wh. pl., deliq
3	cyanide	$In(CN)_3$	192.81	wh. ppt
4	fluoride	InF_3	171 76	
5	"	$InF_3 \cdot 3H_2O$	225 81	cr
6	"	$InF_3 \cdot 9H_2O$	333 91	wh. need
7	hydroxide	$In(OH)_3$	165 78	wh. ppt
8	iodate	$In(IO_3)_3$	639 52	wh. cr
9	iodide, mono-	InI	241 68	br.-red solid
10	" , di-	InI_2	368 60	
11	" , tri-	InI_3	495 52	yel. cr. deliq
12	nitrate	$In(NO_3)_3 \cdot 3H_2O$	354 83	deliq pl
13	"	$In(NO_3)_3 \cdot 4\frac{1}{2}H_2O$	381 86	need , deliq
14	oxide, sub-	In_2O	245 52	blk. cr
15	" , mon-	InO	130 76	wh.-gray
16	" , sesqui-	In_2O_3	277 52	red-br., hot; pa yel., cold, amor. and trig.
17	selenate	$In_2(SeO_4)_3 \cdot 10H_2O$	838 56	deliq. cr
18	sulfate	$In_2(SO_4)_3$	517 70	wh.-gray powd. monocl. pr., hyg
19	"	$In_2(SO_4)_3 \cdot 9H_2O$	679 85	
20	" , acid	$In_2(SO_4)_3 \cdot H_2SO_4 \cdot 7H_2O$	741 89	rhomb
21	sulfide, sub-	In_2S	261 58	yel. to blk. need
22	" , mono-	InS	146 82	dk
23	" , sesqui-	In_2S_3	325 70	red cr or yel ppt
24	sulfite, basic	$2In_2O_3 \cdot 3SO_2 \cdot 8H_2O$	891 35	cr
25	**Iodic acid**	HIO_3	175 93	rhomb. col. or pa. yel. cr powd
26	" " , metaper-	HIO_4	191 93	col
27	" " , paraper-	H_5IO_6 (or $HIO_4 \cdot 2H_2O$)	227 96	monocl. wh., deliq
28	**Iodine**	I_2	253 84	rhomb. vlt.-blk., met. lust., 3.34
29	azide (iod(o)azide)	IN_3	168 94	yellow, exp
30	bromide, mono-	IBr	206 84	dk. gray cr
31	" , tri-	IBr_3	366 67	dk. br. liq
32	chloride, mono-α-	ICl	162 38	cub. need. dk. red; oily red-br. liq
33	chloride, mono-β-	ICl	162 38	rhomb., 6 sided pl., brn.-red
34	" , tri-	ICl_3	233 29	rhomb. yel -br. red, deliq
35	cyanide	ICN	152 94	wh. cr
36	fluoride, penta-	IF_5	221 92	col. liq
37	" , hepta-	IF_7	259 92	col. cr. or liq
38	oxide di- (or tetr-)	IO_2 (or I_2O_4)	158 92	lem. yel. cr
39	" , pent-	I_2O_5	333 84	trim. wh
40	**Iodoplatinic acid**	$H_2PtI_6 \cdot 9H_2O$	1120 91	monocl. blk., deliq
41	**Iodous acid,** hypo- (iodine hydroxide)	HOI	143.93	only in soln., yel. to grnsh
42	**Iridium**	Ir	193 10	cub., silv. wh. met

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	3.655^{25}	235	550–70	d.	d.	
2	4. (3.46)	586; subl. <400	volat. 600	v. s.	v. s.	sl. s. al., eth.
3				unst.		s. HCN; v. sl. s. NaOH; i. dil. a.
4	$4.39^{25} \pm 0.01$	1170 ± 10	>1200			
5		$-3H_2O$, 100		86.4		s. a.; i. al., eth.
6		d.		sl. s.	d.	s. HCl, HNO_3, i. al., eth.
7		$-H_2O$, <150		i.		s. a.; v. sl. s. NaOH; i. NH_4OH
8			d.	0.067^{20}		s. dil. H_2SO_4, HNO_3
9	5.31	351	711-15		slowly d.	s. dil. a.; i. al., eth., chl.
10	4.71^{25}	212				s. a.
11	4.69	210 ± 2 (199)		s. unst.	s.	s. a., chl., bz., xylene
12		$-2H_2O$, 100	d.	v. s.		s. al.
13		$-4\frac{1}{2}H_2O$, 100	d.	v. s.	s.	s. al.
14	6.99^{25}	subl. in vac. 656–700				s. HCl
15				i.		s. a.
16	7.179	d. 850	volat.	i.		amor. s. a.; cr. i. a.
17				v. s.		
18	3.438			s.	v. s.	
19			d. 250	v. s.		
20		$-H_2SO_4+7H_2O$ *ca.* 250		s.		
21	5.87^{25}	653 ± 5				
22	5.18^{25}	692 ± 5	subl. in vac. 850			s. HCl, HNO_3
23	4.90	1050	subl. *ca.* 850 in high vac	i.		s. a.; sl. s. Na_2S
24		$-3H_2O$, 100	$-8H_2O$, 260	i.		s. a.
25	4.629^0	110		286^0	472^{80}	v. s. 87% al., sl. s. HNO_3; i. abs. al., eth., chl.
26			subl. 110	v. s.		
27		d. 140		v. s.	v. s.	s. al., eth.
28	4.93	114	183	0.029^{20}	0.078^{50}	20.5^{15} al., 20.6^{17} eth.; s. chl., glyc., KI, CS_2
29				s. d.		s. $Na_2S_2O_3$
30	4.4157^0	(42); subl. 50	116	s. d.		s. al., eth., chl., CS_2
31				s.		s. al.
32	3.1822^0	27.2	97.4	d. to HIO_3 + Cl		s. HCl, al., eth., CS_2
33	liq. 3.24^{34}	13.92	97.4	d.		s. HCl, al., eth.
34	3.117^{15}	$101^{16 \text{ atm.}}$	77 d.	s. d.		s. bz., CCl_4, al., eth., ac. a.
35				sl. s.	sl. s.	s. al., eth.
36	3.5	−8	97	d.	d.	d. a., alk.
37	liq. 2.8^6	5.5	4.5 subl.	v. s., d.	d.	d. a., alk.
38	4.2^{10}_{10}	d. sly. 75; rap. 130		d. to HIO_3 + I_2		s. H_2SO_4; sl. s. acet.; i. al., eth.
39	4.799^{25}	d. 300–50		187.4^{13}		sl. s. dil. al., i. abs. al., eth., chl., CS_2
40		<100		v. s. d.		
41						
42	22.421	2440 ± 15	4400	i.	i.	amor. s. aq. reg., i. a., aq. reg.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Iridium			
1	bromide, tri-	$IrBr_3 \cdot 4H_2O$	504.91	olv. grn. cryst
2	" , tetra-	$IrBr_4$	512.76	bl., deliq
3	chloride, di-	$IrCl_2$	264.01	blk.-grn. cryst. (exist quest.)
4	" , tri-	$IrCl_3$	299.47	olive grn
5	" , tetra-	$IrCl_4$	334.93	dk. brn.-amor., hyg
6	fluoride, hexa-	IrF_6	307.10	yel. glass or tetr
7	hydroxide	$Ir(OH)_3 \cdot H_2O$ (or $Ir_2O_3 \cdot 5H_2O$)	262.14 (524.28)	olive-grn
8	" , tetra-	$Ir(OH)_4$	261.13	indigo-bl
9	iodide, tri-	IrI_3	573.86	grn
10	" , tetra-	IrI_4	700.78	blk
11	oxide, sesqui-	Ir_2O_3	434.20	bl -blk. (exist. quest)
12	" , di-....	IrO_2	225.10	tetr. blk
13	sulfate	$Ir_2(SO_4)_3 \cdot xH_2O$		yel. pr
14	sulfide, mono-	IrS	225.16	bl. blk
15	" , sesqui-	Ir_2S_3	482.38	br. blk
16	" , di-	IrS_2	257.22	br
17	" , hydro-	$Ir(HS)_3 \cdot 2H_2O$	328.34	choc br
18	**Iron,** pure (*See under Alloys*)	Fe	55.84	cub. silv. metal
19	acetate (ous)	$Fe(C_2H_3O_2)_2 \cdot 4H_2O$	245.99	need
20	" , basic (ic)	$FeOH(C_2H_3O_2)_2$	190.94	br.-red powd
21	*ortho*arsenate (ous)	$Fe_3(AsO_4)_2 \cdot 6H_2O$	553.44	grn. amor. powd
22	" (ic) (scorodite)	$FeAsO_4 \cdot 2H_2O$	230.78	rhomb grn 1.765, 1.774, 1.797
23	arsenide	$FeAs$	130.75	wh
24	" , di- (arsenoferrite)	$FeAs_2$	205.66	cub. silv. gray
25	*ortho*arsenite, basic (ic)	$2FeAsO_3 \cdot Fe_2O_3 \cdot 5H_2O$	607.26	br -yel. powd
26	*pyro*arsenite (ous)	$Fe_2As_2O_5$	341.50	grn.-wh
27	benzoate (ic)	$Fe(C_7H_5O_2)_3$	838.34	br. powd
28	boride	FeB	66.66	gray cryst
29	bromide (ous)	$FeBr_2$	215.67	hex. grn.-yel
30	" (ic)	$FeBr_3$	295.59	dk. red-br., deliq
31	" "	$FeBr_3 \cdot 6H_2O$	403.69	red
32	cacodylate (ic)	$Fe[C_2H_6AsO_2]_3$	466.78	yelsh. amor. powd
33	carbide	Fe_3C	179.53	cub. gray.
34	carbonate (ous) (siderite)	$FeCO_3$	115.85	trig. gray, 1.875, 1.633
35	" (ous)	$FeCO_3 \cdot H_2O$	133.87	amor
36	carbonyl, tetra-	$Fe(CO)_4$	167.88	dk. grn. lust. or
37	"	$Fe_2(CO)_9$	363.77	or. hex. cryst
38	" , penta-	$Fe(CO)_5$	195.89	visc. yel. liq
39	*per*chlorate (ous)	$Fe(ClO_4)_2 \cdot 6H_2O$	362.85	grn
40	chloride (ous) (lawrencite)	$FeCl_2$	126.75	hex. grn to yel., deliq
41	" "	$FeCl_2 \cdot 2H_2O$	162.79	
42	" "	$FeCl_2 \cdot 4H_2O$	198.82	monocl. bl.-grn., deliq
43	" (ferrosoferric)	$FeCl_2 \cdot 2FeCl_3 \cdot 18H_2O$	775.47	yel. deliq
44	" (ic) (molysite)	$FeCl_3$	162.21	hex. blk.-br
45	" "	$FeCl_3 \cdot 6H_2O$	270.31	br.-yel. v. deliq., cr mass
46	chloroplatinate (ous)	$FePtCl_6 \cdot 6H_2O$	571.91	yel. hex
47	*di*chromate (ic)	$Fe_2(Cr_2O_7)_3$	759.74	red-br. gran
48	citrate (ic)	$FeC_6H_5O_7 \cdot 3H_2O(?)$	298.99	red.-br. scales
49	ferricyanide (ous)	$Fe_3[Fe(CN)_6]_2$	591.42	deep bl
50	(" , ic) (Prussian green)	$Fe'''_4Fe''_3[Fe(CN)_6]_6$	1662.57	grn
51	ferricyanide (ic) (Berlin green)	$Fe[Fe(CN)_6]$	267.79	cub.

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		$-3H_2O$, 100		v. s.		i. al.
2		d.		s d.		s. al.
3		d. 773		s.		i. a., alk.
4	5.30	d. 763		i		i. a., alk.
5		d.		s.	d.	s. al., dil. HCl
6	6.0	44 4 (30)	53	d	d.	
7		d.		i.		s. a., alk.
8		$-2H_2O$, 350		i	i.	s. HCl
9				sl. s.	s.	sl. s. al.
10		d. 100		i	i.	s. KI; i. al.
11		−O, 400		i		s. H_2SO_4, h. HCl; i. alk.
12	3.15	d.		i.	i.	i. a., alk.
13		d		s		
14		d.		i		s. K_2S; i. a.
15		d.		sl. s.		s. HNO_3, K_2S
16		d. 300		i		s. aq. reg., i. a.
17		d.		i		s. HNO_3
18	7.86	1535	3000	i	i.	s. a.; i al, alk., eth.
19		d.		v s		
20				i		s. a, al.
21		d		i.	i.	s. dil. HCl; sl. s. NH_4OH
22	3.18	d		i	i.	s. HCl; i. HNO_3
23	7.83	1020		v. sl. s.		
24	7.4	990		i		sl. s. HNO_3; i. HCl
25		d.		sl s.		s. a., alk.
26				i.		s. NH_4OH
27				i.		s. h. eth., al.
28	7.15^{18}			i		s. HNO_3, h. conc. H_2SO_4
29	4.636^{25}	d.		109^{10}	170^{95}	s. al.
30		subl. d		s.	s	s. al., eth., sl. s. NH_3
31		27		v. s.	v. s.	
32				6.67		sl. s. al.
33	7 4	1837		i.	i.	s. a.
34	3 8	d.		0.0067^{25}		s. CO_2 soln.
35		d.		sl. s.		s. a., CO_2 soln.
36	1.996^{18}	d. 140-50		i		s. org. solv.
37	2.085^{18}	d. 100				
38	lq. 1.457	−21	102.8^{749}	i.		s. conc. H_2SO_4, alk., al., eth., bz.
39		d.>100		97.8^{0}	116.1^{60}	86.5^{20} al.; s. $HClO_4$
40	2 98	670-4	subl.	64.4^{10}	105.7^{100}	100 al.; s. acet.; i eth.
41	2.358			160.1^{10}	415.5^{100}	s. al.
42	1.93					
43		d. 50				
44	2.804^{11}	282	315	74.4^{0}	535.7^{100}	v. s. al., eth., 63^{18} acet
45		37	280-5	91.9^{20}	∞	s. al., eth.
46	2 714	d.		v. s.	v. s.	
47				s.		s. a.
48				s.	s.	i. al.
49		d.		i.		i. al., dil. a.
50		d. 180		i.		s. h. HCl
51						

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Iron			
1	ferrocyanide (ous)	$Fe_2Fe(CN)_6$	323.63	amor. bl.-wh.
2	" (ic) (Prussian blue)	$Fe_4[Fe(CN)_6]_3$	859.20	dk. bl. cryst.
3	fluoride (ous)	FeF_2	93.84	
4	" "	$FeF_2 \cdot 4H_2O$	165.90	
5	" "	$FeF_2 \cdot 8H_2O$	237.97	grn.-bl
6	" (ic)	FeF_3	112.84	rhomb. grn
7	" "	$FeF_3 \cdot 4\frac{1}{2}H_2O$	193.91	yel. cryst
8	fluosilicate (ous)	$FeSiF_6 \cdot 6H_2O$	306.00	trig. col., 1.364, 1.385
9	" (ic)	$Fe_2(SiF_6)_3$	537.86	gel., flesh color
10	formate (ic)	$Fe(CHO_2)_3$	190.89	cr., red powd
11	glycerophosphate (ic)	$Fe_2[C_3H_5(OH)_2 \cdot OPO_3]_3$	622.00	yelsh.-grn. scales or powd
12	hydroxide (ous)	$Fe(OH)_2$	89.86	hex. pa. grn. or wh. amor
13	" (ic)	$Fe(OH)_3$ (or $Fe_2O_3 \cdot xH_2O$)	106.86	red.-br
14	iodide (ous)	FeI_2	309.68	hex. gray
15	" "	$FeI_2 \cdot 4H_2O$	381.74	gray-blk. cr., deliq
16	lactate (ous)	$Fe(C_3H_5O_3)_2 \cdot 3H_2O$	288.03	grn.-wh. cr. or powd
17	" (ic)	$Fe(C_3H_5O_3)_3$	323.05	br. amor., deliq
18	malate (ic)	$Fe_2(C_4H_4O_5)_3$	509.90	br. hyg. scales
19	methanearsonate (ic)	$Fe_2(CH_3AsO_3)_3$	525.51	redsh.-br. lust. scales
20	nitrate (ous)	$Fe(NO_3)_2 \cdot 6H_2O$	287.95	rhomb. grn
21	" (ic)	$Fe(NO_3)_3 \cdot 6H_2O$	349.96	cub.
22	" "	$Fe(NO_3)_3 \cdot 9H_2O$	404.01	monocl. col.-pa. vlt., deliq
23	nitride	Fe_2N (or Fe_4N_2)	125.69	gray.
24	"	Fe_4N	237.37	
25	oleate (ic)	$Fe(C_{18}H_{33}O_2)_3$	900.18	br.-red fatty lumps
26	oxalate (ous)	$FeC_2O_4 \cdot 2H_2O$	179.89	rhomb. pa. yel.
27	" (ic)	$Fe_2(C_2O_4)_3$	375.74	amor
28	oxide (ous)	FeO	71.84	blk
29	" (ferrosoferric) (magnetite)	Fe_3O_4	231.52	cub. blk.; red-blk. powd
30	" "	$Fe_3O_4 \cdot xH_2O$		blk
31	" (ic) (hematite)	Fe_2O_3	159.68	hex. red br. to blk., 3.01, 2.94 (Li)
32	2,4-pentanedione deriv. (ic) (acetylacetonate)	$Fe(C_5H_7O_2)_3$	353.16	deep red rhomb
33	*ortho*phosphate (ous) (vivianite)	$Fe_3(PO_4)_2 \cdot 8H_2O$	501.69	monocl. wh.-bl., 1.579, 1.603, 1.633
34	*ortho*phosphate (ic)	$FePO_4 \cdot 2H_2O$	186.89	yel.-wh., dimorph.
35	*pyro*phosphate (ic)	$Fe_4(P_2O_7)_3 \cdot 9H_2O$	907.63	yel.-wh. powd
36	phosphide, mono-	FeP	86.86	rhomb
37	(di-) phosphide	Fe_2P	142.70	bl.-gray cr. or powd
38	(tri-) phosphide	Fe_3P	198.54	gray
39	*hypo*phosphite (ic)	$Fe(H_2PO_2)_3$	250.95	wh. or gray-wh. powd
40	sulfate (ous)	$FeSO_4 \cdot H_2O$	169.92	monocl
41	" "	$FeSO_4 \cdot 4H_2O$	223.96	grn. monocl. pr
42	" " (melanterite)	$FeSO_4 \cdot 7H_2O$	278.01	monocl. bl.-grn., 1.471, 1.478, 1.486
43	" (ic)	$Fe_2(SO_4)_3$	399.86	rhomb. yel.
44	" " (coquimbite)	$Fe_2(SO_4)_3 \cdot 9H_2O$	562.01	rhomb. deliq., 1.552, 1.558
45	sulfide (ous) (troilite)	FeS	87.90	hex. blk.-br.
46	" (ferrosoferric)	Fe_3S_4	295.76	hex., (exist. quest.)
47	" (ic)	Fe_2S_3	207.86	yel., grn
48	", di- (marcasite)	FeS_2	119.96	rhomb. yel
49	" " (pyrite)	FeS_2	119.96	cub. yel
50	sulfite (ous)	$FeSO_3 \cdot 3H_2O$	189.95	grnsh. or wh. cr

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1				i.		
2		d.		i.	i.	s. HCl, H_2SO_4; i. al., eth.
3	3.95-4.33	>1000 (?)		sl. s.		i. al., eth.
4	2.095					
5		$-8H_2O$, 100		sl. s.	s.	s. a., HF; i. al., eth.
6	3.18			sl. s.	s.	s. a.; i. al., eth.
7		$-3H_2O$, 100	d.	sl. s.	s.	i. al.
8	1.961			128.2		
9				s.	s. d.	
10				s.		v. sl. s. al
11				50^{25}		i. al.
12	3.4	d.		0.00067		s. a., NH_4Cl, i. alk.
13	3.4-3.9	$-1\frac{1}{2}H_2O$, 500		i.	i.	s. a.; i. al., eth.
14	5.315	177		s.		
15	2.87	90-8		v. s.	d.	s. al., eth.
16		d.		2.1^{10}	8.5^{100}	s. alk. citrate, v. sl. s. al.
17				s	v. s.	i. eth.
18				s.		s. al.
19				50		i. al., eth.
20		60.5 d.		70^{0}; 83.5^{20}	166.7^{61}	
21		35		s.		
22	1.684	47.2	d.	s	s.	s. al., acet.; sl. s. HNO_3
23	6.35	d 200		i.		s HCl, H_2SO_4
24	6.57 (?)					
25				i.		s a., al., eth.
26	2.28	d. 160		0 022	0.026	s. a.
27		d. 100		v. s.	v. s.	s. a., i. al.
28	5.7	1420		i.	i.	s. a.; i. al., alk.
29	5.18	1538 d.		i.	i.	sl. s. a.; i. al., eth
30		d.		i.	i.	s. a.
31	5.24	1565		i.		s. HCl
32		184		i.		s. al., bz., chl.; sl. s. eth.
33	2.58			i.	i.	s. a.; i. ac. a.
34	2.87	d.		v sl s.	0.67^{100}	s. HCl, H_2SO_4
35				i		s. a., alk. citrates
36	6.07 (5.2^{20})					
37	6.56	1290		i.	i.	s. aq. reg., $HNO_3 + HF$; i dil. a.
38	6.74	1100		i.		
39		d.		0.043^{25}	0.083^{100}	s. alk. citrate
40	2.99-3.08					
41	2.23-.29					
42	1.898	64; $-6H_2O$, 100	$-7H_2O$, 300	15.65	48.6^{50}	i. al.
43	3.097^{18}	d. 480		sl. s.	d.	i. H_2SO_4, NH_3
44	2.1	d.		440	d.	s. abs. al.
45	4.84	1193	d.	$.00062^{18}$		s. a., ev. H_2S; i. NH_3
46	4.55			i.		s. a.
47	4.3	d.		v. sl. s., d.	to FeS+S	d. a.
48	4.87	tr. 450	d.	0.00049		s. HNO_3; i. dil. a.
49	5.00	1171	d.	0.00049		s. HNO_3; i. dil. a.
50		d. 250		v. sl. s.		s. SO_2 soln.; i. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Iron			
1	*d*-tartrate (ous)	$FeC_4H_4O_6$	203.91	cr
2	thiocyanate (ous)	$Fe(SCN)_2{\cdot}3H_2O$	226.04	rhomb. grn
3	" (ic)	$Fe(SCN)_3$ (or $Fe_2(SCN)_6$)	230 07 (460 15)	cub. blk.-red. deliq
4	thiosulfate (ous)	$FeS_2O_3{\cdot}5H_2O$	258 04	grn. cr. deliq
5	*meta*vanadate (ic)	$Fe(VO_3)_3$	352 69	grayish-br. powd
6	**Krypton**	Kr	83 70	col. inert gas
7	**Lanthanum**	La	138 92	lead-gray met
8	acetate	$La(C_2H_3O_2)_3{\cdot}1\frac{1}{2}H_2O$	343 08	
9	bromate	$La(BrO_3)_3{\cdot}9H_2O$	684 81	hex. pr
10	bromide	$LaBr_3{\cdot}7H_2O$	504 78	col. cr
11	carbide	LaC_2	162 94	yel. cryst
12	carbonate	$La_2(CO_3)_3{\cdot}3H_2O$	511 92	trimet. wh
13	chloride	$LaCl_3$	245 29	wh. deliq. cryst
14	"	$LaCl_3{\cdot}7H_2O$	371 40	tricl. wh., hyg
15	hexaantipyrine *perchlo*rate	$[La(C_{11}H_{12}N_2O)_6](ClO_4)_3$	1566 63	col. hex cr
16	hydroxide	$La(OH)_3$	189 94	wh powd
17	iodate	$La(IO_3)_3$	663 68	col
18	iodide	LaI_3	519 68	
19	molybdate	$La_2(MoO_4)_3$	757 69	tetr
20	nitrate	$La(NO_3)_3{\cdot}6H_2O$	433 04	col. deliq
21	oxalate	$La_2(C_2O_4)_3{\cdot}9H_2O$	704 05	wh
22	oxide (lanthana)	La_2O_3	325 84	amor. or rhomb wh
23	sulfate	$La_2(SO_4)_3$	566 02	wh. powd , hyg
24	"	$La_2(SO_4)_3{\cdot}9H_2O$	728 17	hex. col
25	sulfide	La_2S_3	374 02	red-yel. cr
26	**Lead**	Pb	207 21	cub. silv. bl.-wh. soft met
27	acetate	$Pb(C_2H_3O_2)_2{\cdot}3H_2O$	379 35	monocl. wh , β 1.576
28	"	$Pb(C_2H_3O_2)_2{\cdot}10H_2O$	505 46	rhomb. cr
29	" , basic	$Pb_2OH(C_2H_3O_2)_3$	608 56	wh
30	" "	$Pb(C_2H_3O_2)_2{\cdot}Pb(OH)_2{\cdot}H_2O$	584 54	monocl. wh
31	" "	$Pb(C_2H_3O_2)_2{\cdot}2Pb(OH)_2$	807 75	wh. micr. need
32	" , tetra-	$Pb(C_2H_3O_2)_4$	443 39	monocl.
33	*ortho*antimonate	$Pb_3(SbO_4)_2$	993 15	or.-yel. powd., v. pois
34	*pyro*antimonate	$Pb_2Sb_2O_7$	769 94	dk. yel. powd
35	*ortho*arsenate	$Pb_3(AsO_4)_2$	899.45	wh. cr.; v. pois
36	" , di-	$PbHAsO_4$	347 13	monocl. leaf, α 1.90, γ 1.97
37	" , mono-	$Pb(H_2AsO_4)_2$	489 06	tricl., 1.74, 1.82
38	*pyro*arsenate	$Pb_2As_2O_7$	676 24	rhomb., β 2.03
39	*meta*arsenate	$Pb(AsO_3)_2$	453 03	hex. tabl
40	*meta*arsenite	$Pb(AsO_2)_2$	421 03	wh. powd
41	azide	$Pb(N_3)_2$	291 26	col. need
42	benzoate	$Pb(C_7H_5O_2)_2{\cdot}H_2O$	467 45	wh. cr. powd
43	*meta*borate	$Pb(BO_2)_2{\cdot}H_2O$	310 87	cr. wh. powd
44	bromate	$Pb(BrO_3)_2{\cdot}H_2O$	481 06	monocl. col
45	bromide	$PbBr_2$	367 04	rhomb. wh

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1				0.877[16]		
2		d.		v. s.		s. al., eth., acet.
3		d.		s.	v. s.	s. al., eth.
4	...	.		v. s.	d.	v. s. al
5				i.		s. a., i. al
6	3.708[0] g/l, lq. 2.155[-152.9]	−157	−152.9	11.0[0] cm³ 6.0[25] cm³	4.67[50] cm³	
7	6.15	826	1800	d. to $La(OH)_3$	d.	s. a.
8	. .			16.88[25]		
9		37.5	$-7H_2O$, 100	28.5[15]		i. al.
10	5.057[25] anh.	anh. 783 ± 3		v. s.		v. s. al.; i. eth.
11	5.02			d.	d	s. H_2SO_4, i. conc. HNO_3
12				i.		s. dil. a.; sl. s. aq. CO_2; i. acet
13	3.842[25]	872(860)		v. s	d.	v. s. al., pyr.; i. eth., bz.
14	.	d. 91		v. s	v. s.	v. s. al.
15		290-5 d		1.50[20]	.	
16		d.		i.		s. a.
17	. .			1.7[25]	.	
18	5.057[25]	761 ± 2				
19	4.77[16]	1181	...	sl. s.		
20	. .	40	d. 126	151.1[25]	v. s.	v. s. al.; s. acet.
21	. .	d.	. .	.00008[25]		
22	6.51	2315	4200	0.0004[29]	d.	s. a., NH_4Cl, i. acet
23	3.60[15]	d. 1150	.	3.0	0.69[100]	sl. s. al., i. acet.
24	2.821	d.		3.8[0]	0.87[100]	sl. s. HCl, al.
25	4.997^{0}_{0}; 4.911[11]	2100–2150 vac.		d.	d.	s. a.
26	11.3437[16] 11.288^{20}_{20} Ra Pb 11.2960[16] U Pb	327.43	1613	i.	i.	s. HNO_3, h. conc. H_2SO_4
27	2.55	75, anh. 280		45.61[15]	200[100]	i. al.
28	1.69	22		s.		i. al.
29	.	..		v. s		sl. s. al.
30		....		v. s.		v. s. al.
31		..		5.55	18.2	s. al.
32	2.228[17]	175		d.		d. al.; s. chl., hot ac. a.
33		.		i.		
34	6.72			i.	i.	v. sl. s. HCl
35	7.30	1042; sl. d. 1000	..	v. sl. s.		s. HNO_3
36	5.79	d. > 200	$-H_2O$, 280	i.	sl. s	s. HNO_3, caust. alk.
37	4.46[15]	d. 140	. .	d.		s. HNO_3
38	6.85	802		i.	d.	s. HCl, HNO_3; i. ac. a.
39	6.42[15]		. .	d.	d.	s. HNO_3
40	5.85	.	....	i.		s. HNO_3
41	.	exp. 350	....	0.023[18]	0.09[70]	v. s. ac. a.; i. NH_4OH
42	.	$-H_2O$, 100	....	0.16[20]	0.31[49.5]	.
43	5.598 anh.	.	$-H_2O$, 160	i.	i.	s. a.; i. alk.
44	5.53	d. 180	......	1.38[20]	.	
45	6.66	373	916	0.4554[0], 0.8441[20]	4.71[100]	s. a., KBr, sl. s. NH_3, i. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Lead			
1	caprate	$Pb(C_{10}H_{19}O_2)_2$	549.72	
2	caproate	$Pb(C_6H_{11}O_2)_2$	437.51	
3	caprylate	$Pb(C_8H_{15}O_2)_2$	493.61	wh. leaf
4	carbonate (cerussite)	$PbCO_3$	267.22	rhomb. col., 1.804, 2.076, 2.078
5	" , basic (white lead, hydrocerussite)	$2PbCO_3 \cdot Pb(OH)_2$	775.67	wh. hex. or amor. powd., 2.09, 1.94
6	cerotate	$Pb(C_{26}H_{51}O_2)_2$	998.56	wh. need. fr. bz
7	chlorate	$Pb(ClO_3)_2$	374.12	monocl. wh
8	"	$Pb(ClO_3)_2 \cdot H_2O$	392.14	monocl. wh., deliq
9	*per*chlorate	$Pb(ClO_4)_2 \cdot 3H_2O$	460.17	rhomb
10	chloride (cotunnite)	$PbCl_2$	278.12	rhomb. wh., 2.199, 2.217, 2.260
11	" , tetra-	$PbCl_4$	349.04	yel. oily liq
12	" sulfide	$PbCl_2 \cdot 3PbS$	995.93	red
13	chlorite	$Pb(ClO_2)_2$	342.12	monocl. yel
14	chromate (crocoite, chrome yellow)	$PbCrO_4$	323.22	monocl. yel., 2.31, 2.37 (Li), 2.66
15	chromate, basic	$Pb_2(OH)_2CrO_4$	564.45	red, amor. or cr
16	" , " (chrome red)	$PbCrO_4 \cdot PbO$	546.43	red cr. powd
17	*di*chromate	$PbCr_2O_7$	423.23	red cr
18	citrate	$Pb_3(C_6H_5O_7)_2 \cdot 3H_2O$	1053.88	wh. cr. powd
19	cyanate	$Pb(OCN)_2$	291.25	wh. need
20	cyanide	$Pb(CN)_2$	259.25	yelsh.-wh. pois. powd
21	enanthate	$Pb(C_7H_{13}O_2)_2$	465.56	wh. leaf
22	ferricyanide	$Pb_3[Fe(CN)_6]_2 \cdot 5H_2O$ (or $6H_2O$)	1135.61 (1153.62)	blk.-brn. to red, monocl. pr
23	ferrite	$Pb(FeO_2)_2$	382.89	hexag
24	ferrocyanide	$Pb_2Fe(CN)_6 \cdot xH_2O$		yelsh.-wh. powd
25	fluoride	PbF_2	245.21	col
26	fluosilicate	$PbSiF_6 \cdot 2H_2O$	385.30	monocl. col
27	"	$PbSiF_6 \cdot 4H_2O$	421.33	monocl
28	formate	$Pb(CHO_2)_2$	297.25	rhomb wh. lust., 1.789, 1.852, 1.877
29	hydroxide	$Pb(OH)_2$	241.23	wh. amor
30	"	$Pb_2O(OH)_2$ (or $2PbO \cdot H_2O$)	464.44	cub. or wh amor. powd
31	iodate	$Pb(IO_3)_2$	557.05	wh
32	*paraper*iodate	$PbHIO_5$	415.14	cryst
33	"	$PbHIO_5 \cdot H_2O$	433.15	amor
34	iodide, mono-	PbI	334.13	pa. yel
35	" , di-	PbI_2	461.05	hex. yel. powd
36	isobutyrate	$Pb(C_4H_7O_2)_2$	381.40	wh. pr
37	laurate	$Pb(C_{12}H_{23}O_2)_2$	605.82	chalky white powd
38	lignocerate	$Pb(C_{24}H_{47}O_2)_2$	942.45	wh. powd
39	melissate	$Pb(C_{31}H_{61}O_2)_2$	1138.82	wh. powd
40	molybdate (wulfenite)	$PbMoO_4$	367.16	yel.-wh. powd. or pl., oct
41	myristate	$Pb(C_{14}H_{27}O_2)_2$	661.93	wh. powd
42	2-naphthalenesulfonate	$Pb(C_{10}H_7SO_3)_2$	621.64	wh. cr. powd., pois
43	nitrate	$Pb(NO_3)_2$	331.23	cub. or monocl. col., 1.782
44	" , basic	$Pb(OH)NO_3$	286.23	rhomb. cr
45	oleate	$Pb(C_{18}H_{33}O_2)_2$	770.10	wh. powd
46	oxalate	PbC_2O_4	295.23	heavy, wh. powd
47	oxide, sub-	Pb_2O	430.42	amor. blk

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		103–4		i.	i.	0.00290^{20} eth.
2		73–4				1.09^{25} eth.
3		83.5–84.5		i.	i.	s. al.; 0.0938^{20} eth.
4	6.6	d. 315		0.00011^{20}	d.	s. a., alk., i. al., NH_3
5	6.14	d. 400		i.	i.	sl. s. aq. CO_2
6		112.5–3.5		i.		i. al., eth.
7	3.89	d.		v. s.		s. al.
8	4.037	d. 110		151.3^{18}	171^{80}	s. al.
9	2.6	d. 100		499.7^{25}		s. al.
10	5.85	501	950	0.673^{0}; 0.99^{20}	3.34^{100}	sl. s. dil. HCl, NH_3, i. al
11	3.18^{0}	−15	exp. 105	d. ev. Cl_2	d.	s. conc. HCl
12				i.	d.	d. a., alk., i. dil. a
13		exp. 120		0.095^{20}	0.42^{100}	s. KOH
14	6.3 (6.12^{15})	844	d.	$.0000058^{25}$	i.	s. a., alk.; i. ac. a., NH_3
15		920		i.		1.019/100 ml. 2 N KOH
16				i.	i.	s. a., alk.
17				d.		s. a., alk.
18				s.		
19		d.		i.	sl. s	
20				sl. s	s	s. KCN
21		79–80			sl. s	i. al.
22	1.037^{0} (satd. soln.)	$-H_2O$, 110–120, d		sl. s.	s., d 100	s. HNO_3, alk.
23		1530; d.>725				
24		$-H_2O$, 100		i.		sl. s. H_2SO_4
25	8.24	855	1290	0.064^{20}		s. HNO_3, i. acet., NH_3
26		d.		s.	v. s.	
27		<100, d.				
28	4.63	d. 190		1.6^{16}	20^{100}	i. al.
29		d. 145		0.0155^{20}	sl. s.	s. a., alk., i. acet.
30	7.592	d. 145		.014	sl. s.	s. HNO_3, alk., ac. a.
31		d. 300		0.0012^{2}	0.003^{95}	sl. s. HNO_3; i. NH_3
32		d. 130		i.	i.	s. dil. HNO_3
33		$-H_2O$, 110		i.	i.	sl. s. dil. HNO_3
34		d. 300		.01		
35	6.16	402 (393)	954 (900)	$.044^{0}$; 0.063^{20}	0.41^{100}	s. alk., KI; i. al.
36		<100		9.1^{16}		
37		104.7		0.009^{15}		0.008^{25} al.; $0.007^{14.5}$ eth
38		117		i.		v. s. boil. bz., sl. s. al., i. eth.
39		115–16		i.	i.	s. boil. tol., ac. a.; sl. s. h bz., chl.; i al., eth.
40				i.		d. conc. H_2SO_4; s. a., KOH, i. al.
41		107		0.005^{35}	0.006^{50}	0.004^{25} al., $0.010^{14.5}$ eth.
42				i.		s. al
43	4.53^{20}	d. 470		37.65^{0}; 56.5^{20}	127^{100}	8.77^{22} 43% al.; s. NH_3, alk.
44	5.93	180 d.		$19.4^{19.2}$	s.	s. a.
45				i.		6.46^{20} eth.; s. pet. eth.; sl. s. al.
46	5.28	d. 300		0.00016^{18}		s. HNO_3; i. al.
47	8.342	d.		i.	i.	s. a., alk.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Lead			
1	oxide, mono- (litharge)	PbO.	223.21	tetr. yel., 2.665 (Li), 2.535 (Li)
2	" " (massicot)	PbO	223.21	rhomb. yel., 2.51, 2.61 (Li), 2.71
3	" , red (minium)..	Pb_3O_4.	685.63	cr. sc. or red amor. powd .
4	" , sesqui- .	Pb_2O_3	462.42	amor. or.-yel. powd...
5	" , di- (plattnerite)	PbO_2	239.21	tetr. br., ω 2.3 (Li)
6	oxychloride (matlockite)	$PbCl_2·PbO$	501.33	tetr. wh., 2.04, 2.15, 2.15
7	" (laurionite)	$PbCl_2·PbO·H_2O$	519.35	rhomb
8	" (paralaurionite)	$PbCl_2·PbO·H_2O$	519.35	monocl., pr., col. to wh., 2.146
9	" (mendipite)	$PbCl_2·2PbO$	724.54	rhomb. yel., 2.24, 2.27, 2.31
10	"	$PbCl_2·3PbO$	947.75	yel ......
11	" (Cassel yellow)	$PbCl_2·7PbO$	1840.59	yel. cr., or powd
12	palmitate	$Pb(C_{16}H_{31}O_2)_2$	718.03	chalky wh. powd .
13	*ortho*phosphate	$Pb_3(PO_4)_2$	811.67	hex. col. or wh. powd., 1.970, 1.936
14	*ortho*phosphate, di-	$PbHPO_4$	303.24	rhomb. monocl. (?)
15	" , mono-	$Pb(H_2PO_4)_2$	401.28	need
16	*pyro*phosphate	$Pb_2P_2O_7$	588.46	rhomb. wh
17	"	$Pb_2P_2O_7·H_2O$	606.48	rhomb
18	*meta*phosphate	$Pb(PO_3)_2$	365.25	col. cr
19	*ortho*phosphite	$PbHPO_3$	287.24	wh. powd .
20	picrate	$Pb(C_6H_2N_3O_7)_2·H_2O$	681.43	yel. need
21	selenide (clausthalite)	$PbSe$	286.17	cub ...
22	*meta*silicate (alamosite)	$PbSiO_3$	283.27	monocl. col. or wh . .
23	sulfate (anglesite)	$PbSO_4$.	303.27	monocl. or rhomb. wh., 1.877, 1.882, 1.894
24	" , basic (lanarkite)	$PbSO_4.PbO$	526.48	monocl. wh., 1.93, 1.99, 2.02
25	*peroxydi*sulfate	$PbS_2O_8·3H_2O$	453.38	deliq .
26	sulfate, acid	$Pb(HSO_4)_2·H_2O$	419.36	cryst
27	sulfide (galena)	PbS .	239.27	cub. bl. metallic, 3.912
28	sulfite	$PbSO_3$.	287.27	wh. powd
29	stearate	$Pb(C_{18}H_{35}O_2)_2$	774.14	wh. powd
30	tartrate	$PbC_4H_4O_6$	355.28	wh. cr. powd
31	thiocyanate	$Pb(SCN)_2$	323.37	monocl. wh . .
32	*di*thionate	$PbS_2O_6·4H_2O$	439.39	trig., 1.635, 1.653 . .. ...
33	thiosulfate	PbS_2O_3.	319.33	wh. cr . . .. . .
34	*meta*titanate	$PbTiO_3$	303.11	yel. rhomb. pyr .. ..
35	tungstate (raspite)	$PbWO_4$	455.13	monocl. col., 2.27, 2.27, 2.30
36	" (stolzite)	$PbWO_4$	455.13	tetr., 2.269, 2.182
37	*meta*vanadate	$Pb(VO_3)_2$	405.11	yel. powd ..
38	**Lithium**	Li	6.94	cub. silv. wh. soft met., μ_c 3.16
39	acetate	$LiC_2H_3O_2·2H_2O$.	102.02	rhomb. wh., α 1.40, β 1.50
40	acetylsalicylate	$LiC_9H_7O_4$	186.09	sl. hyg. powd., d. in moist air
41	amide	$LiNH_2$	22.96	cub. col
42	*ortho*arsenate	Li_3AsO_4	159.73	wh. powd. rhomb
43	benzoate	$LiC_7H_5O_2$	128.05	wh. cr. or powd
44	*meta*borate	$LiBO_2$	49.76	wh. powd., tricl
45	"	$LiBO_2·8H_2O$.	193.89	trig
46	*tetra*borate	$Li_2B_4O_7·5H_2O$	259.24	.
47	bromide	$LiBr$.	86.86	cub. wh., deliq .
48	carbide .	Li_2C_2	37.90	cr. or wh. powd
49	carbonate..	Li_2CO_3	73.89	monocl. col., 1.428, 1.567, 1.572
50	" , acid (bicarbonate)	$LiHCO_3$	67.96	wh

No.	Sp gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	9.53	888		0.0017^{20}		s. HNO_3, alk., lead acet., NH_4Cl, $CaCl_2$, $SrCl_2$
2	8.0			0.0023^{22}	i.	s. alk.
3	9.1	d. 500		i.	i	s. ac. a., h. HCl; i. al.
4		d. 370		i.	d.	d. a. to Pb salts + PbO_2
5	9.375	d. 290		i.	i.	s. dil. HCl; sl. s. ac. a.; i. al.
6	7.21	d. 524		0.0095^{18}		s. alk.
7	6.24	d. 142				
8	6.05^{15}	d. 150				
9	7.08	693		i.	i	s. alk.
10				0.0056^{15}	0.07^{14}	
11				i.		
12		112.3		0.005^{35}	0.007^{40}	s. al., 0.148^{20} eth.
13	6.9-7.3	1014		0.000014^{20}	i	s. HNO_3, alk.; i. ac. a.
14	5.661^{15}	d.				s. HNO_3, KOH, NaOH, NH_4Cl
15						s. KOH, NaOH, dil. HNO_3, h. conc. HCl; i. 50% acet. a.
16	5.8	824		i.	i.	s. HNO_3, KOH
17		806 anh		i.	d	s. HNO_3, KOH, $Na_4P_2O_7$
18		800 (?)		v. sl. s		
19		d.		i.	i.	s. HNO_3
20	2.831^{20}	$-H_2O$, 130	expl	0.88^{15}		
21	8.10^{15}	1065		i.		s. HNO_3
22	6.49	766		i		d. a.
23	6.2	d. 1000		0.00425^{25}	0.0056^{40}	s. NH_4 salts; sl. s. conc. H_2SO_4; i. al.
24	6.92	977		0.0044^{0}	v. sl. s	sl. s. H_2SO_4
25				v s		
26		d.		0.0001^{18}d		sl. s. H_2SO_4
27	7.5	1114		000086		s. a., i. KOH, al.
28				i.	i.	s. HNO_3
29		115.7		0.005^{35}	0.006^{50}	$0.005^{14.5}$ eth.; i. al.
30	2.53^{19}			0.0025^{20}	0.0074^{100}	s. HNO_3, KOH; i. al., ac. a., amm. acetate
31	3.82			0.05^{20}	d.	s. KCNS, HNO_3
32	3.22	d.		$115.0^{20.5}$		
33	5.18	d.		0.03		s. a., $Na_2S_2O_3$
34	7.52			i.	i.	
35		1123		0.03		d. a.; i. al.
36	8.23			i.		s. KOH; i. HNO_3
37				sl. s.		d. HCl, s. dil. HNO_3
38	0.534	186	1609 ± 5	d to Li	OH + H_2	d. al.; s. a.
39		70	d.	300^{15}	v. s.	21.5 al.
40				100		25 al.
41	1.178	373-375	430	d.	d.	
42	3.07^{15}			v. sl. s.		s. dil. ac.; i. pyr.
43				33^{25}	40^{100}	7.7^{25}, 10^{78} al.
44		840-5		sl. s.		. . .
45	$1.38^{14.7}$	47			.	. .
46		$-2H_2O$, 200		v. s.		i. al.
47	3.464^{25}	547	1265	142.7^{0}	243.6^{82}	s. al., eth.
48	1.65^{18}			d.	d.	s. a.
49	$2.111^{17.5}$	618	d	1.54^{0}, 1.33^{20}	0.72^{100}	s. a.; i. acet. NH_3, al.
50				5.5^{13}		

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Lithium			
1	chlorate	$LiClO_3$	90.40	rhomb. need
2	"	$LiClO_3\cdot\frac{1}{2}H_2O$ (or $\frac{1}{3}H_2O$)	99 41 (96 40)	tetr., deliq
3	*per*chlorate	$LiClO_4$	106 40	col. deliq
4	"	$LiClO_4\cdot 3H_2O$	160 45	hex. col
5	chloride	$LiCl$	42 40	cub. wh, deliq
6	"	$LiCl\cdot H_2O$	60 41	
7	chloroplatinate	$Li_2PtCl_6\cdot 6H_2O$	529 95	hex. or red, deliq
8	chromate	$Li_2CrO_4\cdot 2H_2O$	165 92	rhomb. or.-yel., deliq
9	*di*chromate	$Li_2Cr_2O_7\cdot 2H_2O$	265 93	blk.-br., deliq
10	citrate	$Li_3C_6H_5O_7\cdot 4H_2O$	281 99	col. cr. or wh. powd., deliq
11	fluoride	LiF	25 94	cub. col
12	fluosilicate	$Li_2SiF_6\cdot 2H_2O$	191 97	monocl. wh., 1.300, 1 296
13	formate	$LiCHO_2\ H_2O$	69 97	rhomb. col
14	*meta*germanate	Li_2GeO_3	134 48	monocl., 1.7
15	hydride	LiH	7 95	col
16	hydroxide	$LiOH$	23 95	wh cr. or powd. tetr
17	"	$LiOH\cdot H_2O$	41 96	monocl. col
18	iodate	$LiIO_3$	181 86	hex. wh
19	iodide	LiI	133 86	cub. wh., deliq
20	"	$LiI\cdot 3H_2O$	187 91	hex. col.-yelsh
21	laurate	$LiC_{12}H_{23}O_2$	206 25	wh. powd
22	*per*manganate	$LiMnO_4\cdot 3H_2O$	179 92	cub
23	molybdate	Li_2MoO_4	173 83	trig
24	myristate	$LiC_{14}H_{27}O_2$	234 30	
25	nitrate	$LiNO_3$	68 95	trig. col. deliq., 1 735, 1 435
26	"	$LiNO_3\ 3H_2O$	123 00	col
27	nitride	Li_3N	34 83	red.-brn. amor. or blk. to gray cub. cr
28	nitrite	$LiNO_2\cdot H_2O$	70 96	flat need
29	oxalate	$Li_2C_2O_4$	101 90	col. cr
30	", acid	$LiHC_2O_4\cdot H_2O$	113 98	
31	oxide	Li_2O	29 88	cub. wh. cr
32	palmitate	$LiC_{16}H_{31}O_2$	262 35	wh powd
33	*ortho*phosphate	Li_3PO_4	115 84	rhomb col
34	"	$2Li_3PO_4\cdot H_2O$	249 70	wh. cr. powd.
35	potassium *dl*-tartrate	$LiKC_4H_4O_6\cdot H_2O$	212 12	monocl., β 1.523 (red)
36	salicylate	$LiC_7H_5O_3$	144 05	wh. powd., deliq
37	selenide	$Li_2Se\ 9H_2O$	254 99	rhomb., col. deliq
38	*ortho*silicate	Li_4SiO_4	119 82	rhomb. col., α 1.594, γ 1.614
39	*meta*silicate	Li_2SiO_3	89 94	rhomb. col., lq. 1.548[25], α 1.584, γ 1 604
40	silicide	Li_6Si_2	97 76	bl. cr., hyg
41	sodium aluminum fluoride (cryolithionite)	$3LiF\cdot 3NaF\cdot 2AlF_3$	371 75	cub. cr. 1.3395
42	stearate	$LiC_{18}H_{35}O_2$	290 40	wh. cr
43	sulfate	Li_2SO_4	109 94	col. α monocl., β hex. or rhomb. → γ cub. 500° C; β 1.465
44	"	$Li_2SO_4\cdot H_2O$	127.96	monocl. col., 1 460, 1.477, 1.488
45	", acid	$LiHSO_4$	104 01	pr

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		124.9	d. 270	313.5^{18}	v. s.	
2		(50) 65	$-\frac{1}{2}H_2O$, 90; d. 290	313.5^{18}	∞	v. s. al.
3	2.429	236	d. 380	59.7^{25}		s. al.
4	1.841	95	$-2H_2O$, 100, $-3H_2O$, 150	s.	s.	v. s. al.
5	2.068^{25}	613	1353	45.4^{25}	127.5^{100}	2.48^{25} al., 5.2^{1} meth. al.; 3.94^{25} acet.; s. eth.
6	1.78	$-H_2O$, >98				
7			$-6H_2O$, 180	s.	s.	s. al.; i. eth.
8			$-2H_2O$, 150	141^{18}	128^{10}	
9		$-2H_2O$, 130	d.	151^{30}		
10		d.		74.5^{25}	66.7^{100}	sl. s. al., eth.
11	2.601	870	1676	0.27^{18}		s. a., HF, i. al., acet.
12	2.33^{12}	$-2H_2O$, 100	d.	52.6^{17}		s. al., i. eth., acet.
13	1.46	d.		24.42^{0}	57.64^{104}	s. form. a.
14	3.53^{21}	1239		0.85^{25}		s. a.
15	0.82	680		d. to LiOH + H_2		
16	1.43	450	d.	12.7^{0}	17.5^{100}	sl. s. al.
17				11.28^{10}	$11.68^{45.5}$, 14.9^{100}	sl. s. al.
18				125^{15}		
19	4.061^{25}	446	1190	s.	s.	251^{25} al., v. s. NH_3
20	3.48	73; $-H_2O$, 73	$-2H_2O$, 80; $-3H_2O$, 300	151^{0}	201.2^{60}	s. abs. al., acet.
21		229 2 8		$0.154^{16.3}$, 0.187^{25}		0.322^{25} al., $0.008^{15.5}$ eth.; 0.240^{15} acet.
22	2.06	d. 190				
23		705				
24		223.6 4.2		$0.027^{16.3}$, 0.036^{25}	0.062^{40}	$0.010^{15.8}$ eth, 0.331^{15} acet; 0.155^{20} al
25	2.38	255		52.2	$66.1^{70.9}$	s. al., acet.
26		29.88, $-2\frac{1}{2}H_2O$, 29.9	$-3H_2O$, 61.1	$34.8^{0.1}$	$57.48^{29.6}$	
27		840 5				
28	1.615^{0}	<100	d.	125^{0}	459^{50}	v. s. abs. al.
29	$2.121^{17.5}$	d.		8^{19}		
30		d.		8^{17}		
31	$2.013^{26.2}$	>1700		6.67^{0} d.	10.02^{100}	
32		224.5		0.01^{18}	0.015^{45}	0.347^{15} acet., 0.077^{20} al., $0.005^{15.5}$ eth.
33	$2.537^{17.5}$	837		0.039^{18}		s. a., NH_4OH; i. acet.
34	2.41			0.04		s. a.
35	1.610			s.		
36		d.		133.3		50 al.
37				d.		
38	2.28	1256		i.	d.	
39	2.52^{25}	1201		i.	s. d.	s. dil. HCl
40	*ca* 1.12	d.		d.	d.	d. a.; i. NH_3, turp.
41	2.774–8	710		0.074^{18}		
42		220.5–1.5		0.010^{18}		0.010^{25} al., 0.040^{18} eth., 0.457^{15} acet.
43	2.221	860		26.1^{0}	23^{100}	i. abs. al., acet.
44	2.06	$-H_2O$, 130		34.6^{20}	29.5^{100}	i. abs. al.
45	2.123^{13}	120		d.		

No.	Name	Formula	Mol wt.	Crystalline form, color and index of refraction
	Lithium			
1	sulfide	Li_2S	45 94	cub. wh.-yel
2	" , hydro-	$LiHS$	40 01	wh. powd. hyg
3	sulfite	$Li_2SO_3 \cdot H_2O$	111.96	need
4	tartrate	$Li_2C_4H_4O_6 \cdot H_2O$	179 97	wh. cr. powd
5	thallium *dl*-tartrate	$LiTlC_4H_4O_6 \cdot 2H_2O$	395 43	tricl
6	thiocyanate	$LiSCN$	65 02	deliq., wh. cr
7	tungstate	Li_2WO_4	261 80	trig. col
8	urate, acid	$LiHC_5H_2N_4O_3$	174 05	wh. powd
9	*meta*vanadate	$LiVO_3 \cdot 2H_2O$	141 92	yelsh. powd
10	**Lutecium** (cassiopeium)	Lu	175 00	
11	**Magnesium**	Mg	24 32	hex. silv. wh. met
12	acetate.	$Mg(C_2H_3O_2)_2 \cdot 4H_2O$	214 47	monocl. col., β 1.491
13	aluminate (spinel)	$MgAl_2O_4$	142 26	cub. col., 1.723
14	antimonide	Mg_3Sb_2	316 48	metallic
15	*ortho*arsenate (hoernesite)	$Mg_3(AsO_4)_2 \cdot 8H_2O$	494 91	monocl. wh
16	"	$Mg_3(AsO_4)_2 \cdot 22H_2O$	747 14	
17	" , mono-H (roesslerite)	$MgHAsO_4 \cdot 7H_2O$	290 35	monocl
18	*ortho*arsenite	$Mg_3(AsO_3)_2$	318 78	
19	benzoate	$Mg(C_7H_5O_2)_2 \cdot 3H_2O$	320 59	wh. powd
20	*ortho*borate	$Mg_3(BO_3)_2$	190 60	rhomb. col
21	*pyro*borate (ascharite)	$Mg_2B_2O_5 \cdot H_2O$	168 30	orthorhomb
22	*meta*borate (pinnoite)	$MgB_2O_4 \cdot 3H_2O$	164 01	yel tetr. pyram 1.565, 1.575
23	"	$MgB_2O_4 \cdot 8H_2O$.	254 09	tetr., 1.565, 1.575
24	bromate	$Mg(BrO_3)_2 \cdot 6H_2O$	388 25	cub. col., 1.514
25	bromide	$MgBr_2$	184 15	lg lust. wh. cr., deliq
26	"	$MgBr_2 \cdot 6H_2O$	292 25	hex col. pr. & need , fluo in X-Rays
27	bromoplatinate	$MgPtBr_6 \cdot 12H_2O$	915 24	trig
28	carbonate (magnesite)	$MgCO_3$	84 33	trig. wh., 1.717, 1 515
29	" (nesquehonite)	$MgCO_3 \cdot 3H_2O$	138 38	rhomb. col. need , 1 495, 1.501, 1.526
30	" (lansfordite)	$MgCO_3 \cdot 5H_2O$	174 41	monocl 1.456, 1 468, 1.507
31	" , basic (artinite)	$MgCO_3 \cdot Mg(OH)_2 \cdot 3H_2O$	196 71	rhomb., 1.489, 1.534, 1.557
32	" " (hydromagnesite)	$3MgCO_3 \cdot Mg(OH)_2 \cdot 3H_2O$	365 37	rhomb. wh , 1.527, 1.530, 1.540
33	chlorate	$Mg(ClO_3)_2 \cdot 6H_2O$	299 33	wh. cr or powd deliq
34	*per*chlorate	$Mg(ClO_4)_2$	223 23	
35	"	$Mg(ClO_4)_2 \cdot 6H_2O$	331 33	
36	chloride	$MgCl_2$	95 23	wh. lust hex cr., 1.675, 1.59
37	" (bischofite)	$MgCl_2 \cdot 6H_2O$	203 33	monocl. col. deliq., 1.495, 1.507, 1 528
38	chloropalladate	$MgPdCl_6 \cdot 6H_2O$	451 86	hex
39	chloroplatinate	$MgPtCl_6 \cdot 6H_2O$	540 39	trig
40	chlorostannate	$MgSnCl_6 \cdot 6H_2O$	463 86	tri
41	chromate	$MgCrO_4 \cdot 7H_2O$	266 44	rhomb. yel , 1 521, 1.550, 1 568
42	citrate.	$Mg_3(C_6H_5O_7)_2 \cdot 14H_2O$	703 39	wh. gran powd
43	ferrite (magnesioferrite)	$MgFe_2O_4$	200 00	oct. blk., 2 35
44	ferrocyanide	$Mg_2Fe(CN)_6 \cdot 12H_2O$	476 78	pa. yel. cr
45	fluoride (sellaite).	MgF_2	62 32	tetr. col. faint vlt. lumin., 1.378, 1.390

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	1.66			v. s.	v. s.	v. s. al.
2				s.	s.	s. al.
3		455 sl. d.	$-H_2O$, 180–200	s.	s.	i. al.
4				s.		
5	3.144					
6				v. s.		s. methyl acetate
7		742		v. s.	v. s.	d. a., i. al.
8				$.27^{20}$	2.5^{100}	sl. s. al.
9				s.		
10						
11	1.74^5	651	1100–1120	i.	sl. s., d. to $Mg(OH)_2$	s. min. a. except CrO_3, conc. HF, NH_4 salts, i. alk.
12	1.454	d.		36.2^0, 61.1^{15}	66.4^{65}	v. s. al.
13	3.6	2135				v. sl. s. dil. HCl; i. dil. HNO_3
14		961		i.		
15	2.60–.61					
16	1.788			i.	i.	s. a., NH_4Cl
17	3.155^{15}	$-5H_2O$, 100		d.		
18				s.	v. s.	s. a., NH_4Cl; i. NH_4OH
19		d. 200 (?), $-3H_2O$, 110		6.10^{15}	19.6^{100}	s. al.
20	2.99^{21}			s.	s.	s. min. a.; i. ac. a.
21	2.60–.70					
22	2.27–.30					
23	2.30			i.	i. (v. sl. s.)	s. a.
24	2.29	$-6H_2O$, 200	d.	42^{18}	v. s.	i. al.
25	3.72	700 (695)		47.9^0; 49.1^{20}	53.2^{80}, 54.6^{100}	6.9^0 al.; 21.8^{20} meth. al.
26	2.00?	165 d.		316^0	v. s.	s. al., acet.; sl. s. NH_3
27	2.802					
28	3.037	d. 350	$-CO_2$, 900	0.0106		s. a., aq. CO_2; i. acet., NH_3
29	1.850	165		0.129^{25}	d.	s. a.; 1.4 aq. CO_2
30	1.69–.73					
31	2.02^{20}					
32	2.16	d.		0.04	0.011	s. a., NH_4 salts
33	1.80^{25}	35	d. 120	56.5^{18}	73.7^{93}	s. al.
34	2.60^{25}	251 d.		49.90^{25}	v. s.	
35	1.970^{25}	147				
36	2.316	708	1412	35.3^{20}	42.2^{100}	50 al.
37	1.56	d. 116–8	d.	167	367	50 al.
38	2.12	d.				
39	2.437	d.				
40	2.08	d. 100				
41	1.695			211.5^{18}	v. s.	
42				sl. s.		s. a.
43	4.44–.60	1750 ± 25				s. conc. HCl; i. h. HNO_3, al., dil. a.
44		d. *ca.* 200		33		
45	2.9–3.2	1396	2239	$.0076^{18}$	i.	s. HNO_3; sl. s. a.; i. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Magnesium			
1	fluosilicate	$MgSiF_6$	166 38	wh cr. or powd
2	"	$MgSiF_6 \cdot 6H_2O$	274 48	trig. wh
3	formate	$Mg(CHO_2)_2 \cdot 2H_2O$	150 39	rhomb. col
4	*ortho*germanate	Mg_2GeO_4	185 24	wh ppt
5	hydroxide (brucite)	$Mg(OH)_2$	58 34	trig. col., 1.559, 1.580
6	iodate	$Mg(IO_3)_2 \cdot 4H_2O$	446 22	monocl
7	iodide	MgI_2	278 16	wh cr, deliq
8	"	$MgI_2 \cdot 8H_2O$	422 29	wh. deliq. powd
9	lactate	$Mg(C_3H_5O_3)_2 \cdot 3H_2O$	256 51	wh. cr powd., v. bitter taste.
10	laurate	$Mg(C_{12}H_{23}O_2)_2 \cdot 2H_2O$	458 97	wh. lumps ..
11	*per*manganate	$Mg(MnO_4)_2 \cdot 6H_2O$	370 28	dk purp. need. deliq.
12	myristate	$Mg(C_{14}H_{27}O_2)_2$	479 04	wh powd
13	nitrate	$Mg(NO_3)_2 \cdot 2H_2O$	184 37	pr
14	"	$Mg(NO_3)_2 \cdot 6H_2O$	256 43	monocl. col deliq
15	nitride	Mg_3N_2	100 98	grn. yel. cr ..
16	oleate	$Mg(C_{18}H_{33}O_2)_2$	587 21	yellow powd or mass
17	oxalate	$MgC_2O_4 \cdot 2H_2O$	148 37	wh powd
18	oxide (periclase)	MgO	40 32	cub. col., 1.736
19	" , per-	MgO_2	56 32	wh. powd
20	palmitate	$Mg(C_{16}H_{31}O_2)_2$	535 14	cr. need. or wh. lumps
21	*ortho*phosphate	$Mg_3(PO_4)_2 \cdot 4H_2O$	335 06	monocl
22	" (bobierrite)	$Mg_3(PO_4)_2 \cdot 8H_2O$	407 13	monocl. pl., 1.510, 1.520, 1.543
23	" , mono-H (newberyite)	$MgHPO_4 \cdot 3H_2O$	174 40	rhomb wh., 1.514, 1.518, 1.533
24	" , mono-H	$MgHPO_4 \cdot 7H_2O$	246 46	hex
25	*pyro*phosphate	$Mg_2P_2O_7$	222 68	tabular monocl col, 1 602, 1.604, 1.615
26	"	$Mg_2P_2O_7 \cdot 3H_2O$	276 73	wh amor
27	*hypo*phosphite ...	$Mg(H_2PO_2)_2 \cdot 6H_2O$	262 49	wh. cr
28	*ortho*phosphite....	$MgHPO_3 \cdot 3H_2O$	158 40	
29	salicylate	$Mg(C_7H_5O_3)_2 \cdot 4H_2O$	370 61	col or sl redsh effl. cr. powd
30	selenate	$MgSeO_4 \cdot 6H_2O$	275 38	monocl col, 1 486, 1 489, 1.491
31	silicate (clinoenstatite)	$MgSiO_3$	100 38	monocl
32	(di-) silicide	Mg_2Si	76 70	oct
33	(penta-) silicide, tri-	Mg_5Si_3	205 78	
34	stearate	$Mg(C_{18}H_{35}O_2)_2$	591 25	wh powd. or lumps
35	sulfate	$MgSO_4$	120 38	col. cr..
36	" (kieserite)	$MgSO_4 \cdot H_2O$	138 40	monocl. col pr., 1.523, 1.535, 1.586
37	" (Epsom salt, epsomite)	$MgSO_4 \cdot 7H_2O$	246 49	rhomb. (monocl.) col., 1.433, 1.455, 1 461
38	sulfide	MgS	56 38	cub. pa. red-redsh.-br., phos
39	sulfite	$MgSO_3 \cdot 6H_2O$	212 48	wh. cr powd
40	*d*-tartrate .	$MgC_4H_4O_6 \cdot 5H_2O$	262 47	monocl
41	" , acid	$Mg(HC_4H_4O_6)_2 \cdot 4H_2O$	394 55	rhomb
42	thiosulfate	$MgS_2O_3 \cdot 6H_2O$.	244 54	col. pr
43	thiotellurite	Mg_3TeS_6 ..	360 87	cr. mass pale yel
44	tungstate	$MgWO_4$	272 24	col. monocl
45	**Manganese.**	Mn	54 93	cub. or tetr. gray-pink met
46	acetate (ous)	$Mn(C_2H_3O_2)_2 \cdot 4H_2O$	245 08	monocl. pa. red
47	arsenide, mono-	$MnAs$	129 84	blk. hex

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1				65		.....
2	1.788					..
3		.		7.7		i. al., eth.
4				0.0016^{26}		s. a.; i. alk.
5	2.38–.39	$-H_2O$, 350		0.0009^{18}	0.004^{100}	s. a., NH_4 salts
6	$3.3^{13.5}$	$-4H_2O$, 210	d	10.2^{20}	19.3^{100}	
7	4.244	>700 d.		100^0, 148^{18}	164.9^{110}	s. al., eth., NH_3, methyl l.
8	.	d. 41		81^{20}	90.3^{80}	s. al., eth.
9				3.3	16.7^{100}	i. al., eth.
10		150.4		0.007[illegible]	0.041^{100}	0.415^{15} al., 0.012^{25} eth.
11	2.18 ?	d.		v. s.	d.	s. ac. a., meth. al.
12		131.6		0.006^{15}	0.014^{50}	0.189^{25} al., 0.126^{15} al., 0.007^{25} eth.
13	2.0256^{25}	129.0–.5				
14	1.464	100	$-5H_2O$, 330	42.33^{18}	57.81^{90}	s. al., liq. NH_3
15		d. 1500		i.	d.	s. a.; d. al.
16				0.024^{25}		6.64^{20} al.; s. linseed oil; sl. s., eth.
17	2.45 $\left(2\frac{1}{2}H_2O\right)$	d.		0.07^{16}	0.08^{100}	s. a., alk. oxal.
18	3.65-.75	2500 800		0.00062	0.0086^{30} sl. d.	s. a., NH_4 salts; i. al.
19				i.	i.	s. a.
20		121.5		0.008^{25}	0.009^{50}	0.003^{25} eth., 0.047^{25} al.
21	1.64^{15}			0.0205		s. a., i. NH_4 salts, NH_3
22	2.41					s. NH_4 citrate
23	2.10	.		sl. s.		s. a.
24		$-4H_2O$, 100		0.3	0.2	s. a.; i. al.
25	2.559	1383		i.	i.	s. a., i. al.
26	2.56	d. 150		i.	sl. s.	s. a.; i. al.
27				20		i. al., eth.
28				0.25		s. a.
29				s.		s. al.
30	1.928			v. s.	v. s.	
31	3.28	1557 d				
32		1102		i.	d.	s. a., NH_4Cl, HCl
33	.	1102		i	d	s. a., NH_4Cl
34		88.5		0.003^{15}, 0.004^{25}	0.008^{50}	0.020^{25} al., 0.003^{25} eth.
35	2.66	1124 d.		26^0	73.8^{100}	s. al., glyc., 1.16^{18} eth.; i. acet.
36	2.517 (2.57)				68.4^{100}	
37	1.636 (1.68)	$-6H_2O$, 150	$-7H_2O$, 200	71^{20}	91^{40}	s. al., glyc.
38	2.79–.85	d.		d	d.	s. a., PCl_3
39	1.725	$-6H_2O$, 200	d.	1.25	0.83	i. al, NH_3
40	1.67	d	d	0.8^{15}	1.44^{90}	i. al., NH_3
41	1.72					
42	1.818^{24}	$-3H_2O$, 170	d	v. s.	v. s.	s. al.
43				s.	s.	s. al.
44	5.66			i.		d. a.; i. al.
45	7.20	1260	1900	d.	d.	s. dil. a.
46	1.589			s.		s. al.
47	6.17–.20 (5.55)	d. 400		i.	i.	s. HCl, aq. reg.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Manganese			
1	(di-) arsenide	Mn_2As	184.77	(exist. quest.)
2	(tri-) arsenide, di-	Mn_3As_2	314.61	magnetic (exist. quest.)
3	*ortho*arsenite, acid (ous)	$Mn_3H_6(AsO_3)_4 \cdot 2H_2O$	698.51	rose-red
4	benzoate (ous)	$Mn(C_7H_5O_2)_2 \cdot 3H_2O$	351.20	flat pr
5	boride, mono-	MnB	65.75	cr. powd
6	" , di-	MnB_2	76.57	gray-vlt. cr
7	bromide, di-	$MnBr_2$	214.76	rose-red
8	" "	$MnBr_2 \cdot 4H_2O$	286.83	α stable, monocl. rose-red, deliq., β- or labile, col., rhomb.
9	carbide	Mn_3C	176.80	tetrah
10	carbonate (ous) (rhodochrosite)	$MnCO_3$	114.94	rhbdr. or trig. rose pink or amor. lt. br. powd., 1.817, 1.597
11	chloride, di- (scacchite)	$MnCl_2$	125.84	cub. pink, deliq
12	" "	$MnCl_2 \cdot 4H_2O$	197.91	monocl. rose, deliq
13	" , tri-	$MnCl_3$	161.30	grnsh. blk. solid or brn. cr
14	" , tetra-	$MnCl_4$	196.76	rdsh.-brn. sld. (exist. quest.)
15	chromite (ous)	$Mn(CrO_2)_2$	222.95	oct. gray
16	citrate (ous)	$Mn_3(C_6H_5O_7)_2$	542.99	wh.-redsh. powd
17	ferrocyanide (ous)	$Mn_2Fe(CN)_6 \cdot 7H_2O$	447.92	grnsh-wh. powd
18	fluoride, di-	MnF_2	92.93	red tetrag. or redsh. powd
19	" , tri-	MnF_3	111.93	red cr
20	fluosilicate (ous)	$MnSiF_6 \cdot 6H_2O$	305.09	hex. pr., rose red, 1.357, 1.374
21	formate (ous)	$Mn(CHO_2)_2 \cdot 2H_2O$	181.00	rhomb
22	glycerophosphate (ous)	$MnC_3H_7O_6P$	225.04	wh. or sl. redsh. odorl. powd
23	hydroxide (ous) (pyrochroite)	$Mn(OH)_2$	88.95	trig. wh.-pink, 1.723, 1.681
24	" (ic)	$MnO(OH)$ (or $Mn_2O_3 \cdot H_2O$)	87.94 (175.88)	br
25	" " (manganite)	$MnO(OH)$ (or $Mn_2O_3 \cdot H_2O$)	87.94 (175.88)	rhomb. br.-blk., 2.24, 2.24 (Li) 2.53
26	"	$MnO(OH)_2$	104.95	blk.-br. amor. (exist. quest.)
27	iodide, di-	MnI_2	308.77	yelsh.-br. or pink, deliq., cr. mass or wh. powd.
28	" "	$MnI_2 \cdot 4H_2O$	380.83	monocl. rose-red, deliq
29	lactate (ous)	$Mn(C_3H_5O_3)_2 \cdot 3H_2O$	287.12	monocl. pa. red
30	nitrate (ous)	$Mn(NO_3)_2 \cdot 6H_2O$	287.04	monocl. rose-wh. or col
31	oxalate (ous)	MnC_2O_4	142.95	
32	" "	$MnC_2O_4 \cdot 2H_2O$	178.98	redsh.-wh. cr. powd., oct
33	" "	$MnC_2O_4 \cdot 3H_2O$	197.00	prismatic, pink
34	oxide, mon- (ous) (manganosite)	MnO	70.93	cub. grn., 2.16
35	" (ous, ic), (hausmannite)	Mn_3O_4	228.79	tetr. (rhomb.) blk., 2.46 (Li), 2.15 (Li)
36	" , sesqui- (ic)	Mn_2O_3	157.86	cub. (tetr.) blk
37	" , di-	MnO_2	86.93	rhomb. blk. or br.-blk. powd
38	" , tri-	MnO_3	102.93	redsh., deliq
39	" , hept-	Mn_2O_7	221.86	dk. red oil
40	*ortho*phosphate (ous) (reddingite)	$Mn_3(PO_4)_2 \cdot 3H_2O$	408.88	rhomb., also gran. pa. rose-pink or ylsh. wh., 1.651, 1.656, 1.683
41	" (ous)	$Mn_3(PO_4)_2 \cdot 7H_2O$	480.94	wh.-redsh. amor. powd
42	" , mono-H (ous)	$MnHPO_4 \cdot 3H_2O$	205.01	rhomb. red or pink powd
43	" , di-H (ous)	$Mn(H_2PO_4)_2 \cdot 2H_2O$	285.03	pr
44	*ortho*phosphate (ic)	$MnPO_4 \cdot H_2O$	167.97	grnsh.-gray cr. powd.
45	*pyro*phosphate (ous)	$Mn_2P_2O_7$	283.90	monocl. br.-pink, 1.695, 1.704, 1.710
46	" "	$Mn_2P_2O_7 \cdot 3H_2O$	337.95	amor. wh. powd
47	*meta*phosphate (ic)	$Mn_2(PO_3)_6 \cdot 2H_2O$	620.01	pink
48	phosphide, mono-	MnP	85.95	dk. gray

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		1400		i.	i.	s. aq. reg.
2				i.	i.	s. aq. reg.
3				i.		s. a.
4				6.55^{15}		
5	6.2^{15}					
6	6.9			d.	d.	s. a.
7	4.385^{25}	d		127.3^{0}	228^{100}	i. NH_3
8		64.3 d.	d.	296.7^{0}		
9	6.89^{17}			d.	d.	s. a.
10	3.125	d.		$.0065^{25}$		s. dil. a., .026 aq. CO_2; i. NH_3, al.
11	2.977^{25}	650	1190	62.2^{10}	123.8^{100}	s. al.; i. eth., NH_3
12	2.01	58; $-H_2O$, 106	$-4H_2O$, 198	151^{8}	656^{100}	s. al., i. eth.
13		d. sl				s. abs. al.
14				s.	s.	s. al., eth.
15	3.87					
16				v. sl. s.		s. soln. sod. cit., dil. a.
17				i.		s. HCl, i. NH_4 salts
18	3.98	856		i.	d.	s. a., i. al., eth.
19	3.54	d.		d	d	s. a.
20	1.903	d.		140^{18}	v. s.	s. al
21	1.953	d.		s.	s	
22				sl. s.		s. a., cit. a.; i. al.
23	3.258^{13}	d.		$.0002^{18}$		s. a., NH_4 salts; i. alk.
24	3.26	d		v. sl. s.		
25	4.2-4.4	d		i.	i.	s. h. H_2SO_4, HCl
26	2.58			v. sl. s.		v. sl. s. al.
27	5.01	d. *ca.* 80		s.		
28		d.		s	v. s	
29		d		s.	v. s	s. al.
30	1.82	25.8	129.4	426.4^{0}	∞	v. s. al.
31	$2.43^{21.7}$	d.		i.	i.	s. a., NH_4Cl
32		$-2H_2O$, 100	d.	0.0312^{25}	0.037^{36}	
33		$-H_2O$, 25				
34	5.43–.46 (3.7–3.9)	1650		i.	i.	s. a., NH_4Cl
35	4.856	1705		i.	i.	s. HCl
36	4.50	−O, 1080		i.	i.	s. a.; i. ac. a.
37	5.026	−O, 535		i.	i.	s. HCl; i. HNO_3, acet.
38		d.		s.	d.	s. H_2SO_4, alk.
39	>1.84	<−20	exp. 70	v. s.	d.	s. H_2SO_4
40	3.102					
41				v. sl. s.		s. a., ac. a.; i. al.
42				sl. s.	d.	s. a.; i. al.
43		$-H_2O>100$		s.		i. al.
44						s. boil. conc. H_2SO_4, conc. HCl, molten H_3PO_4
45	3.707^{25}	(1196)		i.		s. a.
46				i.		s. aq. $K_4P_2O_7$, H_2SO_3; i. acet.
47				sl. s.	s	
48	5.39^{21}	1190		i.	i.	sl. s. HNO_3

No.	Name	Formula	Mol wt.	Crystalline form, color and index of refraction
	Manganese			
1	(tri-) phosphide, di-	Mn_3P_2	226 83	dk. gray
2	*hypo*phosphite (ous)	$Mn(H_2PO_2)_2 \cdot H_2O$	203 02	rose-red cr. or powd
3	*ortho*phosphite (ous)	$MnHPO_3 \cdot H_2O$	152 97	redsh
4	selenate	$MnSeO_4 \cdot 2H_2O$	233 92	rhomb
5	"	$MnSeO_4 \cdot 5H_2O$	287 97	
6	selenide	$MnSe$	133 89	gray, cubic
7	selenite (ous)	$MnSeO_3 \cdot 2H_2O$	217 92	cr
8	*ortho*silicate (ous) (tephroite)	Mn_2SiO_4	201 92	rhomb. flesh-red to gray, 1.759, 1 786, 1.797
9	*meta*silicate (ous) (rhodonite)	$MnSiO_3$	130 99	tricl. red., 1.733, 1.740, 1.744
10	(di-) silicide	Mn_2Si	137 92	quad. pr
11	silicide, mono-	$MnSi$	82 99	tetrah
12	" , di-	$MnSi_2$	111 05	gray oct
13	sulfate (ous)	$MnSO_4$	150 99	reddish
14	" " (szmikite)	$MnSO_4 \cdot H_2O$	169 01	monocl. pa. pink, 1.562, 1.595, 1.632
15	" "	$MnSO_4 \cdot 2H_2O$	187 02	(exist. quest.)
16	" "	$MnSO_4 \cdot 3H_2O$	205 04	(exist. quest) . .
17	" " (common form)	$MnSO_4 \cdot 4H_2O$	223 05	monocl. or rhomb. pink effl . .
18	" "	$MnSO_4 \cdot 5H_2O$	241 07	tricl. rose
19	" "	$MnSO_4 \cdot 6H_2O$.	259 09	(exist quest)
20	" "	$MnSO_4 \cdot 7H_2O$	277 10	rhomb or monocl. red
21	" (ic)	$Mn_2(SO_4)_3$	398 04	grn cr., deliq
22	sulfide (ous) (alabandite)	MnS	86 99	cub grn. or amor. pink, 2.70 (Li)
23	" "	$3MnS \cdot H_2O$	278 99	gray-pink .
24	" (ic) (hauerite)	MnS_2	119 05	cub. blk , 2 69 (Li)
25	tartrate (ous)	$MnC_4H_4O_6$	203 00	wh. powd
26	thiocyanate (ous)	$Mn(SCN)_2 \cdot 3H_2O$	225 13	deliq
27	*di*thionate (ous)	MnS_2O_6	215 05	tricl
28	valerate	$Mn(C_5H_9O_2)_2 \cdot 2H_2O$	293 21	br powd
29	**Manganic acid,** per-	$HMnO_4$	119 94	in soln. only
30	**Manganocyanic acid**	$H_4Mn(CN)_6$	215 07	. .
31	**Masurium** .	Ma		. . ..
32	**Mercury**....	Hg	200 61	silv. liq., hex. met .. ..
33	acetate (ous)	$HgC_2H_3O_2$	259 65	micaceous scales ....
34	" (ic)	$Hg(C_2H_3O_2)_2$	318 70	wh sc or powd..... ... .
35	acetylide (ic) .	$3HgC_2 \cdot H_2O$	691 91	wh. powd... .. . .
36	*ortho*arsenate (ous)	Hg_3AsO_4 . .	740 74	dk. red........... ....
37	" , mono-H (ous)	Hg_2HAsO_4 .	541 14	yel.-red.. ....
38	" (ic).....	$Hg_3(AsO_4)_2$....	879 65	yel. ....
39	azide (ous)	HgN_3 ..	242 63	wh. cr ....
40	benzoate (ic)	$Hg(C_7H_5O_2)_2$	442 83	wh. cr. powd. . .. .
41	bromate (ous)	$HgBrO_3$	328 53	cr . . . .
42	" (ic)	$Hg(BrO_3)_2 \cdot 2H_2O$	492 47	cr ....
43	bromide (ous)	$HgBr$	280 53	tetr. wh.-yel .
44	" (ic)	$HgBr_2$	360 44	rhomb. col
45	" iodide (ic)	$HgBrI$	407 45	rhomb. yel .
46	carbonate (ous) .	Hg_2CO_3 .	461 23	yel.-br . ..
47	" , basic (ic)	$HgCO_3 \cdot 2HgO$	693 84	br.-red . . . . . .
48	chlorate (ous)	$HgClO_3$.	284 07	rhomb. wh . .
49	" (ic)	$Hg(ClO_3)_2$	367 52	need

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1	5.12^{18}	1095		i.	i.	sl. s. dil. HNO_3
2		$-H_2O>150$		12.5	16.7	i al.
3		$-H_2O$, 200		sl. s.		s. $MnCl_2$, $MnSO_4$
4	2.95-3.01			s.	s.	
5	2.33 .39					
6	5.59^{15}			i.	i.	d. dil. a.
7				v. sl s	v. sl s	
8	4.043^{25}	1300				
9	3.72^{25}	1323		i	i.	i. HCl
10	6.20^{15}	1316		i	i.	s. HCl, NaOH; i. HNO_3
11	5.90^{15}	1280		i.	i.	s. HF; v. sl. s. a.
12	5.24^{13}			i.	i.	s. HF, alk; i. HNO_3, H_2SO_4
13	3.25	700	d. 850	52^{5}	70^{70}	s. al., i. eth.
14	2.95	stab. 57–117		98.47^{18}	79.8^{100}	
15	2.526^{15}	stab. 40–57		85.27^{30}	106.8^{50}	
16	2.356^{15}	stab. 30–40		74.22	99.31^{57}	
17	2.107	stab. 18–30		105.3^{0}	111.2^{54}	i al.
18	2.103	stab. 8 18		124^{0}	142^{54}	
19		stab −5 to +8		147.4^{0}	134.5^{18}	
20	2.092	$-7H_2O$, 280	stab. −10 to −5	172^{0}	118^{13}	i. al.
21		d. 160		d.	d.	s. HCl, dil. H_2SO_4, i. conc. H_2SO_4, HNO_3
22	3.99	d		$.00047^{18}$		s. dil. a., al.; i. $(NH_4)_2S$
23		d.		0.0006	i.	s. dil. a.; i. $(NH_4)_2S$
24	3.463	d.		i.	i.	d. HCl
25				v. sl. s.		
26		$-3H_2O$, 160–70		s.	v. s.	v. s. al.
27	1.757			s.	v. s	
28				s.		
29				v s.	d.	
30		d.		i.		v. s. al.; i. eth.
31		2300				
32	13.546	−38.89	356.9	i.	i.	s. HNO_3; i. dil. HCl, HBr, HI
33		d.		0.75^{12}		s. H_2SO_4, HNO_3
34	3.270	d.		25^{10}	100^{100}	s. al., ac. a.
35	5.3	exp.		i.	i.	i. al.
36		d		i.		s HNO_3, i. ac. a.
37		d.		i		s. HNO_3, i. NH_4OH, ac. a
38				v. sl s.		s. HCl, HNO_3
39	...	exp. d. by light		0.025	.....	....
40	..	165		1.2^{15}	2.5^{100}	s. al., NaCl, $NH_4C_7H_5O_2$
41	...	d.		d.		sl. s HNO_3
42		d. 130-40		0.15	1.6	s. HNO_3, HCl, $Hg(NO_3)_2$
43	7.307	subl. 345		$.000004^{25}$		s. a.; i. al., acet.
44	6.109^{25}; l. 5.12^{240}	236	322	$.61^{25}$	$20–25^{100}$	15^{0} al.; s. meth. al.; v. sl. s. eth.
45		229	360			s. al., eth.
46	5.07^{218} g/l	d. 130		.0000045	d.	s. NH_4Cl; i. al.
47				i.		s H_2CO_3, NH_4Cl
48	6.409	d. 250		s.	d.	s. al., ac. a.
49	4.998	d.		25		

No	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Mercury			
1	chloride (ous) (calomel).	$HgCl$..	236 07	tetr. wh., 1.973, 2.656 .
2	chloride (ic) (corrosive sublimate)	$HgCl_2$.	271.52	rhomb. col. or wh. powd., pois
3	" iodide (ic)	$HgClI$ .. .	362 99	rhomb red
4	chromate (ous)	Hg_2CrO_4 .	517 23	red need. or powd
5	" (ic) .	$HgCrO_4$	316 62	rhomb red
6	citrate (ous)	$Hg_3C_6H_5O_7$	790 93	wh. powd
7	cyanide (ic)	$Hg(CN)_2$	252 65	tetr. col. or wh. powd., pois.
8	fluoride (ous)	HgF	219 61	cub. yel
9	" (ic)	HgF_2 .	238 61	cub ..
10	fluosilicate (ous)	$Hg_2SiF_6 \cdot 2H_2O$	579 31	col. pr
11	" (ic)	$HgSiF_6 \cdot 6H_2O$	450 77	rhbdr. col
12	" , basic (ic)	$HgSiF_6 \cdot HgO \cdot 3H_2O$	613 33	yel. need
13	formate (ous)	$HgCHO_2$	245 63	glist. scales
14	fulminate (ic) .	$HgC_2N_2O_2$	284 65	cub. wh
15	hydroxide (ic) .	$Hg(OH)_2$	234 63	
16	iodate (ous)	$HgIO_3$	375 53	yelsh
17	" (ic) .	$Hg(IO_3)_2$	550 45	wh. amor. powd .
18	iodide (ous)	HgI .	327 53	tetr. or amor. powd., yel
19	" (ic)	HgI_2..	454 45	rhomb yel., cr. or powd..
20	" "	HgI_2. .	454 45	tetr. red , cr. or powd.. .
21	nitrate (ous)	$HgNO_3 \cdot H_2O$	280 63	monocl. col. effl
22	" (ic)	$Hg(NO_3)_2 \cdot \frac{1}{2}H_2O$	333 63	wh.-yel. deliq. powd. or tr. cr
23	" "	$Hg(NO_3)_2 \cdot H_2O$	342 64	col. cr. or wh. deliq. powd , pois
24	nitride	Hg_3N_2	629 85	br. powd
25	oxalate (ous)	$Hg_2C_2O_4$	489 24	
26	" (ic)	HgC_2O_4	288 63	
27	oxide (ous)	Hg_2O	417 22	blk.-brnsh. powd
28	" (ic) (montroydite)	HgO . .	216 61	rhomb. yel. or red, 2.37, 2 5, 2 65
29	oxybromide (ic)	$HgBr_2 \cdot 3HgO$.	1010 27	yel cr .. .. . .
30	oxychloride (ic)	$HgCl_2 \cdot 2HgO$ ..	704 74	hex red or monocl. blk...
31	" "	$HgCl_2 \cdot 3HgO$.	921 35	hex yel . .
32	oxycyanide (ic)	$Hg(CN)_2 \cdot HgO$	469 26	need or wh. cr. powd. .
33	oxyfluoride (ic)	$HgF_2 \cdot HgO \cdot H_2O$	473 24	yel cr . .
34	oxyiodide (ic)	$HgI_2 \cdot 3HgO$	1104 28	yel. br .
35	*ortho*phosphate (ous)	Hg_3PO_4	696 85	col
36	" (ic)	$Hg_3(PO_4)_2$	791 87	wh -yelsh. powd . ..
37	selenide (ic) (tiemannite)	$HgSe$	279 57	gray plates
38	sulfate (ous)	Hg_2SO_4	497 28	monocl. col., wh -yelsh. powd
39	" (ic)	$HgSO_4$	296 67	rhomb. col. or wh. powd
40	" , basic (ic)	$HgSO_4 \cdot 2HgO$	729 89	lem. yel. powd . .
41	sulfide (ous)	Hg_2S	433 28	blk . .
42	sulfide (ic) (*α*-) (cinnabar, vermilion)	HgS	232.67	hex. red cr. or powd., 2.854, 3.201

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1	7.150	302	383.7	.00021^{19}, .00020^{25}	.0014^{3}	s. $Hg(NO_3)_2$, aq. reg.; sl. s. h. HNO_3, HCl; i. al., eth.
2	5.440^{25}, l. 4.44^{280}	276	302	3.6^{0}; 6.9^{20}	61.3^{100}	33^{25} al., 25 eth.; s. ac. a., pyr.
3		153	315	i.	sl. s.	s. al.
4		d.		v. sl. s.	sl. s.	s. HNO_3, KCN; i. al., acet.
5		d.		sl. s. d.	d.	d. a.; s. NH_4Cl; i. acet.
6				v. sl. s.	.	
7	3 996	d.		9.3^{14}	53.9^{100}	10^{20} al.; 44.1$^{19.5}$ meth. al., s. NH_3, glyc.; i. bz.
8	8.73	570		s. d. to Hg_2O		...
9	8.95^{15}	645 d.	650	d		s. dil. HNO_3, HF
10		.		sl. s.		i. HCl
11				d easily		
12				d.		s. a.
13		d.		0.4^{17}	d.	i. al.
14	4.42	exp.		sl. s.	s.	s. al., NH_4OH
15	.	$-H_2O$, 175		i.	i.	s. a.
16		d.		i.	i.	s. dil. HCl; i. cold HNO_3
17				i.		s. HCl, NH_4Cl, NaCl, KI; i. HNO_3
18	7.70	subl. 140, 290 d	310 d.	v. sl s		s. KI, NH_4OH; i. al., eth.
19	6 271, l. 5.24$^{2.5}$	259	354	v. sl. s.	sl. s.	v. sl. s. al.; s. eth., $Na_2S_2O_3$, KI
20	6.283	tr. 126 7, 259	354	.00610^{25}	sl. s.	1.8^{25} abs. al.; s. eth., acet., $Na_2S_2O_3$, alk. salts
21	4 79^{4}	70	..	d.	s. d.	s. dil. HNO_3; i. NH_4OH
22	4.39	79	d.	v. s.	d.	s. HNO_3, NH_3, acet.; i. al.
23				s.		s. HNO_3; i. al.
24	.	exp.		d.		d. a.; s. NH_4OH, NH_4 salts
25				i	i	sl s. HNO_3
26		d		.0107^{20}		s. HCl; sl. s. HNO_3
27	9.8	d 100		00513		s. H_2SO_4, HNO_3, h. ac. a., i. dil. HCl, alk., NH_3, al., eth.
28	11.14	d 500		0052^{25}	0395^{100}	s. a.; i. al., eth., acet., alk., NH_3
29				i	sl s	v. s. al.
30	red 8.16 43, blk. 8.53					
31	7.93	d. 260		i.	d.	
32	4.437^{19}	exp.		1.25	s.	
33		d. 100		d.		s. dil. HNO_3
34				d.		s. HI
35				i.	d.	s. HNO_3, aq. $HgNO_3$, i. H_3PO_4
36				i.	sl. s.	s. a., NH_4Cl; i. al.
37	7 1 8.9	subl.		i.		s. aq. reg.
38	7.56	d.	d.	.062^{5}	.09^{100}	s. H_2SO_4, HNO_3
39	6.47	d.		d.		s. a., NaCl; i. al., acet., NH_3
40	6.44		volat.	.003^{16}	sl. s.	s. a.; i. al.
41		d. 0		i.		i. a., $(NH_4)_2S$
42	8.10	subl. 583.5		.000001^{18}		s. Na_2S, aq. reg.; i. HNO_3, al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Mercury			
1	sulfide (ic) (β-) (meta-cinnabarite)	HgS	232 67	cub. blk. or amor. powd
2	tartrate (ous)	$Hg_2C_4H_4O_6$	549 29	yelsh.-wh. cr. powd . ...
3	*ortho*tellurate (ic)	Hg_3TeO_6	825 44	cubic dodecahedron trans. amber
4	*meta*tellurate (ic)	$HgTeO_4{\cdot}2H_2O$	428 25	ortho. rhmb., trans., floc
5	thiocyanate (ous)	HgSCN	258 69	
6	" (ic)	$Hg(SCN)_2$	316 77	wh. powd. pois
7	tungstate (ous)	Hg_2WO_4	649 14	yel amor ..
8	" (ic)	$HgWO_4$	448 53	yel
	Mercury-nitrogen compounds:			
	Mercury			
9	bromide (ic), ammono-basic	$Hg(NH_2)Br$	296 55	wh. powd
10	bromide (ic), ammono-basic	Hg_2NBr	495 14	yel
11	" " , diammine	$HgBr_2{\cdot}2NH_3$	394 51	wh. powd
12	chloride (ic), ammono-basic (infusible white ppt.)	$Hg(NH_2)Cl$	252 09	wh. powd. or sm. pr
13	chloride (ic), ammono-basic	Hg_2NCl	450 69	yel
14	" " , aquobasic ammonobasic (chloride of Millon's base)	HOHgNHHgCl	468 70	pa. yel. or wh. powd
15	chloride (ic), diammine (fusible white ppt.)	$HgCl_2{\cdot}2NH_3$	305 59	rhbdr
16	iodide (ic), ammono-basic	$Hg(NH_2)I$	343 55	dirty wh. cr
17	" " "	Hg_2NI	542 15	
18	" " , aquobasic ammonobasic (iodide of Millon's base)	HOHgNHHgI	560 16	yel. to br
19	iodide (ic), diammine	$HgI_2{\cdot}2NH_3$	488 51	col. or pa. yel powd or need
20	**Millon's base**	$Hg_2NOH{\cdot}xH_2O$		
21	**Molybdenum**	Mo	95 95	cub. silv.-wh met or gray-blk powd
22	bromide, di-	$MoBr_2$ (or Mo_3Br_6)	255 78	yel -red
23	" , tri-	$MoBr_3$	335 70	dk. grn. need
24	" , tetra-. .	$MoBr_4$	415 61	blk. need , deliq
25	carbide, mono-	MoC	107 96	dk gray cr powd
26	(di-) carbide	Mo_2C	203 91	pr. wh
27	carbide, di-	MoC_2	119 97	wh. pr
28	carbonyl	$Mo(CO)_6$	264 01	cr. diamagnetic
29	chloride, di-	$MoCl_2$ (or Mo_3Cl_6)	166 86	amor yel . .
30	" , tri-	$MoCl_3$	202 32	dk. red need. or powd
31	" , tetra-	$MoCl_4$.	237 78	br. cr. or powd., deliq
32	" , penta-	$MoCl_5$	273 24	gr.-blk. cr., deliq
33	fluoride, hexa-.	MoF_6	209 95	col. cr
34	hydroxide	$Mo(OH)_3$ (or $Mo_2O_3{\cdot}H_2O$)	146 97	blk. powd
35	"	$MoO(OH)_3$ (or $Mo_2O_5{\cdot}3H_2O$)	162 97 (325 95)	light br. amor

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1	7.73	583.5		i.		s. Na_2S, aq. reg. alk.; i. HNO_3, al.
2				i.		i. a.
3		unalt. at 140		i.	i.	s. HNO_3, HCl
4		d 20		slow d.	rapid d.	
5		d.		i.		s. HCl, KCNS
6		d.		.07^{25}	s.	s. NH_4 salts, NH_3, HCl, KCN, sl. s. al., eth.
7		d.		i.	i.	d. a.; i. al.
8		d.		i.	d.	d. a.; i. al.
9		d.		i.-d.		i. al ; sl. s. NH_4OH
10		d.		i.		s. HCl, KI
11		180		d.		s. NH_4Br, NH_4Cl, NH_4I
12	5.70	infus.		0.14	d.^{100}	d. a.; i. al.
13		d. 300		i.	i.	s. a., KI
14		d.>120		sl. s.		s HCl, HNO_3
15		300		i.	d.	s. a., KI
16						i. eth.
17				i.		s. HCl; d. KI
18		>128	exp.	i.		s. d. HCl, KI soln.
19				d.		s. NH_4OH
20	4.083^{18}					
21	10 2	2620 ± 10	3700	i.	i.	s. h. conc. HNO_3, H_2SO_4, i. HCl, HF, dil. H_2SO_4, NH_3
22	4.88			i.	i.	s. alk.; i. a., aq. reg.
23		d.		i.	i.	d. alk., NH_3; i. a.
24		d.	volat.	v s		d. alk.
25	8 40	2570		i.	i.	sl. s. HNO_3, HF, h. H_2SO_4, HCl; i. alk. hyd.
26	8 9	2380				
27	8 9		4500			
28	1.96	d. 150				
29	3.714^{20}	d.		i.	i.	s. HCl, H_2SO_4, NH_4OH, al., eth.
30	3.578^{25}	d.		i.	d. sly.	d. alk.; s. conc. H_2SO_4, HNO_3; v. sl. s. al., eth.; i. HCl
31		d.		d.	d.	d. al., eth.; s. conc. HNO_3, H_2SO_4, HCl
32	2.928	194	268	d.	d.	s. d. al., eth ; s CCl_4, chl, s. conc HCl, conc H_2SO_4, HNO_3
33	lq. 2.55	17	35	s. d.	d.	d. NH_3; s. NH_4OH, alk.
34		d.		.	.	sl. s. H_2SO_4, HCl; s. 30% H_2O_2
35				0.2 (coll.)	.	sl. s. alk. carb., NH_3, HCl, H_2SO_4

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Molybdenum			
1	hydroxy*tetra*bromide, di-	$Mo_3Br_4(OH)_2$.	641.53	red powd
2	" "	$Mo_3Br_4(OH)_2 \cdot 8H_2O$	785.66	golden-yel. cr
3	hydroxy*tetra*chloride, di-	$Mo_3Cl_4(OH)_2 \cdot 2H_2O$	499.73	amor. pa yel
4	iodide, di-	MoI_2	349.79	amor. br
5	oxide, sesqui-	Mo_2O_3	239.90	blk. opaque
6	" , di-	MoO_2	127.95	tetr. vlt.-red
7	" , tri- (molybdic anhydride, molybdite)	MoO_3	143.95	rhomb. wh.-yelsh. or col
8	oxide, pent-	Mo_2O_5	271.90	violet-bl. powd ...
9	" ("molyb. blue")	$Mo_2O_5 \cdot xMoO_3$.		dk. blue coll ....
10	oxy*di*bromide, di-	MoO_2Br_2	287.78	tabl. yel.-red, deliq
11	oxy*tetra*chloride	$MoOCl_4$.	253.78	grn. cr., deliq
12	oxy*di*chloride, di-	MoO_2Cl_2	198.86	yelsh. wh. scaly cr
13	oxy*penta*chloride tri-	$Mo_2O_3Cl_5$	417.19	dk. br.-blk. cr., deliq .
14	oxy*hexa*chloride, tri-	$Mo_2O_3Cl_6$	452.64	ruby-red cr. or dp. vlt
15	oxy*tetra*fluoride	$MoOF_4$	187.95	col.-wh. deliq .
16	phosphide	MoP(or Mo_2P_3)	126.97	gray-grn. cr. powd
17	"	MoP_2	157.99	blk. powd
18	sulfide, sesqui-	Mo_2S_3	288.08	steel gray need
19	" , di- (molybdenite)	MoS_2	160.07	hex blk. luster
20	" , tri-	MoS_3	192.13	red dk -br
21	" , tetra-	MoS_4	224.19	brown powd .
22	thiocyanate, basic	$Mo(OH)_2(SCN)_3$(?)	304.20	red in aq ...
23	**Molybdic acid**	H_2MoO_4 (or $MoO_3 \cdot H_2O$)	161.97	hex.-wh. or sl. yelsh
24	" "	$H_2MoO_4 \cdot H_2O$ (or $MoO_3 \cdot 2H_2O$)	179.98	monocl. yel .... .
25	**Neodymium**	Nd	144.27	yelsh. met ....
26	acetate	$Nd(C_2H_3O_2)_3 \cdot H_2O$	339.42	
27	bromate	$Nd(BrO_3)_3 \cdot 9H_2O$	690.16	hex. red .
28	bromide	$NdBr_3$	384.02	grn. cr
29	carbide	NdC_2	168.29	hex. leaf. yel
30	chloride.	$NdCl_3$	250.64	rose-vlt. pr
31	"	$NdCl_3 \cdot 6H_2O$	358.74	rhomb. red ..
32	hexaantipyrine *per*-chlorate	$[Nd(C_{11}H_{12}N_2O)_6]$-$(ClO_4)_3$	1571.98	rose hex. cr....
33	iodide	NdI_3	525.03	blk. cr. powd
34	molybdate	$Nd_2(MoO_4)_3$	768.39	tetr., 2.005.
35	nitrate	$Nd(NO_3)_3 \cdot 6H_2O$.	438.39	tricl
36	nitride	NdN . .	158.28	blk. powd . .
37	oxalate	$Nd_2(C_2O_4)_3 \cdot 10H_2O$	732.76	rose cr
38	oxide (neodymia)	Nd_2O_3 ..	336.54	lt. bl. powd. red fluores .. .
39	sulfate	$Nd_2(SO_4)_3 \cdot 8H_2O$	720.85	monocl. red, 1.541, 1.551, 1.562
40	sulfide	Nd_2S_3	384.72	olive grn. powd
41	**Neon**.....	Ne	20.18	col., wholly inert gas
42	**Nickel** ..	Ni	58.69	cub. silvery metal
43	acetate ..	$Ni(C_2H_3O_2)_2$	176.78	grn. pr .. . . .
44	*ortho*arsenate	$Ni_3(AsO_4)_2$	453.89	yelsh-grn. powd
45	arsenide (niccolite) .	NiAs	133.60	hex . . .
46	*ortho*arsenite, acid	$Ni_3H_6(AsO_3)_4 \cdot H_2O$	691.77	grn.-wh ..... .
47	benzenesulfonate	$Ni(C_6H_5O_3S)_2 \cdot 6H_2O$	481.11	green monocl.......

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1						s. alk.
2		d.	d.			d. HNO_3, alk.; s. HCl
3				i.		s. conc. a.; i. al.
4	4.3	d.		sl. s. d.	d.	d. KOH; i. al.
5				i.	i.	i. a., alk., NH_4OH
6	$4.516^{19.0}$			i.	i.	sl. s. h. conc. H_2SO_4; i $KHC_4H_4O_6$; i. alk., HCl, HF
7	$4.50^{19.5}$	795	subl.	0.1066^{18}	2.055^{70}	s. a., NH_4OH, alk. sulf.
8						s. h. H_2SO_4, HCl
9				s.		s. a., CH_3OH; i. $(CH_3)_2O$, chl., C_6H_6, CS_2, acetone
10			.	s.		
11		subl.	....	s.		
12	3.31^{16}	subl.	...	s.	s.	s al., eth
13		melts eas	subl.	s.	s.	
14		d	...	d.	.	s. eth.
15	3 0	98	180	s.	.	s. CCl_4, al., eth.; s.d.H_2SO_4
16	6.167			.	.	s. h. HNO_3
17	5.35^{25}					s. HNO_3, h. conc. H_2SO_4, aq. reg , i. conc. HCl
18	5.91^{15}	d. 1100	volat. 1200		.	i. conc. HCl
19	4.80^{14}	1185	d. in air	i.	i.	s. h. H_2SO_4, aq. reg., HNO_3; i. dil. a., c. H_2SO_4
20		d.	d.	sl. s.	s.	s alk. sulfd , conc. KOH
21		d.		i	i.	s. alk. sulfd., h. H_2SO_4; i. a.
22				s.	s.	s. eth.
23	3.112	d. 115		sl. s.	sl. s.	s. alk., NH_4OH, H_2SO_4; i. NH_3
24	3.124^{15}	$-H_2O$, 70	d.	0.133^{18}	2.568^{70}	s alk. hydx , alk. carb ; sl s acids
25	6 9	840		d.		.
26				26.2		
27		66.7	$-9H_2O$, 150	151^{25}		
28		.		sl. s		.
29	5.15	d		d.	d.	s dil. a., H_2SO_4; i conc. HNO_3
30	4.134^{25}	784		96.7^{13}	149^{100}	44.5 al.; i. eth., chl.
31	$2.282^{16.0}$	124	$-6H_2O$, 160	246^{13}	511^{100}	v. s. al.
32		285-9 d.		0.99^{20}	.	
33		775 + 3				
34	5.14^{18}	1176		.		
35				152.9^{25}		. al., acet.
36				d.		
37				$.000074^{25}$		
38	7 24			$.00019^{29}$		s. a.
39	2.85			$8.^{20}$	5.4^{10}	..
40	5.179^{11}	d.		i.	d.	s. dil. a.
41	$.9002^{0}$ g/l; lq.; 1 204 $^{245.9}$	−248.67	−245.9	1.23^{0} cm^3; 1.16^{25} cm^3	1.08^{50} cm^3	s. liq. O_2
42	8.90	1452	2900	i.	i.	s. dil. HNO_3; sl. s. HCl, H_2SO_4; i. NH_3
43	1.798	d.		16.6		i. al.
44	4.98	..		i.		s. a.
45	7.57^{0}	968		i.	i.	s. aq. reg.
46		d.		i.		s. a., alk.
47	1.628^{15}	$-H_2O$	d.	14.3^{18}	51.5^{82}	5.9 al.; 4.5 eth.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Nickel			
1	boride	NiB	69 51	pr
2	bromate	$Ni(BrO_3)_2 \cdot 6H_2O$	422 62	monocl
3	bromide	$NiBr_2$	218 52	yel.-br., deliq
4	"	$NiBr_2 \cdot 3H_2O$	272 57	yelsh-grn. need., deliq
5	" , hexammine	$NiBr_2 \cdot 6NH_3$	320 72	violet powd
6	carbide	Ni_3C	188 08	
7	carbonate	$NiCO_3$	118 70	rhomb. lt. grn
8	" , basic (zaratite)	$NiCO_3 \cdot 2Ni(OH)_2 \cdot 4H_2O(?)$	376 18	cub. emerald grn., 1.56–1.61
9	" , basic	$2NiCO_3 \cdot 3Ni(OH)_2 \cdot 4H_2O$	587 58	lt. grn. cr. or br. powd
10	carbonyl	$Ni(CO)_4$	170 73	col volat. inflam. liq. or need
11	chlorate	$Ni(ClO_3)_2 \cdot 6H_2O$	333 70	dk. red
12	" , hexammine	$Ni(ClO_3)_2 \cdot 6NH_3$	327 80	
13	*per*chlorate	$Ni(ClO_4)_2 \cdot 6H_2O$	365 70	hex. need. grn., 1.55 av
14	chloride	$NiCl_2$	129 60	yel. sc., deliq
15	"	$NiCl_2 \cdot 6H_2O$	237 70	monocl. grn., deliq
16	" , hexammine	$NiCl_2 \cdot 6NH_3$	231 80	cub. bluish
17	cyanide	$Ni(CN)_2$	110 73	
18	cyanide.	$Ni(CN)_2 \cdot 4H_2O$	182 79	lt. grn. pl. or powd., pois
19	dimethylglyoxime deriv, acid	$Ni(HC_4H_6N_2O_2)_2$	288 92	scarlet-red cr
20	ferrocyanide	$Ni_2Fe(CN)_6 \cdot xH_2O$		grn -wh
21	fluoride	NiF_2	96 69	grn. quad
22	" , acid	$NiF_2 \cdot 5HF \cdot 6H_2O$	304 83	trig. blue-grn
23	fluosilicate	$NiSiF_6 \cdot 6H_2O$	308 85	trig. grn., 1 391, 1 407
24	formate	$Ni(CHO_2)_2 \cdot 2H_2O$	184 76	grn. cr.
25	hydroxide (ous)	$Ni(OH)_2$	92 71	grn amor. or cr
26	" "	$4Ni(OH)_2 \cdot H_2O$	388 84	lt. grn amor or cr
27	" (ic)	$Ni(OH)_3$	109 71	blk amor powd.
28	iodide	NiI_2	312 53	blk, deliq
29	" , hexammine	$NiI_2 \cdot 6NH_3$	414 72	cub. pa. blue
30	nitrate	$Ni(NO_3)_2 \cdot 6H_2O$	290 80	monocl. grn., deliq
31	" , tetrammine	$Ni(NO_3)_2 \cdot 4NH_3 \cdot 2H_2O$	286 87	octahedra blue
32	" , hexammine	$Ni(NO_3)_2 \cdot 6NH_3$	284 90	oct or cub. bl
33	oleate	$Ni(C_{18}H_{33}O_2)_2$	621 58	green oil
34	oxalate	$NiC_2O_4 \cdot 2H_2O$	182 74	lt.-grn. powd
35	oxide, mon- (bunsenite)	NiO	74 69	cub. grn.-blk., 2 18 (red)
36	" (ous, ic)	Ni_3O_4	240 07	cub. or amor gray-blk
37	" , sesqui-	Ni_2O_3	165 38	gray-blk. powd
38	oxyiodide	$NiI_2 \cdot 9NiO \cdot 15H_2O$	1254 98	rdsh -brn. powd. (exist. quest)
39	*ortho*phosphate	$Ni_3(PO_4)_2 \cdot 8H_2O$	510 24	apple grn. pl. or emerald cr. granules
40	*pyro*phosphate	$Ni_2P_2O_7 \cdot xH_2O$		grn
41	(di-) phosphide	Ni_2P	148 40	gray cr
42	(tri-) phosphide, di-	Ni_3P_2	238 11	dk. grn.-blk
43	(penta-) " "	Ni_5P_2	355 49	need. or tabular cr
44	*hypo*phosphite	$Ni(H_2PO_2)_2 \cdot 6H_2O$	296 86	grn
45	selenide	$NiSe$	137 65	cub. wh. or gray
46	stearate	$Ni(C_{18}H_{35}O_2)_2$	625 62	green powd
47	sulfate	$NiSO_4$	154 75	cub. yel
48	"	$NiSO_4 \cdot 6H_2O$	262 85	α, tetr. blue; β, monocl. grn., 1.511, 1.487
49	" (morenosite)	$NiSO_4 \cdot 7H_2O$	280 86	rhomb. grn., 1.467, 1.489, 1.492

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	7.39^{18}			d.	d.	s. HNO_3, aq. reg.
2	2.575	d.		28		
3	4.64^{28}	d.		112.8^{0}	155.1^{100}	s. al., eth., NH_4OH
4		$-3H_2O$, 200		199^{0}	315.7^{100}	s. al., eth., NH_4OH
5	1.837			v. s.	d	
6	7.957^{15}					
7		d.		0.0093^{25}	i.	s. a.
8	2.6					s. h. dil. HCl
9		d.		i.	d	s. a., NH_4 salts
10	1.32^{17}	−25	43	$.018^{9.8}$		s. HNO_3, aq. reg., al., eth., chl., bz.; i. dil. a., alk
11	2.07	d. 80		0.9^{27}		
12	1.52	180		giv. $Ni(NH_3)_4$		
13		149		222.5^{0}	273.7^{15}	s. al., acet.; i. chl.
14	3.55	subl.	973	64.2^{20}	87.6^{100}	s. al., NH_4OH; i. NH_3
15				254^{20}	599^{100}	v. s. al
16	1.468^{2}			s.	d.	s. NH_4OH, i. al.
17				i.	i.	s. KCN
18		$-4H_2O$, 200	d.	i.	i. •	s. KCN, NH_4OH, alk.; sl. s. dil. a.
19		subl. 250		i.	i.	s. abs. al., a., i. ac. a., NH_4OH
20	1.892 (?)			i.		s. NH_4OH, KCN; i. HCl
21	4.63			0.02		i. a., al., eth., NH_3
22	2.132			s.		s. dil. a.
23	2.134	d.		v. s.		
24	2.154	d.		s.		
25	4.1			0.0013		s. a., NH_4OH
26	4.36	d.		i.	i.	s. a., NH_4OH; i. alk
27		d		i.	i.	s. a., NH_4OH, NH_4Cl
28	5.834	subl		124^{20}	188.2^{100}	s. al.
29	2.101	d		d.		s. NH_4OH
30	2.05	56.7	136.7	238.5^{0}	∞	s. al., NH_4OH
31		d		v. s.		sl. s. dil. al.
32				4.46		
33		18–20				
34				i.		s. a., NH_4 salts, v. sl. s. h. oxal. a.
35	7.45	2090	to Ni_2O_3, 400	i.	i.	s. a., NH_4OH
36				i.	i.	s. a.
37	4.83	$-O_2$, 600		i.	i.	s. a., NH_4OH, KCN
38		d		i.		s. HNO_3; i. NH_4OH
39		d		i.	i.	s. a., NH_4 salts; i. methyl and ethyl acetates
40	anh. 3.03^{15}			i.		s. a., NH_4OH
41	6.31^{1}	1112		i.		s. HNO_3 + HF; i. a.
42	5.99			i.	i.	s. HNO_3; i. HCl
43		1185				
44	$1.82^{19.8}$	d. 100		s.		
45	8.46			i.		s. HNO_3, aq. reg.; i. HCl
46		100		i.		s. CCl_4, pyr. sl. s. acet; i. CH_3OH, eth.
47	3.68	$-SO_3$, 840		29.3^{0}	83.7^{100}	i. al., eth., acet.
48	2.07	tr. 53.3	$-6H_2O$, 280	62.52^{0}	340.7^{100}	v. s. al., NH_4OH; 12.5 meth. al.
49	1.948	$-H_2O$, 31.5, 99	$-6H_2O$, 103	$75.6^{15.5}$	475.8^{100}	s. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Nickel			
1	sulfide, sub-	Ni_2S	149 44	yel. cr
2	" , mono- (millerite)	NiS	90 75	trig. or amor. blk
3	" (ous, ic) (polydymite)	Ni_3S_4 ...	304 31	cub. gray-blk
4	sulfite	$NiSO_3 \cdot 6H_2O$	246 85	tetrah. grn
	Nickel complexes:			
5	Diaquotetrammine-nickel (II) nitrate	$[Ni(NH_3)_4(H_2O)_2](NO_3)_2$	286 87	grn. cr
6	Tetrapyridinenickel (II) fluosilicate	$[Ni(C_5H_5N)_4]SiF_6$	517 14	rhomb bl -grn
7	**Niobium**	See *Columbium*		
8	**Nitric acid**	HNO_3	63 02	col. corros pois. liq., $1.397^{16.4}$
9	**Nitrogen**	N_2	28 02	col. gas, col. liq. or cub. cr. at low temp.
10	chloride, tri-	NCl_3	120 38	yel. oil or rhomb cr
11	fluoride, tri-	NF_3	71 01	col. gas
12	iodide, tri-	NI_3	394 77	blk
13	" " , monoammine	$NI_3 \cdot NH_3$	411 80	rhomb. dk. red
14	oxide (ous)	N_2O	44 02	col. gas or liq or cub cr, 1.193^{16} liq
15	" (ic)	NO	30 01	col gas; blue liq and solid, liq. 1.330^{-90}
16	(di-) oxide, tri- (nitrous anhydride)	N_2O_3	76 02	red br. gas, bl solid or liq
17	oxide, di- or tetr-	NO_2 (or N_2O_4)	46 01 (92 02)	col. solid (N_2O_4), yel. liq or red-br. gas
18	" , pent- (nitric anhydride)	N_2O_5	108 02	hex. (rhomb.) wh
19	" , tri- or per-	NO_3	62 01	bluish gas or sld
20	**Nitrosyl** bromide	$NOBr$	109 92	br. gas or dk br liq
21	chloride.	$NOCl$	65 47	yel. gas or yel.-red liq or cr
22	fluoride	NOF	49 01	col. gas
23	**Nitrosylsulfuric acid** (chamber crystals)	$SO_2(OH)ONO$	127 08	rhomb. col
24	**Nitrosylsulfuric anhydride**	$(SO_2ONO)_2O$	236 14	tetr
25	**Nitrous acid**	HNO_2	47 02	known only in solution (pa. blue)
26	" " , hypo-	$H_2N_2O_2$	62 03	wh. sld
27	**Nitryl** chloride	NO_2Cl	81 47	pa. yel. br. gas
28	fluoride	NO_2F	65 01	col. gas and solid
29	**Osmium**	Os	190 20	hex gray-bl met
30	chloride, di-	$OsCl_2$	261 11	dk. br., deliq
31	" , tri-.	$OsCl_3$	296 57	cub. br
32	" "	$OsCl_3 \cdot 3H_2O$	350 62	dk. grn. cr
33	" , tetra-	$OsCl_4$	332 03	red br need
34	fluoride, tetra-	OsF_4	266 20	br powd
35	" , hexa-	OsF_6	304 20	grn cr
36	" , octa-	OsF_8	342 20	citron yel. cr
37	oxide, mon-	OsO	206 20	blk
38	" , sesqui-	Os_2O_3	428 40	dk. br
39	" , di-	OsO_2	222 20	cub. or hex. red-br
40	" , tetra-	OsO_4	254 20	(a) monocl. col. (b) yel. mass

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	5.52			i.		s. HNO_3
2	5.3–5.65	797		$.0003^{18}$	d.	s. HNO_3, KHS, aq. reg; sl. s. a.
3	4 7			i.		s. HNO_3
4				i.		s HCl, H_2SO_4
5				s		i. al.
6	2.307					
7						
8	1.502	−42	86	∞	∞	d. al. viol., s. eth.
9	1.2506^0 g/l, lq. $0.808^{195.8}$, s. $1.026^{252.5}$	−209.86	−195.8	2.33^0 cm^3	1.42^{40} cm^3; 1.32^{60} cm^3	sl. s. al.
10	1.653	<−40	−71, exp 95	i.	d.	s. chl., bz., CCl_4, CS_2, PCl_3
11	lq. 1.537^{129}	−216.6	−120	v. sl. s.		
12		exp.	subl. vac.	i.	d.	s. $Na_2S_2O_3$, KCNS
13	3.5	d.>20	exp.	i.	d.	s. HCl, KCN, $Na_2S_2O_3$; i. abs. al.
14	1.977 g/l, lq. 1.226^{89}	−102.4	−89.5	130.0^0 cm^3; 87.4^{10} cm^3	56.7^{25} cm^3	s. al., eth., H_2SO_4
15	1.3402 g/l; lq. $1.269^{150.2}$	−163.6	−151.8	7.34^0 cm^3	2.37^{60} cm^3	3.5 cm^3 H_2SO_4, 26.6 cm^3 al.; s. $FeSO_4$, CS_2
16	1.447^2	−102	3.5 d.	s.	d.	s. alk., a., eth.
17	1.491^0	−9.3	21.3 d.	s. d.		s. alk., CS_2, chl.
18	1.042^{18}	30	47 d.	s.	d. to HNO_3	s. chl.
19		d. sly. at ord. temp.				s. eth.
20	>1.0	−55.5	−2	i. d.	d.	s. alk.
21	2.99 g/l; lq. 1.417^{12}	−64.5	−5.5	d.	d.	s. fuming H_2SO_4
22	2.176 g/l	−134	−56	s. d. to HNO_2 + HF		
23		73		d.	..	s. H_2SO_4
24		217	360	d.		s H_2SO_4
25						
26		exp.		s.		
27	2.57 g/l, lq. 1.32^{14}	<−31	5	d.		
28	2.90 g/l	−139	−63.5	d.	..	d. al., eth., chl.
29	22.48	2700	>5300	i.	i.	sl. s. HNO_3, aq. reg.; i. NH_3
30		d.		i.	sl. d.	s. al., eth., HNO_3; sl. s. alk.
31		d. 560-600		v. s.		s a., alk., al.; sl. s eth.
32		d.		v s.		s. al.
33		subl.		sl. s. d.		i. al.
34				d.	d.	
35		>50	205	d.	d.	
36		34.4	47.3	s. d.	s. d.	s. KF aq.
37		..		i.	i.	i. a.
38		d.		i.	i.	i. a.
39	7.91^{22}	d. 650		i.	i.	i. a.
40	4.906^{22}	(a) 39.5 (b) 41	130	5.07^0	6.23^{25}	v. s. CCl_4; s. al., eth., NH_4OH, $POCl_3$

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Osmium			
1	sulfide, di-	OsS_2	254 32	cub. blk
2	" , tetra-	OsS_4	318 44	br. blk
3	sulfite	$OsSO_3$	270 26	bl. blk
4	**Oxygen**	O_2	32 00	col. gas or liq or hex. cr
5	**Ozone**	O_3	48 00	col gas or dk bl. liq
6	**Palladium**	Pd	106 70	cub. silv.-wh met
7	bromide	$PdBr_2$	266 53	red-br
8	chloride	$PdCl_2$	177 61	cub. need., dk. red, deliq
9	"	$PdCl_2 \cdot 2H_2O$	213 65	br. prisms, deliq
10	cyanide	$Pd(CN)_2$	158 74	yelsh.-wh...
11	fluoride, di-	PdF_2	144 70	br
12	" , tri-	PdF_3	163 70	rhomb. blk
13	hydride..	Pd_2H (or Pd_4H_2)	428 82	silv. metallic (exist. quest.)......
14	iodide	PdI_2	360 54	blk. powd
15	nitrate .	$Pd(NO_3)_2$	230 72	rhomb. br.-yel., deliq
16	oxide, sub-.	Pd_2O	229 40	blk
17	" , mon-	PdO	122 70	blk.-grn. or amber mass or blk. powd
18	oxide, mon-	$PdO \cdot xH_2O$		yel. to br
19	" , di-	PdO_2	138 70	blk
20	" "	$PdO_2 \cdot xH_2O$		dull red
21	sulfate	$PdSO_4 \cdot 2H_2O$	238 79	red-br. cr., deliq
22	sulfide, sub-	Pd_2S	245 46	grn -gray
23	" , mono-	PdS	138 76	br.-blk
24	" , di-	PdS_2	170 82	dk.-br
25	**Palladium complexes:** Diamminepalladium (II) hydroxide	$[Pd(NH_3)_2(OH)_2]$	174 78	micr.-cr yel
26	Dichlorodiamminepalladium (II), *trans-* (or *α-*)	$[Pd(NH_3)_2Cl_2]$	211 68	tetr. yel
27	Tetramminepalladium (II) chloride	$[Pd(NH_3)_4]Cl_2 \cdot H_2O$	263 76	tetrag col
28	**Phospham**	PN_2H	60 04	wh amor
29	**Phosphomolybdic acid**	$H_3PMo_{12}O_{40} \cdot xH_2O$		yelsh cr
30	" "	$H_3PMo_{12}O_{40} \cdot 29H_2O$	2347 91	oct yel
31	**Phosphonium** bromide	PH_4Br	114 97	cub. col
32	chloride	PH_4Cl	70 51	cub. col
33	iodide	PH_4I	161 97	tetr. col deliq
34	sulfate	$(PH_4)_2SO_4$	166 16	cr. col. deliq
35	**Phosphoric acid,** ortho-	H_3PO_4	98 04	col. liq. or rhomb cr., deliq.
36	" " "	$2H_3PO_4 \cdot H_2O$	214 10	hex pointed pr col , deliq
37	" " , pyro-	$H_4P_2O_7$	178 07	col. need. or liq., hyg
38	" " , meta-	HPO_3	80 03	vitreous col , deliq
39	" " , hypo-	$H_4P_2O_6$	162 07	cryst
40	**Phosphorous acid,** ortho-	$H_2(HPO_3)$	82 04	col.-yel., deliq. cr

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		d.		i.	i.	i. alk.
2		d.		i.	.	s. dil. HNO_3; i. $(NH_4)_2S$
3		d.		i.	..	s. dil. HCl, alk.
4	1.429^0 g/l; lq. 1.14 ^{183}; s. 1.426 $^{252.5}$	−218.4	−183.0	4.89^0 cm^3; 3.16^{25} cm^3	2.46^{50} cm^3; 2.30^{100} cm^3	2.78^{25} cm^3 al.; s. fus. Ag.
5	2.144 g/l; lq. 1.71 ^{183}	−251	−112	49^0 cm^3		s. alk. solns., oils
6	11.97^0, 11.40$^{22.5}$	1549.55	*ca.* 2540	i.	i.	s. aq. reg., h. HNO_3, H_2SO_4; sl. s. HCl
7		d.		i.	i.	s. HBr
8		500 d.		s	-	s. HCl, acet.
9		d.		v. s	v. s.	s. HCl, acet.
10		d		i.	i.	s. KCN, NH_4OH; i. dil. a.
11		volat.	d. red heat	sl. s.		s. HF
12	5.06	d.	d.	d.	d.	s. HF
13	10.76	d.				
14		d. 350		i.	i.	s. KI; i. al., eth., dil. HCl
15		d.		s. d		s. HNO_3
16		d.		i.		i. a.
17	8.31	d. 750		i.	i	sl. s. h. a.
18		d.		i.	i	s. a., NH_3, NH_4Cl
19		−O, 200		v. sl s		sl s. a.
20		d. −H_2O, −O		i.	i.	s. a., alk.
21		d.		v s	d	
22	7.303^{15}	d. 800		i	i.	sl s. a., aq. reg
23		950 d.		i.	i.	s HNO_3, aq. reg.; i. HCl, $(NH_4)_2S$
24		d.		i	i	s. aq. reg., $(NH_4)_2S$
25		>105		v s.	d.	
26	2.5	d.		0.304^{16}	s. d	s a (dec.), NH_4OH
27	1.91^{18}	d. 120		v. s.		
28		infus.		i.	d.	s. conc. H_2SO_4, i a, alk.
29				s.		s. al, eth.
30		−H_2O, 104, 78				
31	g. 2.464 g/l		38.8^{794}; subl ca. 30	d.	d.	
32		28$^{16\ atm}$	subl.	d		
33	2.86	subl 61.8	80	d.		s. d. a., alk.
34				d.		
35	1.834^{18}	42.35	−½H_2O, 213	548	v. s.	s. al.
36		29.32	d.	v. s.		
37		61		70^{23}	d to H_3PO_4	v. s al., eth.
38	2.2 .5	subl.		d. to H_3PO_4	d.	s. al.; i. liq CO_2
39		55	d. 100	s.; d. sly. to H_3PO_3 + HPO_3	d.>30	
40	1.651$^{21.2}$	73.6	d. 200	309^0	694^{40}	s. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Phosphorous acid,			
1	pyro-	$H_4P_2O_5$	146.07	need
2	" " meta-	HPO_2	64.03	feather like cr . .
3	" " hypo-	$H(H_2PO_2)$	66.04	col. oily liq. or deliq. cr .
4	**Phosphorus,** yellow	P_4	124.08	cub. col.-yelsh. wax-like solid, 2.144
5	" , red	P_4 . . .	124.08	cub. redsh.-br. or amor. red br. powd (mixt. of col. and violet?)
6	" , violet .	P_4 .	124.08	monocl. vlt
7	" , black	P_4	124.08	blk. incombust
8	bromide, tri-	PBr_3 .	270.77	col. fum. liq., $1.697^{26.6}$
9	" , penta-	PBr_5	430.60	rhomb. yel
10	bromide (mono-) chloride, tetra-	$PBrCl_4$.	252.76	yel. cr .
11	bromide (di-) chloride, tri-	PBr_2Cl_3.	297.22	or. cr
12	bromide (hepta-) chloride, di-	PBr_7Cl_2 . .	661.35	pr
13	bromide (octa-) chloride, tri-	PBr_8Cl_3	776.72	br. need
14	bromide (di-) fluoride, tri-	PBr_2F_3	247.85	pa. yel .
15	" " nitride	$(PNBr_2)_3$	614.58	rhomb. col
16	" sulfide	$P_2S_3Br_4$	477.88	yel oil
17	chloride, di-.	PCl_2 (or P_2Cl_4)	101.93	col
18	" , tri-	PCl_3	137.39	col. fum. liq., 1.516^{14}
19	" , penta-	PCl_5	208.31	tetr. yelsh.-wh., fum
20	chloride (di-) fluoride, tri-	PCl_2F_3.	158.93	. .
21	chloride (tri-) iodide, di-	PCl_3I_2	391.23	hex. red
22	" (di-) nitride	$(PNCl_2)_3$	347.83	rhomb
23	" " "	$(PNCl_2)_4$	463.77	
24	" " "	$(PNCl_2)_5$	579.71	
25	" " "	$(PNCl_2)_6$	695.65	
26	chloride nitride	$P_6N_7Cl_9$.	603.29	tr. rhomb. pr
27	cyanide	$P(CN)_3$.	109.07	wh. need.
28	fluoride, tri-	PF_3 .	88.02	col. gas
29	" , penta-	PF_5	126.02	col. gas
30	iodide, di-	P_2I_4	569.72	tricl. orange
31	iodide, tri-	PI_3 .	411.78	hex. red., deliq
32	" sulfide	P_2I_2S .	347.94	or. sld
33	nitride	P_3N_5. .	163.10	amor. wh
34	oxide, tri-	P_2O_3 (or P_4O_6)	110.04	monocl. col. or wh. powd., deliq
35	" , tetra-	P_2O_4	126.04	rhomb. col., deliq
36	" , pent- (phosphoric anhydride)	P_2O_5 (or P_4O_{10})	142.04	monocl. or wh. powd., v. deliq
37	oxybromide	$POBr_3$	286.77	col. pl . . . .
38	" chloride, di-	$POBrCl_2$	197.85	tabl. or liq
39	oxychloride	$POCl_3$	153.39	col. fum liq., $1.460^{25.1}$
40	"	$P_2O_3Cl_4$	251.87	col. fuming liq
41	oxy*di*bromide chloride	$POBr_2Cl$	242.31	
42	oxyfluoride	POF_3	104.02	col. gas
43	oxyiodide	$P_3O_8I_6$	982.58	red cr

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1		38	d. 130	d.		
2				d.		
3	1.493^{19}	26.5	d.	s.	v. s.	v. s. al., eth.
4	1.82	44.1; ign. 34	280	$.0003^{15}$	sl. s.	0.3 al., 880^{10} CS_2, s. bz., NH_3, alk., eth., chl.
5	2.20	$590^{13\ atm.}$	ign.>200, 280	i. (v. sl. s.)	i.	s. abs. al., i. CS_2, eth., NH_3
6	2.36	593		i.		i. a., org. solv.
7	2.70					i. CS_2, c. H_2SO_4
8	2.852^{15}	−40	172.9	d.		d. al., s. eth., chl., CS_2, CCl_4
9		<100 d.	106 d.	d		s. CS_2, CCl_4, bz.
10				d.		
11		35 d		d.		
12				d		s. PCl_3, PCl_5
13		25		d.		
14		−20	d. 15	d.		d. glass
15		190	subl. 150 vac.	i.		s. eth., sl. s. CS_2, chl.
16	lq. 2.262^{17}		d	d.		s. CS_2, eth.
17		−28	180	hydr		
18	1.574^{21}	−91, (−111.8)	75.5^{749}	d.	d.	s. eth., bz., chl., CS_2, CCl
19	g. 4.65^{296} g/l	166.8 (press) sl. d.	subl. 162	d.		d. a.; s. CCl_4, CS_2
20			−8, d. 200			
21				d.		s. CS_2
22	1.98	114	256.5	i.	d	s. al., eth., chl., CS_2, bz., ac. a.
23	2.18^{24}_{24}	123.5	328.5			
24		41	224^{13}, polymer. >250			
25		90	262^{13}; polymer. >250			
26		237.5	$251–261^{13}$			
27		subl. 130		d.		v. s. eth., sl. s. h. bz.
28	3.907 g/l	−160	−95	d.		d. alk.; s. al.
29	5.805 g/l	−93.7	−84.5	d.		
30		124.5	d.	d		s. CS_2
31		61	d.	d	d.	v. s. CS_2
32		75	d.			s. CS_2
33	2.51^{18}		d. 800	i.	v. sl. s. d.	i. any solv.
34	2.135^{21}	23.8	173	d. to H_3PO_4	d.	s. CS_2, eth., chl., bz.
35	2.54^{23}	>100	subl. 180	v. s. to H_3PO_4	d.	
36	2.39	563	subl. 347	d. to H_3PO_4	d.	s. H_2SO_4, i. acet., NH_3
37	2.822	56	193	d.		s. H_2SO_4, CS_2, eth., bz., chl.
38	lq. 2.104^{14}	13	137.6	d.		
39	1.675	2	105.3	d.	d.	d. al., a.
40	lq. 1.58^{7}	<−50	212	d.		
41	lq. 2.45^{30}	30	165	d.		
42	4.69 g/l	−68	−39.8	d.		d. al.
43		140	d.	s.		s. al., eth.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Phosphorus			
1	oxynitride	PON	61 03	amor. wh
2	oxysulfide	$P_4O_6S_4$	348 32	tetr., deliq
3	selenide, sub-	P_4Se	203 04	dk. yel. liq. (exist. quest.)
4	" , mono-	P_2Se	141 00	red
5	"	P_4Se_3	360 96	or.-red cr
6	" , tri-	P_2Se_3	298 92	dk. red
7	" , penta-	P_2Se_5	456 84	dk red-blk. need
8	sulfide, tri-	P_4S_3 .	220 26	rhomb. yel
9	" "	P_4S_6 (or P_2S_3)	316 44	gray-yel. cr.
10	" , hepta-	P_4S_7	348 50	lt. yel. cr
11	" , di-	P_3S_6 (or PS_2)	285 42	yel. need
12	" , penta-	P_2S_5 (or P_4S_{10})	222 34	gray-yel. cr. deliq
13	thiocyanate	$P(SCN)_3$	205 25	liq
14	**Phosphoryl** amide (triamidophosphoric acid)	$PO(NH_2)_3$	95 09	amor , wh
15	**Phosphotungstic acid**	$H_3PW_{12}O_{40}$ 14H_2O	3133 31	tricl yel.-grn. cr
16	" "	$H_3PW_{12}O_{40}$ 24H_2O	3313 47	trig
17	**Platinum**	Pt	195 23	cub. silv. metal
18	arsenide (sperrylite)	$PtAs_2$	345 05	cub. tin wh
19	bromide, di- (ous)	$PtBr_2$	355 06	br
20	" , tetra- (ic)	$PtBr_4$	514 89	dk. br
21	chloride, di- (ous)	$PtCl_2$	266 14	olive-grn
22	" , tri-	$PtCl_3$	301 60	grnsh.-blk
23	" , tetra- (ic)	$PtCl_4$	337 06	br.-red cr
24	" " "	$PtCl_4$ 5H_2O	427 14	monocl. red
25	cyanide (ous)	$Pt(CN)_2$	247 27	yel. br. cr
26	fluoride, di- (ous)	PtF_2	233 23	yelsh.-grn
27	" , tetra- (ic)	PtF_4	271 23	deep red, fused mass or yel-lt br cr , deliq
28	hydroxide (ous)	$Pt(OH)_2$	229 25	blk
29	" "	$Pt(OH)_2$ 2H_2O	265 28	
30	iodide, di- (ous)	PtI_2	449 07	blk
31	" , tetra- (ic)	PtI_4	702 91	amor. br. or blk. cr
32	oxide, mon- (ous)	PtO	211 23	vlt. blk
33	" " "	PtO 2H_2O	247 26	
34	" (ous, ic)	Pt_3O_4	649 69	blk
35	" , sesqui-	$Pt_2O_3{\cdot}xH_2O$		br
36	" , di- (ic)	PtO_2	227 23	blk
37	" " "	PtO_2 H_2O	245 25	blk
38	" " " (platinic hydroxide)	PtO_2 2H_2O (or $Pt(OH)_4$)	263 26	yel.-br.-rose
39	oxide, di- (ic)	PtO_2 3H_2O	281 28	ochre
40	" " " (hydroxyplatinic acid)	PtO_2 4H_2O (or $H_2Pt(OH)_6$)	299 29	yel. need..
41	oxide, tri-	PtO_3	243 23	rdsh.-brn. powd
42	*pyro*phosphate	PtP_2O_7	369 27	grn.-yel
43	sulfate	$Pt(SO_4)_2{\cdot}4H_2O$	459 41	yel. pl
44	sulfide, mono- (ous)	PtS	227 29	blk

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		red heat		i.	i.	i. a., alk.
2		102	295	d.	.	50 CS_2
3		−12	ign.	d.		s. CS_2; i. al., eth.
4				d		v. s. CS_2; sl. s. eth.; i. al
5	1.31	242	360–400			
6					d	s. KOH; i. CS_2
7		d.		d.		s. CCl_4; i. CS_2
8	2.03	172.5	407.5	i.	d.	60 CS_2; s. bz., PCl_3, HNO_3; i. HCl, H_2SO_4
9		290	490	d.		s. al., eth., alk.; v. sl. s. CS_2
10	2.19^{17}	310	523			sl. s. CS_2, i. most solv.
11		298	$337^{10.5}$			v. sl. s. CS_2
12	2.03	276	514	d.		0.22 CS_2; s. alk.
13	1.625^{18}	*ca.* −4	265	d.		s. al., eth., CS_2, bz.
14		d.		i.	i.	s. al.; i. a.
15				s.		s. al., eth.
16		89		s.		
17	21.45	1773.5	4300	i.	i.	s. aq. reg., fus. alk.
18	10.602	>800 d.		i.		i.
19	6.65	d. 250		i. (v. sl. s.)	i.	s. HBr, KBr, Br aq.
20	5.69	d. 180		0.41^{20}	sl. s.	v. s. al., eth., HBr
21	5.87^{11} (6.05)	d. 581		i. (v. sl. s.)	i.	s. HCl, NH_4OH, sl. s. NH_3; i. al., eth.
22	5.256^{20}	435		sl. s.	s	v. sl. s. conc. HCl; s. h. HCl
23		d. 370		v. s.	v. s.	s. acet.; sl. s. al., NH_3; i. eth.
24	2.43 ($8H_2O$)	−H_2O, 100		v. s.	v. s.	s. al., eth.
25				i.	i.	s. KCN, i. a., alk., al.
26				i.	i.	
27		d.		s. d.	v. s.	s. a., alk.
28		d.		i.	i.	s. HCl, HBr, alk.; i. H_2SO_4, dil. HNO_3
29		−$2H_2O$, 100		i.	i.	s. conc. a.
30	6.4	d. 300–350		i.	i.	s. HI, sl. s. Na_2SO_3; i. a.
31	6.064^{20}	d. 370		s. d.		s. al., alk., acet., HI, KI, NH_3
32	14.9^{15}	d. 550		i.	i.	s. HCl, H_2SO_3; i. a., aq. reg.
33						s. conc. HCl, H_2SO_4, HNO_3
34		d.		i.		i. a., aq. reg.
35				i.	i.	s. conc. H_2SO_4, caust. alk.
36		450		i.	i.	i. a., aq. reg.
37				i.	i.	sl. s. NaOH; i. ac. a., aq. reg., HCl
38		−$2H_2O$, 100		i.	i.	s. HCl, aq. reg., KOH
39		d.		i.	i.	i. HCl, aq. reg.
40		−$2H_2O$, 100, −$3H_2O$, 120		i.	i.	s. a., dil. caust. alk.
41					.	s. HCl, H_2SO_3; sl. s. HNO_3, H_2SO_4
42	4.85	d. 600		v. sl. s.		. . .
43				s.	d.	s. a., al., eth.
44	8.847	d.		i.	i.	s. $(NH_4)_2S$; i. a., alk.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Platinum			
1	sulfide, sesqui-	Pt_2S_3	486.64	grav
2	" , di- (ic)	PtS_2	259.35	blk.-br. powd
	Platinum complexes:			
3	Tetrammineplatinum (II) chloride	$[Pt(NH_3)_4]Cl_2 \cdot H_2O$	352.29	tetrag. col., 1.672, 1.667
4	Tetrammineplatinum (II) chloroplatinite (Magnus' salt)	$[Pt(NH_3)_4][PtCl_4]$	600.42	tetrag. grn. or red
5	Tetrachlorodiammineplatinum (IV), *cis*-	$[Pt(NH_3)_2Cl_4]$	371.12	rhomb. or hex. pl. or need. or.-yel
6	Tetrachlorodiammineplatinum (IV), *trans*-	$[Pt(NH_3)_2Cl_4]$	371.12	oct. or quad. yel. pl
7	**Plumbous, Plumbic**	See *Lead*		
8	**Potassium...**	K	39.10	cub. silv. metal
9	acetate	$KC_2H_3O_2$	98.14	lust wh. powd., deliq
10	" , acid	$KC_2H_3O_2 \cdot HC_2H_3O_2$	158.19	need. or pl
11	acetylsalicylate	$KC_9H_7O_4 \cdot 2H_2O$	254.28	
12	aluminate	$KAlO_2 \cdot 1\frac{1}{2}H_2O$	125.09	col. cr
13	aluminum borate, basic	$K(AlO)_2(BO_2)_3$	253.50	cub. wh., 1.6935
14	" sulfate (kalinite)	$KAl(SO_4)_2 \cdot 12H_2O$	474.38	cub. or monocl. col., 1.4562; 1.430, 1.452, 1.458
15	amide (potassamide)	KNH_2	55.12	col.-wh. or yel.-grn
16	ammonium tartrate	$KNH_4C_4H_4O_6$	205.21	wh. cr. powd
17	*pyro*antimonate, di-H	$K_2H_2Sb_2O_7 \cdot 4H_2O$	507.79	gran., wh. cr. powd
18	*meta*antimonate	$KSbO_3 \cdot xH_2O$		wh. powd
19	antimony tartrate (tartar emetic)	$KSbC_4H_4O_7 \cdot \frac{1}{2}H_2O$	333.94	rhomb. col., 1.620, 1.636, 1.638
20	argentocyanide	$KAg(CN)_2$	199.01	cub. col
21	*ortho*arsenate	K_3AsO_4	256.20	col. deliq. need
22	" , mono-H	K_2HAsO_4	218.11	col. cr
23	" , di-H	KH_2AsO_4	180.02	tetr. col., 1.567, 1.518
24	*ortho*arsenite	K_3AsO_3	240.20	col. need
25	*meta*arsenite	$KAsO_2$	146.01	wh. powd., hyg
26	" , acid	$KH(AsO_2)_2 \cdot H_2O$	271.94	
27	aurate	$KAuO_2 \cdot 3H_2O$ (or $2H_2O$)	322.34	lt. yel. need
28	azide	KN_3	81.12	col
29	benzoate	$KC_7H_5O_2 \cdot 3H_2O$	214.26	wh. cr. powd
30	*di*borane (diboramide)	$K_2B_2H_6$	105.88	wh. cubical cr., 1.493
31	" , dihydroxy-	$K_2B_2H_6O_2$	137.88	col. cubical cr
32	*penta*borane (pentaboramide)	$K_2B_5H_9$	141.36	wh. powd
33	*meta*borate	KBO_2 (or $K_2B_2O_4$)	81.92	monocl. col
34	*tetra*borate	$K_2B_4O_7 \cdot 5H_2O$	323.55	monocl. or hex. pr
35	*penta*borate	KB_5O_8	221.20	col
36	*per*borate	$KBO_3 \cdot \frac{1}{2}H_2O$	106.92	wh
37	borotartrate (sol. cream of tartar)	$KC_4H_4BO_7$(?)	213.99	wh. cr. powd
38	bromate	$KBrO_3$	167.01	trig. col
39	bromide	KBr	119.01	cub. col. sl. hyg., 1.559
40	bromoaurate	$KAuBr_4$	555.96	rhomb. red-br
41	"	$KAuBr_4 \cdot 2H_2O$	591.99	vlt. cr. monocl
42	bromoiodide, di-.	$KIBr_2$	325.85	rhomb.

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	5.52	d.		i.	i.	slowly s. aq. reg.; i. a.
2	7.22	d. 225–250		i.	i.	s. HCl, HNO_3; i. $(NH_4)_2S$
3	2.737	250; $-H_2O$, 100				... .
4	<4.1	d.		sl. s.	sl. s.	. .
5		240				. .
6	3.3	200–216				.
7						....
8	0.86^{20}, 0.83^{62}	62.3	760	d. to KOH + H_2	d	d. al., s. a., Hg, NH_3
9	1.8	292		253^{20}; 286.3^{61}	492^{60}	33 al.; i. eth.
10		148	d. 200	d.	d	s. al., acet.
11		65		.		
12				v. s., d.	v. s., d.	s. alk., i. al.
13	3.415	<1800		i.	i.	sl. s. HCl
14	1.75	92 (84.5)	$-9H_2O$, 64.5	11.4^{20}	∞	s. dil. a., i. al.
15		335	subl. 400	d.	d.	d. al.
16				v. s.		
17				2.82^{20}	s.	.
18				i.	sl. s.	s. h. KOH; i. al., CS_2
19	2.697	$-\frac{1}{2}H_2O$, 100		$5.26^{8.7}$	35.7^{100}	i. al.; 6.67^{25} glyc.
20	2.36			25^{20}	100	4, 85% al.; i. a.
21				18.87	v. s.	4 al.
22				18.86^{6}	s.	i. al.
23	2.867	288		19^{6}	v. s.	i. al.
24				v. s.		s. al.
25				s.	s.	sl. s. al.
26				s.		sl. s. al.
27		d.		s.	d	s. al.
28	2.04	350		s.	s.	s. al., i. eth.
29		$-3H_2O$, 110	d.	$52^{?}$	112^{100}	s. al.
30	1.18		300^{1} d.	d.		
31	1.39	d. →K		s.		s. al.
32		d. <180		d	d	.
33		947–50		71^{30}	v. s.	..
34	(anh.) 1.74	d.		26.7^{10}	v. s.	..
35		780		$.007^{0}$		. ..
36				1.22^{0}; 2.15^{15}		i. al., eth.
37	1.832			v. s.		i. al., eth., chl.
38	$3.27^{17.5}$	434; d. 370		3.1^{0}; 13.3^{40}	49.75^{100}	sl. s. al.; i. acet.
39	2.75^{25}	730	1380 (1435)	53.48^{0}	102^{100}	0.5 al.; s. glyc.; sl. s. eth.
40		d.		sl. s.	. .	s. al.
41				19.5^{15}	204^{67}	d. eth.; sl. al., KBr
42		60	d. 180	d.		....

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Potassium			
1	bromoplatinate	K_2PtBr_6	752 92	cub. dk. red-br
2	bromoplatinite	K_2PtBr_4	593 09	rhomb. br
3	"	$K_2PtBr_4 \cdot 2H_2O$	629 12	rhomb. blk.
4	cacodylate	$KAsC_2H_6O_2 \cdot H_2O$	194 09	wh. cr
5	cadmicyanide	$K_2Cd(CN)_4$	294 67	cub. col
6	cadmium iodide	$2KI \cdot CdI_2 \cdot 2H_2O$	734 31	wh.-yelsh. cr. powd., deliq
7	calcium chloride (chlorocalcite)	$KCl \cdot CaCl_2$	185 55	cub. β 1.52
8	" magnesium sulfate (krugite)	$K_2Ca_4Mg(SO_4)_6 \cdot 2H_2O$	875 22	gray
9	" magnesium sulfate (polyhalite)	$K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$	602 94	tri., wh., 1.548, 1.562, 1.567
10	" sulfate (kaluszite, syngenite)	$K_2Ca(SO_4)_2 \cdot H_2O$	328 41	monocl., 1.500, 1.517, 1.518
11	*d*-camphorate	$K_2C_{10}H_{14}O_4 \cdot 5H_2O$	366 49	need. clusters, hygr
12	carbonate	K_2CO_3	138 20	monocl. col., hyg
13	"	$K_2CO_3 \cdot 2H_2O$	174 23	rhomb
14	carbonate	$2K_2CO_3 \cdot 3H_2O$	330 45	monocl. col.
15	carbonate, acid	$KHCO_3$	100 11	monocl. col.
16	*peroxy*carbonate	$K_2C_2O_6$	198 21	bl
17	carbonyl	$(KCO)_6$	402 64	gray-red
18	chlorate	$KClO_3$	122 55	monocl. col., 1.409, 1.517, 1 524
19	*per*chlorate	$KClO_4$	138 55	rhomb. col.
20	chloride (sylvite)	KCl	74 55	cub. col., 1.490
21	*hypo*chlorite	$KClO$	90 55	in soln. only
22	chloroaquoruthenite, penta-	$K_2Ru(H_2O)Cl_5$	375 19	rose prisms.
23	chloroaurate	$KAuCl_4$	378 12	monocl. yel
24	"	$KAuCl_4 \cdot 2H_2O$	414 16	rhomb. pl., yel
25	chlorochromate (Peligot's salt)	$KClCrO_3$	174 56	monocl. red.
26	chlorohydroxyruthenate, penta-	$K_2Ru(OH)Cl_5$	374 19	brn.-red cr
27	chloroiodite	$KICl_4$	307 84	rhomb. yel
28	chloroiridate	K_2IrCl_6	484 03	cubic, blk
29	chloronitrosoruthenate, penta-	$K_2Ru(NO)Cl_5$	387 19	rhomb. dk. red.
30	chloroösmate	K_2OsCl_6	481 13	cub. red
31	chloroosmite	$K_3OsCl_6 \cdot 3H_2O$	574.28	cr. dk. red
32	chloropalladate	K_2PdCl_6	397 63	cub. red
33	chloropalladite	K_2PdCl_4	326 72	tetr. red-br. (cub. yel)
34	chloroplatinate	K_2PtCl_6	486 16	cub. yel
35	chloroplatinite	K_2PtCl_4	415 25	tetr. red-br
36	chlororhodite, penta-	K_2RhCl_5	358 39	rhomb. red
37	" , hexa-	$K_3RhCl_6 \cdot 3H_2O$	486 99	tricl. red..
38	chlororuthenate	K_2RuCl_6	392 63	cub. blk
39	chlorostannate	K_2SnCl_6	409 63	cub. col., 1 657
40	chlorotellurate	K_2TeCl_6	418 54	pale yel. octahedral
41	chromate (tarapacaite)	K_2CrO_4	194 20	rhomb. yel., β 1 74
42	*di*chromate	$K_2Cr_2O_7$	294 21	monocl. or tricl. red
43	*peroxy*chromate	K_3CrO_8	297 30	cub. br.-red
44	chromicyanide	$K_3Cr(CN)_6$	325 41	monocl. yel
45	chromium chromate, basic	$K_2CrO_4 \cdot 2Cr(OH)CrO_4$	564 26	vlt.-br. amor. powd
46	chromium sulfate (ic)	$KCr(SO_4)_2 \cdot 12H_2O$	499 42	cub. oct., red or grn., 1.4814
47	citrate	$K_3C_6H_5O_7 \cdot H_2O$	324 40	col
48	" , monobasic	$KH_2C_6H_5O_7$	230 21	wh. cr. powd
49	cobalt carbonate, acid (ous)	$KHCO_3 \cdot CoCO_3 \cdot 4H_2O$	291 13	rose need

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	4.66^{24}	d.>400		2.02^{20}	10^{100}	i. al.
2				v. s.	v. s.	
3		$-H_2O$ vac.		v. s.	v. s.	
4				s.		sl. s. al.; i. eth.
5	1.85			33	100^{100}	sl. s. al.
6	3.359			137^{15}		s. a., al., eth.
7		754		s.		
8	2.801					
9	2.775					
10	2.60	1004		0.25	d.	s. a.; i. al.
11		$-5H_2O$, 110		260^{14}		s. al.
12	2.428^{19}	891	d.	112^{20}	156^{100}	i. al., acet.
13				146.9	331^{100}	
14	2.043			129.4	268.3^{100}	i. conc. NH_4OH, al.
15	2.17	d. 100-200		22.4	60^{60}	i. al.
16		200–300		s.		
17		exp.		exp.		d. al.
18	2.32	368.4	d. 400	7.1^{20}	57^{100}	0.83 al.; s. alk.
19	2.52^{10}	610 ± 10; (525–30)		0.75^{0}	21.8^{100}	i. al., eth.
20	1.984	776	subl. 1500	34.7^{20}	56.7^{100}	sl. s. al.; s. alk., eth., glyc.
21		d.		v. s.	v. s.	
22		$-H_2O$, 200		s.	s.	sl. s. al.
23		d. 357		61.8^{20}	80.2^{60}	s. a.; 25 al.
24				s.	s.	s. al., eth.
25	2.497	d.		s. d.		s. a.
26		d.		s. d.	d.	i. al.
27	1.76^{45}	d.		d.		d. eth.
28	3.546	d.		1.25^{19}	6.67	i. al., KCl. NH_4OH
29		d.		12^{25}	80^{80}	i. al.
30		d.		sl. s.	s.	s. dil. HCl; i. al.
31		$-3H_2O$, 150		v. s.		s. al.; i. eth.
32	2.738	d.		sl. s. d.	d.	sl. s. HCl, i. al.
33	2.67	d. 105		s.	v. s.	s. KCl, NH_4OH; i. al.
34	3.499^{24}	d. 250		0.481^{2}	5.22^{100}	i. al., eth.
35	3.30	d.		0.93^{16}	5.3^{100}	i. al.
36		d.		sl. s.	d.	i. al.
37	3.291	d.		d.		sl. s. al., KCl
38		d.		s. d.		i. al.
39	2.71			s.	s.	
40				d.	d.	s. HCl
41	2.732^{18}	968.3		62.9^{20}	79.2^{100}	i. al.
42	2.69	tr. 2.36; 398	d. 500	4.9^{0}	102^{100}	i. al.
43		d. 170		sl. s.		i. al., eth.
44	1.71			30.9^{20}		i. al.
45	2.28^{14}	300		i.		i. al., acet. a.
46	1.83	89	$-12H_2O$, 400	24.39^{25}	50	s. dil. a.; i. al.
47	1.98	d. 230		167^{15}	199.7^{31}	s. glyc.; sl. s. al.
48				s.		
49				d.		

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Potassium			
1	cobalticyanide..	$K_3Co(CN)_6$	332 34	monocl. yel
2	cobaltinitrite (Fischer's salt)	$K_3Co(NO_2)_6$	452 28	pr. yel .
3	cobaltinitrite......	$K_3Co(NO_2)_6 \cdot H_2O$.	470 29	yel. cr. powd .
4	"	$K_3Co(NO_2)_6 \cdot 1\frac{1}{2}H_2O$	479 30	tetr. yel. . .
5	cobalt malonate (ous)	$K_2Co(C_3H_2O_4)_2$	341 22	....
6	cobaltocyanide .	$K_4Co(CN)_6$	371 43	vlt. need .... . .
7	cobalt sulfate (ous)	$K_2SO_4 \cdot CoSO_4 \cdot 6H_2O$	437 35	monocl. pr. red, 1.481, 1 487, 1.500
8	copper chloride	$KCl\ CuCl_2$	209 04	red need
9	cuprocyanide	$K_3Cu(CN)_4$.	284 93	rhbdr. col .
0	cyanate	KOCN.	81 11	need. col .
11	cyanide.	KCN .	65 11	cub. col., wh. gran., deliq., extr pois
12	cyanoaurate (auricyanide)	$KAu(CN)_4 \cdot 1\frac{1}{2}H_2O$	367 39	col. tabl
13	cyanoaurite (aurocyanide)	$KAu(CN)_2$ ...	288 33	col. rhomb
14	cyanoösmite	$K_4Os(CN)_6 \cdot 3H_2O$	556 74	monocl. col.-yel., β 1.607
15	cyanoplatinite	$K_2Pt(CN)_4 \cdot 3H_2O$	431 54	rhomb. col. yel., blue fluores., deliq.
16	ethylsulfate	$KC_2H_5O_4S$.	164 22	monocl. wh .
17	ferricyanide	$K_3Fe(CN)_6$.	329 24	monocl. red , 1.566, 1.569, 1 583
18	ferrocyanide .	$K_4Fe(CN)_6 \cdot 3H_2O$	422 38	monocl. lem. yel., β 1 577
19	fluoberyllate	K_2BeF_4	163 21	rhomb. col.
20	fluoborate (avogadrite)	KBF_4 .	125 92	rhomb. or cub. col
21	fluocolumbate, penta-	$K_2CbOF_5 \cdot H_2O$	300 12	monocl. leaf. col
22	fluogermanate	K_2GeF_6	264 79	hex. wh .
23	fluomanganite	K_2MnF_6. .	247 12	hex tab., yel
24	fluorescein deriv	$K_2C_{20}H_{10}O_5$..	408 47	yellowish-red powd
25	fluoride	KF	58 10	cub. col., deliq
26	" . .	$KF\ 2H_2O$.	94 13	monocl. pr., deliq
27	" , acid ..	KHF_2	78 10	cub. col .
28	fluosilicate (hieratite)	K_2SiF_6 ...	220 25	hex. or cub. col.
29	fluostannate.	$K_2SnF_6 \cdot H_2O$	328 91	monocl. pr
30	fluosulfonate	$KFSO_3$ .. .	138 16	short, thick pr
31	fluotellurate, di-	$K_2TeO_3F_2 \cdot 3H_2O$	345 85	micros., oct., monocl
32	fluotitanate	$K_2TiF_6 \cdot H_2O$	258 11	col. monocl. sm. lust. leaf
33	fluozirconate	K_2ZrF_6.. .	283 41	monocl. col., 1.466, 1.455
34	formate .	$KCHO_2$.	84 11	rhomb. col., deliq
35	gadolinium sulfate	$K_2SO_4 \cdot Gd_2(SO_4)_3 \cdot 2H_2O$	812 26	cryst
36	gallium sulfate	$KGa(SO_4)_2 \cdot 12H_2O$	517 13	col. cr., 1.46528
37	*meta*germanate	K_2GeO_3.	198 79	wh. cryst
38	*di*germanate	$K_2Ge_2O_5$	303 39	wh. cryst .
39	*tetra*germanate	$K_2Ge_4O_9$	512 59	wh. cryst
40	glycerophosphate	$K_2C_3H_7PO_6$	248 30	col. to sl. yelsh. mass, hyg
41	hydride .	KH	40 10	wh. need
42	hydroxide	KOH .	56 10	rhomb. deliq., wh
43	iodate	KIO_3	214 02	monocl. col...
44	iodate, acid	$KIO_3 \cdot HIO_3$	389 94	monocl..
45	" "	$KIO_3 \cdot 2HIO_3$	565 87	col. tricl . .
46	*metaper*iodate	KIO_4.......	230 02	tetr. col
47	iodide ..	KI ..	166 02	cub. col. or wh. gran., 1.677
48	" , tri- .	KI_3 .	419 86	monocl. dk. bl., deliq
49	iodoaurate ..	$KAuI_4$.	743 98	lust. blk. cr ..
50	iodoiridite	K_3IrI_6	1071 91	grn. cr
51	iodoplatinate.	K_2PtI_6	1034 94	blk rect
52	iron chloride (ic) (erythrosiderite)	$2KCl \cdot FeCl_3 \cdot H_2O$	329.33	orthorhomb. red

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	1.906	d.		s.	s.	i. al.
2	.....			sl. s.	sl. s.	i. al.
3	.....	.....		i.	s. d.	s. min. a.; sl. s. ac. a.; i. al., eth.
4	....	d. 200		0.089^{17}	sl. s.	i. al., eth.
5	2.234					
6	...			s.	s.	i. al., eth.
7	2.218			25.5^{0}	108.4^{49}	
8	2.86					
9		d.		v. s.		
10	2.048^{16}; 2.056^{20}	d. 700–900		s.	s.	i. al.
11	1.52^{16}	634.5; (601–621)		v. s.	v. s.	s. glyc., meth. al.; sl. s. al.
12		d. 200		s.	v. s.	s. al.
13	3.45			14.3	200	sl. s. al.; i. eth.
14		d.		sl. s.	s.	i. al., eth.
15	2.455^{16}	d. 400–600		sl. s.	v. s.	s. al., eth., H_2SO_4
16	1.843			s.		s. al.
17	1.894^{17}	d.		33^{4}	77.5^{100}	s. acet.; i. al.
18	1.85^{17}	$-3H_2O$, 70	d.	27.8^{12}	$90.6^{96.3}$	s. acet.; i. al., NH_3
19		red ht.		2^{20}	5.26^{100}	
20	2.498	530		$.44^{20}$	6.27^{100}	s. al.; sl. s. eth.
21				7.69		
22		730	*ca.* 835	$.542^{18}$	2.58^{100}	
23		d.		d.	d.	s. c. HCl
24				s.		
25	2.48	880	1500	92.3^{18}	v. s.	s. HF, NH_3; i. al.
26	2.454	41		349.3^{18}	v. s.	s. HF, i. al.
27		d.		$41.^{21}$	v. s.	s. $KC_2H_3O_2$; i. al.
28	hex. 3.08; cub. 2.665^{17}	d.		$0.12^{17.5}$	0.954^{100}	s. HCl; i. NH_3, al.
29	3.053			3.7^{18}	33.3^{100}	i. al., NH_3
30		311		6.9^{19}		
31		d.		sl. s.	sl. s.	s. HF
32		$-H_2O$,32,780	d.	$.556^{0}$; 1.3^{20}	1.27^{21}	s. min. a.; i. NH_3
33	3.48			$.781^{?}$	25^{100}	i. NH_3
34	1.91	167.5	d.	331^{18}	657^{90}	s. al.; i. eth.
35	3.503^{16}			s.	s.	s. K_2SO_4
36	1.895			s.		
37	$3.40^{21.5}$	823		s.		s. a.
38	$4.31^{21.5}$	>83		s.		s. a.
39	$4.12^{21.5}$	1033		s.		s. a.
40				v. s.	v. s.	s. al.
41	1.43–.47	d.		d.	d.	i. CS_2, eth., bz.
42	2.044	360.4 ± .7	1320 ±4	97^{0}; 107^{15}	178^{100}	v. s. al., eth.; i. NH_3,
43	3.89	560	d.>100	4.74^{0}	32.3^{100}	s. KI; i. al., NH_3
44				1.33^{15}		
45				4^{15}		
46	3.618^{15}	582	−O, 300	0.66^{13}	s.	v. sl. s. KOH
47	3.13	723	1420 (1330)	127.5^{0}	208^{100}	14.3 al.; s. NH_3; sl. s. eth.
48	3.498	31 (45)	d. 225	v. s.		s. al., KI
49				s., d.		s. dil. soln. KI
50		d.		v. s. (i.)		i. al.
51	5.176 (4.96–5.03)	...		s.	s. d.	i. al.
52	2.320					

No	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Potassium			
1	iron oxalate (ous)	$K_2Fe(C_2O_4)_2 \cdot 2H_2O$	346 10	gold need
2	" " (ic)	$KFe(C_2O_4)_2 \cdot 2\frac{1}{2}H_2O$	316 02	br. cr
3	" " "	$K_3Fe(C_2O_4)_3 \cdot 3H_2O$	491 24	monocl. grn.
4	" sulfate (ous)	$K_2SO_4\ FeSO_4 \cdot 6H_2O$	434 25	grn. monocl. pr
5	" " (ic) (krausite)	$K_2SO_4 \cdot Fe_2(SO_4)_3 \cdot 2H_2O$	610 14	monocl., pale yel. grn
6	" " "	$KFe(SO_4)_2 \cdot 12H_2O$	503 25	cub. oct. col. or vlt., 1.482
7	" sulfide (ic)	$KFeS_2$	159 06	purp., hex
8	lactate	$KC_3H_5O_3\ xH_2O$		col to yelsh. syrupy liq
9	laurate	$KC_{12}H_{23}O_2$	238 40	amor
10	" , acid	$KC_{12}H_{23}O_2 \cdot C_{12}H_{24}O_2$	438 72	wh. wax-like solid
11	lead chloride (pseudo-cotunnite)	$2KCl \cdot PbCl_2$	427 23	yel
12	magnesium carbonate, acid	$KHCO_3 \cdot MgCO_3 \cdot 4H_2O$	256 51	tricl. or rhombic col
13	" chloride (carnallite)	$KCl\ MgCl_2 \cdot 6H_2O$	277.88	rhomb col., deliq, 1.466, 1.475, 1.494
14	" chloride sulfate (kainite)	$K_2SO_4 \cdot MgSO_4 \cdot MgCl_2\ 6H_2O$ (or $KMgClSO_4 \cdot 3H_2O$)	497 96 (248 98)	col. monocl
15	magnesium chromate	$K_2CrO_4 \cdot MgCrO_4 \cdot 2H_2O$	370 56	tric...
16	magnesium sulfate (langbeinite)	$K_2SO_4\ 2MgSO_4$	415 01	tetrah., 1.5329
17	" sulfate (leonite)	$K_2SO_4\ MgSO_4 \cdot 4H_2O$	366 70	col., monocl, 1 483, 1.487, 1.490
18	" " (picromerite, schönite)	$K_2SO_4 \cdot MgSO_4 \cdot 6H_2O$	402 73	monocl col, 1 461, 1.463, 1 476
19	malate	$K_2C_4H_4O_5$	210 26	col., viscid mass
20	manganate	K_2MnO_4	197 12	rhomb. grn
21	*per*manganate	$KMnO_4$	158 03	rhomb. purple, ω 1.59
22	manganese chloride (ous) (chloromanganokalite)	$4KCl \cdot MnCl_2$	424 06	trig., 1.59
23	manganese sulfate (ic)	$KMn(SO_4)_2 \cdot 12H_2O$	502 34	cub. (oct.,) vlt.
24	" " " (manganolangbeinite)	$K_2SO_4 \cdot 2MnSO_4$	476 23	tetrah., rose-red, 1.572
25	manganicyanide	$K_3Mn(CN)_6$	328 33	monocl red, 1.553, 1.555 (Li), 1 571
26	manganocyanide	$K_4Mn(CN)_6 \cdot 3H_2O$	421 47	tetr. deep blue
27	mercuricyanide	$K_2Hg(CN)_4$	382 87	col. cr pois
28	mercury iodide (ic)	$KI \cdot HgI_2$	620 47	yel., deliq. pr
29	" tartrate (ous)	$KHgC_4H_4O_6$	387 78	wh. cr. powd
30	methionate (methane-disulfonate)	$K_2CH_2O_6S_2$	252 34	monocl., β 1 539
31	methylsulfate	$2KCH_3O_4S \cdot H_2O$	318 40	wh. cr
32	molybdate	K_2MoO_4	238 14	wh. deliq. powd
33	"	$K_2MoO_4 \cdot 5H_2O.$	328 22	wh. deliq. powd
34	myristate, acid	$KC_{14}H_{27}O_2 \cdot C_{14}H_{28}O_2$	494 82	wh. wax-like solid
35	naphthalene-1,5-disulfonate	$K_2C_{10}H_6O_6S_2 \cdot 2H_2O$	400 49	monocl., 1 485, 1 669, 1.697
36	nickelocyanide	$K_2Ni(CN)_4 \cdot H_2O$	258 97	monocl. cr. or powd., red-yel
37	nickel sulfate	$K_2SO_4 \cdot NiSO_4 \cdot 6H_2O$	437 10	monocl. bl, 1 484, 1 492, 1.505
38	nitrate (saltpeter)	KNO_3	101 10	rhomb. or trig. col., 1.335, 1.506, 1.506
39	nitride	K_3N	131 30	grnsh. blk
40	nitrite	KNO_2	85 10	col. prism, deliq
41	nitroplatinite	$K_2Pt(NO_2)_4$	457 45	monocl. col

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		d.		s.	s	
2		d.		92^{21}	d.	i. al.
3		$-3H_2O$, 100	d. 230	4.7^{0}	117.7^{100}	s. acet.; i. al., NH_3
4	2.169					
5	2.840					
6	1.83	33		$20^{12.5}$	v. s.	i. al.
7	2.563			d.		
8				s.		s. al.; i. eth.
9						4.5^{15} al.
10		160				$0.904^{13.5}$ al.
11		490		s.		...
12	2.98			s. d. gives	$MgCO_3 \cdot 3H_2O$	
13	1.61	265		64.5^{19} d.	d	d. al.
14	2.131			79.56^{18}		i. eth., al.
15	2.59					
16	2.829	927				
17	2.201^{20}			v.s.		
18	2.15	d. 72		19.26^{0}; 25^{20}	59.8^{70}	
19				s.		
20		d. 190		d.	d.	s. KOH
21	2.703	d.<240		2.83^{0}; 6.38^{20}	25^{60}	d. al., s. H_2SO_4; v. s. meth. al., acet.
22	2.31			s.	s.	
23				d.		
24	3.02	850				
25				s.		
26				s.	d.	
27				s.		s. al.
28				d		s. al., eth., KI, ac. a.
29				i.		i. al.
30	2.376			s.		
31				s.		s. al.
32	lq. 2.342^{981}	919		184.6^{25}	v. s.	i. al.
33				s.		......
34		153				$.453^{13.5}$ al.
35	1.797			s		....
36	1.875^{11}	$-H_2O$, 100		s.		d. a.
37	2.124	d.<100		7^{0}	60.8^{75}	....
38	2.109^{16}	tr.-trig. 129 m.p. 334	d. 400	13.3^{0}, 31.6^{20}	247^{100}	i. al., eth.
39		d		d.		
40	1.915	387(419)		281^{0}; 313^{25}	413^{100}	v. s. NH_3; sl. s. al.; i. 94 % al
41		d.		3.8^{15}	s.	

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Potassium			
1	*m*-nitrophenoxide	$KOC_6H_4NO_2 \cdot 2H_2O$	213 23	flat or. need.....
2	*p*-nitrophenoxide	$KOC_6H_4NO_2\ 2H_2O$	213 23	yel. leaf . . . . . .
3	nitroprusside .	$K_2(NO)Fe(CN)_5 \cdot 2H_2O$	330 16	monocl. red hyg..... .
4	oleate...... .	$KC_{18}H_{33}O_2$	320 54	cr. or yelsh. or brnsh. soft mass, α 1.452, γ 1.465
5	" , acid	$KC_{18}H_{33}O_2 \cdot C_{18}H_{34}O_2$	603 00	white wax-like solid.......
6	osmate . .	$K_2OsO_4 \cdot 2H_2O$.	368 42	cub. vlt., hyg . .
7	oxalate .	$K_2C_2O_4 \cdot H_2O$ ...	184 23	monocl. wh., 1.440, 1.485, 1.550
8	" , acid.	KHC_2O_4 .	128 12	monocl. col , 1.415, 1.545
9	" " . .	$KHC_2O_4 \cdot \frac{1}{2}H_2O$	137 13	trim
10	" "	$KHC_2O_4 \cdot H_2O$	146 14	rhomb
11	" , tetr-	$KHC_2O_4 \cdot H_2C_2O_4 \cdot 2H_2O$	254 19	tricl. col
12	oxide, mon-	K_2O	94 19	cub col -gray. . .
13	" , di-	K_2O_2	110 19	wh .
14	" , tri-. .	K_2O_3. .	126 19	red
15	" , per-.	KO_2. .	71 10	yel. leaf .
16	palmitate, acid .	$KC_{16}H_{31}O_2 \cdot C_{16}H_{32}O_2$	550 93	wh. fatty solid .
17	1-phenol-2-sulfonate (*o*-)	$KC_6H_5O_4S \cdot H_2O$	230 27	rhomb., 1 527, 1 568, 1 647
18	" -4- " (*p*-)	$KC_6H_5O_4S$. .	212 26	rhomb., 1.571, 1.608, 1.694
19	phenyl sulfate . . .	$KC_6H_5SO_4$. .	212 26	rhomb. leaf
20	*ortho*phosphate.	K_3PO_4	212 31	rhomb. col., deliq
21	" , mono-H	K_2HPO_4	174 22	amor. wh., deliq
22	" , di-H.	KH_2PO_4	136 13	tetr. col., deliq., 1.510, 1.4684
23	*pyro*phosphate	$K_4P_2O_7 \cdot 3H_2O$	384 47	col deliq .
24	*meta*phosphate	$K_4(PO_3)_4\ 2H_2O$	508 50	amor. col
25	*ortho*phosphite, mono-H	K_2HPO_3	158 22	wh. powd. deliq
26	" , di-H .	KH_2PO_3	120 13	deliq. wh
27	*hypo*phosphite. . . .	KH_2PO_2	104 13	hex. wh., deliq . .
28	phthalate, acid..	$KHC_8H_4O_4$.	204 22	rhomb. col
29	picrate	$KC_6H_2N_3O_7$	267.20	yel. redsh. or grnsh. rhomb., 1 527, 1 903, 1 952
30	piperate . .	$KC_{12}H_9O_4$	256 29	lt.-yel. cr. powd
31	platinate	$K_2PtO_3 \cdot 3H_2O$	375 47	rhomb. yel
32	platinum (tri-) thio-platinate (ous)	$K_2Pt_4(PtS_6)$	1051 47	bl. gray cr
33	*meta*plumbate	$K_2PbO_3 \cdot 3H_2O$	387 45	rhomb. col
34	praseodymium sulfate	$3K_2SO_4 \cdot Pr_2(SO_4)_3 \cdot H_2O$	1110 79	cr
35	propionate .	$KC_3H_5O_2 \cdot H_2O$	130 18	wh. hyg. cr , leaf., deliq.
36	propyl sulfate	$KC_3H_7O_4S$	178 24	wh. cr. powd
37	rhodium sulfate	$KRh(SO_4)_2\ 12H_2O$	550 32	yel. cub
38	ruthenate .	$K_2RuO_4\ H_2O$	261 91	tetr. blk
39	*per*ruthenate	$KRuO_4$	204 80	tetr. blk
40	*d*-saccharate, acid .	$KHC_6H_8O_8$	248 23	rhomb. need
41	salicylate	$KC_7H_5O_3$	176 21	wh powd
42	santoninate.....	$KC_{15}H_{19}O_4$	302 40	wh. deliq. cr. powd .
43	selenate . ..	K_2SeO_4	221 15	rhomb. col., 1.535, 1.539, 1.545
44	selenide ...	K_2Se	157 15	wh , cr reddens on exposure to air
45	selenite	K_2SeO_3	205 15	wh. deliq . . . .
46	selenocyanate ..	$KSeCN$	144 07	need., deliq
47	*meta*silicate	K_2SiO_3	154 25	amor. col. ... .
48	*di*silicate	$K_2Si_2O_5$	214 31	β, 1.500
49	" , hydrogen	$KHSi_2O_5$.	176 22	rhomb .

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1	1.691^{20}	$-2H_2O$, 130	d.	16.3^{18}		s. al.
2	1.652^{20}	$-2H_2O$, 130	d	7.5^{15}		sl. s. al.
3				100^{16}		s. al.
4				25	s.	s. $4.315^{13.5}$, 100^{50} al.; 3.5^{35} eth.
5		95		s.	s.	$5.2^{13.5}$ al.
6		$-H_2O$, >100		sl. s.	s. d.	i. al., eth.
7	2.127^{39}; 2.08	d.		33^{16}		
8	2.0	d.		2.5	16.7^{100}	sl. s. al.
9		d.		2.2	51.5^{100}	
10	2.044					
11	1.836	d.		1.8^{13}		
12	2.32^{0}			v. s	v. s.	s. al., eth.
13		490				
14		430				
15		*ca.* 400	d.	v. s. d		d. al.
16		138				0.198^{13} al.
17	1.734	400		s		s. al.
18	1.87	>260				
19		150–60 d	d	14^{15}		v. sl. s. al.
20	D^{17} = 2.564	1340		sl. s	s	i. al.
21		d.		v. s	v. s.	v. s. al.
22	2.338	252.6		33^{25}	s.	i. al.
23	2.33	$-2H_2O$, 180	$-3H_2O$, 300	s.	v. s.	i. al.
24	2.26^{11}	$-2H_2O$, 100		sl. s.	sl. s	s. al.
25		d.		v. s	v. s.	i. al
26		d.		v. s	v. s	i. al
27		d.		v. s	v. s	11.1^{25} chl.; v. sl. s. abs. al NH_3, i. eth.
28	1.636			10^{25}	33^{100}	
29	1.852		exp. 310	0.5^{15}	25^{100}	0.184^{25} al.
30				sl. s.	v. s.	
31		d.		s		i. al.
32	6.44^{15}	d. ign.		i.		d. HCl
33				d.	d.	s. KOH
34	3.275^{16}			sl. s.		s. HNO_3, HCl
35		$-H_2O$, 120		207^{16}	359	22.2^{13} 95% al.
36				v. s.		
37	2.23			s.		
38		$-H_2O$, 200	d. 400^{vac}	v. s.	d.	d. a., al.
39		d. 440		sl. s.	s. d.	
40				1.1^{6}	s.	
41				s.		s. al.
42				s.		s. al.
43	3.066			110.5^{0}	122.2^{100}	
44	2.851^{15}			s. d.	s.	
45				s.		sl. s. al.
46	2.347	d. 100		s.	s.	d. a.; s. al.
47		976		s.	s.	i. al.
48	2.456^{25}_{4}	1015 ± 10				
49	2.417^{15}_{4}	515				

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Potassium			
1	*tetra*silicate	$K_2Si_4O_9 \cdot H_2O$	352 45	rhomb., α 1.495, β 1.535
2	silicotungstate (normal)	$K_4SiW_{12}O_{40} \cdot 18H_2O$	3355 78	col. hex
3	silver carbonate	$KAgCO_3$	206 99	rect. pl
4	" nitrate	$KNO_3 \cdot AgNO_3$	270 99	monocl
5	sodium antimony tartrate	$KNaSbC_4H_2O_7$	346 92	wh. scales or powd
6	" carbonate	$KNaCO_3 \cdot 6H_2O$	230 20	monocl. hyg. efflor
7	" cobaltinitrite	$K_2NaCo(NO_2)_6 \cdot H_2O$	454 19	yel. cr
8	" ironchloride (ous) (rinneite)	$3KCl \cdot NaCl \cdot FeCl_2$	408 87	rhbdr., 1.589, 1.590
9	" sulfate	$3K_2SO_4 \cdot Na_2SO_4$	664 81	rhbdr
10	sodium tartrate (Rochelle salt, Seignette salt)	$KNaC_4H_4O_6 \cdot 4H_2O$	282 23	rhomb. col., 1.492, 1.493, 1.496
11	stannate	$K_2SnO_3 \cdot 3H_2O$	298 94	trig. col
12	stearate	$KC_{18}H_{35}O_2$	322 56	wh. cr. powd
13	" , acid	$KC_{18}H_{35}O_2 \cdot C_{18}H_{36}O_2$	607 03	wh powd
14	strontium chromium oxalate (ic)	$KSrCr(C_2O_4)_3 \cdot 6H_2O$	550 89	grnsh.-blk
15	styphnate	$KC_6H_2N_3O_8 \cdot H_2O$	301 21	yel. monocl. pr
16	succinate	$K_2C_4H_4O_4 \cdot 3H_2O$	248 31	rhomb
17	" , acid	$KHC_4H_4O_4$	156 18	monocl
18	" "	$KHC_4H_4O_4 \cdot 2H_2O$	192 21	rhomb., 1.417, 1.530, 1.533
19	" "	$KHC_4H_4O_4 \cdot C_4H_6O_4$	274 27	monocl
20	sulfate (arcanite)	K_2SO_4	174 25	rhomb. or hex. col., 1.494, 1.495, 1.497
21	" , acid (mercallite, misenite)	$KHSO_4$	136 16	monocl. or rhomb. col., deliq
22	*pyro*sulfate	$K_2S_2O_7$	254 31	col. need
23	*peroxydi*sulfate	$K_2S_2O_8$	270 31	tricl. col., 1 461, 1.467, 1.566
24	sulfide, mono-	K_2S	110 25	yel-br., deliq
25	" "	$K_2S \cdot 5H_2O$	200 33	rhomb. col
26	" , hydro-	KHS	72 16	rhomb. yel. deliq
27	" , di-	K_2S_2	142 31	red yel. cr
28	" , "	$K_2S_2 \cdot 3H_2O$	196 36	yel
29	" , tri-	K_2S_3	174 37	br. yel. cr
30	" , tetra-	K_2S_4	206 43	red-br. cr
31	" , "	$K_2S_4 \cdot 2H_2O$	242 46	yel
32	" , penta-	K_2S_5	238 49	orange cr
33	sulfite	$K_2SO_3 \cdot 2H_2O$	194 28	monocl. wh.-yelsh
34	" , acid	$KHSO_3$	120 16	col. cr
35	*pyro*sulfite (metabisulfite)	$K_2S_2O_5$	222 31	monocl. pl
36	tantalum fluoride	K_2TaF_7	392 07	rhomb. col.
37	*d*-tartrate	$K_2C_4H_4O_6 \cdot \frac{1}{2}H_2O$	235 27	monocl. col., β 1.526
38	*dl*-tartrate	$K_2C_4H_4O_6$	226 26	monocl. col
39	*d*- " , acid	$KHC_4H_4O_6$	188 18	rhomb. col
40	*dl*- " "	$KHC_4H_4O_6$	188 18	monocl. col
41	tellurate	K_2TeO_4	269 80	soft, glutinous mass
42	"	$K_2TeO_4 \cdot 5H_2O$	359 88	rhomb. col., deliq
43	telluride	K_2Te	205 80	col
44	tellurite	K_2TeO_3	253 80	wh. deliq. cr
45	thioantimonate	$2K_3SbS_4 \cdot 9H_2O$	896 72	yel. cr
46	thioarsenate	K_3AsS_4	320 44	deliq cr

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.417; anh. 2.335[25]	d. 400; anh. 770		s.	s	i. al.
2		$-17H_2O$, 100		33.3[20]	v. s	v. s. acet.; s. meth. al.; sl. s. al.; i. eth., bz.
3	3.769	d.		d.	d.	
4	3.219	125		v. s.	v. s.	
5				s.		
6	1.61–1.63[14]	$-6H_2O$, 100		185.2[15]		
7	1.633	135		0.07[25]		i. al.
8	2.3					
9	2.7			s.	s.	
10	1.790	70–80	$4H_2O$, 215	26[0]	66[26]	v. sl. s. al.
11	3.197			85[10]	110.5[20]	sl. s. KOH; i. al., acet.
12					s.	0.145[13.5] al.; i. eth., CS_2, chl.
13		153		s.	s	0.091[13.5] al.
14	2.155[13]					
15		$-H_2O$, 120	expl.	1.54[10]		v. sl. s. al.
16	1.564					
17	1.767	242 d				
18	1.616			s.		s. al.
19	1.56	162				
20	2.662	tr 588; 1076		6.85[0], 12[25]	24.1[100]	i. al., acet., CS_2
21	2.24–2.61	210	d.	36.3[0]	121.6[100]	i. al., acet.
22	2.27	>300	d.	s	d.	
23	2.477	d.<100		1.75[0]	5.3[70]	i. al
24	1.805[14]	471		s.	v. s	s. al., glyc.; i. eth.
25		60	$-3H_2O$, 150	s.		s. al., glyc.; i. eth.
26	2.0 (1.68–.70)	455		d.	d.	s. al
27		470		s.	d	s. al.
28				v. s.	v. s	s. al.
29		252		s.	d.	s. al.
30		145	d. 850	s.		s. al.
31				s.	s.	sl. s. al.
32		206		v. s.	v. s.	sl. s. al.
33		d.		100	<100	sl. s. al.; i. NH_3
34		d. 190		s	s.	i. al.
35	2.3	d.		sl. s.		sl. s. al.; i. eth.
36	4.56, 5.24			sl. s., d.		sl. s. HF
37	1.97			150[14]	278[100]	sl. s. al.
38	1.984					
39	1.956			0.37	6.1[100]	s. a., alk.; i. al., ac. a.
40	1.954			.42[25]		s. min. a.; i. al.
41		200 d.		hydrolyzes		
42				sl. s.	s.	sl. s. KOH; i. al.
43	2.51			s.	s.	
44	..	460–470 d.		sl. s.	s.	s. h. K_2CO_3, KOH
45				s.		i. al
46		d.		v. s.		i. al

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Potassium			
1	thioarsenite	K_3AsS_3	288.38	
2	thiocarbonate	K_2CS_3	186.38	yel.-red-br. cr., deliq
3	thiocyanate	$KSCN$	97.17	col. prisms, deliq
4	*di*thionate	$K_2S_2O_6$	238.31	trig. col., 1.455, 1.515
5	*tri*thionate	$K_2S_3O_6$	270.37	rhomb., 1.475, 1.480, 1.487
6	*tetra*thionate	$K_2S_4O_6$	302.43	monocl
7	*penta*thionate	$2K_2S_5O_6 \cdot 3H_2O$	723.03	rhomb. col.
8	thiostannate	$K_2SnS_3 \cdot 3H_2O$	347.12	dk. br. oil
9	thiosulfate	$3K_2S_2O_3 \cdot H_2O$	588.95	monocl. deliq
10	"	$3K_2S_2O_3 \cdot 5H_2O$	661.02	col rhomb
11	thorium fluoride	$K_2ThF_6 \cdot 4H_2O$	496.38	col
12	*ortho*tungstate	$K_2WO_4 \cdot 2H_2O$	362.14	monocl. col., deliq
13	*para*tungstate	$K_6W_7O_{24} \cdot 6H_2O$	2014.11	rhomb
14	*meta*tungstate	$K_2W_4O_{13} \cdot 8H_2O$	1166.00	cubic
15	*meta*uranate	K_2UO_4	380.26	or.-yel., rhomb
16	*per*uranate	$K_2UO_6 \cdot xH_2O$		orange-yel cr.
17	uranium oxalate	$K_4U(C_2O_4)_4 \cdot 5H_2O$	836.62	monocl. yel
18	uranyl acetate	$KUO_2(C_2H_3O_2)_3 \cdot H_2O$	504.32	tetr.
19	" carbonate	$2K_2CO_3 \cdot UO_2CO_3$	606.48	hex. yel
20	" sulfate	$K_2SO_4 \cdot UO_2SO_4 \cdot 2H_2O$	576.41	monocl. yel
21	urate, acid	$KHC_5H_2N_4O_3$	206.20	wh. powd
22	*meta*vanadate	KVO_3	138.05	col. cr
23	*ethyl*xanthate	$KC_3H_5OS_2$	160.29	col.-lt. yel. pr
24	**Praseodymium**	Pr	140.92	pa. yel. met
25	acetate	$Pr(C_2H_3O_2)_3 \cdot 3H_2O$	372.10	grn. need
26	bromate	$Pr(BrO_3)_3 \cdot 9H_2O$	686.81	hex. grn
27	bromide	$PrBr_3$	380.67	grn. cr. powd
28	carbide	PrC_2	164.94	yel. cr
29	carbonate	$Pr_2(CO_3)_3 \cdot 8H_2O$	606.00	grn. silky pl
30	chloride	$PrCl_3$	247.29	bl grn. need
31	"	$PrCl_3 \cdot 7H_2O$	373.40	tricl grn
32	hexaantipyrine *per*-chlorate	$[Pr(C_{11}H_{12}N_2O)_6]-(ClO_4)_3$	1568.63	grn. hex. leaf
33	oxalate	$Pr_2(C_2O_4)_3 \cdot 10H_2O$	726.06	lt. grn. cr
34	oxide, sesqui- (praseodymia)	Pr_2O_3	329.84	yel -grn. amor
35	oxide, di-	PrO_2	172.92	br.-bl. powd
36	" , tetr-	PrO_4	204.92	blk
37	2, 4-pentanedione deriv. (acetylacetonate)	$Pr(C_5H_7O_2)_3$	438.24	cr. ppt
38	sulfate	$Pr_2(SO_4)_3$	570.02	lt. grn. powd
39	"	$Pr_2(SO_4)_3 \cdot 5H_2O$	660.10	monocl. pr
40	"	$Pr_2(SO_4)_3 \cdot 8H_2O$	714.15	monocl grn., 1.540, 1.549, 1.561
41	sulfide	Pr_2S_3	378.02	br. powd
42	**Radium**	Ra	226.05	silv -wh. met
43	bromide	$RaBr_2$	385.88	monocl col -yelsh
44	"	$RaBr_2 \cdot 2H_2O$	421.91	
45	carbonate	$RaCO_3$	286.06	wh. or sl. brnsh
46	chloride	$RaCl_2$	296.96	monocl. col -yelsh
47	"	$RaCl_2 \cdot 2H_2O$	333.00	
48	iodate	$Ra(IO_3)_2$	575.89	
49	sulfate	$RaSO_4$	322.11	col
50	**Radon** (niton) (radium emanation)	Rn	222.00	col. gas. opaque cr

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1		d	.	s.		i. al.
2		d.	..	v. s.	s.	s. NH_3; sl. s. al.; i. eth.
3	1.886	173 2	d. 500	177.2^{0}	217^{20}	s. al., 20.75^{22} acet.; 0.18^{13} amyl. al.
4	2.278	d.		6	66^{100}	i. al.
5	2.304			v. s.	d.	i al.
6	2.296			v. s.		i. al.
7	2.112	d.		50	d.	i. al.
8	1.847^{18}	$-3H_2O$, 100		s.		i al.
9	2.23; (anh.) 2.590	$-H_2O$, 180	d.	96.1^{0}	312^{90}	i al.
10	....	d.		$150.2^{17.2}$	. .	....
11	.			6×10^{-5} (25°)		... .
12	3.113	tr. 388; 921		51.5	151.5	d. a.; i. al.
13		d.		2.15	6.6	d. a.; i. al.
14		ca. 930		s.	v. s.	d a.
15				i.	i.	v. s. a.
16		d. 100		d.	d.	d. HCl
17	2.563					
18	$2.396^{15}(\frac{1}{2}H_2O)$	$-H_2O$ 275		s.		. .
19		$-CO_2$, 300		7.4^{15}	d.	s. aq. K_2CO_3, i. al.
20	$3.363^{19.1}$	$-2H_2O$, 120		s.	.	. .
21				sl. s.		. . . .
22				sl. s.	s.	sl. s. KOH, i. al.
23	$1.558^{21.5}$	d >200		v. s.	d.	20 al.; i. eth.
24	6.5	940		d.		s a.
25				v. s.		.
26		56.5	$-7H_2O$, 100	196^{25}		
27				sl. s. d		
28	5.10	d.		d.	d.	s. dil. a.
29		$-6H_2O$, 100		i.		s. a.
30	4.02^{25}	818 (769-82)	>1000	103.9^{14}	∞^{100}	v. s. al.; 2.4 pyr., i eth., chl.
31	2.25^{17}	115		334^{13}	∞^{100}	s. al., HCl
32		286-91 d				
33				i.		s. a., 0.098^{25} n-H_2SO_4
34	6.88	d.		$.0000020^{29}$		s. a.
35						....
36	5.978					
37		146				s. CS_2
38	3.72^{16}			23.7^{0}, 17.7^{20}	1.02^{95}	.
39	3.176^{16}	.			1.85^{85}	. . .
40	$2.827^{13.3}$			17.4^{20}	sl. s.	. ..
41	5.042^{11}	d.		i.	d.	s. dil. a.
42	5?	960	1140	d. ev. H_2O		d. a.
43	5.79	728		s.	s.	s. al.
44		$-2H_2O$, 100				. . ..
45				i.		d. a.
46	4.91	1000		s.	s.	s. al.
47		$-2H_2O$, 100				
48				$.0175^{0}$	$.170^{100}$	
49				$.000002^{25}$	$.000005^{45}$	i a.
50	9.73 g/l; lq. 4.4^{-62}; sld. 4	−71	−61.8	51.0^{0} cm³; 22.4^{25} cm³	13.0^{50} cm³	

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	**Rhenium**	Re	186.31	hex. met. lust
2	chloride, tri-	$ReCl_3$	292.68	hex. dk. red
3	" , tetra-	$ReCl_4$	328.14	blk. (exist. quest.)
4	" , hexa-	$ReCl_6$	399.05	yelsh. red (exist. quest.)
5	fluoride, tetra-	ReF_4	262.31	
6	" , hexa-	ReF_6	300.31	pa. yel
7	oxide, hept-	Re_2O_7	484.62	br.-yel. pl. or powd
8	" , di-	ReO_2	218.31	blk.
9	oxybromide	ReO_3Br	314.23	wh
10	oxychloride	$ReOCl_4$	344.14	
11	"	ReO_2Cl_3	324.68	br. cryst. sld.
12	"	ReO_3Cl	269.77	yel. liq
13	oxyfluoride	$ReOF_4$	278.31	col
14	"	ReO_2F_2	256.31	col
15	**Rhodium**	Rh	102.91	cub. gray-wh.
16	chloride, tri-	$RhCl_3$	209.28	br. red powd. deliq
17	" "	$RhCl_3 \cdot xH_2O$		dk red
18	fluoride, tri-	RhF_3	159.91	rhomb. red
19	hydroxide, tri-	$Rh(OH)_3$	153.93	yel. gel
20	nitrate	$Rh(NO_3)_3$	288.93	br.-yel
21	"	$Rh(NO_3)_3 \cdot 2H_2O$	324.97	red, deliq
22	oxide, mon-	RhO	118.91	gray (exist. quest.)
23	" , sesqui-	Rh_2O_3	253.82	gray cr. or amor
24	" , di-	RhO_2	134.91	br
25	" , di-	$RhO_2 \cdot xH_2O$		olive-grn
26	" , tri-	RhO_3	150.91	bl
27	sulfate	$Rh_2(SO_4)_3 \cdot 4H_2O$	566.06	red
28	"	$Rh_2(SO_4)_3 \cdot 12H_2O$	710.19	lt. yel. cr
29	"	$Rh_2(SO_4)_3 \cdot 15H_2O$	764.24	pa. yel cr
30	sulfide, mono-	RhS	134.97	gray-blk. cr
31	" , sesqui-	Rh_2S_3	302.00	blk
32	" , hydro-	$Rh(HS)_3$	202.11	blk
33	sulfite	$Rh_2(SO_3)_3 \cdot 6H_2O$	554.10	yel. cr
34	**Rubidium**	Rb	85.48	soft, silv.-wh. met
35	acetate	$RbC_2H_3O_2$	144.52	col. nacreous leaf
36	aluminum sulfate	$RbAl(SO_4)_2 \cdot 12H_2O$	520.76	cub. oct. col., 1.457, 1.45232, 1.46618
37	bromate	$RbBrO_3$	213.40	
38	bromide	$RbBr$	165.40	cub. col., 1.5530
39	" , tri-	$RbBr_3$	325.23	rhomb
40	bromochloroiodide	$RbIBrCl$	327.77	rhomb
41	bromoiodide, di-	$RbIBr_2$	372.23	rhomb
42	chlorobromide, di-	$RbBrCl_2$	236.31	rhomb
43	chloro*di*bromide	$RbBr_2Cl$	280.77	rhomb
44	carbonate	Rb_2CO_3	230.97	col. cr., deliq
45	" , acid	$RbHCO_3$	146.50	rhomb
46	chlorate	$RbClO_3$	168.94	trim
47	*per*chlorate	$RbClO_4$	184.94	rhomb
48	chloride	$RbCl$	120.94	cub. col., 1.493
49	chloroiodide, di-	$RbICl_2$	283.31	rhomb
50	chloroplatinate	Rb_2PtCl_6	578.93	cub. yel.
51	chromate	Rb_2CrO_4	286.97	rhomb. yel
52	*di*chromate	$Rb_2Cr_2O_7$	386.98	tricl. or monocl.
53	chromium sulfate	$RbCr(SO_4)_2 \cdot 12H_2O$	545.80	cub., vlt., 1.482

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	20.53	3167 ± 60				s. conc. HNO_3, H_2O_2
2			>550	s.	s.	s. a., alk.
3			500	s. d.	s. d.	s. HCl
4			<40	s. d.	s. d	s. HCl
5		124.5				
6	lq. 6.1573; sld. 4.251	25.6	47.6	s. d	s. d.	
7	8.2	ca. 220	450 subl.	v. s	v. s	v s al ; s. a., alk.
8				i.	i	s conc. HCl, H_2O_2
9		39.5	163			
10		28	223			
11	3.359^{45}	23.9 ± 0.2				
12		4.5	131			
13	lq. 5.314, sld. 4.032	39.7	62.7			
14		156				
15	12.1	1966	>2500	i.	i.	s. H_2SO_4 + HCl, h. conc. H_2SO_4, sl. s. a., aq. reg.
16		d. 450–500	subl. 800	i.	i.	i a., aq. reg.
17		d.		v. s.		s. al., HCl, i. eth.
18	5.38		>600 subl.	i.	i.	i a., alk.
19		d.		i.		s a , alk.
20		d.		v. s.	s.	i al.
21				s.	s.	i. al.
22				i.	i.	i a.
23		d. 1100–1150		i.	i	i a., aq. reg., KOH
24				i.	i.	i. a., alk.
25		d.		i.		s HCl
26				i.		s. alk , HCl
27		d.		s.	s.	
28				v. s.	d.	i. al.
29		d.		v. s.	d.	i. al., eth.
30		d.		i.	i.	i. a., aq. reg.
31		d.		i.	i.	i. a., aq. reg., aq. Br
32		d.		i.	d.	s. aq. reg., aq. Br; i. Na_2S
33		d.		s		i. al.
34	1.532; lq. $1.475^{38.5}$	38.5	700	d.	d.	s. a.; d al.
35		246		s.		
36	1.867^{0}	99		2.59^{20}	43.25^{80}	
37	3.68	430		2.93^{20}	5.08^{40}	
38	3.35, lq. 2.79^{740}	682	1340	98^{5}	$205.2^{113.5}$	sl s. acet.; i. al.
39		d. 140				
40		205	d. 200			
41		225	d. ?65			
42		d. 110				
43		76				
44		837	d. 740	450^{20}	s	0.7 abs. al
45		d. 175		v. s.		s. al.
46	3.19			5^{19}	62.8^{100}	
47	2.9	fus.	d.	0.5^{0}	18^{100}	i. al.
48	2.76, lq. 2.088^{750}	715	1390	77^{0}; 91.2^{20}	138.9^{100}	0.08^{25} al.; v. sl. s. NH_3; i. al.
49		180–200	d. 265			
50	$3.94^{17.5}$	d.		$.184^{0}$; $.141^{20}$	$.634^{100}$	i al.
51	3.518			62^{0}	95.7^{60}	
52	3.02-.13		tricl. monocl.	4.96^{18} 5.42^{18}	27.3^{60} 28.1^{60}	
53	1.946	107				

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Rubidium			
1	copper sulfate	$Rb_2SO_4 \cdot CuSO_4 \cdot 6H_2O$	534.75	monocl., 1.489, 1.491, 1.504
2	fluogermanate	Rb_2GeF_6...	357.56	wh. cr
3	fluoride	RbF	104.48	col
4	fluosilicate	Rb_2SiF_6 ...	313.02	cub. oct
5	fluosulfonate	$RbFSO_3$ ..	184.54	need
6	gallium sulfate	$RbGa(SO_4)_2 \cdot 12H_2O$	563.51	col. cr., 1.46579
7	hydride	RbH	86.49	col. need
8	hydroxide	RbOH	102.49	gray-wh., deliq
9	iodate	$RbIO_3$	260.40	monocl. or cub
10	*per*iodate	$RbIO_4$	276.40	tetr
11	iodide	RbI	212.40	cub. col., 1.6474
12	" , tri-	RbI_3	466.24	rhomb. blk
13	" , compd with SO_2	$RbI \cdot 4SO_2$	468.64	lemon-yel
14	iron selenate (ous)	$Rb_2SeO_4 \cdot FeSeO_4 \cdot 6H_2O$	620.82	bl.-grn. monocl pr
15	" " (ic)	$RbFe(SeO_4)_2 \cdot 12H_2O$	643.43	cub., 1.507^{18}
16	" sulfate (ous)	$Rb_2SO_4 \cdot FeSO_4 \cdot 6H_2O$	527.02	grn. monocl. pr., 1.4815, 1.4874, 1.4977
17	" " (ic)	$RbFe(SO_4)_2 \cdot 12H_2O$	549.63	cub., 1.4823
18	*per*manganate	$RbMnO_4$	204.41	cryst
19	neodymium nitrate	$2(?)RbNO_3 \cdot Nd(NO_3)_3 \cdot 4H_2O$	697.33	redsh. vlt. pl
20	nitrate	$RbNO_3$	147.49	hex. cub. rhomb. or tricl col., 1.51, 1.52, 1.524
21	" , acid	$RbNO_3 \cdot HNO_3$	210.50	tetr
22	" "	$RbNO_3 \cdot 2HNO_3$	273.52	col. need
23	oxide, mon-	Rb_2O	186.96	cub. col-yel
24	" , di- (per-)	Rb_2O_2	202.96	cub. yel
25	" , tri-	Rb_2O_3	218.96	blk
26	" , tetr-	Rb_2O_4	234.96	yel
27	praseodymium nitrate	$2RbNO_3 \cdot Pr(NO_3)_3 \cdot 4H_2O$	693.98	grnsh. monocl. need, hyg
28	sulfate	Rb_2SO_4	267.02	rhomb. hex. col., 1.513, 1.513, 1.514
29	" , acid	$RbHSO_4$	182.55	rhomb
30	sulfide, mono-	Rb_2S	203.02	col
31	" , "	$Rb_2S \cdot 4H_2O$	275.08	cr, deliq
32	" , di-	Rb_2S_2	235.08	dk red
33	" , tri-	Rb_2S_3	267.14	redsh. yel
34	" , penta-	Rb_2S_5	331.26	rhomb. red, deliq
35	" , hexa-	Rb_2S_6	363.32	brown-red
36	*dl*-tartrate, acid	$RbHC_4H_4O_6$	234.56	trim. pr
37	**Ruthenium**	Ru	101.70	blk. porous
38	"	Ru	101.70	hex. gray-wh. brittle met
39	chloride, di-	$(RuCl_2)_x$	172.61	br.-blk. cr
40	" , tri-	$RuCl_3$	208.07	cr. br., deliq
41	" , tetra-	$RuCl_4 \cdot 5H_2O$	333.61	rdsh.-brn. cr. hygro
42	fluoride, penta-	RuF_5	196.70	dk.-grn. cr.
43	hydroxide	$Ru(OH)_3$	152.72	blk. powd
44	oxide, sesqui-	Ru_2O_3	251.40	bl-blk (exist quest)
45	" "	$Ru_2O_3 \cdot xH_2O$		yel
46	" , di-	RuO_2	133.70	tetr. dk. bl
47	" "	$RuO_2 \cdot xH_2O$		blk
48	" , non-	Ru_4O_9	550.80	blk. cr. (exist. quest.)
49	" , pent-	Ru_2O_5	283.40	blk. cr. (exist. quest.)
50	" , tetr-	RuO_4	165.70	rhomb. yel

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		2.57		10.28^{25}		
2				sl. s.	v. s.	
3	lq. 2.88^{820}	760	1410	130.6^{18}		s. dil. HF, i. al., eth., NH_3
4	3.332		...	0.16^{20}	1.35^{100}	s. a., i. al.
5		304	..			
6	1.962			s.		
7	2.0	d. 300		d.	d.	d. a.
8	3.203^{11}	300		180^{15}	v. s.	s. al.
9	$4.33^{19.5}$	d.		2.1^{23}		v. s. HCl
10	3.918^{16}			0.65^{13}		
11	3.55; lq. 2.87^{825}	642	1300	152^{17}	v. s.	0.674^{25} acet
12	4.03	190	..	s.		
13		13.5				
14	2.819					
15	2.131^{15}	45				
16	2.516					
17	1.91-.95	48-53				
18	$3.235^{10.4}$			0.5^{0}	4.7^{60}	
19	2.56	47	$-4H_2O$, 60			
20	3.11, lq. 2.395^{400}	tr.-cub. 161.4, m.p. 130	tr.-rhomb. 219	34.8^{20}	452^{100}	v. s. HNO_3; s. acet.
21		62				
22		45				
23	3.72	d. 400		s. d.	s. d.	
24	3.65^{0}	600		d. to RbOH + H_2O_2		
25	3.53	<500		s. d.		
26	3.05^{0}	280		d. to RbOH + H_2O_2 + O_2		
27	2.50	63.5	$-4H_2O$, 60			
28	3.613, lq. 2.53^{1100}	1060, tr. 653		42.4^{10}	81.8^{100}	
29	2.892^{16}	<red heat				
30	2.912			v. s.	v. s.	
31				v. s.	v. s.	
32		420	volat.>850			
33		213				
34	2.618^{15}	225		d.		s. 70% al.; i. eth., chl.
35		201				
36	2.282	d.		1.18^{25}	11.7^{100}	
37	8.6	>1950	...	i.	i.	sl. s. a., aq. reg., i. al., eth.
38	12.063	2450	4150	i.	i.	s. fus. alk.; sl. s. aq. reg.; i. a.
39				i.		s. dil. al. (bl.); i. a., alk.
40	3.11	d. >500		i.	d.	s. HCl; sl. s. al.; i. CS_2
41				s.		s. al.
42	$2.963^{16.5}$	101	270	d.	d.	...
43				v. sl. s.		s. a.; i. alk.
44				i.	i.	i. a., alk.
45		d.		i.	i.	s. a., alk.
46	6.97	d.		i.	i.	i. a.; s. fus. alk.
47		d.		i.	i.	s. a.; i. alk.
48		−O, 440		...		....
49		−½O, 360		i.		s. HCl
50	3.29^{21}	25.5	*ca* 100 d.	2.033^{20}	2.249^{74}	s. a., alk., al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Ruthenium			
1	silicide	$RuSi$	129 76	met. pr
2	sulfide (laurite)	RuS_2	165 82	cub. gray-blk
3	**Samarium**	Sm (or Sa)	150 43	hex. gray-wh. met
4	acetate	$Sm(C_2H_3O_2)_3 \cdot 3H_2O$	381 61	
5	bromate	$Sm(BrO_3)_3 \cdot 9H_2O$	696 32	hex. yel
6	bromide	$SmBr_3 \cdot 6H_2O$	498 28	yel. cr., deliq
7	carbide	SmC_2	174 45	hex. yel
8	chloride (ous)	$SmCl_2$	221 34	red-br. cr
9	"	$SmCl_3$	256 80	yelsh.-wh. cr., hyg
10	"	$SmCl_3 \cdot 6H_2O$	364 90	tricl grn-yel., deliq
11	hydroxide	$Sm(OH)_3$	201 45	pa. yel. powd
12	iodide	SmI_3	531 19	or.-yel. cr
13	nitrate	$Sm(NO_3)_3 \cdot 6H_2O$	444 55	tricl. pa. yel
14	oxalate	$Sm_2(C_2O_4)_3 \cdot 10H_2O$	745 08	cryst
15	oxide (samaria)	Sm_2O_3	348 86	wh-yelsh. powd
16	2,4-pentanedione deriv. (acetylacetonate)	$Sm(C_5H_7O_2)_3$	447 75	cr mass
17	sulfate	$Sm_2(SO_4)_3 \cdot 8H_2O$	733 17	monocl. lt yel., 1.543, 1.552, 1.563
18	" , basic	$Sm_2O_2SO_4$	428 92	yel. powd
19	sulfide	Sm_2S_3	397 04	yelsh.-pink
20	**Scandium**	Sc	45 10	silv
21	bromide	$ScBr_3$	284 85	
22	chloride	$ScCl_3$	151 47	col. cr
23	hydroxide	$Sc(OH)_3$	96 12	col. amor
24	nitrate	$Sc(NO_3)_3$	231 12	col
25	"	$Sc(NO_3)_3 \cdot 4H_2O$	303 19	pr., deliq
26	oxalate	$Sc_2(C_2O_4)_3 \cdot 5H_2O$	444 34	cr
27	oxide (scandia)	Sc_2O_3	138 20	wh. powd
28	2,4-pentanedione deriv. (acetylacetonate)	$Sc(C_5H_7O_2)_3$	342 42	col. pl
29	sulfate	$Sc_2(SO_4)_3$	378 38	col. cr.
30	"	$Sc_2(SO_4)_3 \cdot 5H_2O$	468 46	
31	"	$Sc_2(SO_4)_3 \cdot 6H_2O$	486 48	
32	**Selenic acid**	H_2SeO_4	144 98	col hex. pr
33	" "	$H_2SeO_4 \cdot H_2O$	162 99	col liq. or need or rect pl
34	" "	$H_2SeO_4 \cdot 4H_2O$	217 04	col. liq
35	**Selenious acid**	H_2SeO_3	128 98	hex. col
36	**Selenium**	Se_8	631 68	amor. red powd
37	"	Se_8	631 68	colloidal dk. red powd
38		Se_8	631 68	vitreous, dk. brnsh. blk
39	"	Se_8	631 68	monocl. red, 2.9^{220} lq
40	"	$Se_8 < 500$ (Se_2 at 900)	631 68	trig. gray met
41	bromide, mono-	Se_2Br_2	317 75	dk. red liq
42	" , tetra-	$SeBr_4$	398 62	or red-br. cr
43	" (mono-) chloride, tri-	$SeBrCl_3$	265 25	yel. br. cr
44	" (tri-) chloride	$SeBr_3Cl$	354 17	orange cr., hyg.
45	" (mono-) nitride, di-	Se_2N_2Br	265 85	
46	chloride, mono-	Se_2Cl_2	228 83	br.-red liq., 1.596
47	" , tetra-	$SeCl_4$	220 79	cub. wh.-yel., deliq., 1.807

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	5.40^{4}			i.	i.	s. $HNO_3 + HF$
2	6.99			i.	i.	s. fus. alk.; i. a.
3	7.7	1300–1400				...
4	$4H_2O$, 1.94			15^{25}		...
5		75	$-9H_2O$, 150	114^{25}		v. sl. s. al.
6	2.971^{22}		...	...		...
7	5.86			d.	d.	s. a. d.
8	3.687^{22}	740		s. d.		i. al., CS_2
9	4.46^{18}	678 ± 2		92.4^{10}	99.9^{50}	v. s. al., 6.4^{25} pyr.
10	2.383	$-5H_2O$, 110			...	...
11				i.		s. a.; i. alk.
12		816–24	d. 800			...
13	2.375	78–9		v. s.	...	...
14				0.000054		s. H_2SO_4
15	7.43			i.		v. s. a.
16	...	146.7		i.	...	...
17	2.930	$-8H_2O$, 450		2.67^{20}; 4.4^{20}	1.99^{40}	...
18			d. 1100	i.		i. dil. H_2SO_4
19	5.729	1900			d.	d. dil. a.
20	2.5	1200	2400	d. ev. H_2	...	...
21	3.914	subl. >1000			...	...
22		939	subl. 800–50	v. s.	v. s.	i. abs. al.
23				i.	...	s. dil. a.
24		150		s.	...	...
25		$-4H_2O$, 100		v. s.	...	...
26		$-4H_2O$, 140			...	...
27	3.86			i.	i.	s. h. a.
28	...	187.5	subl. 210–15	i.		s. al., bz., chl.
29	2.579	d.		10.3^{25}	v. s.	...
30	...			39.9^{25}		...
31		$-4H_2O$, 100; $-6H_2O$, 250		v. s.		...
32	sld. 2.951^{15}, lq. 2.608^{15}	58; eas. undercools	260 d.	v. s.	v. s.	s. H_2SO_4; i. NH_3; d. al. & org. solv.
33	2.627^{15}, lq. 2.356^{15}	25–6; eas. undercools	205	v. s.	v. s.	d. org. solv., v. s. al.; i. NH_3
34		−51.7, eas. undercools	172^{95}; $-H_2O$	∞		d. org. solv.; s. H_2SO_4
35	3.004^{15}	d.	$-H_2O$	167^{20}	v. s.	v. s. al.; i. NH_3
36	4.26	tr.-vit. 40–50; −met. 200	688	i.	i.	s. H_2SO_4, CS_2, bz.; i. al.
37				s.		s. CS_2
38	4.28 (4.14^{22})	indef.	688	i.	i.	s. H_2SO_4, HNO_3, CS_2
39	4.46^{25} (4.50)	170–180	688	i.	i.	s. H_2SO_4, HNO_3, CS_2
40	4.79^{15}	217	688	i.	i.	s. H_2SO_4, HNO_3; i. CS_2
41	3.604^{15}		227 d.	d.	d.	d. al.; s. CS_2, chl., C_2H_5Br
42		d. 75		d.	d.	s. CS_2, chl., C_2H_5Br, HCl
43		190		...	...	i. CS_2
44		d				v. sl. s. CS_2
45				i.	d.	.....
46	2.91^{17}, 2.77^{23}	−85	130 d.	d.	d.	d. al., eth.; s. CS_2, CCl_4, chl., bz.
47	$3.78–.85^{360}$	305; subl. 170–196	d. 288	d.	d.	d. a., alk.; s. $POCl_3$; v. sl. s. CS_2

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Selenium			
1	fluoride, tetra-	SeF_4	154 96	col. liq. or wh. cr
2	" , hexa-	SeF_6	192 96	gas, col., 1.895.
3	iodide, mono-	Se_2I_2	411 76	steel gray cr. (exist. quest.)
4	" , tetra-	SeI_4	586 64	dk. gray cr. (exist. quest.)
5	nitride	Se_4N_4	371 87	amor. or.-yel. to brk. red hyg
6	oxide, di-	SeO_2	110 96	wh. monocl. (tetr.) col
7	" , tri-	SeO_3	126 96	amor. pa. yel. hyg
8	oxybromide	$SeOBr_2$	254 79	red-yel. cr
9	oxychloride	$SeOCl_2$	165 87	col.-yel liq., 1 651[20]
10	oxyfluoride	$SeOF_2$	132 96	col liq
11	sulfide, mono-	SeS	111 02	or yel tabl. or powd
12	" di-	SeS_2	143 08	br. red-yel
13	sulfur oxide	$SeSO_3$	159 02	grn pr. or yel. powd
14	sulfur oxy*tetra*chloride	$SeSO_3Cl_4$	300 85	hex. pr
15	**Silicane,** bromo-	SiH_3Br	111 00	
16	" , bromotrichloro-	$SiBrCl_3$	214 35	col. liq
17	" , chloro-	SiH_3Cl	66 54	
18	" , dibromo-	SiH_2Br_2	189 91	
19	" , dibromodichloro-	$SiBr_2Cl_2$	258 81	col. liq
20	" , dichloro-	SiH_2Cl_2	100 99	
21	" , tribromo- (silicobromoform)	$SiHBr_3$	268 82	col. liq
22	" , tribromochloro-	$SiBr_3Cl$	303 27	col. liq
23	" , trichloro- (silicochloroform)	$SiHCl_3$	135 44	col. liq
24	" , trichloroiodo-	$SiCl_3I$	261 35	col liq
25	" , trifluoro- (silicofluoroform)	$SiHF_3$	86 07	col. gas
26	" , triiodo- (silicoiodoform)	$SiHI_3$	409 83	red liq
27	**Silicic acid,** ortho-	H_4SiO_4	96 09	amor. col. (exist quest)
28	" " , meta-	H_2SiO_3	78 08	amor. col. (exist. quest.)
29	**Silicon,** adamantine	Si	28 06	cub. steel gray
30	" amorphous	Si	28 06	amor. br
31	" graphitoidal	Si	28 06	blk. pl
32	acetate, tetra-	$Si(C_2H_3O_2)_4$	264 24	hyg. cr.
33	(di-) bromide, hexa- (hexabromodisilicoethane)	Si_2Br_6	535 62	rhomb. wh
34	bromide (di-) sulfide	$SiSBr_2$	219 95	col pl
35	" , tetra- (tetrabromosilicane)	$SiBr_4$	347 72	col fum. liq., 1.579[18] (F)
36	carbide (carborundum)	SiC	40 07	hex. col. or blk., 2.654, 2.697
37	(di-)chloride, hexa-(hexachlorodisilicoethane)	Si_2Cl_6	268 86	col. liq
38	chloride (di-) sulfide.	$SiSCl_2$	131 03	col. pr
39	chloride, tetra-	$SiCl_4$	169.89	col. fum liq , 1.412 (C)
40	" (tri-) sulfide, hydro-	$SiCl_3HS$	167 50	col. liq
41	fluoride, tetra- (tetrafluorosilicane)	SiF_4	104 06	col gas

No.	Sp gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	.	m.p. −13.5; frz. −90	>100 (93)	d.	d.	
2	3.25^{-28} g/l	−39; subl. −46.6	−34.5	s. d.	.	.
3		68–70	d. 100	d.	d.	
4		75–80	−4 I, 100	d.	d.	
5	..	exp. 160–200	d.	i.	i.	v. sl. s. bz., ac. a., CS_2; i. al., eth.
6	3.95^{15}_{15}	340–350	subl. 315–7	38.4^{14}	82.5^{65}	6.67^{14} al., $4.35^{15.3}$ acet.; $1.11^{13.9}$ ac. a.; s. bz.
7	3.6	d. 120		v. s. d.	v. s. d.	s. al., conc. H_2SO_4, i. eth., bz., chl., CCl_4
8	lq. 3.38^{50}	41.6	217^{40} d.	d.		s. CS_2, CCl_4, chl., H_2SO_4, bz.
9	2.42^{22}	8.5 (10.9)	176.4	d.		s. CS_2, CCl_4, chl., bz.
10	2.67	4.6	124	d.		s. al., CCl_4
11	3.056^{0}	d. 118–9	.	i.	i.	s. CS_2; i. eth.
12		<100	d.	i.		d. aq. reg., HNO_3; s. $(NH_4)_2S$
13		−SO_2, 40		d.		s. H_2SO_4, i. SO_3
14		165	183	d.		
15	1.72^{-80}, 1.533^{20}	−94	1.9			.
16		<−60	80	d.	d.	
17	1.145^{-113}	−118.1	−30.4		.	.
18	2.17^{0}	−77	66			
19		<−60	104	d.	d.	
20	1.42^{-122}	−122	8.3	.		..
21	2.7^{17}	<−60	169	d.	d.	d. NH_3
22	2.434	−39	140.5	d.	d.	
23	1.34	−134	33	d.	d.	s. CS_2, CCl_4, chl., bz.
24		<−60	113.5	d.		
25	3.86^{0} g/l	ca. −110	−80.2	d.	d.	d. alk., al., eth.; s. tol.
26	3.314	8	220	d.	d.	s. CS_2, bz.
27	1.57^{17}			sl. s.	sl. s.	s. alk.; i. NH_4Cl
28	2.1–.3			i.	i.	s. alk.; i. NH_4Cl
29	2.4	1420	2600	i.	i.	s. HF + HNO_3; i. a., HF
30	2.00		2600	i.	i.	s. HF, KOH
31	ca. 2.4	.	2600	i.	i.	s. HF + HNO_3; i. HF
32		110, subl.	148	.	d. 160–170	d. al. .
33		95	240	d.	d.	d. KOH; s. CS_2
34		93	$150^{18.3}$	d.	d.	s. bz., CS_2
35	2.814	5	153	d.	d.	d. H_2SO_4
36	3.17	>2700	subl. >2000 d. 2210	i.	i.	d. fused KOH; i. a.
37	lq. 1.58^{0}	−1	139 (145)	d.	d.	d. al.
38		75	$92^{22.5}$	d.	d.	s. CCl_4, CS_2
39	1.483	−70	57.57	d.	d.	d. al.
40	1.45		96–100	d.	d.	d. al.
41	4.67 g/l	−77 (−97)	-65^{181}	d.	d.	s. abs. al., eth., HF

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Silicon			
1	hydride (silicane, silane)	SiH_4	32.09	col. gas
2	" (disilicoethane, disilicane)	Si_2H_6	62.17	col. gas
3	" (trisilicopropane, trisilicane)	Si_3H_8	92.24	col. liq
4	" (tetrasilicobutane, tetrasilicane)	Si_4H_{10}	122.32	col. liq
5	iodide, tetra- (tetraiodosilicane)	SiI_4	535.74	cub. col
6	(di-) iodide, tetra- (tetraiododisilicoethylene)	Si_2I_4	563.80	orange-red
7	(di) iodide, hexa- (hexaiododisilicoethane)	Si_2I_6	817.64	hex. col
8	nitride	Si_3N_4	140.21	amor. grayish-wh powd
9	oxide, di- (cristobalite)	SiO_2	60.06	cub. or tetr. col., 1.487, 1.484
10	" " (lechatelierite)	SiO_2	60.06	col., 1.46
11	" " (quartz)	SiO_2	60.06	hex. col., 1.544, 1.553
12	" " (tridymite)	SiO_2	60.06	rhomb. col., 1.469, 1.470, 1.471
13	" " (amor., opal)	$SiO_2(+xH_2O)$		col. amor., 1.41–1.46
14	oxychloride	Si_2OCl_6	284.86	col. liq
15	sulfide, mono-	SiS	60.12	yel. need. or blk. sld
16	" , di-	SiS_2	92.18	wh. need
17	thiocyanate, tetra-	$Si(SCN)_4$	260.37	small trim. pr
18	**Silicotungstic acid,** normal	$H_4SiW_{12}O_{40}\cdot 24H_2O$	3311.52	trig. col
19	**Silicotungstic acid.**	$H_4SiW_{12}O_{40}\cdot 30H_2O$	3419.62	col. or yelsh. tetrag
20	**Silicylamine,** tri-	$(SiH_3)_3N$	107.26	inflam. liq
21	**Silicyl** oxide (disiloxane)	$(SiH_3)_2O$	78.17	col. gas
22	**Silver**	Ag	107.88	cub. wh. met., 0.54
23	acetate	$AgC_2H_3O_2$	166.92	wh. pl
24	acetylide	Ag_2C_2	239.78	wh. ppt
25	*ortho*arsenate	Ag_3AsO_4	462.55	cub. dk. red
26	*ortho*arsenite	Ag_3AsO_3	446.55	yel. powd
27	azide	AgN_3	149.90	wh. prisms
28	benzoate	$AgC_7H_5O_2$	228.99	wh. powd
29	*tetra*borate	$Ag_2B_4O_7\cdot 2H_2O$	407.07	white
30	bromate	$AgBrO_3$	235.80	tetr. col., 1.847, 1.920
31	bromide (bromyrite)	AgBr	187.80	cub. pa. yel., 2.253
32	carbonate	Ag_2CO_3	275.77	yel. powd
33	chlorate	$AgClO_3$	191.34	tetr. wh
34	*per*chlorate	$AgClO_4$	207.34	wh. cr., deliq
35	chloride (cerargyrite)	AgCl	143.34	cub. wh., 2.071
36	chromate	Ag_2CrO_4	331.77	monocl. red
37	*di*chromate	$Ag_2Cr_2O_7$	431.78	tricl. red
38	citrate	$Ag_3C_6H_5O_7$	512.74	wh. need
39	cyanate	AgOCN	149.90	col
40	cyanide	AgCN	133.90	hex. wh
41	ferricyanide	$Ag_3Fe(CN)_6$	535.59	orange

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	lq. 0.68^{-185}, 1.44 g/l	−185	−111.8	i.		d. KOH
2	lq. 0.686 ^{25}	−132.5	−14.5	slow d., sl. s.		s. bz., al., CS_2
3	.725; 0.743^{0}	−117.4	52.9	d.	d.	d. CCl_4
4	0.79^{0}	−93.5	80	d.		. ...
5	.	120.5	290	d.		2.2^{27} CS_2
6				d.		i. CS_2, chl., bz.
7	.	250	d.	d.	d.	19^{19} CS_2
8	3.44	1900 press.; subl.	.	.		s. HF
9	2 32	1710	2230 (2590)	i.	i.	s. HF; v. sl. s. alk.
10	2.20		2230 (2590)	i.	i.	s. HF, v. sl. s. alk.
11	2.653–2.660	<1470	2230 (2590)	i.	i.	s. HF; v. sl. s. alk.
12	2.28–2.33	1670	2230 (2590)	i.	i.	s. HF; v. sl. s. alk.
13	2.1–2.3	>1600		i.	i.	s. HF, hot alk.
14		−33	137	d.	d.	d. al.; ∞ CS_2, CCl_4, chl., eth.
15	1.853^{15}		subl. 940^{20}	d.	d.	d. alk., al.
16		subl.	white heat	d.		d. al.; s. dil. alk.; i. bz.
17	.	143.8	314.2			s. bz ; sl. s. CS_2, chl.
18	.	$-18H_2O$, 100		v. s.	v. s.	v. s. al., eth.
19	.	$-6H_2O$ *ca.* 28.5, 36–53		v. s.		s. al.
20	0 895^{-106}	−105.6	52			. ..
21	0.881^{-80}	−144	−15.2	v. sl. s.	sl. d.	. .
22	10.5	960.5	1950	i.	i	s HNO_3, h. H_2SO_4, KCN; i. alk.
23	3.259^{15}	d.		0.72^{0}; 1.02^{20}	2 52^{80}	. .
24		exp		i		s. a ; sl. s. al.
25	6.657^{25}			0 00085^{20}		s. ac. a , NH_4OH .
26		150 d.		0.00115^{70}	i.	s. ac. a., NH_4OH, HNO_3; i. al.
27	.	exp. 252		i.	0.01^{100}	s. KCN, dil. HNO_3; sl. s. NH_4OH
28	.			0.262^{15}	s.	.017 al.
29	.			sl. s.		s. a.
30	5.206	d		196^{25}	1.33^{90}	s. NH_4OH; sl s HNO_3
31	6.473^{25}	434	d. 700	8.4×10^{-6}	.00037^{100}	s. KCN, $Na_2S_2O_3$, sl s. NH_4OH; i. al.
32	6.077	218 d.		0.0032^{20}	0.05^{100}	s. NH_4OH, $Na_2S_2O_3$; i. al
33	4 430	230	d 270	10^{15}	50^{80}	sl. s. al.
34	2.806^{25}	d. 486		525^{25}	s.	s. al., tol.
35	5.56	455	1550	000089^{10}	0021^{100}	s. NH_4OH, $Na_2S_2O_3$, KCN
46	5.625			0.0014^{0}	0.008^{70}	s. a., NH_4OH, KCN
37	4.770	d.		0.0083^{15}	d.	s. a., NH_4OH, KCN
38	. .	d.		0.028^{18}		s. a., NH_4OH, KCN, $Na_2S_2O_3$
39	4.00	d.		sl. s.	s.	s. HNO_3, NH_4OH, KCN
40	3.95	320 d.		.000023^{20}		s HNO_3, NH_4OH, KCN, $Na_2S_2O_3$
41	. ....			.000066^{20}		s. NH_4OH, h. $(NH_4)_2CO_3$; i. a.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Silver			
1	ferrocyanide	$Ag_4Fe(CN)_6$	643.47	yel.
2	fluoride, sub-	Ag_2F	234.76	hex. yel
3	"	AgF	126.88	cub. yel, deliq
4	fluosilicate	$Ag_2SiF_6 \cdot 4H_2O$	429 88	col. cr. or wh. powd., deliq
5	fulminate	$Ag_2C_2N_2O_2$	299 80	sm. need.
6	iodate	$AgIO_3$	282 80	rhomb. col
7	iodide (iodyrite)	AgI	234 80	hex. yel., 2.21, 2.22
8	lactate	$AgC_3H_5O_3 \cdot H_2O$	214 97	wh. or sl. gray cr. powd
9	laurate	$AgC_{12}H_{23}O_2$	307.19	wh. greasy powd
10	levulinate	$AgC_5H_7O_3$	222 99	leaf
11	*per*manganate	$AgMnO_4$	226 81	monocl. dk. vlt
12	mercury iodide (ic)	$2AgI \cdot HgI_2$	924 05	deep-yel. powd
13	myristate	$AgC_{14}H_{27}O_2$	335 24	
14	nitrate	$AgNO_3$	169 89	rhomb. col., α 1.729, γ 1 788
15	nitrite	$AgNO_2$	153 89	rhomb. wh
16	nitroprusside	$Ag_2Fe(CN)_5NO$	431 70	lt. pink
17	oxalate	$Ag_2C_2O_4$	303 78	col. cr
18	oxide	Ag_2O	231 76	cub. br.-blk
19	" , per-	Ag_2O_2 (or AgO)	247 76	cub. gray-blk
20	palmitate	$AgC_{16}H_{31}O_2$	363 29	wh. greasy powd
21	*ortho*phosphate	Ag_3PO_4	418 66	cub. yel
22	*pyro*phosphate	$Ag_4P_2O_7$	605 56	wh
23	*meta*phosphate	$AgPO_3$	186 90	wh. amor
24	propionate	$AgC_3H_5O_2$	180 95	wh. leaf. or need
25	salicylate	$AgC_7H_5O_3$	244 99	wh. to redsh. wh. cr
26	selenide	Ag_2Se	294 72	cub. thin gray pl
27	stearate	$AgC_{18}H_{35}O_2$	391 34	wh. powd., amor
28	sulfate	Ag_2SO_4	311 82	rhomb. wh
29	sulfide (acanthite)	Ag_2S	247 82	rhomb. gray-blk
30	" (argentite)	Ag_2S	247 82	cub. blk
31	sulfite	Ag_2SO_3	295.82	wh. cr
32	*d*-tartrate	$Ag_2C_4H_4O_6$	363 83	scales
33	*ortho*tellurate, tetra-H	$Ag_2H_4TeO_6$	443 40	rhomb. bipyr. straw yel
34	telluride (hessite)	Ag_2Te	343 37	cub. gray
35	tellurite	Ag_2TeO_3	391.37	yel. wh. ppt
36	thioantimonite (pyrargyrite)	Ag_3SbS_3 (or $3Ag_2S \cdot Sb_2S_3$)	541 58	trig., 3.084, 2.881 (Li)
37	thioarsenite (proustite)	Ag_3AsS_3 (or $3Ag_2S \cdot As_2S_3$)	494 73	trig., 3.088, 2.792
38	thiocyanate	$AgSCN$	165 96	col. cr. or wh. curd
39	thiosulfate	$Ag_2S_2O_3$	327 88	wh
40	tungstate	Ag_2WO_4	463 68	pa.-yel. cr
41	**Silver complex:** Diamminesilver *per*rhenate	$[Ag(NH_3)_2]ReO_4$	392 25	col. monocl. cr
42	**Sodium.**	Na	22 997	cub. silv. met., 4.22
43	acetate	$NaC_2H_3O_2$	82 04	wh.-gr. powd
44	"	$NaC_2H_3O_2 \cdot 3H_2O$	136 09	monocl. pr. col., effl., β 1.464
45	aluminate	$NaAlO_2$	81 97	amor. wh. powd. hyg
46	aluminum chloride	$NaCl \cdot AlCl_3$	191 80	wh.-yelsh. cr. powd., deliq

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1				i.	i.	s. NH_4OH, KCN; i. a.
2	8.57	90 d.		d.		
3	$5.852^{15.5}$	435	....	$182^{15.5}$	205^{108}	sl. s. NH_4OH
4		<100	d.	v. s.		
5		exp.		0.075^{13}	s.	v. s. NH_4OH; i. HNO_3
6	5.525	>200	d.	0.003^{10}	0.01^{60}	s. NH_4OH, HNO_3, KI
7	5.67	d. 552		3×10^{-7}	3×10^{-6}	s. KCN, $Na_2S_2O_3$, sl. s. NH_4OH
8				*ca.* 7.7		
9		212.5				0.007^{25} al., 0.008^{15} eth.
10				0.67^{17}	d.	
11		d.		0.55^{0}	$1.60^{28.5}$	d. al.
12				i.		s. KI, KCN; i. dil. a.
13		211		0.007^{25}		0.006^{25} al., 0.007^{15} eth.
14	4.352^{19}	212	444 d.	122^{0}	952^{100}	s. eth., glyc.; v. sl. s. abs al.
15	4.453^{26}	d. 140		0.155^{0}	1.363^{60}	s. ac. a., NH_4OH; i. al.
16				i.		s. NH_4OH; i. al., HNO_3
17	5.029^{1}	exp. 140		0.00339^{18}		s. a., NH_4OH, KCN
18	$7.143^{16.8}$	d. 300		0.0013^{20}	0.0053^{90}	s. a., NH_4OH, KCN; i. al.
19	7.44	d.>100		i.		s. H_2SO_4, conc. HNO_3, NH_4OH
20		209		0.0012^{20}; 0.004^{35}	0.006^{60}	0.007^{15} eth.; 0.006^{25} al.
21	6.370^{25}	849		$.00065^{19.5}$		s. a., NH_4OH, KCN; i. NH_3
22	$5.306^{7.5}$	585		i.	i.	s. a., NH_4OH, KCN, i. ac. a.
23	6.37	*ca.* 482		i.		s. HNO_3, NH_4OH
24	$2.687\frac{25}{4}$	. .		0.842^{20}	2.03^{60}	
25				s.		s. al.
26	8.0	880	d.	i.		s. h. HNO_3, NH_4OH
27		205		0.006^{20}		0.006^{25} al.; 0.006^{25} eth.
28	$5.45^{29.2}$	652	d. 1085	0.57^{0}	1.41^{100}	s. a., NH_4OH, i. al.
29	7.326	tr. 175	d.	.00002		s. HNO_3, KCN, conc. H_2SO_4
30	7.317	825	d.	$.000014^{20}$		s. a., KCN
31		d. 100		v. sl. s.		s. a., NH_4OH, KCN; i. HNO_3
32	3.432^{15}	d.		0.2^{18}	0.203^{25}	s. a., NH_4OH, KCN
33		d. >200		i.	i.	s. NH_4OH, KCN
34	8.5	955		i.		s. HNO_3, KCN
35		250-bl; 450-pa. yel		i.	i.	s. NH_3, KCN
36	5.76	>175		i.	i.	s. HNO_3
37	5.49	>175		i.	i.	s. HNO_3
38		d.		.000021	$.00064^{100}$	s. NH_4OH, i. a.
39		d.		sl. s.		s. NH_4OH, $Na_2S_2O_3$
40				0.05^{15}		s. HNO_3, NH_4OH, KCN
41	3.901					1.618 conc. NH_4OH
42	0.97	97.5	880	d. to NaOH + H_2		d. al.; i. bz., eth.
43	1.528	324		119^{0}	170.15^{100}	2.1^{18} al.
44	1.45	58; 78	123	76.2^{0}	138.8^{80}	2.1^{18} al.; s. eth.
45		1650		s.	v. s.	i. al.
46		185		s.	s.	

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Sodium			
1	aluminum fluoride (cryolite)	$3NaF \cdot AlF_3$	209.96	monocl., col., β 1.364
2	" trisilicate (albite)	$Na_2O \cdot Al_2O_3 \cdot 6SiO_2$	524 29	tri. col., 1.525, 1.529, 1.536
3	" sulfate	$NaAl(SO_4)_2 \cdot 12H_2O$	458.28	cub. oct. col., 1.4388
4	amide (sodamide)	$NaNH_2$	39.02	olive grn. fr impurities, or wh. conchoidal tract.
5	ammonium phosphate (microcosmic salt; stercorite)	$NaNH_4HPO_4 \cdot 4H_2O$	209.13	monocl. col., 1.439, 1.441, 1.469
6	*pyro*antimonate, di-H	$Na_2H_2Sb_2O_7 \cdot H_2O$	421 55	tetr. col
7	*meta*antimonate (Leukonin)	$2NaSbO_3 \cdot 7H_2O$	511 63	cub. col
8	*ortho*arsenate	$Na_3AsO_4 \cdot 12H_2O$	424 10	trig. col., 1.457, 1.466, hex. pr
9	" , mono-H	$Na_2HAsO_4 \cdot 7H_2O$	312.03	monocl. col., 1.462, 1.466, 1.478
10	" " "	$Na_2HAsO_4 \cdot 12H_2O$	402.11	monocl. col. eff., 1.445, 1.450, 1.451.
11	" , di-H	$NaH_2AsO_4 \cdot H_2O$	181 94	rhomb. or monocl. col., 1.5382, 1.5535, 1 5607
12	*meta*arsenate	$NaAsO_3$	145 91	rhomb. effl , 1.479, 1.502, 1.5265
13	*ortho*arsenite, mono-H	Na_2HAsO_3	169 91	col. (exist quest)
14	auride	$NaAu_2$	417 40	cub. yel.
15	azide	NaN_3	65.02	col. hex
16	barbital (medinal)	$NaC_8H_{11}N_2O_3$	206 18	wh. powd
17	benzenesulfonate	$NaC_6H_5O_3S$	180 16	wh. cr
18	benzoate	$NaC_7H_5O_2$	144 11	col. cr. or wh. amor., or gran. powd.
19	*tetra*borane deriv.	$Na_2B_4H_{10}$	99 36	wh. cr. powd
20	*meta*borate	$NaBO_2$ (or $Na_2B_2O_4$)	65 82	hex. pr., col.
21	"	$NaBO_2 \cdot 2H_2O$ (or $NaH_2BO_3 \cdot H_2O$)	101 85	monocl. col
22	*tetra*borate	$Na_2B_4O_7$	201.27	
23	"	$Na_2B_4O_7 \cdot 5H_2O$	291 36	cub. or hex., deliq
24	" (borax)	$Na_2B_4O_7 \cdot 10H_2O$	381 44	monocl. col., 1.447, 1 469, 1.472, effl
25	*per*borate	$NaBO_3 \cdot H_2O$ (or $NaBO_2 \cdot H_2O_2$)	99 83	
26	"	$NaBO_3 \cdot 4H_2O$ (or $NaBO_2 \cdot H_2O_2 \cdot 3H_2O$)	153 88	monocl. col
27	bromate	$NaBrO_3$	150 91	cub. col., 1.594
28	bromide	$NaBr$	102 91	cub. col
29	"	$NaBr \cdot 2H_2O$	138 95	monocl. col. pr
30	bromoaurate	$NaAuBr_4 \cdot 2H_2O$	575 89	br.-blk. cr.
31	bromoiridite	$Na_3IrBr_6 \cdot 12H_2O$	957 78	olive gr. rhomb. effl.
32	bromoplatinate	$Na_2PtBr_6 \cdot 6H_2O$	828 82	tricl. dk. red
33	cacodylate	$NaAsC_2H_6O_2 \cdot 3H_2O$	214.02	wh amor. powd. pois
34	calcium sulfate	$Na_2Ca(SO_4)_2 \cdot 2H_2O$	314 23	monocl. need
35	*d*-camphorate	$Na_2C_{10}H_{14}O_4 \cdot 3H_2O$	298 26	hygr. need
36	carbide	Na_2C_2	70 01	wh. powd

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.90	1000		sl. s.		d. alk.; i. HCl
2	2.61	1100		..	...	
3	1.675	61		anh. 110^{15}	anh. 146.3^{30}; d>30	s. dil. a.; i. al.
4		210	400	d.	d.	d. hot al.; s. 0.1 g in liq. NH_3
5	1.554	79 d.		16.7	100	i. al.
6				$.03^{12.3}$	0.3^{100}	sl. s. al.
7		$-2H_2O$, 200		$0.031^{12.3}$		sl. s. al., NH_4 salts; i. ac. a.
8	1.762–1.804	86.3		$38.9^{15.5}$		1.67 al.
9	1.88	120-130	$-H_2O$, 180	5.46^{0}	35.0^{94}; 100^{100}	sl. s. al.
10	1.736-59	28	$-12H_2O$, 100	17.2^{0}, 56^{14}	140.7^{30}	sl. s. al.; i. liq. Cl
11	2.53; 2.67	$-H_2O$, 100–130	d. 200–280	s.		
12	2.301					
13	1.87			v. s.	v. s.	sl. s. al.
14		d. 700				
15	1.846		d. in vac.	40.16^{10}; 41.7^{17}		0.314^{16} al.; s. liq. NH_3; i. eth.
16				20^{25}	40^{100}	sl. s. al.; i. eth.
17				35.8^{30}	v. s.	
18				62.8^{0}, 66^{20}	74.2^{100}	$.81^{15}$, 1.64^{25}, 8.3^{78} al.
19		d $<180 \rightarrow Na_2B_4H_8$		d.	d.	
20	2.464	966	1434	s.	v. s.	
21		57	$-H_2O$, 120	v. s.	v. s.	
22	2.367	741	1575 d.	1.4^{90}	8.79^{40}	i. al.
23	1.815	120, H_2O		22^{65} anh.	52.3^{100} anh.	
24	1.73	75; $-8H_2O$, 60	$-10H_2O$, 200	1.3^{0}; 1.6^{10}	22^{62}; 14.2^{55}; 201^{100}	s. glyc.; v. sl. s. al.; i. a.
25		d. 40		sl. s.	d.	s. glyc., alk.
26		63	$-H_2O$, 130–150	2.55^{15}	3.78^{32}	s. a., al., glyc.
27	$3.339^{17.5}$	381		27.5^{0}	90.9^{100}	i. al.
28	3.203^{25}	755	1390	79.5^{0}; 116^{20}	121^{100}	sl. s. al.
29	2.176	$-2H_2O$, 51		79.5^{0}	116^{20}, $118.6^{80.5}$	sl. s. al.
30	..			s.		
31		100	$-H_2O$, 150			s. NH_4OH
32	3.323	d. 150		v. s.	v. s.	v. s. al.
33	..	*ca.* 60		200^{15-20}; *ca.* 200^{25}		*ca.* 40^{25} al.; 100^{15-20} 90 % al.
34	2.64	$-2H_2O$, 80		d.	d.	
35		$-3H_2O$, 100		122^{14}	..	s. al.
36	1.575^{15}		700	d.	d.	d. al.; s. a.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Sodium			
1	carbonate...	Na_2CO_3	106 00	wh. powd., hyg
2	" (crystal carbonate, thermonatrite)	$Na_2CO_3 \cdot H_2O$	124 02	rhomb. col. deliq
3	carbonate..	$Na_2CO_3 \cdot 7H_2O$	232 12	rhomb. bipyr. effl
4	" (washing soda)	$Na_2CO_3 . 10H_2O$	286 17	monocl. wh., 1.405, 1.425, 1.440
5	" , sesqui-	$Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$	226 05	monocl. 1.5073
6	" , acid (baking soda)	$NaHCO_3$	84 02	monocl. wh. pr
7	cerium carbonate	$Na_6Ce(CO_3)_6 \cdot 12H_2O$	794.36	
8	chlorate	$NaClO_3$	106.45	cub. or trig. col., 1.513
9	*per*chlorate	$NaClO_4$	122 45	rhomb., deliq
10	"	$NaClO_4 \cdot H_2O$	140 47	rhbdr. col., deliq
11	chloride (common salt, halite)	$NaCl$	58 45	cub., col., 1.5442
12	*hypo*chlorite	$NaClO$	74 45	in solution only
13	"	$NaClO \cdot 2\frac{1}{2}H_2O$	119 49	col. hyg
14	"	$NaClO\ 5H_2O$.	164 54	col
15	chloroaurate	$NaAuCl_4 \cdot 2H_2O$	398 06	rhomb. yel
16	chloroiridate	$Na_2IrCl_6 \cdot 6H_2O$	559 93	tricl. dull red-blk
17	chloroiridite	$Na_3IrCl_6 \cdot 12H_2O$	691 03	dk. grn. cr
18	chloroosmate	$Na_2OsCl_6 \cdot 2H_2O$	484 97	or. red rhomb. pr
19	chloropalladite	$Na_2PdCl_4 \cdot 3H_2O$	348 57	br.-red cr., deliq
20	chloroplatinate	Na_2PtCl_6	453 97	or. yel. powd
21	"	$Na_2PtCl_6 \cdot 6H_2O$	562 06	tricl. yel -red
22	chloroplatinite	$Na_2PtCl_4 \cdot 4H_2O$	455 12	red pr
23	chlororhodite	Na_3RhCl_6.	384 64	tricl. red
24	"	$Na_3RhCl_6 \cdot 18H_2O$	708 93	oct. garnet-red effl
25	chromate	Na_2CrO_4	162 00	yel. rhomb. bipyr.
26	"	$Na_2CrO_4 \cdot 10H_2O$	342 17	monocl. yel., deliq
27	*di*chromate	$Na_2Cr_2O_7\ 2H_2O$	298 05	monocl. pr. red, deliq, 1.661, 1.699, 1.751
28	*peroxy*chromate	Na_3CrO_8	249 00	or. pl
29	cinnamate	$NaC_9H_7O_2$	170 14	wh. cr. powd
30	citrate	$Na_3C_6H_5O_7 \cdot 5$ (or $5\frac{1}{2}$) H_2O	348.17	rhomb. wh
31	*meta*columbate	$Na_2Cb_2O_6 \cdot 7H_2O$	453 93	pseudo-cub
32	cuprocyanide	$NaCu(CN)_2$	138 60	col
33	cyanate.	$NaOCN$	65 02	
34	cyanide	$NaCN$	49.02	cub. col., deliq
35	cyanoaurite (aurocyanide)	$NaAu(CN)_2$	272.23	wh. cr. powd
36	enanthate (heptoate)	$NaC_7H_{13}O_2$	152.17	wh. cr. powd. or leaf
37	ethylacetoacetate deriv.	$NaC_6H_9O_3$	152 13	need
38	ethylsulfate	$NaC_2H_5SO_4 \cdot H_2O$	166 13	wh., hex. plates, deliq
39	ferricyanide	$Na_3Fe(CN)_6 \cdot H_2O$	298 96	red, deliq
40	ferrite	$Na_2Fe_2O_4$.	221.67	br. hex. pl. or need
41	ferrocyanide (yellow prussiate of soda)	$Na_4Fe(CN)_6\ 10H_2O$	484.10	monocl. pa. yel., 1.519, 1.530, 1.544
42	fluoantimonate	$NaSbF_6$	258 76	...
43	fluoberyllate	Na_2BeF_4	131.01	rhomb. or monocl. wh
44	fluophosphate	$NaPF_6 \cdot H_2O$	186 03	
45	fluoride (villiaumite)	NaF.	42.00	tetr. or cub. col., 1.336
46	" , acid	$NaF \cdot HF$	62 01	rhbdr. col. or wh. cr. powd
47	" *ortho*phosphate	$NaF \cdot Na_3PO_4 \cdot 12H_2O$	422 20	
48	fluosilicate	Na_2SiF_6	188.05	hex. col., 1.312, 1.309....
49	formaldehydesulfoxylate	$NaHSO_2 \cdot CH_2O \cdot 2H_2O$	154 12	rhomb. pr. hygr

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.509^{0}	851	d.	7.1^{0}	45.5^{100}	sl. s. abs. al.; i. acet
2	2.25	$-H_2O$, 100		33	33.56^{100}	14^{25} glyc.; s. al., eth.
3	1.51	$-H_2O$, 32		16.90	33.9^{35}	
4	1.44^{16}	32.5–34.5	$-H_2O$, 33.5	21.52^{0}	421^{104}	i. al.
5	1.777 (2.112)	d.	.....	13^{0}	42^{100}	
6	2.159–2.22	$-CO_2$, 270		6.9^{0}	16.4^{60}	sl. s. al.
7	1.47	$-H_2O$, 100	d. 200	d.	d.	s. ac. a., Na_2CO_3 soln.
8	2.490^{15}	248–261	d.	79^{0}	230^{100}	s. al., glyc.
9	.	482 d.	d.	s.	v. s.	s. al.
10	2.02	130		209^{15}	284^{50}	s. al.
11	2.165	801	1413 (1490)	35.7^{0}	39.12^{100}	s. glyc., sl. s. al., liq. NH_3; i. HCl
12		d.	d.	s.	d.	
13		57.5		v. s.		
14		24.5		29.3^{0}	94.2^{23}	
15		d.		150^{10}	990^{60}	v. s. al., eth.
16		d. 600		v. s.	v. s.	sl. s. al.
17		$-H_2O$, 50		31.46^{15}	307.26^{25}	
18				v. s.		s. al.
19				v. s.		s. al.
20		tr. 150–160		s.	v. s.	s. al.
21	2.50	$-6H_2O$, 100		66^{15}	v. s.	11.9 al.; s. aq. HCl; i. eth.
22	.	100, d.		s.		s. al.
23	. .	d.>650		v. s.		
24		904 d. effl		v. s.		i. al.
25	2.710–36			87.3^{30}		s. meth. al., sl. s. al.
26	1.483	19.92		31.7^{0}; 50^{10}	126^{100}	sl. s. al., s. ac. a.
27	2.52^{13}	$-2H_2O$, 100, anh. 320	d. 400	238^{0}, anh. 180^{20}	508^{80}, anh. 433^{98}	i. al.
28		d. 115		sl. s.	.	i. al., eth.
29				9.1	5^{100}	s. glyc., 0.025 90% al.
30	$1.857^{20.5}$	$-5H_2O$, 150	d.	92.6^{25}	250^{100}	sl. s. al.
31	4.512–59	$-H_2O$, 100		s.		
32	1.013^{20}	d. 100		s.		
33			.	s.	s.	i. al., eth.
34		563.7	1406	s.	v. s.	sl. s. al., s. NH_3
35				s.		.
36	.	240–350		s.		s. al.
37		d.		d.		s. eth.
38			d.	164^{17}	. . .	d. alk., H_2SO_4, 142 al.
39				18.9^{0}	67^{100}	i. al.
40				d.	. .	v. s. dil. HCl
41	1.458			31.85^{20}	156.5^{98}	i. al.
42	3.375			128.6^{20}	. .	s. al., acet.
43		d.		1.47^{18}	2.94^{100}	.
44	2.369^{19}	.		103.2^{0}		
45	2.79; 2.558^{11}	980–997 (1040)	1700	4.22^{18}	.	s. HF; v. sl. s. al.
46				s.	s.	
47	2.2165			12^{25}	57.5^{70}	
48	2.679	d.		0.652^{17}	2.46^{100}	i. al.
49		64	d.	v. s.	.	d. a., s. al., alk.

No.	Name	Formula	Mol wt.	Crystalline form, color and index of refraction
	Sodium			
1	formate	$NaCHO_2$	68 02	monocl. col., delq. wh
2	2-furanacrylate	$NaC_7H_5O_3$	160 11	lt. br. powd
3	*meta*germanate	Na_2GeO_3	166 59	monocl., wh , delq., 1.59
4	"	$Na_2GeO_3 \cdot 7H_2O$	292 71	rhombic col
5	*d*-glutamate ("Ajinomoto")	$NaC_5H_8NO_4$	169 12	wh. cr., not delq
6	glycerophosphate	$Na_2C_3H_7O_6P \cdot H_2O$	234 12	yelsh , viscid liq , wh. cr or powd
7	"	$Na_2C_3H_7O_6P \cdot 5\frac{1}{2}H_2O$	315 19	wh. odorl pl , sc , or powd
8	gold sulfide	$NaAuS \cdot 4H_2O$	324 32	monocl col
9	" thiosulfate	$Na_3Au(S_2O_3)_2 \cdot 2H_2O$	526 46	wh odorl. cr
10	hydride	NaH	24 01	silv. need
11	hydroxide	$NaOH$	40 01	wh., delq., 1.3576
12	iodate	$NaIO_3$	197 92	rhomb. wh
13	*metaper*iodate	$NaIO_4$	213 92	tetr
14	"	$NaIO_4 \cdot 3H_2O$	267 97	trig. effl
15	iodide	NaI	149 92	cub. col
16	"	$NaI \cdot 2H_2O$	185 95	monocl. col. cr
17	iodoplatinate	$Na_2PtI_6 \cdot 6H_2O$	1110 84	tri
18	iron oxalate (ic)	$Na_3Fe(C_2O_4)_3 \cdot 5H_2O$	478 97	monocl. grn
19	isocyanate	$NaNCO$	65 02	col need
20	lactate	$NaC_3H_5O_3$	112 07	col or yelsh liq very hyg
21	magnesium sulfate (bloedite)	$Na_2SO_4 \cdot MgSO_4 \cdot 4H_2O$	334 50	monocl. col., 1 486, 1.488, 1 489
22	" tartrate	$Na_2Mg(C_4H_4O_6)_2 \cdot 10H_2O$	546 62	wh. powd. or monocl pr
23	manganate	$Na_2MnO_4 \cdot 10H_2O$	345 09	monocl grn
24	*per*manganate	$NaMnO_4$	141 93	red
25	"	$NaMnO_4 \cdot 3H_2O$	195 98	purp. delq , cr
26	methanearsonate (methyl arsenate)	$Na_2AsCH_3O_3 \cdot 6H_2O$	292 04	wh. cr. powd
27	methoxide	$CH_3ONa \cdot 2CH_3OH$	118 12	wh. powd
28	methylsulfate	$NaCH_3SO_4 \cdot H_2O$	152 11	col hyg. cr
29	molybdate	Na_2MoO_4	205 94	opaque wh
30	"	$Na_2MoO_4 \cdot 2H_2O$	241 98	rhbdr. wh
31	*di*molybdate	$Na_2Mo_2O_7$	349 89	need. wh
32	*tri*molybdate	$Na_2Mo_3O_{10} \cdot 7H_2O$	619 96	need. acicular
33	*tetra*molybdate	$Na_2Mo_4O_{13} \cdot 6H_2O$	745 89	need; yel soln
34	*para*molybdate	$Na_6Mo_7O_{24} \cdot 22H_2O$	1589 99	monocl. col., effl
35	*octa*molybdate	$Na_2Mo_8O_{25} \cdot 17H_2O$	1519 87	monocl. cr.
36	*deca*molybdate	$Na_2Mo_{10}O_{31} \cdot 21H_2O$	1879 83	wh. pr
37	*per*molybdate	$Na_2MoO_8 \cdot xH_2O$	..	red. br. cr
38	nitrate (soda niter)	$NaNO_3$	85 01	trig. or rhbdr. col., 1.587 1 336
39	nitride	Na_3N	83 00	dk. gray
40	*hypo*nitrite	$Na_2N_2O_2$	106 01	
41	nitrite	$NaNO_2$	69 01	rhomb. col.-yel pr. hyg
42	nitroplatinite	$Na_2Pt(NO_2)_4$	425 26	pa yel. rhomb or monocl pr , effl
43	*p*-nitrophenoxide	$NaOC_6H_4NO_2 \cdot 4H_2O$	233 16	yel. monocl. pr
44	nitroprusside	$Na_2(NO)Fe(CN)_5 \cdot 2H_2O$	297 96	rhomb. red

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	1.92^{20}	253		44^{0}; 97.2^{20}	160^{100}	s. al., i. eth.
2	1.919	d.		s.	s.	sl. s. al.; i. eth.
3	3.31^{22}	1083			d.	s. a.
4		83		24.6^{0}; 45.5^{25}		s. a.
5		d.		v. s.		. ...
6				s.		s. al.
7			d.>130	v. s.		i. al.
8		d.		s.		s. al.
9				50		i. al.
10	0.92	800 m.p. d.		d.	d.	s. molten metals; i. CS_2, CCl_4, bz., NH_3
11	2.130	318.4	1390	42^{0}	347^{100}	v. s. al., glyc.; i. acet. eth.
12	4.277[illegible]	d.		2.5^{0}	34^{100}	s. ac. a.; i. al.
13	3.865^{16}	d. 300		s.		s. H_2SO_4, HNO_3, ac. a.
14	3.219^{18}	d. 175		s.		
15	3.667	651	1300	158.7^{0}	256.8^{60}	v. s. al.; s. glyc.
16	3.677^{0}, $2.448^{20.8}$	752		317.9^{0}	1550^{100}	v. s. NH_3
17	2.5			s.		s. al.
18	$1.973^{17.5}$	$-4H_2O$, 100	$-10H_2O$, 200	32.5	182^{100}	
19	1.937^{20}			s.	s.	
20		17, d. 140		v. s.		s. al.; i. eth.
21	2.23			s.		
22				s.	s.	
23		17		s.	d.	
24		d.		deliq.	v. s.	
25	2.47	d. 170		v. s.	v. s.	d. alk.; s. NH_3
26		130–140		*ca.* 100		sl. s. al.; i. bz., eth., pet. eth., oils
27		d. $-CH_3OH$		s. d.		s. CH_3OH
28				s.		s. al.
29	lq. 2.59	687		s.	84^{100}	
30	3.28	687		56.2^{0}	115.5^{100}	i. meth. acetate
31		612		sl. s.	sl. s.	
32		528; $-6H_2O$, 100–120		3.878^{20}	13.7^{100}	
33				39.8^{21}	v. s.	
34		700, $-H_2O$ 120-200		117.9^{30}		
35		$-H_2O$, 20		v. s.	v. s.	
36				sl. s.	0.842^{100}	
37		d.	exp. 100			
38	2.261	306.8	d. 380	73^{0}	180^{100}	v. s. NH_3; sl. s. glyc., 0.036^{25}, v. sl. s. acet.
39		d. 300		d.		
40	2.466^{4}, 1.728^{25}	d. 300		d.		i. al.
41	2.168	271	d. 320	72^{0}; 81.5^{15}	163^{100}	$.3^{20}$ eth.; 4.4^{20} meth. al.; 3 abs. al., v. s. NH_3
42		$-H_2O$, 100		s.	s.	
43		$-2H_2O$, 36, $-4H_2O$, 120	d.	5.97^{25}		sl. s. al.
44	1.72			40^{16}		s. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Sodium			
1	oleate (Eunatrol)	$NaC_{18}H_{33}O_2$	304.44	wh. cr. or yel. amor. gran
2	oxalate	$Na_2C_2O_4$	134.01	col. cr.; wh. powd
3	" , acid	$NaHC_2O_4 \cdot H_2O$	130.04	monocl. wh
4	oxide, mon-	Na_2O	61.99	wh.-gray, deliq
5	" , di- (per-)	Na_2O_2	77.99	yel.-wh. powd
6	" " "	$Na_2O_2 \cdot 8H_2O$	222.12	hex
7	palmitate	$NaC_{16}H_{31}O_2$	278.41	cr
8	" , acid	$2NaC_{16}H_{31}O_2 \cdot C_{16}H_{32}O_2$	813.24	
9	pentobarbital (nembutal)	$NaC_{11}H_{17}N_2O_3$	248.26	
10	phenobarbital (luminal)	$NaC_{12}H_{11}N_2O_3$	254.22	wh
11	1-phenol-4-sulfonate (*p*-)	$NaC_6H_5O_4S \cdot 2H_2O$	232.19	col. monocl., or gran., sl. effl
12	phenoxide (phenolate)	$NaOC_6H_5$	116.10	wh. deliq. cr. need
13	*hypo*phosphate	$Na_4P_2O_6 \cdot 10H_2O$	430.19	monocl., 1.477, 1.482, 1.504
14	" , di-H	$Na_2H_2P_2O_6 \cdot 6H_2O$	314.15	monocl. col., 1.486, 1.490, 1.504
15	*ortho*phosphate	$Na_3PO_4 \cdot 10H_2O$	344.17	col. oct
16	"	$Na_3PO_4 \cdot 12H_2O$	380.21	trig. col., 1.446, 1.452
17	" , mono-H	$Na_2HPO_4 \cdot 2H_2O$	178.05	rhombic-bi-sphenoidal, 1.4629
18	" " "	$Na_2HPO_4 \cdot 7H_2O$	268.14	monocl. pr., 1.4424
19	" " "	$Na_2HPO_4 \cdot 12H_2O$	358.22	rhomb. or monocl. col. effl., wh. powd., 1.432, 1.436, 1.437
20	" di-H	$NaH_2PO_4 \cdot H_2O$	138.05	rhomb. col., 1.456, 1.485, 1.487
21	*pyro*phosphate	$Na_4P_2O_7$	266.03	wh. cr., 1.425
22	"	$Na_4P_2O_7 \cdot 10H_2O$	446.19	monocl. col., 1.450, 1.453, 1.460
23	" , di-H	$Na_2H_2P_2O_7 \cdot 6H_2O$	330.15	monocl. 1.460, 1.465, 1.465
24	*hexameta*phosphate	$Na_6(PO_3)_6(?)$	612.10	col.-wh. flakes
25	phosphide	Na_3P	100.01	red
26	*hypo*phosphite	$NaH_2PO_2 \cdot H_2O$	106.05	monocl. col., deliq
27	*ortho*phosphite, mono-H	$Na_2HPO_3 \cdot 5H_2O$	216.10	rhomb. wh., deliq., β 1.443
28	" , di-H	$NaH_2PO_3 \cdot 2\frac{1}{2}H_2O$	149.07	monocl., 1.419, 1.431, 1.449
29	phthalate	$Na_2C_8H_4O_4$	210.11	wh. powd. pearly pl
30	picrate	$NaC_6H_2N_3O_7 \cdot H_2O$	269.11	yel. need
31	platinate	$Na_2PtO_3 \cdot 3H_2O$	343.27	hex. red-br. or yel
32	*meta*plumbate	$Na_2PbO_3 \cdot 3H_2O$	355.25	lt. yel.-wh. fused, hyg. lumps
33	propionate	$NaC_3H_5O_2$	96.07	wh. gran. powd
34	*pyrohypo*rhenate	$Na_4Re_2O_7 \cdot H_2O$	594.62	sandy yel. cr
35	*per*rhenate	$NaReO_4$	273.31	col. hex. pl
36	*per*ruthenate	$NaRuO_4 \cdot H_2O$	206.71	blk. cr. lamellar
37	salicylate	$NaC_7H_5O_3$	160.11	wh. cr. powd
38	selenate	Na_2SeO_4	188.95	rhomb. col
39	"	$Na_2SeO_4 \cdot 10H_2O$	369.12	monocl. col
40	selenide	Na_2Se	124.95	wh. to red, deliq. cr
41	selenite	$Na_2SeO_3 \cdot 5H_2O$	263.04	wh. cr., tetrag
42	*meta*silicate	Na_2SiO_3	122.05	monocl. col., α 1.518, γ 1.527
43	"	$Na_2SiO_3 \cdot 9H_2O$	284.20	effl. rhomb. bipyramids
44	*di*silicate	$Na_2Si_2O_5$	182.11	rhomb. pearly luster, 1.500, 1.510, 1.515
45	*tetra*silicate (water glass) (?)	$Na_2Si_4O_9(?)$	302.23	amor. col., deliq

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	.	232–5		10^{12}	.	10^{32} al; sl. s. eth
2	2.34		..	3.7^{20}	6.33^{100}	
3				1.7^{15}	21^{100}	
4	2.27		1275 subl.	d.	d.	d. al.
5	2.805	460 d.	d. 657	s.	d.	d al, NH_3; s. dil. a.; i. alk.
6		d 30	d.	s.	d.	i. al.
7		270	.	.		.
8		115–17	. .	i.		s. h. eth.
9		. . .	. . . .	s.	s. d.	s. al.
10		. .	..	v. s.	.	s. al.; i. eth., chl.
11			d.	23.8^{25}	125^{100}	0.71^{25}, 7.4^{100} al., 20^{25} glyc.
12	.	. . .	.	v. s.		d. a.; s. al., acet.
13	1.823	d.		1.49^{25}	5.46^{50}	. .
14	1.849	250	$-6H_2O$, 100	2.25	25	s. dil. H_2SO_4, NH_4OH; i. al.
15	$2.536^{17.5}$ anh.	100				
16	1.645^{4}; 1.62^{20}	73.3–76.7 d.	$-12H_2O$, 100	1.5^{0}; 25.8^{20}	157^{70}	i. CS_2
17	2.066^{15}	$-H_2O$, 92.5	..	82.5^{50}	96.6^{80}	..
18	1.6789	$-5H_2O$, 48		63.9^{40}		. . .
19	1.52	34–41	$-H_2O$, 36.4; $-12H_2O$, 100	4.15	87.4^{34}	i. al.
20	2.040	$-H_2O$, 100; d. 204	$-2H_2O$, 200	59.9^{0}; 110.3^{20}	427^{100}	v. sl. s. chl., tol., eth.; i. al.
21	2.534	880		3.16^{0}	40.26^{100}	..
22	1.815–36	880; $-H_2O$, 93.8		5.41^{0}	93.11^{100}	i. al., NH_3
23	1.85	$-H_2O$, 220		s. d.	d.	. . . . . .
24	2.181	640	subl. >1100	s.	s.	. . . .
25		d.		d. ev. PH_3	.	.
26		d. viol.		100	667^{100}	v. s. al.; s. glyc.; sl. s. NH_3, NH_4OH
27		53	200–250 d.	s.	v. s.	i. al., NH_4OH
28		42	$-5H_2O$, 100	56^{0}	193^{42}	. ..
29		.		v. s.		
30		$-H_2O$, 150	expl. 310	5.58^{30}	.	sl. s. al.
31		$-3H_2O$, 150–70	d.	s	.	sl. s. HCl; i. al.
32		.		d. to PbO_2	.	d. acids; s. alk.; hyd. al.
33			.	s.	.	s. al.
34		.	. .	.004	. .	. . . ..
35		300 in oxygen		25^{20}	.	s. al.
36	. . .	d $440^{vac.}$		v. s.	d.	.
37		.	. ..	111^{15}	125^{25}	17^{15} al.; 25 glyc.
38	3.098			84^{35}	72.8^{100}	
39	1.603–1.620	ca 32 trans. pt.	.	43.5^{20}	78.7^{30}	.
40	2.625^{10}	>875		d.	..	i. NH_3
41	. .		.	s.	s.	i. al.
42	2.4	1088		s.	s. d.	i. al., Na and K salts
43		40–48	$-6H_2O$, 100	v. s.	v. s.	29^{18} N/2 NaOH; i. al., a.
44		874	.	s.	s.	. .
45	.	.	.	s.	s.	i. al., Na and K salts

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Sodium			
1	silicotungstate (normal)	$Na_4SiW_{12}O_{40}\cdot 20H_2O$ (?)	3327.41	col. tricl
2	silver thiosulfate	$2Na_2S_2O_3\cdot Ag_2S_2O_3\cdot 2H_2O$	680.14	wh. to gray cr. powd
3	stannate	$Na_2SnO_3\cdot 3H_2O$ (or $Na_2Sn(OH)_6$)	266.74	hex. col. trig. wh. powd. or lumps
4	*meta*stannate	$Na_2Sn_5O_{11}\cdot 4H_2O$.	887.56	wh. cr. powd
5	stearate	$NaC_{18}H_{35}O_2$	306.46	wh. powd., fatty odor
6	succinate	$Na_2C_4H_4O_4\cdot 6H_2O$	270.16	wh. gran. or powd
7	" , tetrahydroxy- (dihydroxytartrate)	$Na_2C_4H_4O_8\cdot 3H_2O$	280.12	wh. ppt
8	sulfanilate	$NaC_6H_6NO_3S\cdot 2H_2O$	231.21	wh., lust. cr. leaf
9	sulfate (thenardite)	Na_2SO_4	142.05	rhomb., 1.464, 1.474, 1.485
10	"	Na_2SO_4	142.05	monocl. col
11	"	Na_2SO_4	142.05	hex. col. (> 500)
12	"	$Na_2SO_4\cdot 7H_2O$	268.17	rhomb. or tetr. wh
13	" (Glauber's salt, mirabilite)	$Na_2SO_4\cdot 10H_2O$	322.22	monocl. col. effl., 1.394, 1.396, 1.398
14	sulfate, acid	$NaHSO_4$	120.07	tricl. col
15	" "	$NaHSO_4\cdot H_2O$	138.08	monocl. col., deliq
16	*pyro*sulfate	$Na_2S_2O_7$	222.11	wh. transluc. cr., deliq
17	*peroxydi*sulfate	$Na_2S_2O_8$	238.11	wh. cr. powd
18	sulfide, mono-	Na_2S	78.05	amor. yel.-pink or wh., deliq
19	" "	$Na_2S\cdot 9H_2O$	240.20	tetr. col., deliq
20	" , hydro-	$NaHS$	56.07	rhomb. col. or wh. gran. cr
21	" "	$NaHS\ 2H_2O$	92.10	col. need., deliq
22	" "	$NaHS\ 3H_2O$	110.11	col. lust. rhomb. cr
23	" , tetra-	Na_2S_4	174.23	yel. cub. hyg. cr
24	" , penta-	Na_2S_5	206.29	yel. (exist. quest.)
25	*hypo*sulfite	$Na_2S_2O_4\cdot 2H_2O$	210.15	monocl. (?) col. cr. or yel.-wh. powd.
26	sulfite	Na_2SO_3	126.05	hex. pr. or wh. powd
27	"	$Na_2SO_3\cdot 7H_2O$	252.17	monocl. col., efflor
28	" , acid	$NaHSO_3$	104.07	monocl. wh., yel. in soln.
29	*pyro*sulfite (metabisulfite)	$Na_2S_2O_5$	190.11	col. pr., wh
30	*d* (& *l*)-tartrate	$Na_2C_4H_4O_6\cdot 2H_2O$	230.10	rhomb. col
31	*d*-tartrate, acid	$NaHC_4H_4O_6\cdot H_2O$	190.09	wh. cr. powd., rhomb
32	*dl*-tartrate, acid	$NaHC_4H_4O_6\cdot H_2O$	190.09	monocl. or tricl
33	tellurate..	$Na_2TeO_4\cdot 2H_2O$	273.64	hex. pl
34	tellurite	Na_2TeO_3	221.60	wh. rhomb. pr
35	thioantimonate (Schlippe's salt)	$Na_3SbS_4\cdot 9H_2O$	481.14	cub. pa. yel
36	thioarsenate	$Na_3AsS_4\cdot 8H_2O$	416.27	monocl. yel., β 1.6802
37	thiocarbonate	$Na_2CS_3\cdot H_2O$	172.20	yel. need., deliq
38	thiocyanate	$NaSCN$	81.08	rhomb. col. pois., deliq
39	*di*thionate	$Na_2S_2O_6\cdot 2H_2O$	242.15	clear, rhomb., 1.482, 1.495, 1.519
40	thiosulfate (hypo)	$Na_2S_2O_3\cdot 5H_2O$	248.20	monocl. col., effl., 1.489, 1.508, 1.536
41	*tri*titanate	$Na_2Ti_3O_7$	301.69	wh. need
42	tungstate	Na_2WO_4	293.91	wh. rhomb.
43	"	$Na_2WO_4\cdot 2H_2O$	329.95	rhomb. col., pl
44	*para*tungstate	$Na_6W_7O_{24}\cdot 16H_2O$	2097.68	col. tricl

No.	Sp. gr or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	.	$-7H_2O$, 100	d.	v. s.	v. s.	s. a.; sl. s. al.
2				s.	.	....
3		$-3H_2O$, 140		$61.3^{15.5}$	50^{100}	i. al., acet.
4		d. 60		sl. s.	d.	i. al., alk., NaOH
5				s.	s.	s. h. al.
6				21.45^{0}	86.63^{75}	v. sl. s. al.
7		d		0.032^{0}	d.	d. min. a.; i. al., eth.
8				s.		. .....
9	2.698	884 tr. −mcl. 100		4.76^{0}	42.7^{100}	s. glyc.; i. al.
10		tr.-hex. 500; 884		48.8^{40}	42.5^{100}	d. HI
11		884		s.	s.	..
12		tr. to anh. 24.4		19.5^{0}	44^{20}	i. al.
13	1.464	d. 32.4		11^{0}	92.7^{30}	i. al.
14	2.435^{13}; 2.742	>315: d 240-50	d. to $Na_2S_2O_7$	28.6^{25}	100^{100}	d. al.; sl. s. al.; i. NH_3
15		58.54 ± .05		*ca.* 67, d.	v. s. d.	i. al.
16	2.658^{25}	400.9	d. 460	s.		s. fum. H_2SO_4
17				s. d.		i. al.
18	1.856^{14}	*ca.* 920		15.4^{10}	57.2^{90}	d. a.; sl. s. al.; i. eth.
19	2.471	920 d		47.5^{10}	96.7^{50}	d. a.; sl. s. al.
20		350		v. s.		s. al.
21		d.		s.	s.	d. a., s. al.
22		22	d.	s.	s.	s. al.
23		275	d.	s.		s. al.
24		251.8		s.	s.	s. al.
25		d. 52		25.4^{20}	d.	d. a.; s. alk.; i. al.
26	$2.633^{15.4}$		d.	12.54^{0}	28.3^{80}	sl. s. al.; i. liq. Cl_2, NH_3
27	1.561, 1.539^{15}	$-7H_2O$, 150	d	32.8^{0}	196^{40}	sl. s. al.
28	1.48	d.		v. s.	v. s.	sl. s. al.
29	1.48	d. >150		54^{20}	81.7^{100}	i. al.
30	1.818			29^{6}	66^{43}	i. al.
31		$-H_2O$, 100	d. 234	6.7^{18}	9.2^{30}	..
32		$-H_2O$, 100	d. 219	8.9^{19}		i. al.
33		d.	d.	0.77^{18}	2^{100}	s. h. dil. HNO_3; i. NaOH soln.
34				sl. s.	s.	. . ..
35	1.839	d.		20.15^{0}; 33	100	i. al.
36		d.		v. s.	d.	i. al.
37		d		s.	d.	s. al.; i. bz., eth.
38		287		$139.3^{21.3}$	v. s.	v. s. al.
39	2.189	$-H_2O$, 110; $-SO_2$, 267		6.05^{0}; 47.6^{16}	90.9^{100}	i. al., HCl
40	1.729^{17} (1.685)	45-50, d. 48.0		79.4^{0}	291.1^{45}; 301.5^{60}	s. NH_3; i. al.
41	3.35–3.50			i.		i. h. HCl
42	4.179	698				....
43	3.23 25	$-2H_2O$, 100, anh. 698		41^{0}; 82.5^{20}	123.5^{100}	sl. s. NH_3; i. a., al.
44	3.987	$-12H_2O$, 100 $-16H_2O$, 300		8	d.	. ...

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Sodium			
1	*meta*uranate	Na_2UO_4	348.06	gr. yel. or red pl. or rhomb. pr, or powd.
2	*per*uranate	$Na_4UO_8 \cdot xH_2O$.	...	yel. cr. powd.... ......
3	uranyl acetate	$NaUO_2(C_2H_3O_2)_3$	470.20	tetr. yel. cr., 1.501.....
4	" carbonate	$2Na_2CO_3 \cdot UO_2CO_3$	542.09	yel. cr
5	urate	$Na_2C_5H_2N_4O_3 \cdot H_2O$	230.11	hard, cr. nodules or wh. gran powd
6	" , acid	$NaHC_5H_2N_4O_3$	190.10	wh. gran. powd
7	valerate	$NaC_5H_9O_2$.	124.12	col. cr. or wh. deliq. mass
8	*ortho*vanadate	Na_3VO_4	183.94	col. hex. pr
9	"	$Na_3VO_4 \cdot 10H_2O$	364.10	wh. cubic or hex. cr. 1.5305; ω 1.5398, ε 1.5475
10	"	$Na_3VO_4 \cdot 16H_2O$	472.20	cr. col. need
11	*pyro*vanadate	$Na_4V_2O_7$	305.89	hex. ..
12	*meta*vanadate	$NaVO_3$.	121.95	col. monocl. pr
13	xanthate	$NaC_3H_5OS_2$	144.19	yelsh. powd.
14	zinc uranyl acetate	$NaZn(UO_2)_3(C_2H_3O_2)_9 \cdot 9H_2O$	1592.13	tab. monocl. cr. α 1.475, γ 1.480
15	zirconium fluoride	$5NaF \cdot 2ZrF_4$	544.43	monocl. pr
16	**Stannous and Stannic**	See under *Tin*		
17	**Strontium**	Sr	87.63	cub. silv. wh.-pa. yel. met
18	acetate	$Sr(C_2H_3O_2)_2 \cdot \frac{1}{2}H_2O$	214.73	wh. cr. powd . ..
19	*ortho*arsenate, acid	$SrHAsO_4 \cdot H_2O$	245.56	rhomb. need. .
20	*ortho*arsenite	$Sr_3(AsO_3)_2 \cdot 4H_2O$	580.77	cr. or wh. powd
21	*tetra*borate	$SrB_4O_7 \cdot 4H_2O$.	314.97	.
22	boride	SrB_6	152.55	blk. cr ..
23	bromate .	$Sr(BrO_3)_2 \cdot H_2O$	361.48	monocl. col.-yelsh. hyg
24	bromide	$SrBr_2$ . .	247.46	wh. need., hyg.
25	"	$SrBr_2 \cdot 6H_2O$ ..	355.56	hex. col., hyg...
26	carbide	SrC_2	111.65	tetr. blk.
27	carbonate	$SrCO_3$	147.64	rhomb. col. or wh. powd, 1.516, 1.664, 1.666
28	chlorate	$Sr(ClO_3)_2$.	254.54	rhomb. col. or wh. powd., 1.567, 1.605, 1.626
29	"	$Sr(ClO_3)_2 \cdot 8H_2O$	398.67	wh. need
30	chloride	$SrCl_2$.	158.54	cub. col., <1.6
31	"	$SrCl_2 \cdot 2H_2O$	194.58	transp. leaf .
32	"	$SrCl_2 \cdot 6H_2O$	266.64	trig. col., 1.536, 1.487
33	" fluoride	$SrCl_2 \cdot SrF_2$..	284.17	tetr. 1.651, 1.627 .
34	chromate	$SrCrO_4$ ..	203.64	monocl. yel . .. .
35	cyanide	$Sr(CN)_2 \cdot 4H_2O$	211.73	wh. rhomb., deliq . .
36	ferrocyanide	$Sr_2Fe(CN)_6 \cdot 15H_2O$	657.45	monocl. yel
37	fluoride	SrF_2	125.63	cub. col. or wh. powd .
38	fluosilicate .	$SrSiF_6 \cdot 2H_2O$.	265.72	monocl..
39	formate	$Sr(CHO_2)_2$	177.67	rhomb., 1.559, 1.574, 1.598
40	"	$Sr(CHO_2)_2 \cdot 2H_2O$	213.70	rhomb. col., 1.484, 1.521, 1.538
41	glycerophosphate	$SrC_3H_7O_6P$	257.74	wh. powd
42	hydroxide .	$Sr(OH)_2$	121.65	wh. deliq
43	" .	$Sr(OH)_2 \cdot 8H_2O$	265.78	tetr. col., deliq., 1.499, 1.476 .
44	iodide .	SrI_2 ,	341.47	col. pl
45	" .	$SrI_2 \cdot 6H_2O$.	449.57	hex. col.-yelsh., deliq.. .
46	lactate .	$Sr(C_3H_5O_3)_2 \cdot 3H_2O$	319.82	wh. cr. or gran. powd
47	permanganate	$Sr(MnO_4)_2 \cdot 3H_2O$	379.54	cub. purp .
48	molybdate	$SrMoO_4$.	247.58	tetr..... ..
49	nitrate . .	$Sr(NO_3)_2$ ...	211.65	cub. col., 1.567 .

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1				i.	i.	s. dil. a., alk. carb.
2				sl. s.	d.	d. HCl, H_2SO_4, ac. a.
3	2.56					
4		d. 400		sl. s.		i. al.
5					1.3^{100}	v. sl. s. 90% al.
6				0.083	0.8^{100}	
7		140		s.	...	s. al
8		850–66		s.		i. al.
9				s.	s.	
10		866 (anh.)		v. s.	d.	i. al.
11		632–54		s.	s.	i. al.
12		630		21.1^{25}	38.8^{75}	
13				s.		s. al.
14				i.		
15				$.387^{18}$	1.67^{100}	
16				.. ...		
17	2.6	752 (800)	1150	d.	d.	s. a., al., liq. NH_3
18	anh. 2.099			s.		sl. s. al.
19	3.606^{15}; anh. 4.035	$-H_2O$, 125		$0.284^{15.5}$	d.	s. a.
20				sl. s.		s. a.; sl. s. al.
21					77^{100}	s. HNO_3, NH_4 salts
22	3.3			i.	i.	s. HNO_3
23	3.773	$-H_2O$, 120	d. 240	33^{16}		
24	4.216^{24}	643	d.	85.2^{0}	222.5^{100}	s. al., amyl. al.
25	2.358^{18}	d. 20	$-6H_2O$, >180	204.2^{0}	∞	s. al.; i. eth.
26	3.2			d.	d.	d. a.
27	3.70	$1497^{60\ atm}$	$-CO_2$, 1340	0.0011^{18}	0.065^{100}	0.12 aq. CO_2; s. a., NH_4 salts
28	3.152	120 d.		174.9^{18}	v. s.	s. al.; i. abs. al.
29				s.	v. s.	s. al
30	3.052	873		43.5^{0}	100.8^{100}	v. sl. s. abs. al., acet.; i. NH_3
31	2.6715^{25}					
32	1.93	$-4H_2O$, 60	$-6H_2O$, 100	106.2^{0}	205.8^{40}	3.8^{6} al.
33	4.18	962		d.	d.	s. conc. HCl, HNO_3; i. al.
34	3.895^{15}			0.12^{15}	3^{100}	s. ac. a., HCl, HNO_3, NH_4 salts
35		d.		v. s.		
36				50	100	
37	4.24	1190		0.011^{0}	0.012^{27}	s. h. HCl; i. HF
38	$2.99^{17.5}$ d	d.		3.2^{15}	v. s.	$.065^{15}$ 50% al.; s. HCl
39	2.69	71.9		s.	s.	
40	2.695	d.		s.	s.	
41				sl. s.		i. al.
42	3.625	375		0.41^{0}	21.83^{100}	s. a., NH_4Cl
43	1.90	$-8H_2O$, 100		0.90^{0}	47.71^{100}	s. a., NH_4Cl; i. acet.
44	4.549^{25}	402	d.	165.3^{0}	383^{100}	3.1^{40}, 4.3^{390} abs. al.
45	4.415			448.9^{0}	∞	s. al.; i. eth.
46				25	200^{100}	sl. s. al.
47	2.75	d. 175		270^{0}	291^{18}	
48	4.145			0.0104^{17}		s. a.
49	2.986	570		40.1^{0}	100^{90}	.012 abs. al.; v. s. NH_3; sl. s. acet.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Strontium			
1	nitrate	$Sr(NO_3)_2 \cdot 4H_2O$	283.71	monocl. wh
2	nitrite	$Sr(NO_2)_2 \cdot H_2O$	197.66	hex.
3	oxalate	$SrC_2O_4 \cdot H_2O$	193.67	col
4	oxide	SrO	103.63	cub. gray-wh
5	" , per-	SrO_2	119.63	wh. powd
6	" "	$SrO_2 \cdot 8H_2O$	263.76	col. cr
7	*ortho*phosphate, di-	$SrHPO_4$	183.66	rhomb. col
8	salicylate	$Sr(C_7H_5O_3)_2 \cdot 2H_2O$	397.88	col. cr
9	selenate	$SrSeO_4$	230.59	rhomb
10	*meta*silicate	$SrSiO_3$	163.69	col. pr., 1.618
11	sulfate (celestite)	$SrSO_4$	183.69	rhomb. col., 1.622, 1.624, 1.631
12	" , acid	$Sr(HSO_4)_2$	281.77	col
13	sulfide, mono-	SrS	119.69	cub. lt. gray
14	" , hydro-	$Sr(HS)_2$	153.77	cryst
15	" , tetra-	$SrS_4 \cdot 6H_2O$	323.97	redsh. cr
16	sulfite	$SrSO_3$	167.69	col. cr
17	tartrate	$SrC_4H_4O_6 \cdot 4H_2O$	307.77	monocl
18	thiocyanate	$Sr(SCN)_2 \cdot 3H_2O$	257.83	deliq
19	*di*thionate	$SrS_2O_6 \cdot 4H_2O$	319.81	trig., 1.530, 1.525
20	thiosulfate	$SrS_2O_3 \cdot 5H_2O$	289.83	monocl. need
21	tungstate	$SrWO_4$	335.55	tetr.
22	**Sulfamic acid** (amidosulfonic acid)	H_2NSO_3H	97.09	col. rhomb
23	**Sulfamide** (sulfuryl amide)	$SO_2(NH_2)_2$	96.11	rhomb. pl
24	**Sulfur,** rhombic (*α*)	S_8	256.48	rhomb. yel., 1.957
25	" , monoclinic (*β*)	S_8	256.48	monocl. pa. yel., 2.038
26	" , amorphous (*γ*)	S_8	256.48	pa. yel. amor
27	bromide, mono-	S_2Br_2 (or SBr)	223.95	red liq., 1.736
28	chloride, mono-	S_2Cl_2 (or SCl)	135.03	yelsh. red liq., 1.666[14]
29	" , di-	SCl_2	102.97	dk. red liq., 1.557[14]
30	" , tetra-	SCl_4	173.89	yel. br. liq
31	fluoride, mono-	S_2F_2	102.12	col. gas
32	" , tetra-	SF_4	108.06	gas (exist. quest.)
33	" , hexa-	SF_6	146.06	col. gas
34	iodide, mono-	S_2I_2	317.96	brittle gray-blk., met. lust. (exist. quest.)
35	" , hexa-	SI_6	793.58	gray-blk. cr. (exist. quest.)
36	(penta-) nitride, di-	S_5N_2	188.32	red liq. or gray solid
37	(tetra-) " , tetra-	S_4N_4	184.27	monocl. or.-red
38	oxide, sesqui-	S_2O_3	112.12	bl.-grn. cr
39	" , di-	SO_2	64.06	col. gas or liq., suffoc. odor, 1.410 liq.
40	" , tri- (*α*-)	SO_3	80.06	trim. col. cr. or liq., 1.4097
41	" " (*β*-)	$(SO_3)_2$	160.12	silky, fibrous need
42	" , hept-	S_2O_7	176.12	visc. liq. or need. (exist. quest.)
43	" , tetra-	SO_4	96.06	wh. solid
44	oxy*tetra*chloride, mono-	S_2OCl_4	221.95	dk. red liq
45	" , tri-	$S_2O_3Cl_4$	253.95	rhomb. need. or pl., wh
46	**Sulfuric acid**	H_2SO_4	98.08	col. oily liq. or hex. cr., 1.429
47	" "	$H_2SO_4 \cdot H_2O$	116.09	col. liq. or monocl. pr., 1.438
48	" "	$H_2SO_4 \cdot 2H_2O$	134.11	col. liq., 1.405
49	" "	$H_2SO_4 \cdot 4H_2O$	170.14	
50	" " , peroxymono- (permono-, Caro's acid)	H_2SO_5	114.08	wh. cr

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	2.2			60.43^{0}	206.5^{100}	v. sl. s. abs. al.; i. HNO_3
2	2.408^{0}_{0}	$-H_2O$, >100	d. 240	58.9^{0}	182^{100}	$.42^{20}$ 90% al.
3		$-H_2O$, 150		0.0051^{18}	5^{100}	s. HCl, HNO_3
4	4.7	2430		d. $Sr(OH)_2$		sl. s. al.; i. eth., acet.
5	4.56	d.		0.008^{20}	d.	v. s. al., NH_4Cl; i. acet.
6	1.951	$-8H_2O$, 100	d.	0.018^{20}	d.	s. al., NH_4Cl; i. NH_4OH
7	3.544^{15}			i.	i.	s. a., NH_4 salts
8		d.		5.6^{25}	28.6^{100}	1.5^{25}, 9.5^{78} al.
9	4.23			i	i.	s. h. HCl; i. HNO_3
10	3.65	1580		i.	i.	
11	3.96	1580 d.	d.	0.0113^{0}	0.0114^{30}	sl. s. a.; i. dil. H_2SO_4, al.
12		d.		d.		14^{70} H_2SO_4
13	3.70^{15}			s. d.		s. a., al.; i. acet.
14		d		s.	d.	
15		25		s.		s. al.
16		d		0.0033^{17}		v. s. H_2SO_3; s. a.
17	1.966			0.112^{0}	0.755^{85}	
18		$-3H_2O$, 100	d. 160–70	v. s.		v. s. al.
19	2.373	$-4H_2O$, 78		22^{16}	67^{100}	i. al.
20	2.17^{17}	$-4H_2O$, 100		25^{13}	57^{100}	i. al.
21	6.187	d		0.14		d. a., i. al.
22	2.03^{12}	200 d.		d.		
23		91.5	d. 250	s.		s. al.
24	2.07, liq 1.803	112.8, tr mel. 95.5	444.6	i.	i.	23^{0} CS_2, s. tol.; sl. s. al., bz., eth.
25	1.96	119.25	444.6	i.	i.	70 CS_2; s. al., bz.
26	1.92, 1.9556^{0}	*ca* 120	444.6	i.	i.	i. CS_2
27	2.635	−40	$54^{0.2}$	d.	d.	s. CS_2
28	1.678	−80	135.6	d.	d.	s. CS_2, bz., eth.
29	1.621^{15}_{15}	−78	59	d.	d	d. al., eth.; s. bz., CCl_4
30		−30	d. −15	d.	d.	
31	lq. 1.5^{100}	−105.5	−99	d.	d.	d. KOH
32		−124	−40	d.	d	
33	6.50 g/l, lq. 1.91	−56	−63.8 subl.	v. sl. s.	sl. s.	s. KOH; sl. s. al.
34						s. CS_2; sl. s. glyc.
35					d.	s. CS_2
36	1.901^{18}	11	d.	i.		s. eth.; sl. s. al., CS_2
37	2.22^{15}	179 subl.	exp. 160	d		s. CS_2, chl., bz., NH_3; sl. s. al., eth.
38		d. 70–95		d.	d.	s. fum. H_2SO_4
39	2.927 g/l. lq. 1.434	−72.7	−10.0	22.8^{0}	0.58^{90}	s. al., H_2SO_4, ac. a.
40	2.75; lq 1.925[13]	16.83	44.8	d.	d.	d. H_2SO_4
41	lq. 1.97	62.2; 32.2^{398}	44.6; (subl. 50)	d.	d.	d. H_2SO_4
42		0	subl. 10	d.	d.	s. H_2SO_4
43		0–3 d.		s. d.		d. dil. H_2SO_4
44	1.656^{0}		60.1	d.	d	d. viol. al.
45		57 d.		d.	d.	d. al.
46	1.834	10.49	330 (98.3%) d.	∞ ev. ht.	∞	d. al.; misc. org. solv.
47	1.788	8.62	290	∞	∞	d. al.
48	1.650^{0}	−38.9	167	∞	∞	d. al., eth.
49		−24.5		∞	∞	d. al., eth.
50		45 d.		d.	d.	s. H_3PO_4

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	**Sulfuric acid,** peroxydi-(per(di)sulfuric)	$H_2S_2O_8$	194 14	hyg. cr
2	**Sulfuric acid,** pyro-	$H_2S_2O_7$	178 14	col. cr., hyg.
3	**Sulfurous acid**	H_2SO_3	82 08	in solution only
4	" " , hypo-	$H_2S_2O_4$	130 14	in solution only
5	**Sulfuryl** chloride	SO_2Cl_2	134 97	col. liq., 1.444
6	" , pyro-, chloride	$S_2O_5Cl_2$	215 03	col. liq., 1.449^{19}
7	fluoride	SO_2F_2	102 06	col. gas
8	See also under **Thio**			
9	**Tantalic acid,** meta- (tantalum hydroxide)	$HTaO_3$	229 89	col. cr
10	**Tantalum**	Ta	180 88	cub. gray-blk. met. or blk. powd
11	bromide	$TaBr_5$	580 46	yel. cr
12	carbide	TaC	192 89	
13	chloride	$TaCl_5$	358 17	lt.-yel. cr. powd
14	fluoride	TaF_5	275 88	tetr. col
15	hydroxide	$Ta(OH)_5$	265 92	wh. amor. or cr
16	nitride	TaN	194 89	hex. blk.
17	(tri-) nitride, di-	Ta_3N_5	612 68	amor. yel.-red
18	oxide, tetr-	Ta_2O_4 (or TaO_2)	425 76	dk.-gray powd
19	" , pent-	Ta_2O_5	441 76	rhomb. col
20	sulfide	Ta_2S_4 (or TaS_2)	490 00	amor. or cr
21	**Telluric acid,** ortho-	$H_6TeO_6 \cdot 4H_2O$ (or $H_2TeO_4 \cdot 6H_2O$)	301 72	hex. need
22	" " "	H_6TeO_6 (or $H_2TeO_4 \cdot 2H_2O$)	229 66	cub. or monocl. col
23	" " , allo-	$(H_2TeO_4)_x$		wh. powd
24	**Tellurium**	Te_2	255 22	rhbdr. sil.-wh. met., 1.0025
25	"	Te_2	255 22	amor. br.-blk., 1.0025
26	bromide, di-	$TeBr_2$	287 44	steel gray-grn. need., unst
27	" , tetra-	$TeBr_4$	447 27	or. cr
28	" " , acid	$TeBr_4 \cdot HBr \cdot 5H_2O$	618 28	need. or.-red
29	chloride, di-	$TeCl_2$	198 52	blk. cr. or amor., unst.
30	" , tetra-	$TeCl_4$	269 44	wh. to yel. cr., deliq
31	ethoxide	$Te(OC_2H_5)_4$	307 85	
32	fluoride, tetra-	TeF_4	203 61	cr. wh
33	" , hexa-	TeF_6	241 61	col. gas, unpleas. odor, 1.0009
34	iodide, di-	TeI_2	381 45	blk. cr
35	" , tetra-	TeI_4	635.29	gray cr
36	" " , acid	$TeI_4 \cdot HI \cdot 8$ (or 9)H_2O	907.35	rect. pr. met. luster
37	methoxide	$Te(OCH_3)_4$	251.75	solid
38	nitrate, basic	$Te_2O_3(OH)NO_3$	382 24	rhomb. col
39	oxide, mon-	TeO	143 61	amor., blk
40	" , di- (tellurite)	TeO_2	159 61	tetr. or rhomb. wh., 2.00, 2.18 (Li), 2.35
41	" , tri-	TeO_3	175 61	or. cr
42	sulfate, basic	$Te_2O_3SO_4$	399 28	rhomb. col
43	sulfide	TeS_2	191 73	red-blk. amor. powd. (exist. quest.)
44	sulfur oxide	$TeSO_3$	207 67	amor. deep red solid

INORGANIC COMPOUNDS (Continued)

No	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1	. .	65 d.	d.	d.	d.	s. al., eth., H_2SO_4
2	1.9	35	d.	d.	d.	d. al.
3	. .			s.	.	s. al., eth., ac. a.
4		.		s.		. .
5	1.6674	−54.1	69.1	d.	d.	s. ac. a., bz.
6	g. 9.6 g/l; lq. 1.818^{11}_{4}	−39 to −37	140	d.	d.	d. a.
7	3.72 g/l	−120	−52	10^0		s. al.; sl. s. alk.
8	.			.	. .	. . ..
9				i.	. .	s.
10	met. 16 6; powd. 14.491	2996	ca. 4100	i.	i.	s. HF, fused alk.; i. a.
11	4 67	240	320	d.	d.	s. abs. al., eth.
12		4150	5500	i.	i.	sl. s. H_2SO_4, HF
13	3.68^{27}	221	242	d.	.	s. abs. al., H_2SO_4
14	4.74	96.8	229.5	s.		s. HF
15				i.		s. alk.; i. a.
16		3360		i.		
17		ign.		i.		s. HNO_3 + Hf; i. a.
18		oxidizes		i.		i. a.
19	$8.735^{61.2}$	1470 d.		i.	i.	s. fus. $KHSO_4$; i. a.
20		d.>1300		i	i.	sl. s. HF + HNO_3; i. HCl
21		$-4H_2O$, 10		13.92^0		s. alk , dil. a.; sl. s. strong a.; i. al.
22	cub. 3.05; mcl. 5.09	$-2H_2O$, 140		19.7^0	258.5^{100}	s a., alk.; i. al.
23	$3.44^{19.2}$	d.>160		sl. s.	s.	s. al., sl. s. KOH
24	6.25	452	1390	i.	i.	s. H_2SO_4, HNO_3, aq. reg., KCN, KOH: i. HCl, CS_2
25	6.00	452	1390	i.	i.	s. H_2SO_4, HNO_3, aq. reg., KCN, KOH; i. HCl, CS_2
26		210 (280)	339	d.		d. NaOH; sl. s. min. a., tart. a.
27	4.31^{15}_{4}	380 ± 6	421	sl. s. d.	d.	s. min. a., tart. a., NaOH
28	.	20		d.	d.	
29	7.05	209 ± 5(175)	327	d.	d.	d. NaOH; sl. s. min. a., tart. a.
30	3.26, lq. 2.559^{232}	224 (214)	414	s. d.	s. d.	s. HCl, bz., al., chl., CCl_4; i. CS_2
31		20	$107\text{–}107.5^{7.5}$			.
32		subl.		d.	d.	
33	$3.025^{-35.5}$	−36	−35.5	d.	d.	d. a., alk.
34		subl.	.	i.	i.	. .
35	8.403^{15}	259	d.	sl. s.	d.	s. HI, alk., aq. NH_3
36		−55	.	d.	d.	
37			123–4		.	
38		$-NO_2$, 190	d.	sl. d.	d.	s. NaOH, a.
39		d.	d.	i.	i.	s. HCl, dil. a., H_2SO_4, NaOH
40	tetr. 5.67^{15}; rhomb. 5.91^0	dull red	subl. 450	0.00067	. .	s. HCl, HNO_3, alk.; i. NH_4OH
41	$5.08^{10.6}$	d.	.	i.	i.	d. conc. HCl; s. h. KOH; i. a., al.
42	4.7	d. 500		d.		s. HCl, HNO_3
43				i.		s. alk., sulfides; i. a.
44		soft. 30 d.	d.	d.	rapid d.	s. H_2SO_4

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	**Tellurous acid**	H_2TeO_3	177 63	rhomb. or monocl. col
2	**Terbium**	Tb	159 20	
3	chloride	$TbCl_3$	265 57	wh. need.
4	"	$TbCl_3 \cdot 6H_2O$	373 67	col. cr., hyg
5	nitrate	$Tb(NO_3)_3 \cdot 6H_2O$	453 32	monocl. need. col
6	oxide (terbia)	Tb_2O_3	366 40	wh. cr
7	" , per-	Tb_4O_7(?)	748 80	dk. br. or blk
8	sulfate	$Tb_2(SO_4)_3 \cdot 8H_2O$	750 71	cryst
9	**Thallium**	Tl	204 39	tetr. bl. wh. met
10	acetate	$TlC_2H_3O_2$	263 43	silk wh. cr., deliq
11	azide	TlN_3	246 41	yel
12	bromate	$TlBrO_3$	332 31	col
13	bromide, mono-	$TlBr$	284 31	cub. yelsh. wh
14	" , di-	$TlBr_2$	364 22	yel. need
15	" , tri-	$TlBr_3$	444 14	yel., deliq. (exist. quest.)
16	" "	$TlBr_3 \cdot 4H_2O$	516 20	lt.-yel. need
17	carbonate	Tl_2CO_3	468 79	monocl col
18	chlorate	$TlClO_3$	287 85	
19	*per*chlorate	$TlClO_4$	303 85	col
20	chloride, mono-	$TlCl$	239.85	cub. col or wh. powd
21	" , sesqui-	Tl_2Cl_3 (or Tl_4Cl_6)	515 15	hex. yel. or yel. powd
22	" , tri-	$TlCl_3$	310 76	hex. pl
23	" "	$TlCl_3 \cdot H_2O$	328 78	
24	" "	$TlCl_3 \cdot 4H_2O$	382 83	col. need
25	chloroplatinate	Tl_2PtCl_6	816 75	pa. orange cr
26	chromate	Tl_2CrO_4	524 79	yel
27	*di*chromate	$Tl_2Cr_2O_7$	624 80	red cr
28	cyanide	$TlCN$	230 41	tabl
29	ethoxide	$[TlOC_2H_5]_4$	997 80	col. liq
30	ferrocyanide	$Tl_4Fe(CN)_6 \cdot 2H_2O$	1065 54	tricl. yel
31	fluoride, mono-	TlF	223 39	cub. oct. col
32	" , tri-	TlF_3	261 39	olive grn
33	fluosilicate	$Tl_2SiF_6 \cdot 2H_2O$	586 87	hex. pl
34	hydroxide (ous)	$TlOH$	221 40	pa. yel. need
35	" , ortho- (ic)	$Tl(OH)_3$	255 41	hex. br
36	" , meta- "	$TlOOH$	237 40	yel. cr. or red br. amor
37	iodide, mono-	TlI	331 31	cub. red, rhomb. yel
38	" , sesqui-	Tl_2I_3	789 54	blk. need
39	" , tri-	TlI_3	585.15	br. need
40	methoxide	$TlOCH_3$	235 42	wh. cr. powd
41	myristate	$TlC_{14}H_{27}O_2$	431 75	wh. powd
42	nitrate (ous) (α)	$TlNO_3$	266 40	cubic
43	" " (β)	$TlNO_3$	266 40	trig
44	" " (γ)	$TlNO_3$	266 40	rhomb., α 1.817
45	" , (ic)	$Tl(NO_3)_3$	390 41	cryst
46	" "	$Tl(NO_3)_3 \cdot 3H_2O$	444 46	rhomb. col., deliq
47	oleate	$TlC_{18}H_{33}O_2$	485 84	wh. cr. clusters
48	oxalate	$Tl_2C_2O_4$	496 80	monocl. pr
49	oxide (ous)	Tl_2O	424 78	blk, deliq
50	" (ic)	Tl_2O_3	456 78	hex. blk., amor. br
51	palmitate	$TlC_{16}H_{31}O_2$	459 80	cr. need
52	phenoxide	$[TlOC_6H_5]_4$	892 47	wh. cr
53	*ortho*phosphate	Tl_3PO_4	708 19	col. need
54	" , di-H	TlH_2PO_4	301 43	monocl
55	*pyro*phosphate	$Tl_4P_2O_7$	991 60	monocl pr

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		d. 40		0.00067	d.	s. NaOH, a., sl. s. NH_4OH; i. al.
2	...					
3	4.35	588		s.		s. al.
4				v. s.		
5		89.3		s.		
6						s. dil. a
7						s. min. a.
8		$-8H_2O$, 360		3.561^{20}	2.51^{10}	
9	11.85	302	1457 ± 10	i.	i.	s. HNO_3, H_2SO_4; sl. s. HCl
10	3.68	110		v. s.		v. s. al.
11		334		v. sl. s.		
12				0.35^{20}		
13	$7.557^{14.3}$	460	815	$.05^{25}$	$.25^{68}$	s. al.; i. HBr, acet.
14				d.	d.	
15		d.		s.	v. s.	v. s. al.
16				v. s.		s. al.
17	7.11	273		$4.03^{15.5}$	27.2^{100}	i. abs. al., eth., acet.
18	5.047^{9}			2^{0}	57.31^{100}	
19	4.89	501	d.	20.5^{30}	167^{100}	sl. s. al.
20	7.00	430	720 (806)	0.32^{20}	1.97^{100}	sl. s. HCl; i. a., NH_4OH, al.
21	5.9	400-500	d.	0.26^{14}	1.9^{100}	
22		25	d.	v. s.		
23		$-H_2O$, 60	d. 100	v. s.	d.	
24		37		86.2^{17}	d.	s. al., eth.
25	5.76^{14}			0.0064^{15}	0.05^{100}	
26				0.03^{60}	0.2^{100}	sl. s. a., alk.; i. ac. a.
27				i.		d. a.
28		d		$16.8^{28.5}$		
29	3.522	−3	d. 80	s. d.		9.11^{25} al., s. bz; i. liq. NH_3
30	4.641			0.37^{18}	3.93^{101}	
31			300	78.6^{15}	v. s.	sl. s. al.
32				d.		i. c. HCl
33				v. s.		
34			d. 139	25.9^{0}	52^{40}; 148^{100}	s. al.
35		>340		i.		v. s. dil. a.
36		$-H_2O$, 115		i.		s. a., NH_4 salts, al.; i. alk.
37	7.09	440	824	$.0064^{20}$	0.120^{100}	s. HNO_3, aq. reg.; sl. s. al.; i. KI
38				i.		sl. s. al.
39						s. al., eth.
40		d.>120		s. d.		1.70^{25} CH_3OH; 3.16^{25} bz.
41		120.3				0.52^{25} 50% al.
42		206	430	9.55^{20}	413^{100}	s. acet.; i. al.
43		tr. 145 $-\alpha$				
44	$5.556^{21.4}$	tr. 75 $-\beta$		3.91^{0}	414^{100}	s. acet.; i. al.
45				s.		
46		d. 100		d.	d.	
47		131.2		0.05^{15}	0.3^{80}	1.75^{15}, 3.0^{25} al.
48	6.31			1.48^{15}	9.02^{100}	
49		300	1080^{600}; −O, 1865	v. s., d. to TlOH		s. a., al.
50	amor. 9.65^{21}, hex. 10.19^{22}	717 ± 5	−2O, 875	i.	i.	s. a.; i. alk.
51		115–7		0.01^{15}	0.07^{60}	0.20^{15}, 1.04^{45} al.
52	...	233-5		d.		s. h. bz., pyr.; sl. s. lgr.
53	6.89			0.5^{15}	0.67^{100}	s. NH_4 salts; i. al.
54	4.723	*ca.* 190		sl. s.	sl. s.	i. al.
55	6.786^{20}	>120		40		

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Thallium			
1	picrate	$TlC_6H_2N_3O_7$	432 49	red monocl. or yel tricl
2	selenate	Tl_2SeO_4....	551 74	rhomb. need., 1.949, 1.959, 1.964
3	selenide	Tl_2Se	487.74	gray leaf.
4	silver nitrate	$TlNO_3 \cdot AgNO_3$	436 29	wh. cr. powd
5	stearate	$TlC_{18}H_{35}O_2$	487 85	need
6	sulfate (ous)	Tl_2SO_4	504 84	rhomb. col., 1.860, 1.867, 1.885
7	" " , acid	$TlHSO_4$	301 46	
8	sulfate (ic).	$Tl_2(SO_4)_3 \cdot 7H_2O$	823 07	col. leaf
9	sulfide (ous)	Tl_2S ..	440 84	tetr. bl.-blk
10	" (ic)	Tl_2S_3	504 96	blk. amor
11	sulfite	Tl_2SO_3 .	488 84	cryst
12	tellurate . .	Tl_2TeO_4	600 39	heavy ppt. wh
13	thiocyanate .	$TlSCN$	262 47	tetr. col
	Thio compounds:			
14	Thiocarbonyl chloride (thiophosgene)	$CSCl_2$	114 98	red-yel. liq., 1.5442
15	Thiocarbonyl chloride, tetra-	$CSCl_4$	185 90	yel
16	Thiocyanic acid	$HSCN$	59 09	col. gas
17	Thionyl bromide	$SOBr_2$	207 89	or.-yel. liq
18	" " chloride	$SOBrCl$.	163 43	yel
19	" chloride	$SOCl_2$..	118 97	col. yel. liq., 1.527^{10}
20	" fluoride	SOF_2	86 06	col. gas
21	Thiophosphoric acid	$PS(OH)_3$	114 10	
22	Thiophosphoryl amide	$PS(NH_2)_3$	111 15	amor. yel.-wh . .
23	" bromide	$PSBr_3$.	302 83	cub. yel .
24	" "	$PSBr_3 \cdot H_2O$	320 84	yel. cr .
25	" " (mono-) chloride, di-	$PSBrCl_2$	213 91	yel. liq ..
26	Thiophosphoryl bromide (di-) chloride	$PSBr_2Cl$	258 37	pale gr. fum. liq
27	Thiophosphoryl chloride	$PSCl_3$.	169 45	col liq. 1.563 (C).
28	" fluoride	PSF_3	120 08	gas
29	Thiosulfuric acid	$H_2S_2O_3$	114 14	in soln. only
30	**Thorium** .	Th .	232 12	cub. gray, radioactive
31	boride, tetra-	ThB_4	275 40	pr
32	" , hexa-	ThB_6	297 04	amor., violet
33	bromide	$ThBr_4$	551.78	col. cr .
34	carbide	ThC_2	256 14	tetrag. yel.
35	carbonate	$Th(CO_3)_2$	352 14	(exist. quest.)
36	chloride	$ThCl_4$..	373 95	rhomb. wh., deliq
37	cyanoplatinite	$Th[Pt(CN)_4]_2 \cdot 16H_2O$	1118 98	rhomb. yel grn
38	fluoride .. .	ThF_4. .	308 12	wh. powd., cub.
39	fluoride..	$ThF_4 \cdot 4H_2O$	380 18	cr
40	hydroxide	$Th(OH)_4$.	300 15	wh. gelat .
41	iodide . .	ThI_4 . .	739 80	
42	nitrate . .	$Th(NO_3)_4$	480 15	plates, deliq ..
43	" ..	$Th(NO_3)_4 \cdot 4H_2O$	552 22	col .
44	" .	$Th(NO_3)_4 \cdot 12H_2O$	696 35	col. leaf, deliq...
45	oxalate	$Th(C_2O_4)_2$	408 16	wh. cr .
46	"	$Th(C_2O_4)_2 \cdot 6H_2O$.	516 26	wh. amor. powd

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	red 3.164^{17}; yel. 2.993^{17}	exp. 273–5		0.135^{0}	2.43^{70}	0.40 CH_3OH
2	6.875	>400		2.13^{10}	8.5^{80}	i. al., eth.
3		340		i.		i. a.
4		75		s.		
5		119		0.005^{15}	0.095^{75}	0.18^{16}, 0.60^{60} al.
6	6.77	632	d.	4.87^{20}	$15.57^{99.7}$	
7		120 d.				v. sl. s. aq. H_2SO_4
8		$-6H_2O$, 220	d.	d.		s. dil. H_2SO_4
9	8.0	443	d.	0.02^{20}	sl. s.	s. a.; i. alk., acet.
10		soft. 12; 260	d.	i.	i.	s. h. H_2SO_4
11	6.427			3.34^{15}	v. s.	i. al.
12	5.712, $6.760^{17.6}$	red heat		sl. s.	sl. s.	
13				0.315^{20}	0.727^{40}	i. al.
14	1.509^{15}		73.5	d.		d. al.; s. eth.
15	1.712^{13}		146–7		d.	
16		>−10 d.		v. s.		v. s. al., eth., bz.
17	2.68^{18}	−52 to −50	138^{773}; 68^{10}	d.	d.	s. bz., chl., CS_2, CCl_4
18	lq. 2.31^{0}		115 d.	d.		
19	$1.655^{10.4}$	−105	78.8^{746}	d.	d.	d. a., al., alk.; s. bz., chl.
20	2.93	−110	−30	d.	d.	s. eth., bz., chl. acet., $AsCl_3$
21				s.	d.	s. al.
22	1.7^{15}	d. 200		sl. s.	d.	
23	2.85^{17}	38	d. 175	d.		s. CS_2, eth., PCl_3
24	2.794^{18}	35				
25	lq. 2.12^{0}	−30	150 d.	d.		
26	lq. 2.48^{0}	−60	95^{60}	d.		
27	lq. 1.635	−35	125	d.		s. CS_2, CCl_4, bz.
28		3 $8^{7\ 6atm}$	d.	sl. sol., sl. d		s. eth.; i. CS_2, bz.
29				s.		
30	11.2	1845	>3000	i.	i.	s. HCl, H_2SO_4, aq. reg.; sl. s. HNO_3
31	7.5^{15}			i.	i.	s. HNO_3, HCl, h. H_2SO_4
32	6.4^{15}			i.	i.	s. HNO_3; i. H_2SO_4, HCl, HF, aq. alk.
33	5.67		subl. 610	s.	s.	
34	8.96	2773, ign.	5000	d.		v. sl. s. conc. a.
35				i.	d.	s. conc. Na_2CO_3; i. aq. CO_2
36	4.59	820; subl. 720–50	d. 1100	v. s.	v. s.	s. KCl, al., eth., a.
37	2.460			sl. s.	s.	
38		red ht.				sl. d. dil. H_2SO_4, HCl; i. conc. H_2SO_4
39		$-H_2O$, 100	$-2H_2O$, 140–200	$.017^{20}$		i. HF
40		d.		i.	i.	s. a.; i. alk., $H_2C_2O_4$, HF
41		d.		s.		
42		d. 500		v. s.		s. al.
43		swells		v. s.		v. s. al.
44		d.		v. s.		v. s. al., a.
45	4.637^{16}	d.		i.	i.	s. h. aq. $(NH_4)_2C_2O_4$; sl. s. a.
46				i.		s. Na_2CO_3, $(NH_4)_2C_2O_4$ soln.; i. HNO_3

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Thorium			
1	oxide, di- (thoria)	ThO_2	264 12	cubic, white, 2.20 (lq.)
2	oxysulfide	$ThOS$	280 18	yel. cr
3	2,4-pentanedione deriv. (acetylacetonate)	$Th(C_5H_7O_2)_4$	628 55	col. cr
4	*ortho*phosphate	$Th_3(PO_4)_4 \cdot 4H_2O$	1148 50	gelat. wh
5	*meta*phosphate	$Th(PO_3)_4$	548 20	col., rhomb. pl
6	*hypo*phosphate	$ThP_2O_6 \cdot 11H_2O$	588 34	amor. wh. ppt
7	picrate	$Th(C_6H_2N_3O_7)_4 \cdot 10H_2O$	1324 68	
8	*ortho*silicate (thorite)	$ThSiO_4$	324 18	col. tetr
9	sulfate	$Th(SO_4)_2$	424 24	wh., cryst
10	"	$Th(SO_4)_2 \cdot 4H_2O$	496 30	need. or wh. cr. powd.
11	"	$Th(SO_4)_2 \cdot 6H_2O$	532 34	
12	"	$Th(SO_4)_2 \cdot 8H_2O$	568 37	monocl. pr
13	"	$Th(SO_4)_2 \cdot 9H_2O$	586 39	monocl. wh
14	sulfide	ThS_2	296 24	yel-br. cryst
15	*pyro*vanadate	$ThV_2O_7 \cdot 6H_2O$	554 12	yellow
16	**Thulium**	Tm	169 40	
17	chloride	$TmCl_3 \cdot 7H_2O$	401 88	grn. cr
18	oxalate	$Tm_2(C_2O_4)_3 \cdot 6H_2O$	710 96	grnsh. wh. ppt
19	oxide (thulia)	Tm_2O_3	386 80	grnsh. wh. powd
20	**Tin** gray (α-)	Sn	118 70	cubic, gray
21	" , ordinary (β-)	Sn	118 70	tetr. wh. met
22	" , brittle (γ-)	Sn	118 70	rhomb. wh
	Tin, acids of:			
23	Stannic acid, ortho-	H_4SnO_4	186 73	wh gel. (exist. quest.)
24	" " , meta- (α-acid)	H_2SnO_3	168 72	amor or coll ppt., wh (exist. quest.)
25	" " , meta- (β-acid)	$H_{10}Sn_5O_{15}$	843 58	amor. or gel wh. (exist. quest.)
26	**Tin** acetate (ous)	$Sn(C_2H_3O_2)_2$	236 79	yelsh. powd
27	*pyro*arsenate (ous)	$Sn_2As_2O_7$	499 22	flocculent ppt
28	bromide (ous)	$SnBr_2$	278 53	rhomb. pa. yel
29	" (ic)	$SnBr_4$	438 36	rhomb. pyramids, col., deliq
30	bromide (tri-) chloride.	$SnBr_3Cl$	393 91	liq
31	bromide (di-) chloride, di-	$SnBr_2Cl_2$	349 45	
32	bromide chloride, tri-	$SnBrCl_3$	304 99	col. liq
33	bromide (di-) iodide, di-	$SnBr_2I_2$	532 37	or-red hex. pl
34	chloride (ous)	$SnCl_2$	189 61	rhomb. wh
35	" "	$SnCl_2 \cdot 2H_2O$	225 65	wh. monocl
36	" (ic)	$SnCl_4$	260 53	col. liq.
37	" "	$SnCl_4 \cdot 3H_2O$	314 58	monocl cr
38	" "	$SnCl_4 \cdot 4H_2O$	332 59	opaque
39	" "	$SnCl_4 \cdot 5H_2O$	350 61	monocl. cr
40	" , basic (ic)	$SnOCl_2$	205 61	wh
41	" , diammine (ic)	$SnCl_4 \cdot 2NH_3$	294 59	cr
42	chloride (di-) iodide, di-	$SnCl_2I_2$	443 45	red mobile liq
43	chromate (ic)	$Sn(CrO_4)_2$	350 72	br-yel. cr powd
44	ferricyanide (ous)	$Sn_3[Fe(CN)_6]_2$	780 00	wh
45	ferrocyanide (ous)	$Sn_2Fe(CN)_6$	449 35	wh. gel

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	9.69	>2800	4400	i.	i.	s. h. H_2SO_4; i. alk., dil. a.
2	6.44^{0}	d.		i.		s. aq. reg.; sl. s. HNO_3
3		171; subl 160^{10}	$260\text{-}270^{10}$	sl. s.		v. s. al., chl.; s. eth.
4				i.	i	s. 30% HCl; i. a.
5	$4.08^{16.4}$			.		. . .
6				i.	i.	i. a., alk.
7				0.305^{25}		. . .
8	5.3			v. sl. s.		
9	4.225^{17}			v. s.	s.	v. s. $NH_4C_2H_3O_2$
10				9.41^{17} (anh.)	2.54^{90} (anh.)	. . . . .
11				1.5^{0}; 1.63^{15}	3.85^{15}, 6.64^{60}	.
12		$-4H_2O$, 42		1^{0}; 1.85^{25}	3.71^{41}	. .
13	2.77	$-9H_2O$, 400		$.74^{0}$; 1.57^{20}	6.76^{55}	s. HCl, HNO_3
14	6.80	d.		i.	i.	s. h. aq. reg.; sl. s. a.
15				i.	i.	s. conc. a.
16				i.	i.	. .
17				v. s		v. s. al.
18						s. soln. alk. oxal.
19						s. min. a.
20	5.75	231.9, stab. <18	2270	i.	i.	d. HCl, H_2SO_4, dil. HNO_3 aq. reg., h. KOH, NaOH
21	7.28	231.9 stab 18-170	2270	i.	i.	d. HCl, H_2SO_4, dil. HNO_3 aq. reg., h. KOH, NaOH
22	6.52-.56	231.9 stab. >161	2270	i.	i	d. HCl, H_2SO_4, dil. HNO_3 aq. reg., h. KOH, NaOH
23				s.		d. KOH, NaOH, a.
24				i.	i	d. KOH, NaOH; i. a.
25		.		i.	i	d. KOH, NaOH; i. a.
26		182	240	d.		s. dil. HCl
27	. .	d. As_2O_3 +	SnO_2	i.	i.	i. conc. ac. a.
28	5.117^{17}	215.5	620	85.2^{0}	222.5^{100}	
29	lq. 3.340^{35}	31	202^{24}	s. d.	d.	s. acet., $AsBr_3$, PCl_3
30	3.12^{13}	1	73^{10}			
31	2.82^{13}	−20	65^{30}; d 191	d.^{0}	d	
32	2.51^{13}	−1	50^{10}			
33	3.631^{15}	d. 50		s.	d.<80	
34	lq. 3.393^{245}	246.0	623	83.9^{0} d.	269.8^{100} d.	s. al., eth., acet., pyr., ethyl acetate, methyl acetate
35	$2.710^{15.5}$	37.7	d.	118.7 d.	∞ d.	s. al., eth., acet., glac. ac. a.
36	2.232	−33	114.1	s.	d.	s. eth.
37		80	stab. 64-83	s.		.
38			stab 56-63	s.		.
39			stab. 19-56	s.	. . .	. .
40	1.8			s.	. . .	. . . .
41				s.	.	d. HCl
42	3.287^{15}		2 7	s. conc. sol.	d. dil. sol	s. bz., CS_2, chl.
43	. . . .	d.		s.	. . . .	. . . .
44	. . . .	d		i.	. .	d. HCl
45	. . . .			i.	i.	d. HCl

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Tin			
1	ferrocyanide (ic) ..	$SnFe(CN)_6$	330 65	grnsh. wh. gel . . ...
2	fluoride (ous)	SnF_2	156 70	wh. monocl. cr ....
3	" (ic)..	SnF_4	194 70	wh. cr. mass, hyg ...
4	hydride (stannane)	SnH_4 ..	122 73	gas .. . .
5	hydroxide (ous)	$SnO \cdot xH_2O$.		wh. powd. or yelsh.-br cr ....
6	iodide (ous).. .	SnI_2 . .	372 54	monocl. yel.-red . . ..
7	" (ic)..	SnI_4	626 38	cub. yel ....
8	nitrate (ous)	$Sn(NO_3)_2 \cdot 20H_2O$	603 04	col. leaf ..... .
9	" , basic (ous)	$SnO \cdot Sn(NO_3)_2$	377 42	wh. cr. mass . . ..
10	" (ic)	$Sn(NO_3)_4$	366 73	silky need ....
11	oxalate (ous).. .	SnC_2O_4	206 72	wh. cr. or heavy wh. powd...
12	oxide (ous). . .	SnO	134 70	tetr. (cub.) blk ....
13	" (ic) (cassiterite)	SnO_2 .	150 70	tetr. wh., 1.997, 2 093 .. ..
14	*ortho*phosphate (ous)	$Sn_3(PO_4)_2$	546 14	wh. amor. solid ..
15	" , mono-H (ous)	$SnHPO_4$	214 73	cr ..
16	" , di-H (ous)	$Sn(H_2PO_4)_2$.	312 77	rhomb. cr . .
17	" , basic (ic)	$Sn_2O(PO_4)_2$.	443 44	oct. cr
18	" , basic (ic)	$Sn_2O(PO_4)_2 \cdot 10H_2O$	623 60	.
19	*pyro*phosphate (ous)	$Sn_2P_2O_7$.	411 44	amor. powd
20	*meta*phosphate (ous)	$Sn(PO_3)_2$. .	276 74	amor. mass ...
21	phosphide, mono-	SnP	149 72	silv.-wh . .
22	" , tri-	SnP_3.	211 76	cr
23	(tetra-) phosphide, tri-	Sn_4P_3	567 86	wh. cr
24	phosphorus chloride (ic).	$SnCl_4 \cdot PCl_5$	468 83	cr
25	phosphoryl chloride (ic)	$SnCl_4 \cdot POCl_3$.	413 92	cr .
26	selenide (ous)	$SnSe$	197 66	steel-gray cr
27	" (ic)	$SnSe_2$	276 62	cr ..
28	sulfate (ous) .	$SnSO_4$	214 76	wh -yelsh. cr. powd .. ...
29	" (ic)	$Sn(SO_4)_2 \cdot 2H_2O$	346 85	hex. pr., deliq .
30	" , basic (ic)	$Sn(OH)_2SO_4$	248 78	slender wh. need ...
31	sulfide (ous)	SnS	150 76	rhomb. gray-blk ....
32	" (ic) (mosaic gold)	SnS_2	182 82	hex gold-yel
33	sulfur chloride (ic)	$SnCl_4 \cdot 2SCl_4$	608 30	yel. cr
34	tartrate (ous)	$SnC_4H_4O_6$	266 77	heavy wh. powd
35	telluride (ous)	$SnTe$	246 31	gray cr
36	" (ic)	$SnTe_2$	373 92	blk. floc. ppt
37	**Titanic acid,** ortho-	H_4TiO_4	115 93	wh
38	" " , meta-	H_2TiO_3	97 92	wh. amor. powd .
39	**Titanium**	Ti	47 90	α hex., tr. -β cub. 800° C., silv gray

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	...	.	.	i.	i.	d. h. HCl
2	...	..		s.	..	...
3	4.780^{19}	.	705	v. s.	d. to SnO_2	...
4	..	−150; d.	−52		...	s. $AgNO_3$, $HgCl_2$, conc. H_2SO_4, conc. alk.
5	.	..			d. to SnO	d. a., alk.; s. alk. carb.; i. NH_4OH
6	5.28^{25}	320	720	$1.32^{20.8}$	$3.55^{98.5}$	d. KOH, HCl; s. HF, CS_2
7	4.696^{11}	143.5	341; sub. 180	d.	d.	145^{15} CS_2; s. al., eth., chl., bz.
8		−20		d.	d.	d HNO_3
9	.	d.<100 exp.		d.	d.	...
10		d. compl. 50		d.	.	...
11	3.56^{18}	.		..	.	d. HCl, sl.s. NH_4Cl, $(NH_4)_2C_2O_4$
12	6.446^{0}	d. 700–950		i.	i.	d a , fixed alk. hydx.; sl.s. NH_4Cl
13	6.95	1127 d.		i.	i.	d. KOH, NaOH; i. aq. a.
14	3.823^{17}	.	...	i.	i.	d. a., alk hydx.
15	$3.476^{15.5}$	stab.<100	d.	i.	i.	...
16	$3.167^{22.8}$		...	...	...	...
17	3.98	...	...	i.	i.	sl. s. HNO_3
18			...	i.	i.	i. HNO_3
19	$4.009^{16.4}$	.	...	...	...	...
20	$3.380^{22.8}$		...	...	...	...
21	6.56			i.	...	s. HCl; i. HNO_3
22	4.10^{0}	d.<415 to Sn_4P_3	.	i.	i.	d. HNO_3; i. HCl
23	5.181	d.<480	...	i.	i.	d HCl, fixed alk. hydx.
24		subl. 200	...	d.	d.	...
25		58	180	d.	d.	...
26	6.179^{0}	861	.	i.	i.	d. HCl, HNO_3, aq. reg., alk. sulfd.
27	5.133	650	..	i	i.	d. h. conc. a.; i. dil. a.
28		d.<360 to SO_2		33^{25}		s H_2SO_4
29	.	.	..	v. s.	d.	s. eth., dil. H_2SO_4; reacts with HCl
30		...		s. d.	d.	
31	5.080^{0}	882	1230	$.000002^{18}$	...	d. HCl, alk., $(NH_4)_2S_x$
32	4.5	d.	.	0.000002^{18}	..	d. alk. sulf., aq. reg., PCl_5, $SnCl_2$, alk. hydx.; i. HCl, HNO_3
33		37	d.<40	d.	d.	d. HNO_3, s. CS_2, eth., bz., ethyl acetate
34	..	..	...	s.	...	v. s. dil. HCl
35	6.48	780	...	i.	i.	d. alk. sulfd.
36	.		...	i.	i.	d. dil. a., alk. hydx., $(NH_4)_2S_x$
37	...	d.	..	v. sl. s.; sl. d.	..	s. dil. HCl, H_2SO_4
38	.		.	i.	i.	s. conc. H_2SO_4, alk.; i. other a., al.
39	4.5^{20}	1800	>3000	i.	d.	s. dil. a.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Titanium			
1	bromide, di-	$TiBr_2$	207 73	blk. powd
2	" , tetra-	$TiBr_4$	367 56	or.-yel., deliq
3	carbide	TiC	59 91	cubic, metallic
4	chloride, di-	$TiCl_2$	118 81	lt. brn.-blk., deliq
5	" , tri-	$TiCl_3$	154 27	dk.-vlt., deliq
6	" , tetra-	$TiCl_4$	189 73	col.- lt. yel. liq., 1.61
7	fluoride, tri-	TiF_3	104 90	purp.-red or violet
8	" , tetra-	TiF_4	123 90	wh. powd
9	iodide, di-	TiI_2	301 74	blk hyg
10	" , tetra-	TiI_4	555 58	cub. red
11	nitride	TiN	61 91	bronze red cr
12	(tri-) nitride, tetra-	Ti_3N_4	199 73	br
13	oxalate	$Ti_2(C_2O_4)_3 \cdot 10H_2O$	540 02	yel. pr
14	oxide, mon-	TiO	63 90	pr. blk
15	" , sesqui-	Ti_2O_3	143 80	trig., vlt. blk
16	" , di- (brookite)	TiO_2	79 90	rhomb., 2.583, 2 586, 2.741
17	" " (octahedrite, anatase)	TiO_2	79 90	br -blk., tetr., 2.554, 2.493
18	" " (rutile)	TiO_2	79 90	tetr. bl., 2.616, 2.903
19	" , tri- (or per-)	TiO_3(?)	95 90	yel
20	sulfate	$Ti_2(SO_4)_3$	383 98	cr. grn., deliq
21	" , basic	$TiOSO_4$	159 96	wh. or sl. yelsh powd
22	sulfide, mono-	TiS	79 96	redsh sld
23	" , sesqui-	Ti_2S_3	191 98	grayish blk. cr
24	" , di-	TiS_2	112 02	yel. scales
25	**Tungsten**	W	183 92	cub. gray-blk
26	bromide, di-	WBr_2	343 75	bl.-blk., need
27	" , penta-	WBr_5	583 50	vlt -br., need
28	" , hexa-	WBr_6	663 42	bl.-blk., need
29	carbide	WC	195 93	gray
30	"	W_2C	379 85	grn
31	chloride, di-	WCl_2	254 83	gray, amor
32	" , tetra-	WCl_4	325 75	gray, deliq
33	" , penta-	WCl_5	361 21	blk., deliq
34	" , hexa-	WCl_6	396 66	cub. dk bl
35	fluoride, hexa-	WF_6	297 92	lt. yel. liq., or col. gas
36	iodide, di-	WI_2	437 76	br -grn. amor
37	" , tetra-	WI_4	691 60	blk. cr
38	oxide, di-	WO_2	215 92	cub br
39	" , tri-	WO_3	231 92	rhomb. yel. or yel.-or. powd.
40	oxy*tetra*bromide	$WOBr_4$	519 58	blk., deliq
41	oxy*di*bromide, di-	WO_2Br_2	375 75	red pr
42	oxy*tetra*chloride	$WOCl_4$	341 75	red need
43	oxy*di*chloride, di-	WO_2Cl_2	286 83	lt. yel. tabl
44	oxy*tetra*fluoride	WOF_4	275 92	col. pl., hyg
45	phosphide	WP	214 94	gray pr
46	"	WP_2	245 96	blk. cr

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		d.>500		s. ev. H		
2	2.6	39	230	d.		s. abs. al., abs. eth.
3	4.25	3140	4300	i.	i.	s. HNO_3, HNO_3 + HCl
4		subl. in H_2		d.		s. al.; i. eth., chl., CS_2
5		d. 440		s.	s.	v. s. al.; s. HCl; i. eth.
6	lq. 1.726	−30	136.4	s.	d	s. dil. HCl, al.
7				red s.; vlt i.		
8	$2.798^{20.5}$		284	s., d		s. H_2SO_4, al., C_5H_5N; i. eth.
9	4.3^{20}			d.		d. alk.; s. conc. HF, HCl
10		150	>360	v. s.	d.	
11	5.29	3220		i		i. a.
12		d.		d.		
13				s	s.	i. al., eth.
14	4.93	1750				s. dil. H_2SO_4; i. HNO_3
15	4.6	2130, d		i	i	s. H_2SO_4; i. HCl, HNO_3
16	4.17			i	i.	s. H_2SO_4, alk.; i. a.
17	3.84			i.	i.	s. H_2SO_4, alk.; i. a.
18	4.26	1640 d		i.	i.	s. H_2SO_4, alk.; i. a.
19						s. a.
20				i.	i	s. dil. a.; i. al., eth., conc H_2SO_4
21				d		
22				i		s. conc. H_2SO_4; i. HCl, HF, dil. H_2SO_4
23				i	i.	s. conc. H_2SO_4, HNO_3; i. dil. HCl, dil. H_2SO_4
24				hyd. sly	d. in steam	d. HCl; s. dil. HNO_3, H_2SO_4
25	19.3	3370	5900	i	i.	s. h. conc. KOH, sl. s. HNO_3, aq. reg.
26		d. 400		d.		
27		276	333	d		s. alk., abs. al., chl., eth.
28	6.9			i.	d.	s. NH_4OH
29	15.7^{18}	2777	6000	i.		
30	16.06^{18}	2857 d.	6000	i.		s. HNO_3; sl. s. HCl, H_2SO_4
31	5.436			d		
32	4.624	d.	d	d.		
33	3.875	248	275.6	d. to W_2O_5		v. sl. s. CS_2
34	3.52	275	346.7		d^{60}	v. s. CS_2, $POCl_3$; s. al., eth., bz.
35	g 12.9 g/l, lq 3.44	2.5	19.5	d.	d.	s. alk.
36	6.9			i.	d.	s. KOH, alk.; i. CS_2, al.
37	5.2^{18}	d.	d	i	d.	s. abs. al.; i. eth., chl., turp
38	12.11			i	i.	s. a., KOH
39	7.16	1473		i.	i.	s. h. alk., HF; i. a.
40		277	327	d.	d.	
41		d.	d.			
42		211	227.5	d.	d	s. CS_2, S_2Cl_2, bz.
43		266		s.	d.	s. alk., NH_4OH, i. al.
44		110	187.5	d.		sl. s. CS_2; i. CCl_4
45	8.5			i.		s. HNO_3 + HF; i. alk., HCl
46	5.8	d.		i.	i.	s. HNO_3 + HF, aq. reg.; i. al., eth

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Tungsten			
1	phosphide	W_4P_2 (or W_2P)	797 72	dk. gray pr
2	sulfide, di- ..	WS_2	248 04	dk gray cr
3	" , tri-..	WS_3	280 10	choc.-br. powd
4	**Tungstic acid**	H_2WO_4	249 94	yel
5	" " .	$H_2WO_4 \cdot H_2O$	267 95	wh
6	" " , meta- .	$H_2W_4O_{13} \cdot xH_2O$	. .	cub. yel
7	**Uranic acid, meta-**	H_2UO_4 ..	304 09	rhomb. or yel. powd
8	**Uranium**	U .	238 07	cub. silv. wh or blk radioact
9	bromide, tri-	UBr_3	477 82	dk.-br. need., hyg
10	" , tetra-	UBr_4	557 73	br. leaf., deliq
11	carbide	UC_2 .	262 09	gray cr..
12	chloride, tri-	UCl_3	344 44	need. dk. red, hyg
13	" , tetra-	UCl_4	379 90	cub. oct. dk. grn -gray, deliq
14	" , penta-	UCl_5	415 36	dk. grn -gray need., red by trans. light, deliq.
15	fluoride, tetra-	UF_4	314 07	grn . amor. powd
16	" , hexa-	UF_6	352 07	monocl. col -pa yel., deliq
17	iodide, tetra-	UI_4	745 75	blk. need
18	nitride	U_3N_4	770 24	brn.-blk
19	oxide, di- .	UO_2 .	270 07	rhomb. or cub., br -blk
20	"	U_3O_8	842 21	olive-grn
21	" , tri- (uranyl oxide)	UO_3	286 07	yel.-red powd
22	" , per-	$UO_4 \cdot 2H_2O$.	338 10	pa -yel. cr., hyg
23	sulfate (ous)	$U(SO_4)_2\ 4H_2O$.	502 25	rhomb. grn
24	" "	$U(SO_4)_2 \cdot 8H_2O$	574 32	monocl. grn
25	sulfide, sesqui-	U_2S_3	572 32	gray-blk. need
26	" , di-	US_2	302 19	tetr. gray-blk
27	**Uranyl** acetate	$UO_2(C_2H_3O_2)_2 \cdot 2H_2O$	424 19	rhomb. yel
28	benzoate	$UO_2(C_7H_5O_2)_2$.	512 29	yel. powd
29	bromide	$UO_2Br_2(7H_2O?)$	556 02	grn.-yel. need
30	perchlorate	$UO_2(ClO_4)_2\ 4H_2O$..	509 04	
31	chloride	UO_2Cl_2	340 98	yel., deliq
32	formate	$UO_2(CHO_2)_2 \cdot H_2O$	378 12	oct. yel
33	iodate .	$UO_2(IO_3)_2$.	619 91	rhomb. yel
34	" .	$UO_2(IO_3)_2 \cdot H_2O$...	637 93	α prismatic, stable; β pyramidal
35	iodide	UO_2I_2 . .	523 91	red, deliq .
36	nitrate	$UO_2(NO_3)_2 \cdot 6H_2O$..	502 18	rhomb. yel., deliq., β 1.4967
37	oxalate	$UO_2C_2O_4 \cdot 3H_2O$ ..	412 14	yel. cr
38	phosphate, mono-H	$UO_2HPO_4 \cdot 4H_2O$.	438 16	tetr. yel. pl
39	sulfate	$UO_2SO_4 \cdot 3H_2O$	420 18	yel.-grn. cr ....
40	"	$2UO_2SO_4 \cdot 7H_2O$.	858 37	yel ..
41	sulfide	UO_2S .	302.13	br.-blk. tetr
42	sulfite..... . .	$UO_2SO_3\ 4H_2O$.	422 19	pa. grn. cr ..

INORGANIC COMPOUNDS (Continued)

No	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	5.21					s. fus. $Na_2CO_3 + NaNO_3$; i. a., aq. reg.
2	7.5^{10}			i.	..	s. $HNO_3 + HF$, fus. alk.; i. al.
3	....			sl. s.	s.	s. alk.
4	5.5	$-\frac{1}{2}H_2O$, 100		i.	sl. s.	s. alk., HF, NH_3
5	....	$H_2W_2O_7$ at 100		sl. s.	...	s. alk.
6	....	.. ..	.	s.	...	s. alk.
7	5.926	$-H_2O$, 250-300		i.	i.	s. a., alk. carb.; i. alk.
8	18.7	*ca.* 1150	ign.	i.	i.	s. a.; i. alk., al.
9			volat.	s.	....	....
10	4.84^{21}_{4}		volat.	s.	s.	s. acet.; i. al., eth.
11	11.28^{18}	2260	4100	d.	d.	s. a.
12	5.44^{25}_{4}			v. s.	d.	s. HCl, NH_4Cl, acet. a.
13	4.725^{25}_{4}	subl.	618	v. s.	d.	s. al., acet., C_6H_5COOH, ac. a., NH_4Cl; i. eth.
14		d. 120	.	d.	..	s. abs. al., ac. a., acet., NH_4Cl, i. eth., bz.
15	.	*ca.* 1000		i.	..	s. conc. a., alk.; i. dil. a., alk
16	$4.68^{20.7}$	69.2^{2atm}	$56.2^{764.6}$	s.	.	d. al., eth.; v. s. $C_2H_2Cl_4$; s. CCl_4, chl.; i. CS_2
17	5.6^{15}	500		s.	s., d	..
18	10.09			d		s. HNO_3; i. conc. HCl, H_2SO_4
19	10.9	2176		i.	i.	s. HNO_3, conc. H_2SO_4
20	7.31	d.		i	i.	s. HNO_3, H_2SO_4
21	7.29	d.		i.		s. min. a.; i. $K_2C_4H_4O_6$
22		d. 115		$.0006^{20}$	$.008^{90}$	d. HCl
23		$-4H_2O$, 300		d.		s. dil. a.
24		d. 90		s. d.		s. dil. a.; i. al.
25		ign.				+O aq. reg., conc. HNO_3; i. dil. a.
26		>1100	oxidizes	sly. d.		d. HNO_3; s. conc. HCl
27	2.893^{15}	$-2H_2O$, 110	d. 275	7.694^{15}	d.	v. s. al.
28	..			sl. s.		sl. s. al.
29				s.	.	s. al., eth.
30		d. 110				....
31		<red ht.	d.	320^{18}	v. s.	s. al., eth., amyl. al.
32	3.695^{19}	$-H_2O$, 110	.	420^{15}	.	sl. s. form. a.
33	5.2	d. 250				i. HNO_3
34	$\alpha 5.220^{18}$, $\beta 5.052^{18}$	..		$\alpha .1049^{18}$; $\beta .1214^{18}$		sl. s. dil. HNO_3
35		d. in air		. .	..	s. al., eth., bz.
36	2.807^{13}	60.2 d. 100	118	170.3^{0}	∞^{60}	v. s. al., eth., ac. a., acet., meth. al.
37		$-H_2O$, 110		0.8^{14}	3.3^{100}	s. min. a., alk. oxal.
38		. .		i.	i.	s. aq. Na_2CO_3, HNO_3; i. ac. a.
39	$3.28^{16.5}$	d. 100		$20.5^{15.5}$	22.2^{100}	4 al.; s. H_2SO_4
40		anh. 300		v. s.	v. s.	s. H_2SO_4
41	.	d. 40-50		sl. s.	....	s. dil. a., al., $(NH_4)_2CO_3$; i. abs. al.
42	. .		.. .	i.	... ..	s. H_2SO_3

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
1	**Vanadic acid**, pyro-	$H_4V_2O_7$	217.93	amor., br
2	" " , meta-	HVO_3	99.96	yel. sc
3	**Vanadium**	V	50.95	cub. lt. gray met., 3.03
4	bromide, tri-	VBr_3	290.70	grn. blk., deliq
5	carbide	VC	62.96	gray, cr. mass
6	chloride, di-	VCl_2	121.86	hex. grn., deliq
7	" , tri-	VCl_3	157.32	pink, deliq. cr
8	" , tetra-	VCl_4	192.78	red-br., liq
9	fluoride, tri-	VF_3	107.95	rhomb. grn
10	" "	$VF_3 \cdot 3H_2O$	162.00	rhomb
11	" , tetra-	VF_4	126.95	br.-yel
12	" , penta-	VF_5	145.95	
13	iodide	$VI_3 \cdot 6H_2O$	539.81	grn. cr., deliq
14	nitride	VN	64.96	grn.-br
15	oxide, di- (or mono-)	V_2O_2 (or VO)	133.90	lt.-gray cr
16	" , sesqui- (or tri-)	V_2O_3	149.90	blk. cr
17	" , tetr- (or di-)	V_2O_4 (or VO_2)	165.90	bl. cr
18	" , pent-	V_2O_5	181.90	rhomb. yel.-red
19	oxybromide	VOBr	146.87	oct., vlt
20	oxy*di*bromide	$VOBr_2$	226.78	br., deliq., powd
21	oxy*tri*bromide	$VOBr_3$	306.70	red liq
22	oxychloride	VOCl	102.41	yel.-brn. powd
23	oxy*di*chloride	$VOCl_2$	137.86	grn., deliq
24	oxy*tri*chloride	$VOCl_3$	173.82	yel. liq., deliq
25	oxy*mono*chloride, di-	V_2O_2Cl (or $(VO)_2Cl$)	169.36	yel.-brn. cr
26	oxy*di*fluoride	VOF_2	104.95	yel. solid
27	oxy*tri*fluoride	VOF_3	123.95	yel.-wh., hyg
28	silicide	VSi_2	107.07	met., prisms
29	(di-) silicide	V_2Si	129.96	silv. wh. pr
30	sulfate (hypovanadous)	$VSO_4 \cdot 7H_2O$	273.12	monocl. vlt
31	sulfide, di- (or mono-)	V_2S_2 (or VS)	166.02	blk., pl.
32	" , sesqui- (or tri-)	V_2S_3	198.08	grn.-blk. pl. or powd
33	" , penta-	V_2S_5	262.20	blk.-grn. powd
34	**Vanadyl** sulfate	$VOSO_4$	163.01	bl
35	" (di-) sulfate, tri-	$(VO)_2(SO_4)_3$	422.08	red, deliq
36	**Water**	H_2O	18.02	col. liq. or hex. col. cr., liq. 1.333, sld 1.309, 1.313
37	**Xenon**	Xe	131.30	col. inert. gas
38	**Ytterbium**	Yb	173.04	
39	acetate	$Yb(C_2H_3O_2)_3 \cdot 4H_2O$	422.24	hex. pl
40	chloride	$YbCl_3 \cdot 6H_2O$	387.51	rhomb. grn., deliq
41	oxalate	$Yb_2(C_2O_4)_3 \cdot 10H_2O$	790.30	col. cr
42	oxide (ytterbia)	Yb_2O_3	394.08	col
43	selenate	$Yb_2(SeO_4)_3 \cdot 8H_2O$	919.09	hex. pl
44	selenite	$Yb_2(SeO_3)_3$	726.96	
45	sulfate	$Yb_2(SO_4)_3$	634.26	col
46	"	$Yb_2(SO_4)_3 \cdot 8H_2O$	778.39	prisms
47	**Yttrium**	Y	88.92	hex. gray-blk. met
48	acetate	$Y(C_2H_3O_2)_3 \cdot 4H_2O$	338.12	col. tricl
49	bromate	$Y(BrO_3)_3 \cdot 9H_2O$	634.81	hex. pr
50	bromide	YBr_3	328.67	deliq

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1				i.		s. a., alk., NH_4OH
2				i.		s. a., alk.; i. NH_3
3	5.866^{15}	1720 + 20	3000	i.	i.	s. HNO_3, H_2SO_4, HF, aq. reg.; i. HCl, alk.
4		d.		s.		s. al., eth.; i. HBr
5	5.4	2810	3900	i.		s. HNO_3, fus. KNO_3; i. HCl, H_2SO_4
6	3.23^{18}			s. d.	s. d.	s. al., eth.
7	3.00^{18}	d		s. d.	s. d.	s. abs. al., eth.
8	1.816^{30}	-28 ± 2	148.5^{765}	s. d.		s. abs. al., eth., chl., ac. a.
9	3.363^{19}	>800	subl	i		i. al., chl., CS_2
10		$-3H_2O$, 130		s.	v. s. d.	i. abs. al.
11	2.975^{23}	d. 325		s.		s. acet.; sl. s. al., chl.
12	2.177^{19}		111.2	s.		s. al., chl.; i. CS_2
13						s. al.
14	5.63	*ca.* 2320		i.		
15	5.758^{11}	ign.		i.	i.	s. a.
16	4.87^{18}	1970		sl. s.	s.	s. HNO_3, HF, alk.
17	4.339	1967		i.	i.	s. a., alk.
18	3.357^{15}	690	d. 1750	0.8^{20}		s. a., alk.; i. abs. al.
19	4.00^{18}	d. 480		v. sl. s.		s. acet. anhyd., eth. ac., acet.
20		d. 180		s.		
21	$2.933^{11.5}$	d. 180	130^{100}	s.		
22	2.824, 3.64^{6}		127	i.		v. s. HNO_3
23	2.88^{13}			d.		s. dil. HNO_3
24	1.829	-77 ± 2	126.7	s. d.		s. al., eth., ac. a.
25	3.64			i		s. HNO_3
26	3.396^{19}	d.				sl. s. acet.
27	2.459^{19}	300	480			
28	4.42			i.	i.	s. HF; i. a., al., eth.
29	5.48^{17}			i.	i.	s. HF; i. a., al., eth.
30		d. in air				
31	4.20	d.				s. h. HSO_4, HNO_3; sl. s. KSH; i. alk., HCl
32	4.7^{21}	d.		i.		s. alk. sulf.; sl. s. alk., HCl, HNO_3, H_2SO_4
33	3.00	d.		i.		s. dil. HNO_3, alk. sulf., alk.
34				v. s.		
35				v. s.	d.	s. al.
36	lq 1.000_4^4, s. $.9168^0$	0	100			∞ al.
37	5.851 g/l, lq 3.06^{-109}, s. 2.7^{-140}	−112	−107.1	24^{10} cm^3; 11.9^{25} cm^3	8.4^{50} cm^3; 7.12^{80} cm^3	
38		1800		d. ev. H_2		
39	2.09	$-4H_2O$, 100		v. s.	v. s.	
40	2.575	150.5	$-6H_2O$, 180	v. s.	v. s.	s. abs. al.
41	2.644			$.000033^{20}$		sl. s. dil. a.
42	9.17			i.	i.	s. h. dil. a.
43	3.30			s. d.	s.	
44				i.		
45	3.793	d. 900		44.2^{0}	4.7^{100}	
46	3.286			35.9^{20}	21.1^{40}	
47	5.51	1490	2500 d.	sl. d.	d.	v. s. dil. a., h. KOH
48				9.03^{25}		
49		74	$-6H_2O$, 100	168^{25}		sl. s. al.; i. eth.
50				v. s.		s. al.; i. eth.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Yttrium			
1	bromide.	$YBr_3 \cdot 9H_2O$	490 81	col. tabl., deliq
2	carbide	YC_2	112 94	micro-cr. yel
3	carbonate.	$Y_2(CO_3)_3 \cdot 3H_2O$	411 92	wh.-redsh. powd
4	chloride	YCl_3	195 29	shin. wh. leaf..
5	"	$YCl_3 \cdot H_2O$	213 31	col
6	"	$YCl_3 \cdot 6H_2O$	303 39	rhomb. redsh.-wh., deliq
7	fluoride	$YF_3 \frac{1}{2}H_2O$	154 93	gelat
8	hydroxide	$Y(OH)_3$	139 94	wh.-yel., gelat. or powd
9	iodide	YI_3	469 68	deliq
10	nitrate	$Y(NO_3)_3 \cdot 4H_2O$	347 01	redsh. wh. pr
11	"	$Y(NO_3)_3 \cdot 6H_2O$	383 04	redsh.-col., deliq. cr
12	oxalate	$Y_2(C_2O_4)_3 \cdot 9H_2O$	604 05	wh cr. powd
13	oxide (yttria)	Y_2O_3	225 84	col.-yelsh. cr. or powd
14	sulfate	$Y_2(SO_4)_3$	466 02	wh. powd
15	"	$Y_2(SO_4)_3 \cdot 8H_2O$	610 15	monocl. col.-redsh., 1.543, 1.549, 1.576
16	sulfide	Y_2S_3	274 02	yel.-gray powd
	Yttrium complexes:			
17	Hexaantipyrineyttrium *per*chlorate	$[Y(C_{11}H_{12}N_2O)_6](ClO_4)_3$	1516.63	col hex cr
18	Hexaantipyrineyttrium iodide	$[Y(C_{11}H_{12}N_2O)_6]I_3$	1599 02	col. cr
19	**Zinc**	Zn	65 38	hex bluish-wh. met
20	acetate	$Zn(C_2H_3O_2)_2$	183 47	monocl
21	"	$Zn(C_2H_3O_2)_2 \cdot 2H_2O$	219 50	monocl. col. β 1.494
22	aluminate (gahnite)	$ZnAl_2O_4$	183 32	1.78
23	amide	$Zn(NH_2)_2$	97 43	amor., wh powd
24	*ortho*arsenate (kottigite)	$Zn_3(AsO_4)_2 \cdot 8H_2O$	618 09	monocl. 1.662, 1.683, 1 717
25	benzoate	$Zn(C_7H_5O_2)_2$	307 60	wh. powd
26	borate..	$3ZnO \cdot 2B_2O_3$	383 42	wh. amor. powd., or tricl cr
27	bromate....	$Zn(BrO_3)_2 \cdot 6H_2O$	429 31	cub. wh
28	bromide	$ZnBr_2$	225 21	rhomb. col., hyg..
29	butyrate..	$Zn(C_4H_7O_2)_2 \cdot 2H_2O$	275 61	wh. pr
30	caproate	$Zn(C_6H_{11}O_2)_2$	295 68	wh. need
31	carbonate (smithsonite)	$ZnCO_3$	125 39	trig. col., 1.818, 1.618
32	chlorate ...	$Zn(ClO_3)_2 \cdot 4H_2O$	304 36	cub. col.-yelsh., deliq
33	chloride	$ZnCl_2$	136 29	cubic wh., deliq
34	", diammine	$ZnCl_2 \cdot 2NH_3$	170 36	col
35	chromate	$ZnCrO_4$	181 39	lem. yel., pr
36	*di*chromate.	$ZnCr_2O_7\ 3H_2O$	335 45	or.-yel. powd., or redsh br. cr., hyg
37	citrate	$Zn_3(C_6H_5O_7)_2 \cdot 2H_2O$	610 37	wh. amor. powd
38	cyanide	$Zn(CN)_2$	117 42	rhomb. col.
39	ferrite	$ZnFe_2O_4$	241 06	oct. blk
40	ferrocyanide	$Zn_2Fe(CN)_6$	342 71	wh. powd
41	"	$Zn_2Fe(CN)_6 \cdot 3H_2O$	396.76	wh. powd
42	fluoride...	ZnF_2	103 38	col., monocl. or tricl
43	"	$ZnF_2\ 4H_2O$	175 44	rhomb
44	fluosilicate	$ZnSiF_6 \cdot 6H_2O$	315 54	hex. pr., col..
45	formaldehydesulfoxylate	$Zn(HSO_2 \cdot CH_2O)_2$	255 57	rhomb. pr
46	", basic	$Zn(OH)HSO_2 \cdot CH_2O$	177.48	rhomb. pr
47	formate ..	$Zn(CHO_2)_2$	155 42	.
48	"	$Zn(CHO_2)_2 \cdot 2H_2O$	191 45	monocl. wh , 1.513, 1.526, 1.566

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1				v. s.		sl. s. al.; i. eth.
2	4.13^{18}			d.		
3				i.		sl. s. aq. CO_2; s. $(NH_4)_2CO_3$, dil. min a.; i. al., eth.
4	2.8^{18}	680		78^{10}	82^{50}	60.1^{15} al., 60.6^{15} pyr.
5		$-H_2O$, 160		v. s.		
6	2.18^{18}	$-5H_2O$, 100		217^{20}	233^{50}	s. al.; i. eth.
7				i.		v. sl. s. dil. a.
8		d.		i.	i.	s. a., NH_4Cl; i. alk.
9				v. s.		s. al ; sl. s. eth.
10	2.682			s.		s al., HNO_3
11	2.68	$-3H_2O$, 100		$134.7^{22.5}$		v. s. al., eth., HNO_3
12		d.		0.0001		sl. s. HCl
13	4.84; 5.046	2410		$.00018^{29}$		s. a.; i. alk
14	2.52	d. 1000		5.38^{25}	s.	s. satd. aq. K_2SO_4
15	2.558	$-8H_2O$, 120	d. 700	9.763^{20}	4.90^{40}	s. conc. H_2SO_4; i. al., alk.
16				d.		d. a.
17		293–6 d.		0.55^{20}		
18		280–2		4.65^{20}		
19	7.14	419.4	907	i.	i.	s. a., alk., ac. a.
20	1.84	242	subl. vac.	30^{20}	44.6^{100}	2.8^{25}, 166^{79} al.
21	1.735	237	$-2H_2O$, 100	31.1^{20}	66.6^{100}	2 al.
22	4.58			i.	i.	sl. s. alk.; i. a.
23	2.13^{25}	d. 200		d.	d.	i. eth., al.
24	3.309^{15}	d. 100		i.	i.	s. HNO_3, H_3AsO_4, alk.
25				$2.61^{15.9}$; 2.46^{20}	1.44^{60}	
26	amor. 3.64, cr. 4.22	980		s.		amor. s. HCl; cr. i. HCl
27	2.566	100	$-6H_2O$, 200	100	v. s.	
28	4.219^{4}	394	650	447^{20}; 471^{25}	675^{100}	v. s. al., eth., NH_4OH
29				10.7^{16}	d.	
30				$1.03^{24.5}$		
31	4.44	$-CO_2$, 300		0.001^{15}		s. a., alk., NH_4 salts; i. NH_3, acet., pyr.
32	2.15	d. 60	d.	262^{20}	v. s.	167 al.; s. glyc., eth.
33	2.91^{25}	262	732	432^{25}	615^{100}	$100^{12.5}$ al.; v. s. eth.; i NH_3
34		210.8	d. 271	d.		
35				i.	d.	s. a.; i. acet., liq. NH_3
36				v. s.	d.	s. a.; i. al., eth.
37				sl. s		
38		d. 800		0.0005^{20}		s. alk., KCN, NH_3; i. al.
39	5.33^{20}	1590				s. conc. HCl; i. alk., dil. a.
40				i.		s. excess alk; i. dil. a.
41		d.		i.	i.	d. NaOH; s. NH_4OH; v. sl. s. NH_3; i. HCl, al.
42	4.84^{15}	872		sl. s.	s.	s. h. a., NH_4OH; i. al., NH_3
43	2.535^{12}	$-4H_2O$, 100		1.6^{18}	s.	s. NH_4OH, a., alk.
44	2.104			v. s.		
45		d.		v. s.	v. s.	d. a.; trans. by alk.; i. al.
46		d.		i.	i.	d. a.; trans. by alk.; [illegible] al.
47	2.36		d.			
48	2.207^{20}		d.	5.2^{20}	38^{100}	i. al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Zinc			
1	gallate	$ZnGa_2O_4$	268.82	fine wh. cr., 1.74
2	glycerophosphate	$ZnC_3H_7O_6P$	235.49	wh. amor. powd
3	hydroxide	$Zn(OH)_2$	99.40	rhomb. col
4	iodate	$Zn(IO_3)_2$	415.22	wh. cr. powd.
5	"	$Zn(IO_3)_2\cdot 2H_2O$	451.25	
6	iodide	ZnI_2	319.22	cub. col. or wh. powd., deliq
7	*dl*-lactate	$Zn(C_3H_5O_3)_2\cdot 3H_2O$	297.57	wh. rhomb. cr
8	*d*-lactate	$Zn(C_3H_5O_3)_2\cdot 3H_2O$	297.57	wh. need
9	laurate	$Zn(C_{12}H_{23}O_2)_2$	463.99	wh. powd
10	*per*manganate	$Zn(MnO_4)_2\cdot 6H_2O$	411.34	vlt. br. or blk., deliq
11	nitrate	$Zn(NO_3)_2\cdot 3H_2O$	243.44	need
12	"	$Zn(NO_3)_2\cdot 6H_2O$	297.49	tetr. col.
13	nitride	Zn_3N_2	224.16	gray
14	oleate	$Zn(C_{18}H_{33}O_2)_2$	628.27	wax-like solid
15	oxalate	$ZnC_2O_4\cdot 2H_2O$	189.43	wh. powd
16	oxide	ZnO	81.38	wh. or yelsh., amor. powd
17	" (zincite)	ZnO	81.38	hex. wh., 2.008, 2.029
18	" , per-	ZnO_2	97.38	wh.-yel. powd
19	2,4-pentanedione deriv. (acetylacetonate)	$Zn(C_5H_7O_2)_2$	263.59	need
20	1-phenol-4-sulfonate (*p*-)	$Zn(C_6H_5O_4S)_2\cdot 8H_2O$	555.83	clear, col. cr. or fine wh. powd., effl
21	*ortho*phosphate	$Zn_3(PO_4)_2$	386.18	rhomb. col
22	*ortho*phosphate (α-hopeite)	$Zn_3(PO_4)_2\cdot 4H_2O$	458.24	rhomb. col., 1.572, 1.591, 1.59
23	*ortho*phosphate (β-hopeite)	$Zn_3(PO_4)_2\cdot 4H_2O$	458.24	rhomb. col., 1.574, 1.582, 1.582
24	*ortho*phosphate (parahopeite)	$Zn_3(PO_4)_2\cdot 4H_2O$	458.24	tricl. col., 1.614, 1.625, 1.665
25	*ortho*phosphate	$Zn_3(PO_4)_2\cdot 8H_2O$	530.31	rhomb. pl
26	" , tetra-H	$Zn(H_2PO_4)_2\cdot 2H_2O$	295.48	tricl
27	*pyro*phosphate	$Zn_2P_2O_7$	304.80	wh. powd
28	phosphide	Zn_3P_2	258.18	cub. dk. gray
29	*hypo*phosphite	$Zn(H_2PO_2)_2\cdot H_2O$	213.47	col., hyg. cr. powd
30	picrate	$Zn(C_6H_2N_3O_7)_2\cdot 8H_2O$	665.71	yel. cr. powd., exp
31	salicylate	$Zn(C_7H_5O_3)_2\cdot 3H_2O$	393.65	need
32	selenide	$ZnSe$	144.34	hex., 2.89
33	*ortho*silicate (willemite)	Zn_2SiO_4 (or $2ZnO\cdot SiO_2$)	222.82	trig., 1.694, 1.723
34	silicate (calamine)	$2ZnO\cdot SiO_2\cdot H_2O$	240.84	rhomb., 1.614, 1.617, 1.636
35	*meta*silicate	$ZnSiO_3$	141.44	hex. col.
36	stearate	$Zn(C_{18}H_{35}O_2)_2$	632.31	light powd.
37	sulfate (zinkosite)	$ZnSO_4$	161.44	rhomb. col., 1.658, 1.669, 1.670
38	"	$ZnSO_4\cdot 6H_2O$	269.54	monocl. or tetr. col
39	" (goslarite)	$ZnSO_4\cdot 7H_2O$	287.55	rhomb. col., effl., 1.457, 1.480, 1.484
40	sulfide (α-) (wurzite)	ZnS	97.44	hex. col., 2.356, 2.378
41	" (β-) (sphalerite)	ZnS	97.44	cub. col., 2.368
42	"	$ZnS\cdot H_2O$	115.46	yelsh.-wh. powd
43	sulfite	$ZnSO_3\cdot 2(\text{or } 2\tfrac{1}{2})H_2O$	181.47 (190.48)	wh. cr. powd
44	tartrate	$ZnC_4H_4O_6\cdot H_2O$ (or $2H_2O$)	231.47 (249.48)	wh. powd
45	tellurate	Zn_3TeO_6	419.75	heavy granular ppt. wh
46	telluride	$ZnTe$	192.99	cub. red, 3.56

INORGANIC COMPOUNDS (Continued)

No	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	6.15 calc.	<800				
2				s.		i. al., eth.
3	3.053	d. 125		$.00000026^{18}$		s. a., alk.
4	4.98	d.		sl. s.		s. HNO_3, alk.
5				0.877	1.32	s. HNO_3, NH_4OH
6	$4.666^{14.2}$	446	624	430^{0}; 437.7^{30}	510^{100}	s. a., al., eth., NH_3, $(NH_4)_2CO_3$
7				1.67^{15}	16.7^{100}	v. sl. s. al.
8				5.7^{15}	9^{33}	.104 h. 98% al.
9		128		0.01^{15}	0.019^{100}	0.010^{15} al.
10	2.47	$-5H_2O$, 100		v. s.	v. s.	d. al., a.
11		45.5		327.3^{40}		
12	2.065^{14}	36.4	$-6H_2O$, 105–131	184.3^{20}	∞	v. s. al.
13				d.		s. HCl
14		70		i.		sl. s. acet.
15	$2.562^{24.5}$	s. 100		$.00079^{18}$		s. a., alk.
16	5.47	>1800		$.00016^{29}$		s. min. a., dil. ac. a., NH_4OH
17	5.606	>1800	subl. 1800	$.00016^{29}$		s. a., alk., NH_4Cl; i. NH_3, al.
18	1.571			0.0022		d. a.
19		138	subl.		v. s. d.	v. s. bz., acet.; s. al.
20		$-8H_2O$, 125		62.5	250^{100}	55.6^{25} al.
21	3.998^{15}	900		i.	i.	s. a., NH_4OH; i. al.
22	3.04	tr.>105		i.	i.	v. s. a., NH_4OH, NH_4 salts
23	3.03	tr.>140		i.	i.	v. s. a., NH_4OH, NH_4 salts
24	3.75	tr.>163		i.	i.	v. s. a., NH_4OH, NH_4 salts
25	3.109^{15}			i.		s. alk.
26		100 d.		d.		
27	3.75^{24}			i.	i.	s. a., alk., NH_4OH
28	4.55^{13}	>420	1100	i.		d. H_2SO_4 ev. H_3P, HNO_3; viol. s. dil. a.; i. al.
29				s.		s. alk.
30		exp.		s.		
31				5^{20}		s. al.
32	5.42^{15}			i.		s. a.
33	3.9	1509			i.	
34	3.45			i.	i.	
35	3.52	1437		i.		
36		130		i.		i. al., eth.
37	3.74^{15}; (3.4)	d. 740		86.5^{80}	80.8^{100}	sl. s. al.
38	2.072^{15}	tr. 70		s.	117.5^{40}	
39	1.97	tr. 39	$-7H_2O$, 280	96.5^{20}	663.6^{100}	sl. s. al.
40	4.087	$1850^{150 atm}$	subl. 1185	$.00069^{18}$		v. s. a.; i. ac. a.
41	4.102^{25}	tr. 1020		$.000065^{18}$		v. s. a.
42	3.98	1049		i.		s. a.
43				0.16	d.	s. H_2SO_3; i. al.
44				0.055^{30}		
45				i.	i.	s. a.
46	6.34^{15}; 5.54^{13}	1238.5		i.	i.	s. a.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Zinc			
1	thiocyanate	$Zn(SCN)_2$	181 54	wh. powd
2	valerate	$Zn(C_5H_9O_2)_2 \cdot 2H_2O$	303 66	wh. glist. sc. or powd., disg. odor
	Zinc complexes:			
3	Tetramminezinc perrhenate	$[Zn(NH_3)_4](ReO_4)_2$	634 13	wh. cub. cr
4	Tetrapyridinezinc fluosilicate	$Zn(C_5H_5N)_4SiF_6$	523 83	rhomb. wh
5	**Zirconium**	Zr	91 22	cub silv. wh.-gray
6	acetate, basic	$ZrOH(C_2H_3O_2)_3$(?)	285 36	wh. cr
7	bromide, di-	$ZrBr_2$	251 05	blk. powd., ign. in air
8	" , tri-	$ZrBr_3$	330 97	bl.-blk. powd
9	" , tetra-	$ZrBr_4$	410 88	wh. cr. powd., hyg
10	carbide	ZrC	103 23	hard gray metallic
11	chloride, di-.	$ZrCl_2$	162 13	blk
12	" , tri-	$ZrCl_3$	197 59	brn
13	" , tetra-	$ZrCl_4$	233 05	wh. lust. cr
14	fluoride	ZrF_4	167 22	hex. col .
15	hydroxide	$Zr(OH)_4$	159 25	gelat. or wh amor. powd
16	iodide	ZrI_4	598 90	wh. or yel cr
17	oxide, di- (baddeleyite)	ZrO_2	123 22	col.-yel. or br., monocl., 2.13, 2.19, 2.20
18	" " (zirconia) ($HfO_2 < 1\%$)	ZrO_2	123 22	
19	phosphide	ZrP_2	153 26	gray
20	selenate	$Zr(SeO_4)_2 \cdot 4H_2O$	449 20	hex. transp. cr
21	*ortho*silicate (zircon, hyacinth)	$ZrSiO_4$	183 28	tetr. col-red or var color, 1 92–96, 1.97–2.02
22	silicide	$ZrSi_2$	147 34	steel-gray rhomb. lust. met
23	sulfate	$Zr(SO_4)_2 \cdot 4H_2O$	355 40	rhomb. col. or wh. cr. powd
24	sulfide	ZrS_2	155 34	steel-gray cr
25	**Zirconyl** bromide	$ZrOBr_2 \cdot xH_2O$		brill. need., deliq
26	chloride	$ZrOCl_2 \cdot 8H_2O$	322.26	tetr. need. wh., effl., 1.552, 1.563
27	hydroxide (metazirconic acid)	$ZrO(OH)_2$ (or H_2ZrO_3)	141.24	gelat. wh
28	iodide	$ZrOI_2 \cdot 8H_2O$	505 19	col. need., hyg
29	sulfide .	$ZrOS$	139 28	yel. powd

INORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	. .			s.		s. al., NH_4OH
2	..			$2.6^{24\ 25}$	s.	*ca.* 2.5 al.; v. sl. s. eth.
3	3.608^{25}_{4}			.		0.1852 conc. NH_4OH
4	2.197		..			. . . . .
5	6.4	1900	>2900	i.	i.	s. HF, aq. reg.; sl. s. a.
6			.	s.	.	.
7		d.>350	. .	d. ev. H_2		
8		d. 350	.	d. ev. H_2		
9		volat.		d.		s. al., eth.
10		3532	5100	i.		s. a., dil. HF
11		d.>350		d. ev. H_2		
12	.	d 350—$ZrCl_2$		d. ev. H_2		
13	2.80	subl. 300	.	d. to $ZrOCl_2$		s al., eth., conc. HCl
14	4.43	subl.	d.	1.39	d.	s. HF; i. a.
15	3.25	$-2H_2O$, 550		0.02		s. a.; i. alk., al.
16	.			s., d.	s.	d. al.; s. a., eth.; sl. s. bz., CS_2
17	5.49	2700	(4300)	i.	i.	s. H_2SO_4, HF
18	5.71-3	2950-3000		i.	i.	s. H_2SO_4, HF
19	4.77^{25}_{4}			i.		
20		$-3H_2O$, 100	$-4H_2O$, 130	s.		sl. s. al., conc. a.
21	4.56	2550		i.		i. a., aq. reg., alk.
22	4.88^{22}					
23		$-3H_2O$, 120		$146^{19.5}$		s. H_2SO_4, i. al.
24	3.87					
25	. .	$-H_2O$, 120		s.		s. h. conc. HBr
26	. . . .	$-6H_2O$, 150	$-8H_2O$, 210	s.	d.	s. al., eth.; sl. s. HCl
27	.. .			sl. s.	.	s. al.; sl. s. dil. HCl, dil. HNO_3, oxal. a.
28		d.		v. s.	v. s.	v. s. eth.; s. al.
29	4.87	ign. in air				. . . .

Metallic salts of organic acids will be

No	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Aluminum:			
1	Diethylaluminum malonate	$Al(C_7H_{11}O_4)_3$	504.45	wh. need. or pr
2	Triethylaluminum	$Al(C_2H_5)_3$	114.15	col. liq., ign. in air, $1.480^{6.5}$
3	Triethylaluminum etherate	$4Al(C_2H_5)_3\cdot 3(C_2H_5)_2O$	678.97	col. liq
4	Trimethylaluminum	$Al(CH_3)_3$	72.07	col. liq., ign. in air, 1.432^{12}
5	Triphenylaluminum	$Al(C_6H_5)_3$	258.27	wh. need
	Antimony:			
6	Antimony ethoxide(ous) (triethyl antimonite)	$Sb(C_2H_5O)_3$	256.94	col. liq
7	Pentamethylantimony	$Sb(CH_3)_5$	196.93	existence doubtful
8	Triethylantimony	$Sb(C_2H_5)_3$	208.94	liq
9	Trimethylantimony	$Sb(CH_3)_3$	166.86	liq
10	Triphenylantimony, (triphenylstibine)	$Sb(C_6H_5)_3$	353.06	col. tricl. pl
	Arsenic:			
11	Arsanilic acid (*p*) (*p*-aminophenylarsinic acid)	$H_2NC_6H_4AsO(OH)_2$	217.04	wh. need.
12	Arsenoacetic acid	$(AsCH_2COOH)_2$	267.91	sm. yel. need
13	Arsenobenzene	$C_6H_5As:AsC_6H_5$	304.02	wh. need
14	Cacodyl oxide (dicacodyl oxide)	$[(CH_3)_2As]_2O$	225.96	col. liq
15	Cacodyl sulfide (dicacodyl sulfide)	$[(CH_3)_2As]_2S$	242.02	oil
16	Dimethylarsine (cacodyl hydride)	$(CH_3)_2AsH$	105.99	col. liq., ign. in air
17	Dimethylarsinic acid (cacodylic acid)	$As(CH_3)_2O\cdot OH$	137.99	odorl., col. pr
18	Dimethylbromarsine (cacodyl bromide)	$(CH_3)_2AsBr$	184.89	yel. oil
19	Dimethylchlorarsine (cacodyl chloride)	$(CH_3)_2AsCl$	140.44	col. liq., infl
20	Methylarsine	CH_3AsH_2	91.96	col. liq
21	Phenylarsonic acid (benzene arsonic acid)	$C_6H_5AsO_3H_2$	202.03	col. pr
22	Tetraethyldiarsine (ethyl cacodyl)	$[(C_2H_5)_2As]_2$	266.06	oil
23	Tetraethyldiarsyl	$[As(C_2H_5)_2]_2$	266.06	liq
24	Tetramethyldiarsyl	$[As(CH_3)_2]_2$	209.96	col.-yel. oily liq., highly poisonous.
25	Triethylarsine (arsenic triethyl)	$As(C_2H_5)_3$	162.09	col. liq
26	Trimethylarsine (arsenic trimethyl)	$As(CH_3)_3$	120.01	col. liq
27	Triphenylarsine (arsenic triphenyl)	$As(C_6H_5)_3$	306.21	wh. need. or rhomb. pl., 1.6139^{48}
	Beryllium:			
28	Di-*n*-butylberyllium	$Be(C_4H_9)_2$	123.25	col. liq
29	Diethylberyllium	$Be(C_2H_5)_2$	67.14	col. liq
30	Dimethylberyllium	$Be(CH_3)_2$	39.09	wh. need
31	Dipropylberyllium	$Be(C_3H_7)_2$	95.19	liq
	Bismuth:			
32	Methylbismuthine	CH_3BiH_2	226.05	liq. (exist. quest.)
33	Triethylbismuthine (bismuth triethyl)	$Bi(C_2H_5)_3$	296.18	liq.
34	Trimethylbismuthine (bismuth trimethyl)	$Bi(CH_3)_3$	254.10	liq.

METAL-ORGANIC COMPOUNDS

found in the preceding section of the table.

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	1.084^{100}	98		i.		s. org. solv.
2		<−18	194	exp.; d. to $Al(OH)_3 + C_2H_6$		
3			112^{16}	exp.		d. al; s. bz., eth.
4		0	130	d. to $Al(OH)_3 + CH_4$		s. eth.
5		196 200		d.		d. al., chl., CCl_4, s. bz.
6	1.524^{17}		95^{11}	d.		s. org. liqs.
7		96-100		i.	i.	
8	1.324^{16}	<−29	159 5	i.	i.	s. al., eth.
9	1.523^{15}		80 6	sl. s.	sl. s	s. eth.; i. al.
10	1.4343^{25} (1.4998)	50, (46 53)	$>220^{1}$; $>360^{760}$	i.	i.	s. org. solv.; sl. s. al.
11		232				s. eth., MeOH; sl. s. al., acet.; i. bz., chl.
12		>260, d. 205		i.		s. pyr., alks., alk. carb; i. al., eth., chl.
13		212		i.		s. bz., chl., CS_2; sl. s. al., i. eth.
14	1 486[illegible]	−25	149-51	sl. s.		s. al., eth.
15			211	sl. s.		s. al., eth.
16	1.213[illegible]		35.6[illegible]			s. al., eth., chl., bz., CS_2
17		200		82.9^{22}	v. s.	s. al.; i. eth.
18			130			
19	>1	< 45	106 5 107, (109)	i.		v. s al.; i. eth.
20			2	0.00085		s. al., eth.
21	1.760	158–62 d.		$3\ 36^{28}$	$31\ 6^{84}$	18.4^{26} 95 % al.
22			185 90	i		s. al , eth.
23	1.+		186	i		s. al., eth.
24	1.15	−6	170	sl. s.		s. al., eth.
25	1.152		$140^{7.36}$	i.		
26	1.124		70	sl. s.		s. eth.
27	1.2225^{48}	60-60.5 (57)	>360 (in CO_2)	i.		v. s. eth., bz.; sl. s. cold. al
28			170^{25}	d.	d.	
29		12	110^{15}	d. to C_2H_6		
30			subl. 200	d. to CH_4		
31		<−17	245			. . . .
32	$2\ 30^{18}$		110	i.	i.	s. al., eth.
33	1 82	..	107^{79}	i.	. . . .	s. al., eth.
34	$2\ 300^{18}$	...	110	i.	i.	s. al , eth.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Bismuth:			
1	Triphenylbismuthine (bismuth triphenyl)	$Bi(C_6H_5)_3$	440 30	monocl
	Boron:			
2	Aminophenylboric acid (*m*)	$(NH_2C_6H_4)B(OH)_2$	136 95	wh. hex. pl
3	Amylboric acid (*n*).	$(C_5H_{11})B(OH)_2$	115 98	col. fl
4	Anisylboric acids, *o,m,p* (methoxyphenylboric acids)	$CH_3OC_6H_4B(OH)_2$	151 96	wh. cr
5	Borine carbonyl	BH_3CO	41 85	col. unst. gas
6	Butylboric acid (*n*).	$C_4H_9B(OH)_2$	101 95	col cr
7	Butylboric acid (*tert*)	$C_4H_9B(OH)_2$	101 95	wh. cr
8	Diethoxyboron chloride	$(C_2H_5O)_2BCl$	136 40	col. liq
9	Diisoamyloxyboron chloride	$(C_5H_{11}O)_2BCl$	188 56	col. liq
10	Dimethoxyborine	$(CH_3O)_2BH$	73 90	col liq., unst
11	Dimethoxyboron chloride	$(CH_3O)_2BCl$	108 35	col liq
12	Dimethylboric acid (dimethylhydroxyborine)	$(CH_3)_2BOH$	57 90	col. liq
13	Dimethylboric anhydride	$(CH_3)_2BOB(CH_3)_2$	97 78	col
14	Dimethylborine trimethylammine	$(CH_3)_3NBH(CH_3)_2$	101 01	col liq
15	Dimethylboron bromide	$(CH_3)_2BBr$	120 80	col liq. or gas
16	Dimethylboron iodide	$(CH_3)_2BI$	167 81	col liq
17	Dimethyldiborane (1,1) (unsym.)	$B_2H_4(CH_3)_2$	55 74	col gas
18	Dimethyldiborane (1,2) (sym.)	$B_2H_4(CH_3)_2$	55 74	col. unst. gas
19	Dimethyltriborine triamine (*B*)	$(CH_3)_2B_3N_3H_4$	108 59	col liq
20	Dimethyltriborine triamine (*N*)	$(CH_3)_2B_3N_3H_4$	108 59	col liq
21	Dimethyltriborine triamine (*N-B*)	$(CH_3)_2B_3N_3H_4$	108 59	col liq
22	Diphenylboric acid (diphenylhydroxyborine)	$(C_6H_5)_2BOH$	182 03	col. radiating cr
23	Diphenylboron bromide	$(C_6H_5)_2BBr$	244 93	col. visc. liq or cr
24	Diphenylboron chloride	$(C_6H_5)_2BCl$	200 48	col visc liq
25	Di-*p*-tolylboric anhydride	$(C_7H_7)_2BOB(C_7H_7)_2$	402 15	wh powd
26	Ethoxyboron dichloride	$C_2H_5OBCl_2$	126 79	col. liq
27	Ethyl boric acid	$(C_2H_5)B(OH)_2$	73 90	wh. cr
28	Furanylboric acid (*β*)	$(C_4H_3O)B(OH)_2$	111 90	wh. cr
29	Hexylboric acid (*n*)	$C_6H_{13}B(OH)_2$	130 00	wh cr
30	Isobutylboric acid	$C_4H_9B(OH)_2$	101 95	col cr
31	Methoxyboron dichloride	CH_3OBCl_2	112 77	col liq
32	Methoxyboron difluoride	CH_3OBF_2	79 85	col. liq
33	Methylboric acid	$CH_3B(OH)_2$	59 87	wh. pl
34	Methylborine trimethylammine	$(CH_3)_3NBH_2CH_3$	86 98	col liq
35	Methyldiborane	$B_2H_5CH_3$	41 71	col. very unst gas
36	Methyltriborine triamine (*B*)	$CH_3B_3N_3H_5$	94 56	col liq

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	1.585	78		..		v. s. chl.; s. eth., acet.; sl. s. al.
2	.	d.	d.	sl. s.	.	s. al.; sl. s. eth.
3	. ..	93-4, d.	d.	s.	s.	s. eth., dichloroethane
4		d.	d.	sl. s.	. .	s. al., eth., bz.
5	..	−137.0	−63	d.	d.	
6		92-4	d.	s.	s.	v. s. al., eth., chl., acet., acet. a. and esters; sl. s. bz., CCl_4, pet. eth.
7		105 d.	d.	s.	..	s. eth.
8			112.3	d.	d.	
9		.. .	110-15[14]	d.	d.	.
10		−130.6	25.9	d.	d.	.
11		−87.5	74.7	d.	d.	
12			0[36]	v. s.	.	. .
13		−37.3	43	hyd.	hyd.	
14		−18.0	d. 172	d.	d.	s. eth.
15		−123.4	22	d.	d.	. .
16		−110 7	65	d.	d	
17		−150.2	−2.6	d.	d.	
18		−125	4.9	d.	d.	
19	.	−48	107	hyd.	hyd.	
20			108	hyd.	hyd.	.
21		.	124	hyd.	hyd.	
22		264-67	215-35[17]	i.	i.	s. eth., al., pet. eth.
23		25	150-60[8]	d.	d.	s. bz.
24			271	d.	d.	s. bz., pet. eth.
25		78		i.		s. al., eth., bz.
26		.	77.9	d.	d.	. . .
27		subl. 40		s.	s.	s. al., eth.
28		110 d.	d.	s		v. s. eth., al., acet., sl. s. bz., tol.
29		88-90, d.	d.	sl s		s. eth.
30		106-12, d.	d.	s.	. .	s. eth., dichloroethane
31		−15	58.0	d.	d.	. .
32	1.417[35.5]; 1.354[78.5]	. . .	86	d.	d.	.. .. .
33		d.	d.	sl. s.	...	s. al., eth.
34		0.8	177	d.	d.	s. eth.
35			−80[60]; d. appr. −20	d.	d.	.
36		−59 . ..	87	hyd.	hyd.	

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Boron:			
1	Methyltriborine triamine (*N*)	$CH_3B_3N_3H_5$	94.56	col. liq
2	Nitrophenylboric acids *o, m, p*	$NO_2C_6H_4B(OH)_2$	166 94	yel. need. or pr
3	Phenylboron dibromide	$C_6H_5BBr_2$	247 75	col. cr
4	Phenylboron dichloride	$C_6H_5BCl_2$	158.83	col. liq
5	Sodium tri-α-naphthyl boride	$Na_2B(C_{10}H_7)_3$	438 28	bl. cr. (purple in dil. soln.)
6	Tetramethoxydiborine	$(CH_3O)_4B_2$	145 78	col. liq
7	Tetramethyldiborane (1,1,2,2)	$B_2H_2(CH_3)_4$	83.79	col. liq
8	Tetramethyltriborine triamine (*N-B-B'B''*)	$(CH_3)_4B_3N_3H_2$	136 64	col. liq
9	Thiophenylboric acid (α) ("thienylboric" acid)	$(C_4H_3S)B(OH)_2$	127.96	col. star-formed need
10	Tribenzylborine	$B(C_6H_5CH_2)_3$	284.20	prismatic need. or col. oily liq
11	Tri-*n*-butylborine	$B(C_4H_9)_3$	182 16	col. mobile liq
12	Tri-*tert*-butylborine	$B(C_4H_9)_3$	182.16	col. mobile liq
13	Tri-*n*-butyltriborine trioxane (*n*-butyl boron oxide)	$(C_4H_9)_3B_3O_3$	251 80	col. liq
14	Tri-*tert*-butyltriborine trioxane (tert-butyl boric oxide)	$(C_4H_9)_3B_3O_3$	251 80	col. liq
15	Trichloroborine dimethyletherate	$(CH_3)_2OBCl_3$	163 26	col. cr
16	Trichloroborine trimethylammine	$(CH_3)_3NBCl_3$	176.30	col. cr
17	Tricyclohexylborine (boron tricyclohexyl)	$B(C_6H_{11})_3$	260 27	col. interlocking cr
18	Triethyl borate (triethoxyborine)	$B(OC_2H_5)_3$	146 00	col. liq., 1.381
19	Triethylboron (triethylborine)	$B(C_2H_5)_3$	98.00	col. liq
20	Tri-*n*-hexyltriborine trioxane (hexylboric oxide)	$(C_6H_{13})_3B_3O_3$	335 96	col. liq., 1.4323^{30}
21	Triisoamyl borate (triisoamyloxyborine)	$B(OC_5H_{11})_3$	272 24	liq., 1.421
22	Triisoamylborine	$B(C_5H_{11})_3$	224 24	col. mobile liq., $1.43207^{22.6}$
23	Tri-*p*-anisylborine	$B(CH_3OC_6H_4)_3$	332 20	wh. need
24	Triisobutyl borate (triisobutoxyborine)	$B(OC_4H_9)_3$	230.16	liq., 1.408
25	Triisobutylborine	$B(C_4H_9)_3$	182.16	col., mobile liq., $1.41882^{22.8}$
26	Trimethylamminoborine	$(CH_3)_3NBH_3$	72.96	col. hex., columns or need
27	Trimethyl borate (trimethoxyborine)	$B(OCH_3)_3$	103 92	col. liq
28	Trimethylboron (trimethylborine)	$B(CH_3)_3$	55 92	col. gas
29	Trimethyldiborane (1,1,2)	$B_2H_3(CH_3)_3$	69 77	col. liq
30	Trimethyltriborine triamine (*B*)	$(CH_3)_3B_3N_3H_3$	122 61	col. cr. or liq
31	Trimethyltriborine triamine (*N*)	$(CH_3)_3B_3N_3H_3$	122 61	col. liq
32	Trimethyltriborine triamine (*N-B-B'*)	$(CH_3)_3B_3N_3H_3$	122.61	col. liq
33	Trimethyl triborine trioxane (methylboric anhydride or anide)	$(CH_3)_3B_3O_3$	125.56	col. mobile liq

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids etc.
1	.	....	84	hyd.	hyd.	....
2	....	d.	d.	sl. s.	s.	s. al., eth.
3	....	34	100^{20}	d.	d.	s. bz.
4	....	0	175	d.	d.	s. bz.
5	...	....	d.	d.	......	s. eth.; sl. s. lgr.
6	....	−24	d. 93; 21^{44}	d.	d.	....
7	....	−72.5	68.6	d.	d.	....
8	..	...	158	hyd.	hyd.	....
9	.	134	d.	s.	....	s. eth., al., acet., bz., CCl_4
10		47	230^{13}	i.	......	v. s. al., bz.; sl. s. eth.
11	...	....	$90–1^{9}$; $108–10^{20}$	i.	i.	v. s. eth., al.
12		glass at low temp.	71^{12}	i.	....	s. eth.
13	..	....	154^{20}	hyd.	hyd.	v. s. eth.
14		20	$66–8^{5}$	hyd.	hyd.	s. eth.
15		d. 76	d.	d.	.....	....
16	..	243	.		s.	s. al.
17		100	194^{15}	i.	......	s. eth.
18	0.8746^{10}; $0.864^{26.5}$		117.4, (120)	d.	.....	.....
19	0.6961^{23}	−92.9	$0^{12.5}$	i.	i.	s. al., eth.
20	0.8876	..	$178–82^{24}$	hyd.	hyd.	s. org. solv.
21	0.872^{0}		255	.	...	.....
22	0.76		119^{14}	i.	...	s. eth.
23		128	.....	i.	i.	s al., eth., bz.
24	0.864^{0}		212	...	.....	....
25	0.74	....	188, 86^{20}	i.	i.	s. eth.
26		94	172	d.	d.	s. eth.
27	0.915; $0.9205^{24.3}$	−29	68.7, (65)	d.	....	s. al., eth.
28	1.9108 g/l, 0.625^{-100}	−161.5	−20.2	v. sl. s.	.....	v. s. al., eth.
29	.	−123	45.5	d.	....	....
30	....	31.5	129	hyd.	hyd.	....
31		......	134	hyd.	hyd.	....
32	.	....	139	hyd.	hyd.	....
33		−37	79	hyd.	hyd.	s. eth.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Boron:			
1	Tri-β-naphthyl borate..	$B(C_{10}H_7O)_3$	440 29	col. leaflets .
2	Tri-α-naphthylborine.	$B(C_{10}H_7)_3$	392 29	col. need. .
3	Triphenyl borate (triphenoxyborine)	$(C_6H_5O)_3B$	290.12	col. cr ..... .
4	Triphenylborine ammine*	$(C_6H_5)_3BNH_3$.	259 15	col. cr
5	Triphenylboron	$B(C_6H_5)_3$	242 12	hex. need
6	Tripropyl borate (tripropoxyboron)	$B(OC_3H_7)_3$.	188.08	liq . .
7	Tri-*n*-propylborine	$B(C_3H_7)_3$	140 08	col., mobile liq., $1.41352^{22.8}$.
8	Tri-*sec*-propylborine.	$B(C_3H_7)_3$ . ..	140 08	col. mobile liq .
9	Tri-*p*-tolylborine. .	$B(CH_3C_6H_4)_3$	284 20	separate wh. cr. . .
10	Tri-*p*-xylylborine .	$B(CH_3C_6H_3CH_3)_3$	326 28	col. bushed need .
	Cadmium:			
11	Dibutylcadmium .	$Cd(C_4H_9)_2$	226.64	oil ... .
12	Diethylcadmium .	$Cd(C_2H_5)_2$	170 53	oil ....
13	Diisoamylcadmium .	$Cd(C_5H_{11})_2$	254 69	oil ... . .
14	Diisobutylcadmium .	$Cd(C_4H_9)_2$. ..	226 64	oil
15	Dimethylcadmium	$Cd(CH_3)_2$	142 48	oil .
16	Dipropylcadmium .	$Cd(C_3H_7)_2$	198 58	oil .
	Calcium:			
17	Dianilinecalcium . .	$Ca(NHC_6H_5)_2$	224 31	wh. cr . .
18	Ethylcalcium iodide.	C_2H_5CaI	196 06	amor. powd . .
19	Glycocollcalcium	$(CH_2NHCOO)Ca$	113 13	cr
	Cobalt:			
20	Bis-dimethylglyoxime cobalto chloride	$HON{:}CCH_3CCH_3{:}NOH\cdot Co$ $HON{:}CCH_3CCH_3{:}NOCl_2$	361 09	lt. grn. cr .. ...
21	Cobalt(ous) hexamethylenetetramine	$CoCl_2C_6H_{12}N_4$. .	270 04	ultramarine blue . . .
22	Cobalt(ous) hydroxyquinone	$Co(C_{10}H_5O_3)_2$	405 22	ruby red . .
	Copper			
23	diazoaminobenzene(ous)	$CuN_3(C_6H_5)_2$	259 80	or. cr
	Gallium:			
24	Dimethylgallium amide	$Ga(CH_3)_2NH_2$	115 81	wh. cr . .
25	Dimethylgallium chloride monammine	$Ga(CH_3)_2Cl\cdot NH_3$	152 28	wh. cr . .
26	Dimethylgallium chloride diammine	$Ga(CH_3)_2Cl\cdot 2NH_3$	169 31	wh. cr . ...
27	Methylgallium dichloride	$Ga(CH_3)Cl_2$	155 67	wh. cr ......
28	Methylgallium dichloride monammine	$Ga(CH_3)Cl_2\cdot NH_3$	172 70	wh. cr .. .
29	Methylgallium dichloride pentammine	$Ga(CH_3)Cl_2\cdot 5NH_3$	240 83	wh. cr. ... .
30	Triethylgallium .. .	$Ga(C_2H_5)_3$.	156 90	col. liq ...
31	Triethylgallium monammine	$Ga(C_2H_5)_3\cdot NH_3$.	173 93	col. liq
32	Triethylgallium monoetherate	$Ga(C_2H_5)_3\cdot(C_2H_5)_2O$ . .	231 02	col. liq . .
33	Trimethylgallium	$Ga(CH_3)_3$ ...	114 82	col. liq
34	Trimethylgallium monammine	$Ga(CH_3)_3\cdot NH_3$	131.86	wh. cr . .
35	Trimethylgallium monoetherate	$Ga(CH_3)_3\cdot(C_2H_5)_2O$	188 94	col. liq .. . ..

* This compound is the prototype of numerous stable complex compounds formed from organic

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1		115	...	d.	..	s. bz.
2		203	d.	i.		sl. s. eth., al.; v. s. bz., CCl_4, chl., CS_2
3		ca. 35	>360	d.		s. eth., bz.
4		d. 216	d.	..	.	s. al.; sl. s. bz.
5		136	203[15]	d.	.	d. al.; s. bz.
6	liq. 0.867[16]		175	.	.	. . . .
7	0.725		156, 60[20]	i.		s. eth.
8			148-54, 33-5[12]	i.		s. eth.
9		175	233[12]	i.		v. s. bz.; sl. s. eth.
10		147	221[.2]	i.	.	v. s. bz., chl., CCl_4; sl. s. eth.
11	1.3056[19.5]	−48	103.5[12.5]	d.	d.	. ...
12	1.6564[18.1]	−21	64	d.	d.	. . . .. .
13	1.2210[19]	−115	121.5[15]			... .
14	1.2693[18]	−37	90.5[20]	d.	d.	
15	1.9846[17.9]	−4.5	105.5[758]	d.	d.	. . .
16	1.4201[17.6]	−83	84[21.5]	d.	d.	. ...
17		d.	.	d.	.	i. eth., bz., lgr.
18				d.		sl. s.
19				s.	.	....
20				s.		s. al.
21				s.	.	....
22		d. 210-15				.. ..
23		d. 270		i.	.	s. bz.; i. al., lgr.
24			subl. 60 vac.			....
25		54		d.	d.	v. s. NH_3; s. eth.
26		112		d.	d.	v. s. NH_3; i. eth.
27		75		d.	.	v. s. eth.
28				d.	.	i. eth.
29		d. > 80		d.	.	i. NH_3
30	1.0576[30]	−82.3	142.6	d.	..	s. eth.
31		...	.	d.	. . .	.. . .
32		. .	.	d.	.... .	s. eth.
33	.	−19	55.7 ± .2[762]	d.	..... .	s. eth., NH_3
34	.	31	subl. vac.	d.	. .	s. eth., NH_3; i. pet. eth.
35	.	<−76	99	d.	..	s. NH_3, eth.

amines and tri-aryl-borines.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Germanium:			
1	Amyltriphenylgermanium (*n*)	$Ge(C_5H_{11})(C_6H_5)_3$	375.04	col. pl
2	Benzyltriphenylgermanium	$Ge(CH_2C_6H_5)(C_6H_5)_3$	395.03	col. pl
3	Bis-acetylacetone germanium dibromide	$[CH(CCH_3O)_2]_2GeBr_2$	430.65	col. micr. cr.
4	Bis-acetylacetone germanium dichloride	$[CH(CCH_3O)_2]_2GeCl_2$	341.73	col. pr
5	Bis-(5-oxy-2, 8 dithio octane) germanium	$[SCH_2CH_2)_2O]_2Ge$	345.05	col. cr.
6	Bis-propionylacetone germanium dichloride	$[CHC_2(C_2H_5)(CH_3)O_2]_2GeCl_2$	369.78	wh. cr. powd.
7	Bis-tribenzyl germanyl sulfide	$[(C_6H_5CH_2)_3Ge]_2S$	724 02	col. cr
8	Bis-tribiphenylyl germanyl sulfide	$[(C_6H_5 \cdot C_6H_4)_3Ge]_2S$	1096 42	col. cr
9	Bis-trichlorogermanyl methane	$CH_2(GeCl_3)_2$	371 97	col. liq
10	Bis-tricyclohexylgermanium disulfide	$[(C_6H_{11})_3Ge]_2S_2$	708 21	col. cr
11	Bis-triethylgermanyl sulfide	$[(C_2H_5)_3Ge]_2S$	351 62	col. oily liq
12	Bis-triphenylgermanyl sulfide	$[(C_6H_5)_3Ge]_2S$	639.86	col. cr
13	Bis-tri-tolylgermanyl sulfide	$[(C_6H_4CH_3)_3Ge]_2S$	724 02	col. cr
14	Butyltriphenylgermanium (*n*)	$Ge(C_4H_9)(C_6H_5)_3$	361.01	col. need
15	Cyclopentamethylene germanium dichloride	$(CH_2)_5GeCl_2$	213 65	col. liq
16	Diethylcyclopentamethylenegermanium (1,1)	$(CH_2)_5Ge(C_2H_5)_2$	200 85	col. liq
17	Diethyldiphenylgermanium	$Ge(C_2H_5)_2(C_6H_5)_2$	284 92	col. liq
18	Diethylgermanium bromide	$(C_2H_5)_2GeBr_2$	290 55	col. liq
19	Diethylgermanium chloride	$(C_2H_5)_2GeCl_2$	201 64	col. liq
20	Diethylgermanium imine	$(C_2H_5)_2GeNH$	145 74	col. liq
21	Diethylgermanium iodide	$(C_2H_5)_2GeI_2$	384 56	col. liq
22	Diethylgermanium oxide(α)	$[(C_2H_5)_2GeO]_x$	146 72$_x$	stable wh. amor. solid
23	Diethylgermanium oxide(β)	$[(C_2H_5)_2GeO]_3$	440 16	unst. col. liq
24	Diphenylgermanium	$[(C_6H_5)_2Ge]_4$	907 20	wh. cr
25	Diphenylgermanium dibromide	$(C_6H_5)_2GeBr_2$	386 63	col. liq
26	Diphenylgermanium dichloride	$(C_6H_5)_2GeCl_2$	297 72	col. liq
27	Diphenylgermanium difluoride	$(C_6H_5)_2GeF_2$	264 80	col. liq
28	Diphenyl-*sec*-propylgermanium bromide	$(C_6H_5)_2(C_3H_7)GeBr$	349 80	col. liq.
29	Di-*p*-tolylgermanium dibromide	$(CH_3C_6H_4)_2GeBr_2$	414.69	lt. yel. liq.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		42–3		i.	i.	v. s. bz., pet. eth.; sl. s. me. al.
2		82.5–3.5		i.	i.	v. s. bz., pet. eth., chl.; sl. s. isopropyl al.; i. me. al.
3		226				sl. s. h. acetyl acet.; i. org. solv.
4		240 d.				sl. s. org. solv.
5		159.0–.5				s. bz., abs. al.
6		128–9				s. c. chl.; i. pet. eth.
7		124				s. al., me. al. bz.; i. alk.
8		238				s. org. solv.; i. alk.
9			110^{18}	hyd.	hyd.	s. org. solv.
10		87–8		i.	....	s. abs. al.
11			$148–50^{12}$	....	....	s. org. solv.; i. alk.
12		138		......	......	s. org. solv.; i. alk.
13		156–7				s. org. solv.; i. alk.
14		84.5–5.5		i.	i.	v. s. pet. eth., bz., chl., eth.; sl. s. isopropyl al.; i. me. al.
15			$55–60^{12}$			
16			52^{13}			
17			316	i.	i.	v. s. org. solv.
18		<−33	202	d.	d.	d. liq. NH_3; s. org. solv.
19		−39 to −37	175	d.	d.	d. liq. NH_3; s. org. solv.
20			$100^{0.01}$			
21		−2 to −1	252	d.	d.	d. liq. NH_3; s. org. solv.
22		175		i.	i.	i. org. solv., liq. NH_3
23		18		i.	i.	s. org. solv.; i. liq. NH_3
24		294–5		i.	i.	sl. s. bz., tol., chl.; i. pet. eth.
25			$120^{0.07}$, $205–7^{12}$	hyd.	hyd.	s. org. solv.
26	.71	9	223^{12}	hyd.	hyd.	s. org. solv.
27			$100^{0.007}$	hyd.	hyd.	s. org. solv.
28			$215–50^{13}$			....
29			$230–33^{13}$	hyd.	hyd.	s. org. solv.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Germanium:			
1	Di-*p*-tolylphenylgermanium bromide	$(CH_3C_6H_4)_2(C_6H_5)GeBr$	411 87	col. pr
2	Di-triphenylgermanyl methane	$[(C_6H_5)_3Ge]_2CH_2$	621 83	lg. col. pr..
3	Ethyl-*tris*-*p*-biphenylylgermanium	$Ge(C_2H_5)(C_6H_4\text{-}C_6H_5)_3$	561 24	col. cr
4	Ethylgermanium oxide	$(C_2H_5GeO)_2O$	251 32	wh. powd .. .
5	Ethylgermanium tribromide	$(C_2H_5)GeBr_3$. .	341 41	col. liq . .
6	Ethylgermanium trichloride	$C_2H_5GeCl_3$.	208 03	col. liq ....
7	Ethylgermanium trifluoride	$C_2H_5GeF_3$ . .	158 66	col liq . .. .
8	Ethylgermanium triiodide	$C_2H_5GeI_3$.. .	482 42	yel. liq ..
9	Ethylphenyldi-*p*-tolylgermanium	$Ge(C_2H_5)(C_6H_5)(C_6H_4CH_3)_2$	361 01	wh. cr ..
10	Ethyl-*sec*-propyldiphenylgermanium	$Ge(C_2H_5)(C_3H_7)(C_6H_5)_2$	298 95	liq ....
11	Ethyltribenzylgermanium	$Ge(C_2H_5)(CH_2\text{-}C_6H_5)_3$	375 04	col. cr
12	Ethyltriphenylgermanium	$Ge(C_2H_5)(C_6H_5)_3$.	332 96	col. sld . .
13	Hexabenzyldigermane	$(C_6H_5CH_2)_6Ge_2$	691 96	col. cr . . .
14	Hexaethyldigermane	$[(C_2H_5)_3Ge]_2$	319 56	col. liq
15	Hexaphenyldigermane.	$[(C_6H_5)_3Ge]_2$	607.80	wh. cr .
16	Hexaphenyldigermane (tribenzene)	$[(C_6H_5)_3Ge]_2\cdot 3C_6H_6$	842 13	col. cr.. .
17	Hexa-*p*-tolyldigermane	$(CH_3C_6H_4)_6Ge_2$	691 96	col. cr
18	Methyltriphenylgermanium	$Ge(CH_3)(C_6H_5)_3$	318.94	trans. col. cr
19	Octaphenyltrigermane.	$(C_6H_5)_8Ge_3$	834 60	wh cr
20	Phenylethyl-*sec*-propylgermanium bromide	$(C_6H_5)(C_2H_5)[CH(CH_3)_2]GeBr$	301 76	col. oil; opt. act , *d* & *l*. forms
21	Phenylgermanium tribromide	$(C_6H_5)GeBr_3$	389 45	col. liq
22	Phenylgermanium trichloride	$(C_6H_5)GeCl_3$	256 07	col. liq .
23	Phenylgermanium triiodide	$C_6H_5GeI_3$	530 46	wh. sol., dec. by light
24	Phenyltri-*p*-tolylgermanium	$Ge(C_6H_5)(C_6H_4CH_3)_3$	423 08	wh. pr
25	Propyltriphenylgermanium (*n*)	$Ge(C_3H_7)(C_6H_5)_3$	346 99	col. need
26	Tetra-*i*-amylgermanium	$Ge(C_5H_{11})_4$	357 16	col. oily liq., $1.457^{17.5}$
27	Tetra-*n*-amylthiogermanium	$Ge[S(CH_2)_4CH_3]_4$.	485 40	col. liq., 1.5336^{25}
28	Tetraanhydro-tetrakis-diphenylgermanediol (*cyclo*)	$[Ge(C_6H_5)_2O]_4$	971 20	monocl. pr. & cubes
29	Tetrabenzylgermanium.	$Ge(CH_2C_6H_5)_4$	437 11	col. sol ...
30	*Tetra-*p*-biphenylylgermanium	$Ge(C_6H_4C_6H_5)_4$	685 37	wh. need .
31	Tetra-*p*-bromophenylthiogermanium	$Ge(SC_6H_4Br)_4$.	824 87	col. cr. ..
32	Tetra-*n*-butylgermanium	$Ge(C_4H_9)_4$	301 05	col. oily liq

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	. .	119			. ..	.. .. ..
2	... .	132–33	.. .	i.	. . . .	v. s. bz., eth., pet. eth., chl; i. liq. NH_3, al.
3	.. ... .	154–6	. ..	....	. ...	. . . .
4	.	>300	d.	s.	s.	s. HCl, al.; i. pet. eth.
5	.	<−33	200^{766}	d.	d.	d. liq. NH_3; s. bz., eth.
6	. . .	<−33	144^{762}	d.	d.	d. liq. NH_3; s. bz., eth.
7	.	−16.5 to −15.5	112^{760}	d.	d.	d. liq. NH_3; s. bz., eth.
8	.	−2.5 to −1.5	281^{766}, d.>350	d.	d.	d. liq. NH_3; s. bz., eth.
9	. .	55	.....			. . . .
10		175–90	....			.
11	.	56–7	.....		.	s. meth. al.
12	.	78.0–.5	....	i.	i.	s. eth., pet. eth., bz., chl., acet.; i. meth. al.
13	.	183–4		..		s. glac. acet. a.
14		<−60	265^{758}	i.	i.	s. bz., eth.
15		340	....	i.	i.	sl. s. h. bz., h. chl.; i. liq. NH_3, lgr.
16		d. $-C_6H_6$	......	i.	. .	s. bz.
17		226–7	. .... .	.. .		....
18		70.5–1.0	.	i.	i.	v. s. bz., eth., acet., chl. pet. eth.; i. c. meth. al., liq. NH_3
19	.	247–8	. .	i.	i.	s. h. bz., h. chl.
20			$130–5^{13}$			. ..
21			$120–2^{13}$	hyd.	hyd.	d. liq. NH_3; s. org. solv.
22			$105–6^{12}$	hyd.	hyd	d. liq. NH_3; s. org. solv.
23		55–6	. .	hyd.	hyd.	d. liq. NH_3; s. glac. acet. a.; org. solv.
24		191		i.	i.	s. org. solv.
25	.	86.0–.5	. .	i.	i.	v. s. chl., bz., pet. eth.; sl. s. isopropyl al.; i. meth. al., liq. NH_3
26	$0.9147\frac{20}{20}$	. ..	163–4	.		. .. .
27	1.0697^{25}	. .	$240–1^{3-4}$	. .	.	s. bz., abs. al.
28		218	..		. .	s. ethyl acetate, pet. eth., eth.
29		107–8	.		.	. .. .
30		270–2	.. .	i.	i.	s. bz.
31		196.0–.5	...		.	s. bz., abs. al.
32		. . ..	$178–80^{783}$?		.	.. ..

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Germanium:			
1	Tetra-*p*-*tert*-butylphenylthiogermanium	$Ge[SC_6H_4C(CH_3)_3]_4$	733 66	col. tetrag.
2	Tetra-*n*-butylthiogermanium	$Ge[S(CH_2)_3CH_3]_4$	429 29	liq., 1.5439^{25}
3	Tetra-*sec*-butylthiogermanium	$Ge[SCH(CH_3)(C_2H_5)]_4$	429 29	liq., 1.5497^{25}
4	Tetra-*tert*-butylthiogermanium	$Ge[SC(CH_3)_3]_4$	161.77	tetrag. columns
5	Tetracetylthiogermanium	$Ge[SCH_2(CH_2)_{14}CH_3]_4$	1102.55	wh. cr
6	Tetracyclohexylthiogermanium	$Ge(SC_6H_{11})_4$	533 44	2 cr. mod. α (stab.) tetrag.; β (metastab.) monocl.
7	Tetraethoxylgermanium (tetraethyl germanate)	$Ge(OC_2H_5)_4$	252.84	col. liq
8	Tetraethylgermanium	$Ge(C_2H_5)_4$	188 84	col. oil, $1.443^{17.5}$; 1.554^{0}; 1.439^{20}
9	Tetraethylthiogermanium	$Ge(SC_2H_5)_4$	317.08	liq., 1.5886^{25}
10	Tetra-iso-butylthiogermanium	$Ge[SCH_2CH(CH_3)_2]_4$	429 29	liq., 1.5381^{25}
11	Tetraisopropylthiogermanium	$Ge[SCH(CH_3)_2]_4$	373 19	liq., 1.5535^{25}
12	Tetramethylgermanium	$Ge(CH_3)_4$	132.74	col. liq
13	Tetramethylthiogermanium	$Ge(SCH_3)_4$	260 98	liq., 1.6379^{25}
14	Tetraphenoxygermanium	$Ge(OC_6H_5)_4$	445 00	col. oil
15	Tetraphenylgermanium	$Ge(C_6H_5)_4$	381.00	tetr., col
16	Tetra(2-phenylethyl)-germanium	$Ge(C_6H_5C_2H_4)_4$	493.21	col. cr
17	Tetraphenylthiogermanium	$Ge(SC_6H_5)_4$	509.24	col., rhomb. cr., 1.7348, 1.7821 (H green)
18	Tetra-*n*-propylgermanium	$Ge(C_3H_7)_4$	244 95	col. mob. liq., $1.451^{17.5}$
19	Tetrapropylthiogermanium	$Ge(SC_3H_7)_4$	373 19	liq., 1.5612^{25}
20	Tetra-*N*-pyrrylgermanium	$Ge(C_4H_4N)_4$	336 92	lt. yel. cr.
21	Tetra-α-thienylgermanium	$Ge(C_4H_3S)_4$	405 10	wh. need., doubly refract.
22	Tetra-*o*-tolylgermanium	$Ge(C_6H_4CH_3)_4$	437.11	wh. hex. cr
23	Tetra-*m*-tolylgermanium	$Ge(C_6H_4CH_3)_4$	437.11	wh. need
24	Tetra-*p*-tolylgermanium	$Ge(C_6H_4CH_3)_4$	437 11	wh. rhbdr. tab
25	Tetra-*p*-tolylthiogermanium	$Ge(SC_6H_4CH_3)_4$	565.35	col., rhomb. cr., 1.726, 1.7716 (H green)
26	Tolylgermanium tribromide(*p*)	$(CH_3C_6H_4)GeBr_3$	403.47	col. liq
27	Tolylgermanium trichloride(*p*)	$(CH_3C_6H_4)GeCl_3$	270.10	col. liq
28	Tolylgermanium triiodide(*p*)	$(CH_3C_6H_4)GeI_3$	544.49	col. cr., sensit. to light.
29	Trianhydrotetrakisdiphenylgermanediol	$[HO\text{-}Ge(C_6H_5)_2\text{-}O\text{-}Ge(C_6H_5)_2]_2O$	989.22	
30	Tribenzylgermanium bromide	$(C_6H_5CH_2)_3GeBr$	425.90	col. cr

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	..	155–6		. .	.	sl. s. al., glac. acet. a.; s. pet. eth., eth., acet.; v. s. chl., bz.
2	1.1072^{25}	.	222.5^{45}		.	s. abs. al.
3	1.1119^{25}	.	200.5^{4}	. .	.	s. bz.
4		172–73	subl. 170^{4}	.	..	s. abs. al.
5		50–1		.	..	v. s. chl., bz.; s. pet eth., eth.; sl. s. acet., al., glac. acet. a.
6	$\alpha 1.270^{15}$	84		i.	. ...	s. abs. al., pet. eth.
	$\beta 1.259^{15}$	88	.	i.	.	s. abs. al ,pet. eth.
7	..	−81	185–7	. ...	...	. ...
8	1.198^{0}	−90	162.5-3.0	d.	d.	s. bz., eth., HCl
	$0.991\frac{24.5}{24.5}$					
9	1.2574^{25}	.	$164.5\text{–}5.0^{5}$	. .		s. bz.
10	1.0984^{25}	..	$199\text{–}200^{4-5}$		..	s. al.
11	1.1478^{25}	15	$162\text{–}64^{4}$	..	...	s. abs. al.
12	1.006^{0}	−88	43 4		. .	s. al., eth., bz.
13	1.4364^{25}	−3	$138\text{–}40^{4}$		... .	s. al., bz.
14			$210\text{–}20^{0.3}$	...	. .	s. bz.
15	.	235.7	>400	i.	i.	s. chl., bz., tol.; sl. s. eth., acet., lgr.
16	.	56–7		. . .	.	s. eth., al.
17		101.5				s. bz., abs. al., meth. al.
18	$0.9539\frac{20}{20}$	−73	225^{715}	.		... .
19	1.1662^{25}		$191\text{–}92^{5}$	.		s. abs. al.
20		202		.		s. pet. eth., chl.
21		149–50		i.	i.	s. bz., tol., acet., chl., CCl_4; sl. s. al., meth. al.; i. pet. eth.
22	. .	175–6		i.	i.	s. CCl_4, bz., xylene; sl. s. h. al.; i. pet. eth., al.
23	.	146	..	i.	i.	s. bz., tol., CCl_4; sl. s. meth. al.
24		227		i.	i.	s. bz.
25	.	110–11		.	....	s. bz., abs. al.
26		$155\text{–}6^{13}$	.	hyd.	hyd.	d. liq. NH_3; s. org. solv.
27	. .	. . .	$115\text{–}6^{12}$	hyd.	hyd.	d. liq. NH_3; s. org. solv.
28	.	72		hyd.	hyd.	d. liq. NH_3; s. org. solv.
29	. .	149		.		s. eth. acetate
30	. ...	145		.. .	.... .	. ...

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Germanium:			
1	Tribenzylgermanium chloride	$(C_6H_5CH_2)_3GeCl$	381 44	col cr
2	Tribenzylgermanium fluoride	$(C_6H_5CH_2)_3GeF$	364 98	col. need . .
3	Tribenzylgermanium iodide	$(C_6H_5CH_2)_3GeI$	472 90	col. cr . . . . .
4	Tribenzylgermanium oxide	$[(C_6H_5CH_2)_3Ge]_2O$	707 96	
5	Tri-*p*-biphenylylgermanium bromide	$(C_6H_5C_6H_4)_3GeBr$	612 09	wh. cr. . . .
6	Tri-*tert*-butylthiogermanium chloride	$Ge[SC(CH_3)_3]_3Cl$	375 58	col. cr .
7	Tricyclohexylgermanium bromide	$(C_6H_{11})_3GeBr$	401 96	col. cr . . .
8	Tricyclohexylgermanium chloride	$(C_6H_{11})_3GeCl$	357 50	col. cr
9	Tricyclohexylgermanium fluoride	$(C_6H_{11})_3GeF$	341 05	col need. .
10	Tricyclohexylgermanium hydroxide	$(C_6H_{11})_3GeOH$	339 06	
11	Tricyclohexylgermanium iodide	$(C_6H_{11})_3GeI$	448 97	col. cr
12	Triethylgermanium bromide	$(C_2H_5)_3GeBr$	239 70	col liq . .
13	Triethylgermanium chloride	$(C_2H_5)_3GeCl$. .	195 24	col liq
14	Triethylgermanium fluoride	$(C_2H_5)_3GeF$	178 78	col liq .
15	Triethylgermanium hydride	$(C_2H_5)_3GeH$	160 79	col. liq
16	Triethylgermanium imine	$[(C_2H_5)_3Ge]_2NH$	334 58	col. liq
17	Triethylgermanium iodide	$(C_2H_5)_3GeI$	286 70	col. liq
18	Triethylgermanium oxide	$[(C_2H_5)_3Ge]_2O$	335 56	col. liq
19	Triethylphenylgermanium	$Ge(C_2H_5)_3(C_6H_5)$.	236 88	col. liq
20	Triethyl-*p*-tolyl-germanium	$Ge(C_2H_5)_3CH_3C_6H_4$	250 91	col. liq
21	Triethyl-2,2,2, triphenyl-digermane (1,1,1)	$(C_2H_5)_3Ge$-$Ge(C_6H_5)_3$	463 68	rhomb. cr
22	Trimethylgermanium bromide	$Ge(CH_3)_3Br$	197 62	col. oily liq., 1.4705
23	Trimethylphenylgermanium	$Ge(CH_3)_3(C_6H_5)$	194 80	col liq
24	Trimethylstannyl-triphenylgermanium	$(CH_3)_3Sn$-$Ge(C_6H_5)_3$	467 70	wh. cr
25	Triphenylanisylgermanium	$Ge(C_6H_5)_3(CH_3OC_6H_4)$	411.03	wh. sld .
26	Triphenyldimethylaminophenylgermanium	$Ge(C_6H_5)_3C_6H_4N(CH_3)_2$	424 07	wh. need
27	Triphenylgermanium amide	$(C_6H_5)_3GeNH_2$.	319.93	wh. ppt .
28	Triphenylgermanium bromide	$(C_6H_5)_3GeBr$	383 82	hex. col
29	Triphenylgermanium chloride	$(C_6H_5)_3GeCl$	339 36	wh. cr
30	Triphenylgermanium fluoride	$(C_6H_5)_3GeF$	322 90	wh. cr

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		155				
2		96				
3		141				
4		135				s. pet. eth.
5		242				s. bz.
6		66–7	156–7$^{2.4}$			s. al., org. solv.
7		110		hyd.	hyd.	s. al.
8		102		hyd.	hyd.	s. meth. al.
9		92		hyd.	hyd.	s. meth. al.
10		176–7				s. al., bz., pet. eth.
11		99–100		hyd.	hyd.	s. meth. al.
12		−33	190.9	hyd.	hyd.	s. bz., eth., chl., CCl_4
13		<−50	175.9	hyd.	hyd.	s. bz., eth., chl., CCl_4
14			149.0^{751}	hyd.	hyd.	s. bz., eth., chl., CCl_4
15			124.4^{751}	i.	i.	s. bz., eth.; i. liq. NH_3
16			100$^{0.1}$	hyd.	hyd.	s. bz., eth., CCl_4, chl.; i. liq. NH_3
17		<−50	212.3	hyd.	hyd.	s. bz., eth., chl., CCl_4; i. liq. NH_3
18		<−50	253.9	i.	i.	s. $C_2H_5NH_2$, bz., eth., org. solv.; i. liq. NH_3
19			116–7^{13}	i.		s. org. solv.
20			125–6^{12}	i.		s. org. solv.
21		89.5–90.5		i.		v. s. bz., chl.; s. pet. eth., al.; sl. s. meth. al.
22	$1.544\frac{18}{40}$	−25	113.7	d.	d.	s. org. solv.
23			182–3	i.		s. org. solv.
24		88		i.		s. pet. eth., CCl_4, chl., bz.; sl. s. al.; i. liq. NH_3
25		158–9				s. al., glac. acet. a.
26		140–1				
27		d. $-NH_3$		d.	d.	i. liq. NH_3
28		138.7		i.	hyd.	s. bz., chl.; sl. s. lgr.
29		117–8	285^{12}	i.	hyd.	s. bz., eth.
30		76.6		i.	hyd.	v. s. bz., eth., lgr., chl.; i. liq. NH_3

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Germanium:			
1	Triphenylgermanium hydride	$(C_6H_5)_3GeH$	304 91	wh. cr. (two forms)
2	Triphenylgermanium hydroxide	$(C_6H_5)_3GeOH$	320 91	wh. cr
3	Triphenylgermanium iodide	$(C_6H_5)_3GeI$	430 82	wh. cr.
4	Triphenylgermanium oxide	$[(C_6H_5)_3Ge]_2O$	623 80	col. pl
5	Triphenylgermanium sodium	$Ge(C_6H_5)_3Na$	326 90	lt. yel
6	Triphenylgermanium sodiumoxide	$Ge(C_6H_5)_3ONa$	342 90	wh. sld
7	Triphenylgermanium sodiumtriammine	$Ge(C_6H_5)_3Na \cdot 3NH_3$	378 00	yel. sld
8	Triphenyl-*m*-tolyl germanium	$Ge(C_6H_5)_3(C_6H_4\text{-}CH_3)$	395 03	wh. anisotropic need
9	Triphenyl-*p*-tolyl germanium	$Ge(C_6H_5)_3(C_6H_4\text{-}CH_3)$	395 03	wh. sld
10	Tri-*o*-tolylgermanium bromide	$(CH_3C_6H_5)_3GeBr.$	428 92	col. oil, (blue fluores.)
11	Tri-*m*-tolylgermanium bromide	$(CH_3C_6H_5)_3GeBr.$	428 92	wh. need., anisotropic
12	Tri-*p*-tolylgermanium bromide	$(CH_3C_6H_5)_3GeBr.$	428 92	col. cr
13	Tri-*o*-tolylgermanium chloride	$(CH_3C_6H_4)_3GeCl$	381 44	col. oil
14	Tri-*m*-tolylgermanium chloride	$(CH_7C_6H_5)_3GeCl$	384 46	sm. silky need., opt act
15	Tri-*p*-tolylgermanium chloride	$(CH_3C_6H_5)_3GeCl$	384 46	wh. cr
16	Tri-*o*-tolylgermanium hydroxide	$(CH_3C_6H_5)_3GeOH$	366 01	amor. powd
17	Tri-*m*-tolylgermanium oxide	$[(CH_3C_6H_5)_3Ge]_2O.$	714 01	wh. cr
18	Tri-*p*-tolylgermanium oxide	$[(CH_3C_6H_5)_3Ge]_2O.$	714 01	wh. pr. anisotropic
19	Tri-*m*-tolyl-*p*-tolyl germanium	$Ge(C_6H_4CH_3)_3 \cdot (C_6H_4CH_3)$	437 11	wh. sld
20	Tri-*p*-tolyl-*o*-tolyl germanium	$Ge(C_6H_4CH_3)_3 \cdot (C_6H_4CH_3)$	437 11	wh. cr
21	Tri-triphenylgermanium nitride	$[(C_6H_5)_3Ge]_3N$	925 71	col. need
22	Tris-acetylacetonegermanium cupribromide	$[(C_5H_7O_2)_3Ge]CuBr_3$	673 24	gr.-blk. cr
23	Tris-acetylacetonegermanium cuprobromide	$[(C_5H_7O_2)_3Ge]CuBr_2$	593 32	col. rect. pr
24	Tris-acetylacetonegermanium cuprochloride	$[(C_5H_7O_2)_3Ge]CuCl_2$	504 40	col. pr
25	Tris-acetylacetonegermanium dicuprobromide	$[(C_5H_7O_2)_3Ge]Cu_2Br_3$	736 81	col. pr
	Gold:			
26	Aminopyridinotribromogold (2)	$H_2NC_5H_4NAuBr_3$	531 06	blk. pr
27	Ethylenediaminodibutylgold bromide	$(CH_2NH_2)_2Au(C_4H_9)_2Br$	451 44	col. need
28	Ethylenediaminodipropylgold bromide	$(CH_2NH_2)_2Au(C_3H_7)_2Br$	423 39	col. cr.
29	Pyridinotribromogold	$C_5H_5NAuBr_3$	528.06	red need.
30	Quinolinotribromogold	$C_9H_7NBr_3Au$	566 10	deep red lust. pr
	Indium			
31	trimethyl	$In(CH_3)_3$	159 86	col. cr

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	...	α, 47; β, 27	...	i.	i.	v. s. bz., tol., eth., chl., CCl_4; sl. s. liq. NH_3
2	...	134.2	...	i.	i.	s. bz., chl.; sl. s. lgr.
3	...	157	...	hyd.	hyd.	s. bz., eth.
4	...	183–4	...	i.	i.	s. bz., lgr., eth.
5	...	v. high	...	d.	d.	v. s. liq. NH_3; sl. s. eth., bz.
6	...	high	...	d.	d.	i. liq. NH_3
7	...	d.	...	d.	d.	v. s. liq. NH_3
8	...	136.5–8.5	...	i.	i.	s. bz., h. pet. eth.; i. meth. al.
9	...	123–4	...	...	...	s. org. solv.
10	...	...	205–10[1]	...	...	...
11	...	78.0–.9	222–3[1]	...	...	s. CCl_4, bz., eth.
12	...	128–9	...	...	...	s. pet. eth.
13	...	...	216–22[1]	...	...	...
14	...	84–5	221–4[1]		...	s. pet. eth., bz.; i. c. CH_3OH
15	...	121	...	...	...	s. pet. eth.
16	...	...	212–4[1]	...	...	...
17	...	125.0–.2	...	i.	i.	s. al., bz., pet. eth.
18	...	148–50	...	i.	i.	s. h. lgr., c. bz.; sl. s. eth. al., meth. al.
19	...	98.5–100.5	...	...	...	s. meth. al.
20		164–6	...		...	...
21		163–4	...	hyd.	hyd.	s. lgr., eth., bz.
22	...	139	...	...	...	i. chl.
23		165–6	...	...	...	s. chl.
24	...	147–8	...	...	...	s. chl.
25	...	195 d.	...	...	...	s. h. acet. acet.; i. chl.
26	...	160 d.	...	s.	...	s. chl.
27	...	d. 190	...	s.	...	s. al.
28	...	volat. 130	d. 190	...	...	...
29	...	d. 150	...	s.	...	s. al., act.
30	...	d.>200	...		...	s. chl.
31	$1.568\frac{19}{19}$	89.0–.8	subl.	d.	...	s. eth.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Lanthanum			
1	hexaantipyrine iodide	$La(COC_{10}H_{11}N_2)_6I_3$	2297 56	yel. cr
	Lead:			
2	Hexaethyldilead (triethyllead)	$Pb(C_2H_5)_6$	588 78	liq...
3	Tetraethyllead	$Pb(C_2H_5)_4$	323 45	col. liq.; or. flame, grn. marg., 1.5195[20]
4	Tetraisobutyllead	$Pb[CH_2CH(CH_3)_2]_4$	435 66	pl, 1.5042
5	Tetraisopropyllead	$Pb[CH(CH_3)_2]_4$	379 56	col. liq., dec. in air, 1.5223
6	Tetramethyllead	$Pb(CH_3)_4$	267 35	liq., 1.5120[20]
7	Tetraphenyllead	$Pb(C_6H_5)_4$	515 61	wh. need
8	Tetra-*n*-propyllead	$Pb(C_3H_7)_4$	379.56	col. liq., 1.5094
	Lithium:			
9	Ethyllithium	LiC_2H_5	36.00	hex. transp. pl
	Mercury:			
10	Aminophenylmercuric acetate (*p*)	$C_6H_4(NH_2)HgO_2C_2H_3$	351 77	col. pr
11	Biphenylmercury	$Hg(C_6H_5C_6H_4)_2$	507 00	sm. scales
12	Chloromercuriphenol (*o*)	$C_6H_4OHHgCl$	329 17	
13	Di-*n*-amylmercury	$Hg(C_5H_{11})_2$	342 89	1.4998
14	Di-(*dl*)-amylmercury	$Hg(C_5H_{11})_2$	342 89	1.5014
15	Dibenzylmercury	$Hg(C_7H_7)_2$	382 86	long brittle col. need
16	Di-*n*-butylmercury	$Hg(C_4H_9)_2$	314 84	1 5057
17	Diethylmercury	$Hg(C_2H_5)_2$	258 73	col. liq. of hazel odor
18	Di-*n*-hexylmercury	$Hg(C_6H_{13})_2$	370 94	1 4973
19	Diisoamylmercury	$Hg(C_5H_{11})_2$	342 89	1 4989
20	Diisobutylmercury	$Hg(C_4H_9)_2$	314 84	col. liq., 1 4965
21	Diisopropylmercury	$Hg(C_3H_7)_2$	286 78	1 5263
22	Dimethylaminophenylmercuric acetate (*p*)	$C_6H_4N(CH_3)_2HgO_2C_2H_3$	379 82	long. col. need
23	Dimethylanilinemercury (*p*)	$Hg[C_6H_4N(CH_3)_2]_2$	440 95	lust. need
24	Dimethylmercury	$Hg(CH_3)_2$	230 68	col. liq., sweet odor
25	Dinaphthylmercury (α)	$Hg(C_{10}H_7)_2$	454 92	rhomb. wh
26	Dinaphthylmercury (β)	$Hg(C_{10}H_7)_2$	454 92	cryst. from bz
27	Diphenylmercury	$Hg(C_6H_5)_2$	354 81	wh. glassy need
28	Dipropylmercury	$Hg(C_3H_7)_2$	286 78	col. mobile liq., 1.5170
29	Ditolylmercury (*o*)	$Hg(C_7H_7)_2$	382 86	wh. tabl
30	Ditolylmercury (*m*)	$Hg(C_7H_7)_2$	382 86	col. or lt. yel. need
31	Ditolylmercury (*p*)	$Hg(C_7H_7)_2$	382 86	need
32	Ethane hexamercarbide	$C_2Hg_6O_2(OH)_2$	1293 70	yelsh.-wh. powd
33	Ethylmercuric chloride	C_2H_5HgCl	265 13	silv. irid. leaf
34	Ethylmercuric hydroxide	C_2H_5HgOH	246 68	silv. irid. leaf
35	Ethylmercuric iodide	C_2H_5HgI	356 59	cr. from EtOH
36	Mercury ethylmercaptide (ic)	$Hg(SC_2H_5)_2$	322 85	leaf
37	Mercury phenylmercaptide (ic)	$Hg(SC_6H_5)_2$	418 93	yelsh. need
38	Methylmercuric chloride	CH_3HgCl	251 10	wh. cr., disg. odor
39	Methylmercuric iodide	CH_3HgI	342.56	col. pearly leaf
40	Naphthylmercuric acetate (α)	$C_{10}H_7HgO_2C_2H_3$	386 81	fine need......
41	Naphthylmercuric chloride (α)	$C_{10}H_7HgCl$	363 22	silk quad. tabl

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	. .	268–9 d.		41.8[20]	. . . . .	. . . .
2	1.471	. . . .	d.	i.	. . .	. . . .
3	1.659[18]	. . . . . .	200 d.; 91[19]	i.	. . .	s. bz., pet., al., eth.
4	1.324	−23			. .	. . .
5	1.4504	−53.5	120[14]; 133–8[27]	i.	. .	s. bz., pet. eth.
6	1.995	−27.5	110	i.	. . .	s. bz., pet. eth., al.
7		227.7				s. bz.
8	1.44		126[18]			s. bz., pet. eth.; sl. s. al.
9		95		d.	.	d. eth.; s. bz., lgr.
10		167		i.	i.	s. dil. a.; sl. s. chl., al; i. eth.
11		216	. . .	difficultly	soluble in	common solv.
12		152.5[0]				s. NaOH
13	1.6369	.	133[10]			. . . .
14	1.6700		93[1]			
15						s. al., eth., chl., CS_2, ac. a., bz., eth. acet.; sl. s. lgr.
16	1.7779		105[10]			
17	liq. 2.444		159	i.	i.	v. s. eth.; sl. s. al.
18	1.5361		158[10]			
19	1.6397		125[10]			
20	1.835[15], 1.7678	volat. 100	205–7, 86[10]	v. sl. s.		s. eth., al.
21	2.0024	.	63[10]			.
22		165	. . . . . .	i.	i.	s. bz., chl., al., dil. a.
23		169				s. chl.; sl. s. al., eth., dil. HCl
24	3.069	. .	96			s. al., eth.
25	1.929	188 (243)	249	i.	sl. s.	s. h. CS_2., chl.; sl. s. bz., eth.; v. sl. s. h. bz.
26	. . . . .	247–8	.	i.		sl. s. al., eth.
27	2.318	121.8, subl.	204[10.5]; >306 d.	i.	i.	s. chl., CS_2, bz., sl. s. eth., h. al.
28	2.0208	. . . . . .	189–91; 73[10]	i.		v. s. eth.; s. al.
29	. .	107	219[14]			s. h. bz.
30	. . . .	102	. . .	i.		s. bz., chl., acet., eth. acet.
31	. . . . .	238		i.	.	s. h. bz., chl., CS_2; sl. s. c. al.
32	. . .	exp. 230	. .	i.	i.	i.
33	3.482	193	.	i.		v. s. h. al.; sl. s. eth.
34	. . . .	37	. . . .	i.	i.	v. s. h. al.; s. eth.; sl. s. c. al.
35	. . . . . .	186	. . . .		.	s. al.
36	. .	76–7	d.	i.	. .	d. a.
37	.	153 d.	d.	i.	.	sl. s. h. al.; v. s. bz., pyr.
38	4.063	170	volat. 100	.	.	. .
39	.	143		i.	.	v. s. meth. al.; s. eth., al.
40	.	154		i.	i.	s. al., ac. a., bz., CS_2, fats; sl. s. eth.
41	. . .	188–9		i.	i.	sl. s. bz., al.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Mercury:			
1	Phenylmercuric acetate	$C_6H_5HgO_2C_2H_3$	336 75	rhomb. sm. wh. lust. pr ..
2	Phenylmercuric bromide	C_6H_5HgBr	357 63	rhomb. wh. lust. tabl .
3	Phenylmercuric chloride	C_6H_5HgCl	313 17	wh. satiny leaf ...
4	Phenylmercuric cyanide	C_6H_5HgCN	303 73	rhomb. long pr . .
5	Phenylmercuric iodide .	C_6H_5HgI	404 63	rhomb. satiny tabl .
6	Phenylmercuric nitrate..	$C_6H_5HgNO_3$.	339.72	rhomb. tabl . ..
7	Tolylmercuric bromide (*p*)	C_7H_7HgBr	371 65	thin lust. gray sc ...
8	Tolylmercuric chloride (*p*)	C_7H_7HgCl	327 19	rhomb. silky tabl .
	Neodymium:			
9	Neodymium hexaantipyrine iodide	$[Nd(COC_{10}H_{12}N_2)_6I_3]$	2302 91	rose cr .
	Potassium:			
10	Potassium saccharate, acid (*d*)	$KHC_6H_8O_8$.	248 23	rhomb. need .
11	Potassium-*m*-nitrophenoxide	$KOC_6H_4NO_2{\cdot}2H_2O$	213 23	flat or. need .
12	Potassium-*p*-nitrophenoxide	$KOC_6H_4NO_2{\cdot}2H_2O$	213 23	yel. leaf ...
	Rhenium:			
13	Bis-2:2′-dipyridyl rhenichloride	$(C_{10}H_9N_2)_2ReCl_6$	713 43	pa grn. cr
14	Dipyridyl *per*-rhenate (2:2′)	$(C_5H_4N_2)HReO_4$	343 42	col. need .
15	Dipyridyl rhenichloride (2:2′)	$(C_5H_6N)_2ReCl_6$	557 25	yel. need ..
16	Trimethylrhenium	$Re(CH_3)_3$	231 41	col. oil .
17	Tripyridyl rhenichloride (2:2′:2″)	$(C_5H_4N)_3HReCl_6$.	634 33	pa. grn. cr....
	Silicon:			
18	Chloromethylsilicane	SiH_2ClCH_3	80 57	.
19	Di-*p*-aminoazobenzene fluosilicate	$(NH_2C_6H_4N_2C_6H_5)_2{\cdot}H_2SiF_6$	538 54	long cinnamon br. need .
20	Di-*p*-aminobenzoic acid fluosilicate	$(NH_2C_6H_4COOH)_2H_2SiF_6$	418 35	pr. wh. long, narrow
21	Dianiline fluosilicate	$(C_6H_5NH_2)_2{\cdot}H_2SiF_6$	330 33	irreg. pl. wh .
22	Dichloromethylsilicane	$SiHCl_2CH_3$.	115 02	
23	Didiphenylamine fluosilicate	$[(C_6H_5)_2NH]_2{\cdot}H_2SiF_6$	482 51	wh. rods forming rosettes
24	Diethylaniline fluosilicate	$(C_6H_5NHC_2H_5)_2{\cdot}H_2SiF_6$	386.43	wh. pointed pr . ...
25	Dimethylaniline fluosilicate	$(C_6H_5NHCH_3)_2{\cdot}H_2SiF_6$	358 38	monocl. wh. need . .
26	Dimethylsilicane	$SiH_2(CH_3)_2$	60 14	. . . .
27	Di-α-naphthylamine fluosilicate	$(C_{10}H_7NH_2)_2{\cdot}H_2SiF_6$	430 44	rosettes of wh. need. ...
28	Di-β-naphthylamine fluosilicate	$(C_{10}H_7NH_2)_2{\cdot}H_2SiF_6$	430 44	hex. wh. pl.. . ...
29	Di-*m*-nitraniline fluosilicate	$(C_6H_4NH_2NO_2)_2{\cdot}H_2SiF_6$	420 33	rhomb. wh. pl
30	Dinitrosodiphenylamine fluosilicate	$[(C_6H_5)_2N = NO]_2{\cdot}H_2SiF_6$	540 51	butterfly shaped indigo cr.
31	Di-*o*-toluidine fluosilicate	$(C_6H_4NH_2CH_3)_2{\cdot}H_2SiF_6$	358 38	rhomb. wh ....
32	Di-*m*-toluidine fluosilicate	$(C_6H_4NH_2CH_3)_2{\cdot}H_2SiF_6$	358 38	wh. rect. pr. pl .. . ..
33	Di-*p*-toluidine fluosilicate	$(C_6H_4NH_2CH_3)_2{\cdot}H_2SiF_6$	358 38	wh. need., unst. irreg. outline...

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1		149		sl. s.	sl. s.	s. glac. ac. a., bz., al.
2		276		i.	i.	s. al., bz., pyr.
3		251				sl. s. h. al., bz., pyr., eth.
4		204			sl. s.	s. h. al., bz.
5		266		i.		s. chl., CS_2; sl. s. al., eth., bz.
6		176–86		i.	sl. s.	s. h. al., bz.
7		228				s. chl., al., bz.; i. c. CS_2
8		233		i.	i.	sl. s. h. al., bz., chl., acet., pyr.; i. eth.
9		270–2		12.7^{20}		
10				1.1^{6}	more sol.	
11	1.691^{20}	$-2H_2O$, 130	d.	16.3^{15}		s. al.
12	1.652^{20}	$-2H_2O$, 130	d.	7.5^{15}		sl. s. al.
13				sl. s.		
14				2.1		
15				sl. s.		
16			60			
17				i.		
18	0.935^{-80}	−134.1	7			
19		220 d				$.187^{25}$ 95 % al.
20		242				0.91^{25} 95 % al.
21		subl. 230		v.s.		s. h. al.
22	0.93^{0}	−93				
23		169				2.4492^{25} 95 % al.
24		165.3				$.979^{25}$ 95 % al.
25						s. h. al.; i. c. al.
26	0.68^{-80}	−150	−20.1			
27		218				$.1504^{25}$ 95 % al.
28		236.3				$.0816^{25}$; 1248^{35} 95 % al.
29		200				$.121^{25}$; $.4736^{35}$ 95 % al.
30		124.5				$.84^{25}$ 95 % al.
31						s. h. al.; i. c. al.
32						s. h. al.; i. c. al.
33						

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Silicon:			
1	Ethyltriphenylsilicane.	$(C_2H_5)(C_6H_5)_3Si$	288 42	rhomboidal pr
2	Hexamethyldisilicane	$Si_2(CH_3)_6$	146 33	.. .. .
3	Methylsilicane.	SiH_3CH_3	46 12	.
4	Methyltriphenyl silicane	$(CH_3)(C_6H_5)_3Si$	274 40	
5	Phenylenediamine fluosilicate (*m*)	$C_6H_4(NH_2)_2 H_2SiF_6$	252 22	choc. br. need.-like pr
6	Phenylenediamine fluosilicate (*p*)	$C_6H_4(NH_2)_2 \cdot H_2SiF_6$	252 22	pink irreg. six-sided pl
7	Silico-benzoic acid .	C_6H_5SiOOH	138 17	col. flaky resin
8	Tetrabenzylsilicane.	$Si(C_6H_5CH_2)_4$	392 57	
9	Tetraethylsilicane.	$Si(C_2H_5)_4$	144 30	liq., 1 4246...
10	Tetramethylsilicane	$Si(CH_3)_4$	88 20	col. liq .
11	Tetraphenylsilicane	$Si(C_6H_5)_4$	336 46	col. flocc. amor. part
12	Tolidine fluosilicate(*o*)	$(CH_3NH_2C_6H_3)_2 H_2SiF_6$	356 36	tiny, micr. wh. pr
13	Triethylphenylsilicane	$(C_2H_5)_3(C_6H_5)Si$	192 34	
	Sodium:			
14	Sodium acetamide	$NaNHCOCH_3$	81 06	wh. tabl
15	Sodium acetylide (ethinylsodium)	$NaHC_2$	48 03	wh. cr
16	Sodium anilide	$NaNHC_6H_5$	115 11	wh cr., v hygr
17	Sodium anthraquinone-*β*-sulfonate ("Silver salt")	$NaC_{14}H_7O_5S \cdot H_2O$	328 27	silvery leaf
18	Sodium arsanilate (atoxyl, soamin)	$NaC_6H_7O_3NAs \cdot 6H_2O$	347 13	wh cr powd , monocl
19	Sodium benzamide .	$NaNHCOC_6H_5$	143 12	wh. powd
20	Sodium-*N*-chloro-*p*-toluenesulfonamide	$NaC_7H_7O_2NClS \cdot 3H_2O$	281 70	col. pr
21	Sodium ethoxide (sodium ethylate)	$NaOC_2H_5 \cdot 2C_2H_5OH$	160 19	wh. powd. or need
22	Sodium, ethyl-	NaC_2H_5	52 06	wh. cr , d. air
23	Sodium-*β*-naphthoxide	$NaOC_{10}H_7$	166 15	wh. powd., v. hygr
24	Sodium-*p*-nitrobenzene isodiazotate	$NaC_6H_4O_3N_2 \cdot 2H_2O$	225 15	gold. leaf. or need
25	Sodium-*p*-nitrophenoxide	$NaOC_6H_4NO_2 \cdot 4H_2O$	233.16	yel. monocl. pr
26	Sodium-*o*-sulfobenzoic imide (soluble saccharin)	$NaC_7H_4O_3NS \cdot 2H_2O$	241.20	wh. tabl... .
27	Triphenylborylsodium*	$NaB(C_6H_5)_3$	265 12	yel.-or. silky need
28	Triphenylmethylsodium	$NaC(C_6H_5)_3$	266 31	red. cr .
	Tellurium:			
29	Di-*n*-butyl telluride	$(C_4H_9)_2Te$.	241 84	yel. oil. .... .
30	Diethyl telluride...	$(C_2H_5)_2Te$.	185 73	.. ..
31	Dimethyl telluride	$(CH_3)_2Te$	157 68	pa. yel oil; garlic-like odor
32	Dimethyltelluronium dibromide (*α*)	$C_2H_6Br_2Te$	317 51	or. leaf-like cr
33	Dimethyltelluronium dichloride (*α*)	$C_2H_6Cl_2Te$	228 59	leaf-like cr
34	Dimethyltelluronium dichloride (*β*)	$C_2H_6Cl_2Te$.	228 59	leaf-like cr
35	Dimethyltelluronium diiodide (*α*)	$C_2H_6I_2Te$	411 52	red cr

* All of the tri-arylborines form analogous addition-salts of the alkali metals.

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Cold water	Hot water	Alcohol, acids, etc.
1	.. .	76		i.	..	s. chl., bz., eth. acet.; sl. s. al.
2		12.5–14	112.5			.... .
3	0.62^{-57}	−156.4	31			....
4		67.3		i.		s. eth., chl., bz.; sl. s. al.
5		243–4			. .	0.065^{25} 95% al.
6		d.			. .	0.014^{25} 95% al.
7		40–50	215–6			s. eth., bz., chl.; sl s. al., ac. a.
8			127.5	i.	.	s. eth., chl., bz.; sl. s. al.
9	$.762^{25}$		152 8–3.2			
10	$.651^{15}$		26.5	. .	.	s. eth., i. conc. H_2SO_4
11						s. acetic anh. and chlorosulphonic acid
12		268–9				$.013^{25}$, $.041^{35}$ 95% al.
13		148	230			.... .
14		300–50 d		d.		d. al.; sl. s. bz., liq. NH_3
15		d.>210		d.		d. a., s. liq. NH_3
16		d.	d.	d	.	d. a., al.; s. liq. NH_3
17		d.		0.84	27	v. sl. s. al.
18				$16^{1.7}$	... .	sl. s. al.; s. CH_3OH
19		d.		d.	.	d. al.; i. eth., bz., chl.
20		expl. 175–180		s.	v.s.	.
21		$-2C_2H_5OH$, 200	d.	d.	d.	v. s. al.; i. NH_3
22		d.		d		d. al., eth.; s. diethylzinc; i. bz., lgr.
23		d.		s.		v s al., eth.; i lgr.
24		$-H_2O$ over H_2SO_4	exp.	v. s.		. ...
25		$-2H_2O$, 36; $-4H_2O$, 120	d.	5.97^{25}		sl. s. al.
26		$-H_2O$		v. s.	.	sl. s. h. al.
27			d.	d	d.	0.08^{18} eth.
28				d.		s. eth., bz., liq. NH_3
29	1.334^{40}		132–5			. ...
30			137–8	sl. s.		. . . .
31	.	sld. in liq. air	82, 94^{770}		.	.... .
32	..	142 d.			..	s. al., eth.
33	.	92		s	s.	s. al., eth.
34	.	134		... .	..... .	s. al., eth.
35	.	127 d.	... .	i.	v. sl. s.	s. chl., bz.

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Tellurium:			
1	Di-*p*-phenetyl ditelluride	$(C_2H_5OC_6H_4)_2Te_2$	497 53	or. brown need
2	Ditelluromethane	CH_2Te_2	269 25	dk. red amor. sld
3	Ethylmethyltellurophetone	$C_2H_5CTeCH_3$	183 71	dark yel. oil, 1.5055^{25}
	Thallium			
4	triethyl	$Tl(C_2H_5)_3$	291 57	yel. liq
	Tin:			
5	Amyltetrathioorthostannate (*n*)	$Sn(SC_5H_{11})_4$	531 50	
6	Amyltetrathioorthostannate (*tert*)	$[CH_3CH_2C(CH_3)_2S]_4Sn$	531 50	
7	Bromobenzenetetrathioorthostannate (*p*)	$Sn(SC_6H_4Br)_4$	870 97	
8	Butylbenzenetetrathioorthostannate (*p*)	$Sn(SC_6H_4C_4H_9)_4$	779.76	
9	Butyltetrathioorthostannate (*n*)	$Sn(SC_4H_9)_4$	475 39	
10	Butyltetrathioorthostannate (*sec*)	$Sn(SC_4H_9)_4$	475 39	
11	Carbomethoxyphenyltrichlorostannane (*o*)	$(CH_3OCOC_6H_4)SnCl_3$	360 21	
12	Chlorobenzenetetrathioorthostannate (*p*)	$Sn(SC_6H_4Cl)_4$	693 14	
13	Cyclohexyltetrathioorthostannate	$Sn(SC_6H_{11})_4$	579 54	
14	Di-*o*-anisyldichlorostannane	$(CH_3OC_6H_4)_2SnCl_2$	403 87	
15	Dibenzyldiethylstannane	$(C_6H_5{\cdot}CH_2)_2Sn(C_2H_5)_2$	359 07	liq
16	Dibenzylethylpropylstannane	$(C_6H_5{\cdot}CH_2)_2(C_2H_5)(C_3H_7)Sn$	373 10	liq
17	Dibenzyltin acetate	$(C_6H_5CH_2)_2Sn(OCOCH_3)_2$	419 04	col. need. f. al
18	Dibenzyltin dibromide	$(C_6H_5{\cdot}CH_2)_2SnBr_2$	460 79	col. need. f. pet
19	Dibenzyltin dichloride	$(C_6H_5{\cdot}CH_2)_2SnCl_2$	371 87	col. need. f. acet.-HCl
20	Dibenzyltin diiodide	$(C_6H_5{\cdot}CH_2)_2SnI_2$	554 79	col. lng. silky yel. need. f. pet. eth.
21	Dibutyltin dibromide	$(C_4H_9)_2SnBr_2$	392 76	sm. need
22	Dibutyltin dichloride	$(C_4H_9)_2SnCl_2$	303 84	need
23	Dichlorodi-*m*-tolyl stannane	$(CH_3C_6H_4)_2SnCl_2$	371 87	
24	Diethyldibromodipyridinetin	$(C_2H_5)_2SnBr_2{\cdot}(C_5H_5N)_2$	494.85	
25	Diethyldiisoamyltin	$(C_2H_5)_2Sn(C_5H_{11})_2$	319 10	
26	Diethyldiisobutyltin	$(C_2H_5)_2Sn(C_4H_9)_2$	291 05	
27	Diethyldiphenyltin	$(C_2H_5)_2(C_6H_5)_2Sn$	331 02	
28	Diethylisoamyltin bromide	$(C_2H_5)_2(C_5H_{11})SnBr$	327 88	
29	Diethylisoamyltin chloride	$(C_2H_5)_2(C_5H_{11})SnCl$	283 42	
30	Diethylisobutyltin bromide	$(C_2H_5)_2(C_4H_9)SnBr$	313 85	
31	Diethyl-*n*-propyltin bromide	$(C_2H_5)_2(C_3H_7)SnBr$	299 82	
32	Diethyl-*n*-propyltin chloride	$(C_2H_5)_2(C_3H_7)SnCl$	255 36	
33	Diethyl-*n*-propyltin fluoride	$(C_2H_5)_2(C_3H_7)SnF$	238 91	
34	Diethyltin	$Sn(C_2H_5)_2$	176 82	sl. yel. oily liq

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.666	108	d.>108			s. lgr.
2		d. 214		i.	i.	i.
3	1.8711		63–6			
4	$1.957\frac{23}{23}$	−63	192			
5			$162^{0.004}$			
6		44				
7		217				
8		106				
9			$136^{.001}$			
10			$111^{.001}$			
11		164				
12		189				
13		53–4				
14		113				
15	1.+	<20	$223–4^{20}$			s. org. solv.
16		>0	$220–5^{15}$			misc. all org. solv.
17		136–7				s. acet., chl., bz.
18		130				s. acet., al., eth., chl., CCl_4
19		163–4				s. acet., al., eth., chl., CCl_4, h. ac. a.
20		86–7				s. acet., al., eth., chl., CCl_4
21		20				
22		43				
23		39–40				
24		140				
25	1.0725^{19}		$131^{13.5}$			
26	1.1030		108.2^{13}			
27			$154–6^{4}$			
28	1.4881^{17}		137.5^{17}			
29	$1.2994^{19.9}$		125.5^{13}			
30	1.5108		122^{17}			
31	1.5910^{21}		112.2^{16}			
32	$1.3848^{15.7}$		108^{17}			
33		271				6.93^{31} meth. al.; 3.78^{31} al.; $.05^{31}$ bz.
34	1.654	<−12	150 d.	i.	i.	s. bz., eth., lgr., chl., CCl_4

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Tin:			
1	Diethyltin dibromide	$(C_2H_5)_2SnBr_2$	336 65	col. need
2	Diethyltin dichloride	$(C_2H_5)_2SnCl_2$	247 74	wh. need
3	Diethyltin difluoride	$(C_2H_5)_2SnF_2$	214 82	sq. pl. or long rhomb. tab. f. meth. al.
4	Diethyltin diiodide	$(C_2H_5)_2SnI_2$	430 66	wh. need
5	Diethyltin oxide	$(C_2H_5)_2SnO$	192 82	wh. powd
6	Diisoamyltin dibromide	$(C_5H_{11})_2SnBr_2$	420 81	
7	Diisoamyltin dichloride	$(C_5H_{11})_2SnCl_2$	331 89	
8	Diisoamyltin diiodide	$(C_5H_{11})_2SnI_2$	514 82	oily liq
9	Diisobutyltin diiodide.	$(C_4H_9)SnI_2$	429 65	
10	Diisopropyltin dibromide	$(C_3H_7)_2SnBr_2$	364 71	pale yel hyg. cr
11	Diisopropyltin dichloride	$(C_3H_7)_2SnCl_2$	275 79	col. transp cr
12	Diisopropyltin oxide	$(C_3H_7)_2SnO$	220 87	
13	Dimethyldibromodipyridinetin	$(CH_3)_2SnBr_2(C_5H_5N)_2$	466 80	
14	Dimethyldichlorodipyridinetin	$(CH_3)_2SnCl_2(C_5H_5N)_2$	377 88	
15	Dimethyldiethyltin	$(CH_3)_2Sn(C_2H_5)_2$	206 89	col. liq
16	Dimethyldiisobutyltin	$(CH_3)_2Sn(C_4H_9)_2$	262 99	
17	Dimethylethylpropyltin	$(CH_3)_2C_2H_5C_3H_7Sn$	220 92	
18	Dimethylethyltin iodide	$(CH_3)_2C_2H_5SnI$	304 75	1 5705[18]
19	Dimethyltin	$[(CH_3)_2Sn]_x$	$(148.77)_x$	yel. sld
20	Dimethyltin dibromide	$(CH_3)_2SnBr_2$	308 60	col. pr
21	Dimethyltin dichloride	$(CH_3)_2SnCl_2$	219 68	
22	Dimethyltin difluoride	$(CH_3)_2SnF_2$	186 77	wh. fine pl
23	Dimethyltin diiodide	$(CH_3)_2SnI_2$	402 61	rhomb wh
24	Dimethyltin oxide	$(CH_3)_2SnO$	164 77	wh. powd
25	Dimethyltin sulfide.	$(CH_3)_2SnS$	180 83	
26	Di-α-naphthyltin	$Sn(C_{10}H_7)_2$	373 01	
27	Di (phenylthiol) diphenylstannane	$Sn(C_6H_5)_2(SC_6H_5)_2$	491 22	
28	Diphenyltin	$Sn(C_6H_5)_2$	272 90	yel. amor. powd
29	Diphenyltin dibromide	$(C_6H_5)_2SnBr_2$	432 73	col. cr
30	Diphenyltin dichloride	$(C_6H_5)_2SnCl_2$	343 82	col. cr
31	Diphenyltin difluoride	$(C_6H_5)_2SnF_2$	310 90	
32	Diphenyltin diiodide	$(C_6H_5)_2SnI_2$	526 74	col. cr
33	Diphenyltin hydroxychloride	$(C_6H_5)_2Sn(OH)Cl$	325 37	amor wh. powd
34	Diphenyltin oxide	$(C_6H_5)_2SnO$	288 90	col. amor. powd
35	Di-*n*-propyldibromodipyridinetin	$(C_3H_7)_2SnBr_2(C_5H_5N)_2$	522 90	
36	Dipropyltin dibromide	$(C_3H_7)_2SnBr_2$	364 71	col. need
37	Dipropyltin dichloride	$(C_3H_7)_2SnCl_2$	275 79	col. cr
38	Dipropyltin difluoride	$(C_3H_7)_2SnF_2$	242 87	leaf
39	Dipropyltin diiodide	$(C_3H_7)_2SnI_2$	458 71	col. oily liq
40	Di-*m*-tolylstannane	$(CH_3C_6H_4)_2SnO$	316 95	wh. amor. infus
41	Di-*m*-tolyl thiostannane	$(CH_3C_6H_4)_2SnS$	333 01	
42	Di-*p*-tolyltin	$(CH_3C_6H_4)_2Sn$	300 95	or.-yel. amor. powd
43	Di-*o*-tolyltin dichloride	$(CH_3C_6H_4)_2SnCl_2$	371 87	
44	Di-*p*-tolyltin dichloride	$(CH_3C_6H_4)_2SnCl_2$	371 87	
45	Ditriphenylstannylmethane	$[(C_6H_5)_3Sn]_2CH_2$	714 03	wh. cr. sld
46	Di-*p*-xylyltin	$[(CH_3)_2C_6H_3]_2Sn$	329 01	
47	Dodecyltetrathioorthostannate (*n*)	$Sn(SC_{12}H_{25})_4$	924 23	

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.068^{74}	63	232–3	s.	s.	s. eth., org. solv.
2		84–5	220	s.	s.	s. HCl, org. solv.
3		229				$.45^{31}$ al.; 2.64^{31} meth. al.; $.047^{31}$ bz.
4		44.5–5.0	240–5 d.	v. sl. s.	sl. s.	s. org. solv.
5		infus.		i.	i.	s. HCl, dil. a., conc. alk.; i. org. solv.
6		−25 to −24				
7		28				
8			$202–5^{8}$			
9			290–5			
10		54		d.	d.	i. org. solv.
11		80–4		s.	s.	s. al., h. bz., glac. ac. a.
12		d.		i.	i.	s. h. HCl; i. org. solv., alk.
13		172				
14		163				
15	1.2319^{19}	<−13	144–6	i.	i.	s. org. solv.
16	$1.1179^{20.1}$		$85^{16.5}$			
17	$1.2014\frac{20}{20}$		149–51			
18	$2.0264\frac{20}{20}$		$77–8^{11}$; $185–7^{718}$			
19				i.	i.	i. org. solv.
20		74–6	208–13	s.	s.	s. org. solv.
21		90 (107)	188–90	s.		s. org. solv.
22			d.<360	$4.66^{20.7}$		$.08^{31}$ al., 33^{31} meth. al.
23	2.872	43 (80)	228	sl. s.	s.	s. org. solv.
24		infus.	d.	i.	i.	s. a., NaOH; i. org. solv., NH_4OH
25		148				
26		200	d 255			
27		65–65 5				
28		225.7, (126–30)		i.	i.	s. chl., bz., eth.; i. abs. al.
29		38	230^{42}			s. al., eth.
30		42	333–7 d	v. sl. s., d		s. al., eth., lgr.
31		360				
32		71–72	$176–82^{2}$	i.	i.	s. org. solv.
33		187		i.	i.	s. conc. a.; i. org. solv.
34		infus.		i.	i.	s. conc. a.; i. org. solv.
35		128				
36		49		v. sl. s.		s. org. solv.
37		81		v. sl. s.		s. org. solv.
38		205		0.22^{32}		$.93^{32}$ al., 1.91^{32} meth. al.
39		<−15	270–3	i.	i.	s. org. solv.
40				i.	i.	s. min. a.; i. org. solv.
41		121.5–2				v. s. chl., bz., eth. acetate, pyr., eth.; s. HCl
42		111.5	d.<245			s. bz.
43		49–50				
44		49–50				
45		104.5				v. s. bz., eth., chl., s. h. pet. eth.
46		157	d. 240			
47		35.5				

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Tin:			
1	Ethylchlorostannic acid	$H_2SnC_2H_5Cl_5$	327.06	col. deliq. pr
2	Ethyldiisoamyltin bromide	$(C_2H_5)(C_5H_{11})_2SnBr$	369 95	
3	Ethyldiisobutyltin bromide	$(C_2H_5)(C_4H_9)_2SnBr$	341.90	
4	Ethylmethylpropyltin iodide	$CH_3C_2H_5C_3H_7SnI$	332 80	1 5548[17]
5	Ethyl-*n*-propyldiiso-amyltin	$(C_2H_5)(C_3H_7)Sn(C_5H_{11})_2$	333.13	
6	Ethylpropyltin dichloride	$(C_2H_5)(C_3H_7)SnCl_2$	261.76	need. f. lt. pet
7	Ethyl stannic acid	$C_2H_5 \cdot SnO \cdot OH$	180 77	wh. amor. gel or powd
8	Ethyltetrathioortho-stannate	$Sn(SC_2H_5)_4$	363 18	
9	Ethyltin tribromide	$C_2H_5SnBr_3$	387 51	col. feath. cr
10	Ethyltin triiodide	$C_2H_5SnI_3$	528.52	
11	Ethyltri-*n*-butyltin	$C_2H_5(C_4H_9)_3Sn$	319 10	1 4732
12	Ethyltri-*n*-propyltin	$C_2H_5(C_3H_7)_3Sn$	277 02	
13	Hexadecyltetrathio-orthostannate (*n*)	$Sn(SC_{16}H_{33})_4$	1148 65	
14	Hexaethyl distannane	$[Sn(C_2H_5)_3]_2$	411 76	
15	Hexaethylditin	$[(C_2H_5)_3Sn]_2$	411 76	liq
16	Hexaphenylditin	$[(C_6H_5)_3Sn]_2$	700 00	
17	Hexa-*p*-tolylditin	$[(C_6H_4CH_3)_3Sn]_2$	784 16	flat tabl. f. bz
18	Hexa-*p*-xylylditin	$[((CH_3)_2C_6H_3)_3Sn]_2$	868 32	flat rhomb. tabl. f. bz.-al
19	Isopropylstannic acid	$C_3H_7SnO \cdot OH$	194 79	wh. amor
20	Isopropyltetrathio-orthostannate	$Sn(SC_3H_7)_4$	419 29	
21	Isopropyltin tribromide	$C_3H_7SnBr_3$	401 53	pa. yel. deliq., pr
22	Isopropyltin trichloride	$C_3H_7SnCl_3$	268 16	
23	Methylstannic acid	$(CH_3)SnOOH$	166 74	wh. amor. powd
24	Methyltetrathioortho-stannate	$Sn(SCH_3)_4$	307 08	
25	Methyltin tribromide	CH_3SnBr_3	373 48	wh. need
26	Methyltin trichloride	CH_3SnCl_3	240 11	col. cr
27	Methyltin triiodide	CH_3SnI_3	514 49	lt. yel. need
28	Methyltribromodipy-ridinetin	$CH_3SnBr_3(C_5H_5N)_2$	531 68	
29	Methyltri-*n*-butyltin	$CH_3(C_4H_9)_3Sn$	305 07	1 4735
30	Methyltri-*n*-propyltin	$CH_3(C_3H_7)_3Sn$	262.99	
31	Phenylbenzyltin dichloride	$(C_6H_5)(C_6H_5CH_2)SnCl_2$	357 84	col. need. f. dil. HCl
32	Phenyltetrathioortho-stannate	$Sn(SC_6H_5)_4$	555 34	
33	Phenyltin tribromide	$C_6H_5SnBr_3$	435 55	
34	Phenyltin trichloride	$C_6H_5SnCl_3$	302 17	
35	Phenyltribenzyltin	$(C_6H_5)Sn(C_6H_5CH_2)_3$	469 18	liq
36	Propyltetrathioortho-stannate (*n*)	$Sn(SC_3H_7)_4$	419 29	
37	Propyltin triiodide	$C_3H_7SnI_3$	542 55	

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1		d.		d.		
2	1.3650		154–5^{16}			
3	1.4089$^{19.5}$		130.6^{13}			
4	$1.8182\frac{20}{20}$		108–11^{11}; 226–30^{720} sl. d.			
5	1.0654$^{21.9}$		141^{17}			
6		57–8		s.		s. eth., al.
7		d. below red	heat	i.	i.	s. dil. min. a., KOH; i. al., eth., chl., xylene
8			105$^{.001}$			
9		310		s.		s. al.
10			181–4^{19}			
11	1.0783		129^{10}			
12			101^{10}			
13		53–54				
14			160^{23}			
15	1.412^{0}		d. 270			
16		232.5	d.<280			.029 eth.; 18.08 chl.; 7.82 bz.
17		143.5	d. 335			sl. s. bz., eth.; v. sl. s. abs. al.
18		192.5	d. 368			21$^{30.4}$ bz.
19		d.		i.		s. dil. min. a., KOH; i. org. solv.
20			92$^{.001}$			
21		112				s. glac. ac. a.; sl. s. h. bz., chl.; i. dry eth.
22			75^{16}			
23		infus.		i.	i.	s. a., alk.; i. org. solv.
24		31	81$^{.001}$			
25		53–5	210–11^{746}	s.		s. eth., al., bz., lgr., hyd. by alk.
26		43		s.		hyd. by alk.; s. org. solv.
27		86.5		s	s.	s. eth., al., bz., chl., meth. al.
28		203				
29	$1.0898\frac{20}{4}$		121^{10}			
30			93^{10}			
31		83–4	80–100			
32		67				
33			182–3^{20}			
34			142–3^{25}	s.		
35			290^{5}			s. all ord. org. solv. except al.
36			123$^{.001}$			
37			d. 200^{15}			

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Tin:			
1	Propyltri-*n*-amyltin (*n*)	$C_3H_7(C_5H_{11})_3Sn$	375 20	1 4732
2	Stannic bisacetylacetone dibromide	$(C_5H_7O_2)_2SnBr_2$	476 75	col. six sided cr.
3	Stannic bisacetylacetone dichloride	$(C_5H_7O_2)_2SnCl_2$	387 83	col. six sided cr.
4	Stannic bisbenzoylacetone dibromide	$(C_{10}H_{10}O_2)_2SnBr_2$	614 99	pa. yel. powd
5	Stannic bisdibenzoylmethane dibromide	$(C_{15}H_{10}O_2)_2SnBr_2$	722 99	sulfur yel. cr
6	Stannic bis-3-ethylacetylacetone dibromide	$(C_7H_{11}O_2)_2SnBr_2$	532 85	col. six sided pr
7	Tetra-*dl*-amyltin	$Sn(C_5H_{11})_4$	403 26	1 4730
8	Tetra-*n*-amyltin	$Sn(C_5H_{11})_4$	403.26	col. stable liq., 1.4720
9	Tetraaquastannic bisacetylacetone stannibromide	$(C_5H_7O_2)_2Sn(OH_2)_4SnBr_6$	987 17	col. tab. pr
10	Tetrabenzyltin	$Sn(C_6H_5CH_2)_4$	483 21	col. pr. f. lt. pet
11	Tetra-*n*-butyltin	$Sn(C_4H_9)_4$	347.15	col. stable liq., 1.4730
12	Tetracyclohexyltin	$Sn(C_6H_{11})_4$	451.30	wh. micr. grains
13	Tetraethyltin	$Sn(C_2H_5)_4$	234 94	col. liq
14	Tetra-*n*-heptyltin	$Sn(C_7H_{15})_4$	515 47	1 4698
15	Tetra-*n*-hexyltin	$Sn(C_6H_{13})_4$	459 36	1 4706
16	Tetraisoamyltin	$Sn(C_5H_{11})_4$	403 26	liq
17	Tetraisobutyltin	$Sn(C_4H_9)_4$	347 15	col. liq
18	Tetramethyltin	$Sn(CH_3)_4$	178.84	col. liq
19	Tetra-*n*-octyltin	$Sn(C_8H_{17})_4$	571 57	1 4691
20	Tetraphenyltin	$Sn(C_6H_5)_4$	427 10	tetr. col. f. xylene
21	Tetrapropyltin	$Sn(C_3H_7)_4$	291 05	col. liq
22	Tetra-*o*-tolyltin	$Sn(C_6H_4CH_3)_4$	483.21	wh. cr. powd
23	Tetra-*m*-tolyltin	$Sn(C_6H_4CH_3)_4$	483 21	col. need
24	Tetra-*p*-tolyltin	$Sn(C_6H_4CH_3)_4$	483.21	col. need
25	Tetra-*m*-xylyltin	$[(CH_3)_2C_6H_3]_4Sn$	539 31	rhomb. need. f. bz -al
26	Tetra-*p*-xylyltin	$[(CH_3)_2C_6H_3]_4Sn$	539 31	wh. quad. pr.
27	Tolylstannonic acid (*o*)	$CH_3C_6H_4SnO_2H$	242 83	amor. powd
28	Tolylstannonic acid (*m*)	$CH_3C_6H_4SnO_2H$	242 83	
29	Tolyltetrathioorthostannate (*p*)	$Sn(SCH_3C_6H_4)_4$	611 45	
30	Tolyltin trichloride (*o*)	$CH_3C_6H_4SnCl_3$	316 20	
31	Tolyltin trichloride (*p*)	$CH_3C_6H_4SnCl_3$	316 20	
32	Tolyltrichlorostannane (*m*)	$CH_3C_6H_4SnCl_3$	316.20	col. liq
33	Tri-*n*-amyltin bromide	$(C_5H_{11})_3SnBr$	412 03	1 4963
34	Tribenzylethyltin	$(C_6H_5CH_2)_3(C_2H_5)Sn$	421 14	col. tabl. f. al.-lt. pet
35	Tribenzyltin chloride	$(C_6H_5CH_2)_3SnCl$	427.54	wh. need
36	Tribenzyltin hydroxide	$(C_6H_5CH_2)_3SnOH$	409 09	rhomb., col. tabl
37	Tribenzyltin iodide	$(C_6H_5CH_2)_3SnI$	519.00	need. like pr. f. glac. ac. a
38	Tri-*n*-butyltin bromide	$(C_4H_9)_3SnBr$	369 95	1 5000
39	Triethyl-*n*-amyltin	$(C_2H_5)_3C_5H_{11}Sn$	277.02	

METAL-ORGANIC COMPOUNDS (Continued)

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.0368		163^{10}			
2			187			s. bz., chl., acet.; sl. s. eth., CCl_4
3			202–3	s.		s. bz., acet.
4			213–4			sl. s. org. solv.
5			276–8	i.		sl. s. org. solv.
6		164–6				s. c. chl., bz.; sl. s. lt. pet.
7	1.0222		174^{10}			
8	1.0206		181^{10}			
9		105–7				s. bz.
10		42–3		i.	i.	s. common org. solv.; sl. s. lt. pet.
11	1.0572		145^{10}			
12		263–4		i.	i.	6.25^{30} bz.; $.086^{30}$ al.; s. chl. CS_2
13	1.187^{23}	−112	181	i.	i.	s. org. solv.
14	0.9748		239^{10}			
15	0.9959		209^{10}			
16	$1.035^{19.6}$		188^{24}			
17	1.054^{23}	−13	267; $143^{16.5}$	i.	i.	s. org. solv.
18	1.314^{0}		78	i.	i.	s. org. solv.
19	0.9605		268^{10}			
20	1.490^{0}	226	>420	i.	i.	s. h. bz., pyr., CCl_4, chl., ac. a.; sl. s. al.
21	$1.1065^{20.2}$		222–5	i.	i.	s. org. solv.
22		158–9 (215)		i.	i.	s. bz., eth.; i. al.
23		128.5		i.	i.	s. bz., h. eth., h. al.
24		230–3		i.	i.	s. bz., chl., CS_2, pyr.; sl. s. al., eth.
25		219.5	d. 360			$.314^{30}$ al.; 5.28^{30} eth.; 35.1^{30} bz.; 43.2^{30} chl.
26		272–3	d. 360	i.	i.	$.015^{30}$ al.; 1.73^{30} bz.; 2.80^{30} chl., $.29^{30}$ eth.; $.017^{30}$ meth. al.
27		d. 295				
28			d. 295	i.	i.	s. c. meth. al., al., eth., chl., eth. acet., pyr., a. and bases; i. pet. eth.
29		100				
30	1.7619		$154–8^{20}$			
31	1.7522		$156–7^{23}$	sl. d.		
32	1.7516	<−20	$150–1^{28}$			
33	1.2678					
34		31–2				s. eth., bz., chl.; sl. s. al.
35		142–4	d.	i.	i.	s. ac. a., acet., bz., eth., chl., pyr., i. al.
36		117–21				s. h. al., CS_2, bz.; sl. s. eth., lgr.; i. KOH
37		102–3				
38	1.3365					
39			102^{10}			

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Tin:			
1	Triethyl (*p*-dimethylaminophenyl) stannane	$(C_2H_5)_3(CH_3)_2NC_6H_4Sn$	326.05	1.5610^{22}
2	Triethyl-*o*-hydroxyphenyl stannane	$(C_2H_5)_3OHC_6H_4Sn$	298.98	1.5377^{25}
3	Triethylisoamyltin	$(C_2H_5)_3Sn(C_5H_{11})$	277.02	
4	Triethylisobutyltin	$(C_2H_5)_3Sn(C_4H_9)$	262.99	
5	Triethylphenyltin	$(C_2H_5)_3(C_6H_5)Sn$	282.98	col. liq.
6	Triethyl-*n*-propyltin	$(C_2H_5)_3Sn(C_3H_7)$	248.97	
7	Triethyltin	$Sn(C_2H_5)_3$	205.88	col. liq
8	Triethyltin bromide	$(C_2H_5)_3SnBr$	285.80	col. liq
9	Triethyltin chloride	$(C_2H_5)_3SnCl$	241.34	col. liq
10	Triethyltin ethoxide	$(C_2H_5)_3Sn(OC_2H_5)$	250.94	col. liq
11	Triethyltin hydroxide	$(C_2H_5)_3SnOH$	222.89	col. cr
12	Triethyltin iodide	$(C_2H_5)_3SnI$	332.80	col. liq
13	Triisoamyltin bromide	$(C_5H_{11})_3SnBr$	412.03	
14	Triisoamyltin chloride	$(C_5H_{11})_3SnCl$	367.57	
15	Triisoamyltin fluoride	$(C_5H_{11})_3SnF$	351.12	need
16	Triisoamyltin iodide	$(C_5H_{11})_3SnI$	459.04	
17	Triisobutylethyltin	$(C_4H_9)_3Sn(C_2H_5)$	319.10	
18	Triisobutylisoamyltin	$(C_4H_9)_3Sn(C_5H_{11})$	361.18	
19	Triisobutyltin bromide	$(C_4H_9)_3SnBr$	369.95	
20	Triisobutyltin chloride	$(C_4H_9)_3SnCl$	325.50	
21	Triisobutyltin fluoride	$(C_4H_9)_3SnF$	309.04	fine long pr
22	Triisopropyltin iodide	$(C_4H_9)_3SnI$	416.96	col. liq
23	Triisopropyltin bromide	$(C_3H_7)_3SnBr$	327.88	
24	Triisopropyltin iodide	$(C_3H_7)_3SnI$	374.88	
25	Trimethylethyltin	$(CH_3)_3(C_2H_5)Sn$	192.86	col. liq.
26	Trimethyltin	$Sn(CH_3)_3$	163.80	col. liq
27	Trimethyltin bromide	$(CH_3)_3SnBr$	243.72	col. cr. or liq
28	Trimethyltin chloride	$(CH_3)_3SnCl$	199.26	col. cr
29	Trimethyltin fluoride	$(CH_3)_3SnF$	182.80	wh. short. thick rect. pr
30	Trimethyltin hydride	$(CH_3)_3SnH$	164.81	col. oily liq
31	Trimethyltin hydroxide	$(CH_3)_3SnOH$	180.81	col. pr
32	Trimethyltin iodide	$(CH_3)_3SnI$	290.72	col. liq.
33	Trimethyltin oxide	$[(CH_3)_3Sn]_2O$	343.61	wh. amor. powd
34	Trimethyltin sulfide	$[(CH_3)_3Sn]_2S$	359.67	lt. yel. oil
35	Triphenylbenzyltin	$(C_6H_5)_3Sn(C_6H_5CH_2)$	441.13	col. pl. f. al
36	Triphenylethyltin	$(C_6H_5)_3SnC_2H_5$	379.06	wh. pr. f. al
37	Triphenylmethyltin	$(C_6H_5)_3SnCH_3$	365.04	col. tetr. f. eth
38	Triphenyl-α-naphthyltin	$(C_6H_5)_3Sn(C_{10}H_7)$	477.16	col. pr
39	Triphenyltin	$Sn(C_6H_5)_3$	350.00	wh. powd
40	Triphenyltin bromide	$(C_6H_5)_3SnBr$	429.92	col. cr
41	Triphenyltin chloride	$(C_6H_5)_3SnCl$	385.46	col. cr.
42	Triphenyltin fluoride	$(C_6H_5)_3SnF$	369.00	fine pr
43	Triphenyltin hydroxide	$(C_6H_5)_3SnOH$	367.01	
44	Triphenyltin iodide	$(C_6H_5)_3SnI$	476.92	4-sided monocl. wh
45	Triphenyl-*p*-tolyltin	$(C_6H_5)_3Sn(C_7H_7)$	441.13	need. f. eth.
46	Triphenyl-*p*-xylyltin	$(C_6H_5)_3Sn[C_6H_3(CH_3)_2]$	560.31	col. lng. hex. sheets f. al
47	Tri-*n*-propyl-*n*-butyl tin	$(C_3H_7)_3C_4H_9Sn$	305.07	
48	Tri-*n*-propylethyltin	$(C_3H_7)_3Sn(C_2H_5)$	277.02	
49	Tri-*n*-propylisobutyltin	$(C_3H_7)_3Sn(C_4H_9)$	305.07	
50	Tripropyltin chloride	$(C_3H_7)_3SnCl$	283.42	col. liq
51	Tri-*n*-propyltin chloride	$(C_3H_7)_3SnCl$	283.42	

No	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Cold water	Hot water	Alcohol, acids, etc.
1	1.2425	..	$172\text{-}3^{3}$	.		......
2	1.3229^{25}	......	$197\text{-}200^{3}$	...	.	....
3	$1.1203^{20.1}$	.	$111^{18.5}$	...	.	...
4	$1.139^{20.3}$	. .	96.5^{17}	...	.	...
5	1.2639	.	254	i.	i.	s. al., eth., org. solv.
6	$1.1680^{20.6}$	.	82^{13}	...	.	...
7	1.3774	<−75	161^{23}	i.	i.	s. al., org. solv.
8	1.630	−13.5	223-4	v. sl. s.	.	s. org. solv.
9	1.428^{8}	10 (15.5)	208-10	i.		s. org. solv.
10	1.2634	.....	190	d.		s. org. solv.
11	.....	43	271	s.	s.	s. org. solv.
12	1.833	−34.5	225 (231)	v. sl. s.		s. org. solv.
13	$1.2613^{20.7}$	21	177^{15}			.
14	$1.1290^{34.2}$	−30.2	174^{13}			...
15	....	288	..	.		1.03^{31} al.; $.967^{31}$ bz.; 1.22^{31} meth. al.
16	$1.3777^{28.5}$	−22	182^{13}			....
17	1.0779^{21}		125^{16}	.		...
18	$1.0356^{28.8}$		$152.9^{16.5}$			..
19	1.3523	−26.5	148^{13}		...	.
20	$1.1290^{34.2}$	+30.2	174^{13}		..	
21	....	244	....	.	....	$.414^{32}$ al.; 614^{32} meth. al.; $.1^{32}$ bz.
22	$1.378^{28.5}$	−22	284-6		...	s. eth., org. solv.
23	$1.4263^{25.2}$	−49	133^{12}		..	s. org. solv.
24	$1.4378^{22.2}$	...	151^{13}		....	....
25	.	......	108.2	i.	i.	s. org. solv.
26	1.570^{25}	23	182	i.	i.	s. org. solv.
27		27	165	s.	s.	s. org. solv.
28		37		s.	s.	s. org. solv.
29		360 seal. tube	d.<375		.....	2.45^{31} meth. al.; 1.08^{31} al.; 0.05^{31} bz.
30		...	60	v. sl. s	....	s. org. solv.
31		118 d.	subl. > 80	s.	s.	s. a., al., bz., chl., CCl_4, alk.
32	2.1432	3.4	170	v. sl s	.	s. bz., al., eth., acet.
33		d.		i.	i.	s. a., alk.; i. org. solv.
34	1.649^{25}	6	233.5	i.	.	s. org. solv., HNO_3
35		90	250^{3}			s. org. solv. except al.
36	1.2953^{82}	56	.			......
37	$1.3113^{83.85}$	60-1				s. bz., chl., eth.
38		125				s. bz., chl., eth.
39		232.5	d. 280	i.	i.	$.079^{30}$ al.; 7.82^{30} bz.; $.92^{30}$ eth.; 18.1^{30} chl.
40	.	120.5	$249^{13.5}$	i.	i.	s. al., eth., org. solv.
41	.	106	$240^{13.5}$	i.	i.	s. org. solv.
42		357	.	sl. s.		sl. s. c. al., eth.
43		118				.....
44		121	$253^{13.5}$	i.	i.	s. org. solv.
45		124				s. bz., chl., eth.
46	....	100.5				s. bz., eth., chl.
47	....		121^{10}			.
48	$1.1225^{21.8}$		$117.5^{23.3}$			..
49	$1.0841^{24.1}$		128^{18}			.
50	1.2678^{28}	−23.5				s. org. solv.
51	1.2678^{28}	−23.5	123^{13}			...

No.	Name	Formula	Mol. wt.	Crystalline form, color and index of refraction
	Tin:			
1	Tri-*n*-propyltin fluoride	$(C_3H_7)_3SnF$	266.96	flat pr.
2	Tri-*n*-propyltin iodide	$(C_3H_7)_3SnI$	374.88	col. liq.
3	Tri-*o*-tolyltin bromide	$(C_6H_4CH_3)_3SnBr$	472.00	rhomb. tabl. f. al
4	Tri-*p*-tolyltin bromide	$(C_6H_4CH_3)_3SnBr$	472.00	rhbdr. f. al
5	Tri-*o*-tolyltin chloride	$(C_6H_4CH_3)_3SnCl$	427 54	short. thick pr. f. al
6	Tri-*m*-tolyltin chloride	$(CH_3C_6H_4)_3SnCl$	427 54	
7	Tri-*p*-tolyltin chloride	$(C_6H_4CH_3)_3SnCl$	427.54	rhomb. pl. f. al
8	Tri-*p*-tolyltin fluoride	$(C_6H_4CH_3)_3SnF$	411.08	hairlike felted need
9	Tri-*p*-tolyltin hydroxide	$(CH_3C_6H_4)_3SnOH$	409.09	
10	Tri-*o*-tolyltin iodide	$(C_6H_4CH_3)_3SnI$	519.00	rhomb. cr. fr. al. eth
11	Tri-*p*-tolyltin iodide	$(C_6H_4CH_3)_3SnI$	519.00	rhomb. pl. fr. eth.-al
12	Tritriphenylstannylmethane	$[(C_6H_5)_3Sn]_3CH$	1063 02	wh. cr. sld
13	Tri-*p*-xylyltin bromide	$[(CH_3)_2C_6H_3]_3SnBr$	514 07	lng. hex. cr. f. al
14	Tri-*p*-xylyltin chloride	$[(CH_3)_2C_6H_3]_3SnCl$	469.62	6-cornered col. f. al
15	Tri-*m*-xylyltin fluoride	$[(CH_3)_2C_6H_3]_3SnF$	453 16	fine felted need
16	Tri-*p*-xylyltin fluoride	$[(CH_3)_2C_6H_3]_3SnF$	453 16	fine lng. need
17	Tri-*p*-xylyltin iodide	$[(CH_3)_2C_6H_3]_3SnI$	561.08	hex. tabl. f. al
	Zinc:			
18	Di-*n*-butylzinc	$Zn(CH_2CH_2CH_2CH_3)_2$	179 61	liq
19	Diethylzinc	$Zn(C_2H_5)_2$	123 50	col. liq. ign. in air or Cl
20	Dimethylzinc	$Zn(CH_3)_2$	95 45	col. liq
21	Diphenylzinc	$Zn(C_6H_5)_2$	219.58	wh. cr
22	Di-*n*-propylzinc	$Zn(CH_2CH_2CH_3)_2$	151 55	liq
23	Di-*o*-tolylzinc	$Zn(C_6H_4CH_3)_2$	247 63	wh. cr

No.	Sp. gr. or density	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
				Cold water	Hot water	Alcohol, acids, etc.
1		275				4.26^{31} meth. al.; 2.73^{31} al.; 0.118^{31} bz.
2	1.692^{16}	−53	260–2; 141^{13}			s. org. solv.
3		99.5				s. bz., eth.; sl. s. al.
4		98.5				s. bz., eth.; sl. s. al.
5		99.5				s. bz., eth.; sl. s. al.
6		108				
7		97.5				sl. s. al., bz., eth.
8		305				s. al.
9		108–9				
10		119.5				s. bz., eth.; sl. s. al.
11		120.5				s. bz.-eth.; sl. s. al.
12		128		i.	i.	v. s. bz., eth., chl.; s. h. pet. eth.; sl. s. c. pet. eth., al.
13		151				s. bz., chl., eth.; i. c. al.
14		141.5				s. bz., chl., eth.; i. c. al.
15		205				s. bz., eth., al.
16		247				sl. s. bz., h. eth., al.
17		159.5				s. bz., chl., eth.; i. c. al.
18			$81–2^{9}$	d.		
19	1.182^{18}		118	d.		
20	$1.386^{10.5}$	−42.2	46	d.		d. al., a.; s. eth.
21		107		d.		s. xylene
22			146; $39–40^{9}$	d.		
23		207–10				s. xylene; v. sl. s. pet. eth.

PHYSICAL CONSTANTS OF ORGANIC COMPOUNDS

The naming and arrangement of compounds, the preparation of the abridged form of the International Union Rules for the Naming of Organic Compounds and the Prefix Names of Organic Radicals have been in charge of

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INTERNATIONAL UNION RULES FOR THE NAMING OF ORGANIC COMPOUNDS

Editor's Note.—These rules are taken from the "Definitive Report of the Commission on the Reform of the Nomenclature of Organic Chemistry," which was unanimously adopted by the Commission and by the Council of the International Union of Chemistry at Liége in 1930. A translation of the report, with comments, appeared in the *Journal of the American Chemical Society*, **55**, 3905–25 (1933), and the reader is referred there for the full text and more extended comments. The comments here given in fine type are the editor's. A. M. P.

I. General

1. As few changes as possible will be made in terminology universally adopted.

2. For the present, only the nomenclature of compounds of known constitution will be dealt with; the question of substances of imperfectly known constitution is postponed.

3. The precise form of words, endings, etc., prescribed in the rules should be adapted to the genius of each language by the subcommittees.

II. Hydrocarbons

4. The ending *ane* is adopted for saturated hydrocarbons. Open-chain hydrocarbons will have the generic name *alkanes*.

5. The present names of the first four normal saturated hydrocarbons (methane, ethane, propane, butane) are retained. Names derived from the Greek or Latin numerals will be used for those having more than four atoms of carbon.

As the names in this series are also used in forming names of unsaturated hydrocarbons, of alcohols, aldehydes, acids, etc. a list of them is here given, with the numbers of carbon atoms:

1	Methane	27	Heptacosane
2	Ethane	28	Octacosane
3	Propane	29	Nonacosane
4	Butane	30	Triacontane
5	Pentane	31	Hentriacontane
6	Hexane	32	Dotriacontane
7	Heptane	33	Tritriacontane
8	Octane	34	Tetratriacontane
9	Nonane	35	Pentatriacontane
10	Decane	36	Hexatriacontane
11	Hendecane (Undecane)	37	Heptatriacontane
12	Dodecane	38	Octatriacontane
13	Tridecane	39	Nonatriacontane
14	Tetradecane	40	Tetracontane
15	Pentadecane	41	Hentetracontane
16	Hexadecane	42	Dotetracontane
17	Heptadecane	43	Tritetracontane
18	Octadecane	44	Tetratetracontane
19	Nonadecane	45	Pentatetracontane
20	Eicosane	46	Hexatetracontane
21	Heneicosane	47	Heptatetracontane
22	Docosane	48	Octatetracontane
23	Tricosane	49	Nonatetracontane
24	Tetracosane	50	Pentacontane
25	Pentacosane	51	Henpentacontane
26	Hexacosane	52	Dopentacontane
		53	Tripentacontane

54 Tetrapentacontane
55 Pentapentacontane
56 Hexapentacontane
57 Heptapentacontane
58 Octapentacontane
59 Nonapentacontane
60 Hexacontane

6. Branched-chain hydrocarbons are regarded as derivatives of the normal hydrocarbons; their names will be referred to the longest normal chain present in the formula by adding to it the designations of the side chains. In case of ambiguity, or if a simpler name would result, that chain which admits of the maximum of substitutions will be selected as the fundamental chain.

A simple example is 2-methylbutane, $CH_3CH(CH_3)CH_2CH_3$. The principle of "maximum of substitutions" may be illustrated as follows: In the compound

$$\begin{array}{l} CH_3CH_2CH_2CH_2CHCH_2CH_2CH_2CH_3 \\ | \\ CH(CH_3)CH(CH_3)CH_3 \end{array}$$

the longest straight chain contains nine carbon atoms, which would lead to the name 5-(1, 2-dimethylpropyl)nonane; the number of substitutions in the main chain is only one, but the radical is a complicated one. By selecting a chain of eight we get three substitutions of simpler radicals and arrive at the name 4-butyl-2,3-dimethyloctane. Rules 6 and 7 apply to saturated hydrocarbons only.

7. In case there are several side chains, the order in which such chains are named will correspond to the order of their complexity. The chain having the greatest number of secondary and tertiary atoms will be considered the most complex. The alphabetic order may also be followed in such cases.

Two possible orders to be followed in arranging the names of substituting radicals in a compound are here referred to. In the "order of complexity" the radical of lowest weight comes first, then that of next lowest weight, and so on; of those having the same weight the least branched comes first and the most branched last, thus: methyl, ethyl, propyl, isopropyl, butyl, isobutyl, etc. The "alphabetic order" would of course be: butyl, ethyl, isobutyl, isopropyl, methyl, propyl (or else butyl, *iso*butyl, ethyl, methyl, propyl, *iso*propyl). (The alphabetic order is followed in the Organic Table in this handbook.)

8. In the names of open-chain unsaturated hydrocarbons having one double bond the ending *ane* of the corresponding saturated hydrocarbon will be replaced by the ending *ene;* if there are two double bonds, the ending will be *diene,* etc. These hydrocarbons will bear the generic names *alkenes, alkadienes, alkatrienes,* etc. Examples: propene, hexene, etc.

9. The names of triple-bond hydrocarbons will end in *yne, diyne,* etc. They will bear the generic name *alkynes.* Examples: propyne, heptyne, etc.

The ending *-yne* replaces *-ine* because the latter is reserved for bases (see Rule 33).

10. If there are both double and triple bonds in the fundamental chain the endings *enyne, dienyne,* etc., will be used. The generic names of these hydrocarbons will be *alkenynes, alkadienynes,* etc.

The double bonds are expressed first in the name (ene before yne) and take precedence in numbering (cf. Rule 64). Example: CH_2:CHCH:CH-C:CH, hexa-1,3-dien-5-yne, not hex-1-yne-3,5-diene. No provision is made for branched unsaturated hydrocarbons. It seems best, for general use, to select as the fundamental straight chain the longest one that contains the maximum of double and triple bonds. Example: CH_2:C(C_2H_5)CH_2CH_3, 2-ethyl-1-butene, not 3-methylenepentane.

11. Saturated monocyclic hydrocarbons will take the names of the corresponding open-chain saturated hydrocarbons, preceded by the prefix *cyclo*. They will bear the generic name *cycloalkanes*.

Examples: cyclopropane, cyclobutane, cycloheptane.

12. When they are unsaturated, rules 8–10 will be applied. However, in the case of partially saturated polycyclic aromatic compounds the prefix *hydro*, preceded by *di-*, *tetra-*, etc., will be used. Example: dihydroanthracene.

Further examples: cyclobutadiene, cyclohexene (not tetrahydrobenzene).

13. Aromatic hydrocarbons will be denoted by the ending *ene* and will otherwise retain their customary names. However, the name *phene* may be used instead of benzene.

Examples: benzene, toluene, xylene (not benzol, toluol, xylol).

III. Fundamental Heterocyclic Compounds

14. The endings of customary names, endings which do not correspond to the function of the substance, will undergo the following modifications, so far as they are in accord with the genius of each language: (a) The ending *ol* will be changed to *ole*. Example: pyrrole. (b) The ending *ane* will be changed to *an*. Example: pyran.

15. When nitrogenous heterocycles not having the ending *ine* give basic compounds on progressive hydrogenation, such derivation will be indicated by the successive endings *ine*, *idine*. Examples: pyrrole, pyrroline, pyrrolidine; oxazole, oxazoline.

16. The ending *a* is adopted for hetero atoms occurring in a ring. Oxygen will accordingly be indicated by *oxa*, sulfur by *thia*, nitrogen by *aza*, etc. The letter *a* may be elided before a vowel. Examples: thiadiazole, oxadiazole, thiazine, oxazine.

While the universally accepted names of heterocyclic compounds are retained, the names of other heterocyclic compounds are derived from that of the corresponding homocyclic compound by adding to it the names of the hetero atoms ending in *a*. Example: 2, 7, 9-triazaphenanthrene.

The custom of naming complex heterocyclic ring systems from the names of their component rings (as, anthrapyrrole, naphthopyridine) is so "universally accepted" that it will no doubt continue to be followed. The rule adds a useful new device for certain cases.

RULES FOR NAMING ORGANIC COMPOUNDS (Continued)

IV. Simple Functions

17. Substances of simple functions are defined as those containing a function of one kind only, which may be repeated several times in the same molecule.

That is, an alcohol may have one, two or more OH groups and still be a substance of simple function, while a hydroxy aldehyde or an amino acid is one of complex function.

18. When there is only one functional group, the fundamental chain will be selected so as to contain this group. When there are several functional groups the fundamental chain will be selected so as to contain the maximum number of these groups.

Example: $CH_3CH_2CH(COOH)_2$, 2-ethylpropanedioic acid (ethylmalonic acid). According to the original Geneva system it was butanoic-2-methyloic acid.

19. Halogen derivatives will be designated by the name of the hydrocarbon from which they are derived, preceded by a prefix indicating the nature and number of the halogen atoms.

Examples: C_2H_5Cl, chloroethane; CH_2BrCH_2Br, 1, 2-dibromoethane.

20. Alcohols and phenols will be given the name of the hydrocarbon from which they are derived, followed by the suffix *ol*. In accordance with rule 1 names universally adopted will be retained, as: phenol, cresol, naphthol, etc.

This nomenclature may also be applied to heterocycles. Example: quinolinol.

Further examples: $CH_3CHOHCH_3$, 2-propanol; $C_6H_{11}OH$, cyclohexanol.

21. In naming polyhydric alcohols or phenols, one of the forms *di*, *tri*, *tetra*, etc., will be inserted between the name of the parent hydrocarbon and the suffix *ol*.

Examples: CH_2OHCH_2OH, 1, 2-ethanediol; *p*-$C_6H_4(OH)_2$, 1, 4-benzenediol.

22. The name *mercaptan* as a suffix is abandoned; this function will be denoted by the suffix *thiol*.

Examples: CH_3SH, methanethiol; CH_2SHCH_2SH, 1, 2-ethanedithiol.

23. Ethers are considered as hydrocarbons in which one or several hydrogen atoms are replaced by alkoxy groups. However, for symmetrical ethers the present nomenclature may be retained. Examples: $CH_3OC_2H_5$, methoxyethane; CH_3OCH_3, methoxymethane or methyl ether.

24. Oxygen linked, in a chain of carbon atoms, to two of these atoms will be denoted by the prefix *epoxy* in all cases where it would be unprofitable to name the substance as a cyclic compound. Examples: ethylene oxide = epoxyethane; epichlorohydrin = 3-chloro-1,2-epoxypropane; tetramethylene oxide = 1,4-epoxybutane.

25. Sulfides, disulfides, sulfoxides and sulfones will be named like the ethers, *oxy* being replaced by *thio*, *dithio*, *sulfinyl* and

sulfonyl, respectively. Examples: $CH_3SO_2C_2H_5$, methylsulfonylethane; $CH_3SC_3H_7$, methylthiopropane; $CH_3CH_2CH_2$-$SOCH_2CH_2CH_2CH_3$, 1-(propylsulfinyl)butane.

26. Aldehydes are characterized by the suffix *al* added to the name of the hydrocarbon from which they are derived; thioaldehydes, by the suffix *thial.* Acetals will be named as 1,1-dialkoxyalkanes.

Examples: CH_3CHO, ethanal; CHOCHO, ethanedial; CH_3CH_2CHS propanethial; $CH_3C(OC_2H_5)_2$, 1,1-diethoxyethane; C_6H_5CHO, benzenecarbonal? (cf. rule 32, paragraph 2).

27. Ketones will receive the ending *one.* Diketones, triketones, thioketones will be designated by the suffixes *dione, trione, thione.*

Examples: CH_3COCH_3, 2-propanone; $CH_3COCOCH_3$, 2, 3-butanedione· $CH_3CSCH_2CH_3$, 2-butanethione; cyclohexanone.

28. The name *ketene* is retained.

Example: $(CH_3)_2C{:}CO$, dimethylketene.

29. For acids the rule of the Geneva nomenclature is retained. However, in cases where the use of that nomenclature would not be convenient the carboxyl group will be considered as a substituting group and the name of the acid will be formed by adding to the name of the hydrocarbon the suffix *carbonique* or *carboxylic,* according to the language.

Examples: CH_3CH_2COOH, propanoic acid; $HOOCCH_2COOH$, propanedioic acid; $HOOCCH_2CH(COOH)CH_2COOH$, 1, 2, 3-propanetricarboxylic acid. In the Geneva system the last-named compound would have been called pentanedioic-3-methyloic acid.

30. Acids in which an atom of sulfur replaces an atom of oxygen will be named according to the Geneva nomenclature. Example: ethanethioic, -thiolic, -thionic, -thionothiolic. If the carboxyl is considered as a substituent the compounds will be named *carbothioic* acids. The suffix *carbothiolic* will be used if it is certain that the oxygen of the OH group is replaced by sulfur; the suffix *carbothionic* if it is the oxygen of the CO group; the suffix *carbodithioic* will be used if both oxygen atoms are replaced.

Examples of the two systems of names: CH_3COSH or CH_3CSOH (either one), ethanethioic acid, methanecarbothioic acid; CH_3COSH, ethanethiolic acid, methanecarbothiolic acid; CH_3CSOH, ethanethionic acid, methanecarbothionic acid; CH_3CSSH, ethanethionothiolic acid, methanecarbodithioic acid.

31. The existing conventions will be retained for salts and esters.

Examples: Sodium butanoate or sodium salt of butanoic acid; diethyl 1,2-ethanedicarboxylate or diethyl ester of 1,2-ethanedicarboxylic acid; sodium acetate; methyl succinate.

32. Acid anhydrides will retain their present mode of designation according to the names of the corresponding acids. For names formed in accordance with the Geneva nomenclature,

the amides, amidoximes, amidines, imides and nitriles will be named like the acids by adding to the name of the corresponding hydrocarbon the endings *amide*, *amidine*, *amidoxime*, *imide*, and *nitrile*, respectively, while the halides will be named by combining *chloride*, etc., with the name of the radical. Examples: C_3H_7COCl, butanoyl chloride; $C_3H_7CONH_2$, butanamide; etc.

If the carboxyl is considered as a substituent the endings *carbonamide*, *carbonamidine*, *carbonamidoxime*, *carbonimide*, *carbonitrile* will be used. Examples: C_3H_7COCl, propanecarbonyl chloride; $C_3H_7CONH_2$, propanecarbonamide; etc.

33. The ending *ine* is reserved exclusively for nitrogenous bases. The present nomenclature of monoamines is retained. For polyamines, the name of the hydrocarbon will be followed by the suffixes *diamine*, *triamine*, etc.

For aliphatic compounds containing quinquevalent nitrogen the ending *ine* will be changed to *onium*. For cyclic substances containing quinquevalent nitrogen in the ring the ending *ine* will be changed to *inium*; for those with the ending *ole*, this will be changed to *olium*. Examples: pyridine, pyridinium; imidazole, imidazolium.

Further examples: CH_3NH_2, methylamine; $(CH_3)_2NH$, dimethylamine; $(CH_3)_3N$, trimethylamine; $NH_2CH_2CH_2NH_2$, 1,2-ethanediamine; dextrin (not dextrine); glycerol (not glycerine).

34. (revised 1938) (a) Derivatives of hydrogen arsenide, AsH_3, will be named like the amines and their derivatives, with the ending *arsine*. The univalent radical $-AsH_2$ will be designated by the prefix *arsino*.

Examples: CH_3AsH_2, methylarsine; $(CH_3)_3As$, trimethylarsine; $(CH_3)_2AsCl$, chlorodimethylarsine; $(CH_3)_3AsO$, trimethylarsine oxide; $H_2AsCH_2CH_2AsH_2$, 1, 2-diarsinoethane or ethane-1, 2-diarsine; $(C_2H_5)_4AsOH$, tetraethylarsonium hydroxide; $(CH_3)_2AsAs(CH_3)_2$, tetramethylbiarsine.

(b) Acids of the types $RHAs(:O)OH$ and $RR'As(:O)OH$ will be named *arsinic* acids; those of the type $RAs(:O)(OH)_2$ will be named *arsonic acids*. The radical $>AsO_2H$ will be designated by the prefix *arsinico*, the radical $-AsO_3H_2$ by the prefix *arsono*.

Examples: $(CH_3)_2AsO_2H$, dimethylarsinic acid; $C_6H_5AsO_3H_2$, benzenearsonic acid.

(c) Rules *a* and *b* are applicable to the analogous compounds of phosphorus and antimony, the syllable "ars" being replaced respectively by *phosph* or *stib*.

(d) The following list includes the prefixes and suffixes applicable to the most common compounds of phosphorus, arsenic and antimony:

Radical	*Prefix*	*Suffix*
$-AsH_2$	arsino	arsine
$-AsO$	arsenoso	
$-AsO_2$	arso	
$>As(:O)OH$	arsinico	arsinic
$-As(:O)(OH)_2$	arsono	arsonic
$-As = As-$	arseno	
$-PH_2$	phosphino	phosphine
$-PO$	phosphoroso	
$-PO_2$	phospho	
$>P(:O)OH$	phosphinico	phosphinic
$-P(:O)(OH)_2$	phosphono	phosphonic
$-P = P-$	phosphoro	
$-P = N-$	phosphazo	
$-P = As-$	phospharseno	
$-SbH_2$	stibino	stibine
$-SbO$	stiboso	
$-SbO_2$	stibo	
$>Sb(:O)OH$	stibinico	stibinic
$-Sb(:O)(OH)_2$	stibono	stibonic
$-Sb = Sb-$	antimono	
$-Sb = As-$	stibarseno	

(e) Derivatives of bismuthine, BiH_3, will be named like the arsines.

(f) Compounds of arsenic, phosphorus, antimony and bismuth which cannot be named clearly by the preceding rules will be named as derivatives of arsines, phosphines, stibines or bismuthines or (if possible) as organometallic derivatives (rule 48).

Examples: CH_3BiO, methylbismuth oxide; CH_3SbCl_4, methylantimony tetrachloride; $(C_6H_5)_2AsOC_2H_5$, ethoxydiphenylarsine; $(CH_3)_2AsOH$, hydroxydimethylarsine or dimethylarsenic hydroxide; CH_3SbS, methylantimony sulfide; $[(CH_3)_2As]_2O$, bis(dimethylarsenic) oxide or cacodyl oxide.

35. Compounds derived from hydroxylamine by replacement of the hydrogen of the hydroxyl will be regarded as alkoxy derivatives; those in which an atom of hydrogen of the NH_2 group is replaced, as alkylhydroxylamines. Oximes will be named by adding the suffix *oxime* to the name of the corresponding aldehyde, ketone or quinone. Examples: $C_2H_5ONH_2$ ethoxyamine; C_2H_5NHOH, ethylhydroxylamine.

Further examples: $CH_3CH_2CH{:}NOH$, propanal oxime; $CH_3C(:NOH)CH_3$, propanone oxime.

36. The generic term *urea* is retained; it will be used as a suffix for the alkyl and acyl derivatives of urea. Examples: butylurea, $C_4H_9NHCONH_2$; butyrylurea, $C_3H_7CONHCONH_2$. The bivalent radical -NHCONH- will be named *ureylene.*

37. The generic name *guanidine* is retained.

38. The name *carbylamine* is retained.

Example: C_2H_5NC, ethylcarbylamine (or ethyl isocyanide).

39. Isocyanic and isothiocyanic esters (RNCO, RNCS) will be named *isocyanates* and *isothiocyanates*.

40. The name *cyanate* is reserved for true esters which on saponification yield cyanic acid or its hydration products. The name *sulfocyanate* will be replaced by *thiocyanate*.

41. Nitro derivatives: no change in the present nomenclature.

Examples: C_6H_5NO, nitrosobenzene; $(NO_2)_3C_6H_2OH$, trinitrophenol.

42. Azo derivatives: the forms *azo*, *azoxy* are retained.

43. (a) Diazonium compounds, RN_2X, are named by addition of the suffix *diazonium* to the name of the parent substance (benzenediazonium chloride).

(b) Compounds having the same empirical formula but containing trivalent nitrogen will be named by replacing diazonium with *diazo* (benzenediazohydroxide).

(c) Substances of the type RN_2OM will be named *diazoates*.

(d) Compounds in which the two nitrogen atoms are united to a single carbon atom will be designated by the prefix *diazo* (diazomethane, diazoacetic acid).

(e) The term *diazoamino* is retained; however, these compounds may also be regarded as derivatives of triazene.

(f) Derivatives of the substances $H_2NNHNHNH_2$; $NH:NNHNH_2$; $NH:NNHN:NH$ will be named *tetrazanes*, *tetrazenes*, *pentazdienes*, etc.

Examples: (a) $C_6H_5N(.N)Cl$, benzenediazonium chloride; (b) $C_6H_5N:NOH$, benzenediazohydroxide; (c) $C_6H_5N:NONa$, sodium benzenediazoate; (d) N_2CH_2, diazomethane; N_2CH_2COOH, diazoacetic acid, diazoethanoic acid or diazomethanecarboxylic acid; (e) $C_6H_5N:NNHC_6H_5$, diazoaminobenzene or 1,3-diphenyltriazene; (f) $C_6H_5NHNHNHNHC_6H_5$, 1,4-diphenyltetrazane; $C_6H_5N:NNHNH_2$, 1-phenyl-1-tetrazene.

44. Hydrazines are designated by the name of the alkyl radicals from which they are derived, followed by the suffix *hydrazine*. In cases where the amino group of carbonamides is replaced by the hydrazino group, the suffix *hydrazide* will be used. Hydrazo derivatives are regarded as derivatives of hydrazine. Examples: CH_3NHNH_2, methylhydrazine; $C_2H_5NHNHC_3H_7$, 1-ethyl-2-propylhydrazine; $C_3H_7CONHNH_2$, butyrohydrazide or propanecarbohydrazide.

45. Hydrazones and semicarbazones are named like the oximes. The term *osazone* is retained.

Examples: $CH_3CH:NNHC_6H_5$, ethanal (or acetaldehyde) phenylhydrazone: $(CH_3)_2C:NNHCONH_2$, propane (or acetone) semicarbazone.

46. The name *quinone* is retained.

Examples: *p*-benzoquinone or *p*-quinone, 1,2-naphthoquinone or 1,2-naphthaquinone, phenanthrenequinone or phenanthraquinone.

47. Sulfonic and sulfinic acids will be designated by adding the suffixes *sulfonic* and *sulfinic* to the name of the hydrocarbon.

The analogous acids of selenium and tellurium will bear the names *alkaneselenonic* and *-seleninic* acids; *alkanetelluronic* and *-tellurinic* acids.

Examples: $C_2H_5SO_3H$, ethanesulfonic acid, $C_{10}H_6(SO_2H)_2$, naphthalenedisulfinic acid; CH_3SeO_3H, methaneselenonic acid; $C_6H_5TeO_2H$, benzenetellurinic acid.

48. Organometallic compounds will be designated by the names of the organic radicals united to the metal which they contain, followed by the name of the metal. Examples: dimethylzinc, tetraethyllead, methylmagnesium chloride.

However, if the metal is united in a complex manner it may be considered as a substituent Example: $ClHgC_6H_4CO_2H$, chloromercuribenzoic acid.

49*a* (revised 1938)

I. Cyclic hydrocarbons with aliphatic side chains are to be named according to one of the two following methods: (α) The radical names denoting the side chains are prefixed to the name of the cyclic hydrocarbon. (β) The cyclic hydrocarbon residue, if it can be named as a radical, is considered a substituent of the aliphatic chain. Naming according to (α) is in general preferable when the side chain is short or when several side chains are present. Naming according to (β) is more convenient when the side chain is long, and particularly when the cyclic hydrocarbon residue is not at the end of this chain.

Examples: (α) $C_6H_5C_2H_5$, ethylbenzene; $CH_3C_6H_4C_2H_5$, methylethylbenzene; $C_{10}H_7CH{:}CH_2$, ethenylnaphthalene.
(β) $CH_3CH(C_6H_5)(CH_2)_5CH_3$, 2-phenyloctane; p-$(CH_3)_2CHC_6H_4CH(CH_3)CH(CH_3)(CH_2)_3CH_3$, 3-methyl-2-(4-isopropylphenyl)heptane.

For naming cyclic hydrocarbons with side chains according to (α), it is advisable in many cases to use the common names of simple aromatic hydrocarbons.

Examples: *o*-$CH_3C_6H_4C_2H_5$, 2-ethyltoluene; $(CH_3)_2C_6H_4CH{:}CH_2(1,3,2)$, 2-ethenyl-*m*-xylene; $CH_3C_6H_3(C_2H_5)CH(CH_3)_2(1,2,4)$, 2-ethyl-*p*-cymene.

II. When several cyclic hydrocarbon residues are united by an aliphatic chain the name of the compound will be derived from that of the aliphatic hydrocarbon, provided radical names are available for the cyclic hydrocarbon residues.

Examples: $C_6H_5CH_2C_6H_5$, diphenylmethane; $C_6H_5CH_2CH(C_6H_5)(CH_2)_2CH_3$, 1,2-diphenylpentane.

If this is not the case, or if the possibility of using a convenient radical name makes it desirable, the name of the compound will be derived from that of one of the cyclic hydrocarbons, on the principle of substitution.

Examples: $C_{14}H_9CH_2C_6H_5(2)$, 2-benzylanthracene (better than phenyl-(2-anthryl) methane); $C_{16}H_9CH_2CH_2C_6H_5$, (β-phenylethyl) pyrene.

49*b* (revised 1938). When the cyclic hydrocarbons treated of in rule 49*a* carry functions which can be expressed only by a prefix, the same possibilities for names exist as those indicated in rule 49*a*.

Examples: $C_6H_5CHClCH_2Cl$, 1,2-dichloro-1-phenylethane or (α, β-dichloroethyl) benzene; $C_6H_5CH_2CHCH_3CH_2Cl$, 3-chloro-2-methyl-1-phenylpropane or (γ-chloroisobutyl) benzene; *p*-$ClC_6H_4CH_2CH_2Cl$, 4-chloro-1-(β-chloroethyl) benzene or 2-chloro-1-(4-chlorophenyl) ethane.

For naming derivatives of monocyclic hydrocarbons which have common names, it will be of advantage to employ these names.

Examples: p-$ClC_6H_4CH_3$, 4-chlorotoluene (4-chloro-1-methylbenzene); p-$ClC_6H_4CH_2Cl$, 4, ω-dichlorotoluene (4-chloro-1-(chloromethyl) benzene, 4-chlorobenzyl chloride); $CH_3C_6H_3(NO_2)CH(CH_3)_2(1,2,4)$, 2-nitro-$p$-cymene (2-nitro-1-methyl-4-isopropylbenzene).

50. If it is necessary to avoid ambiguity, the names of complex radicals will be placed in parentheses. Examples: (dimethylphenyl)amine = $(CH_3)_2C_6H_3NH_2$; dimethylphenylamine = $C_6H_5N(CH_3)_2$.

V. Complex Functions

51. For compounds of complex function, that is to say, for compounds possessing different functions, only one kind of function (the principal function) will be expressed by the ending of the name. The other functions will be designated by appropriate prefixes.

Example: 2-aminoethanol (not ethanolamine). By rule 1 very commonly used names like phenolsulfonic acid, naphthylaminesulfonic acid might still be used.

52. The following prefixes and suffixes will be used for designating the functions.

Function	Prefix	Suffix
Acid and derivatives	carboxy	carboxylic, carbonyl, carbonamide, etc., or oic, oyl, etc.
Alcohol	hydroxy	ol
Aldehyde	oxo, aldo (for aldehyde O) or formyl (for CHO)	al
Amine	amino	amine
Azo derivative	azo	. . .
Azoxy derivative	azoxy	. . .
Carbonitrile (nitrile)	cyano	carbonitrile or nitrile
Double bond	. .	ene
Ether	alkoxy	. . .
Ethylene oxide, etc.	epoxy	. . .
Halide	halogeno (halo)	. . .
Hydrazine	hydrazino	hydrazine
Ketone	oxo or keto	one
Mercaptan	mercapto	thiol
Nitro derivative	nitro	. . .
Nitroso derivative	nitroso	. . .
Quinquevalent nitrogen	. . .	onium, inium (olium)
Sulfide	alkylthio	. . .
Sulfinic derivative	sulfino	sulfinic
Sulfone	sulfonyl	. . .
Sulfonic derivative	sulfo	sulfonic
Sulfoxide	sulfinyl	. . .
Triple bond	. . .	yne
Urea	ureido	urea

The order in which the functions are here listed has no significance; the rules do not establish any general order of precedence (cf. rules 7, 63).

53. The names of derivatives of fundamental heterocyclic substances will be formed according to the preceding rules.

Example: Hydroxyquinolinecarbonamide, not quinolinolcarbonamide.

VI. Radicals

54. Univalent radicals derived from saturated aliphatic hydrocarbons by removal of one atom of hydrogen will be named by replacing the ending *ane* of the hydrocarbon by the ending *yl*.

Examples: methyl, ethyl, pentyl (or amyl), etc. Since isopropylidene is recognized (rule 56) it was no doubt the intention of the Committee to recognize isopropyl similarly.

55. The names of univalent radicals derived from unsaturated aliphatic hydrocarbons will have the endings *enyl*, *ynyl*, *dienyl*, etc., the positions of the double or triple bonds being indicated by numerals or letters where necessary.

Examples: CH_2:CH—, ethenyl (or vinyl); CH⋮C—, ethynyl; CH_3—CH:CH—CH_2—, 2-butenyl; CH_2:CH—CH:CH—, 1, 3-butadienyl.

56. Bivalent or trivalent radicals derived from saturated hydrocarbons by removal of 2 or 3 hydrogen atoms from the same carbon atom will be named by replacing the ending *ane* of the hydrocarbon by the endings *ylidene* or *ylidyne*. For radicals derived from unsaturated hydrocarbons, these endings will be added to the name of the hydrocarbon. The names isopropylidene and methylene are retained.

Examples: $CH_2<$, methylene; $CH_3CH<$, ethylidene; $CH_3CH_2CH<$, propylidene; $(CH_3)_2C<$, (1-methylethylidene) or isopropylidene, $CH_3C⋮$, ethylidyne; CH_2.CH—$CH_2CH<$, 3-butenylidene.

57. The names of bivalent radicals derived from aliphatic hydrocarbons by removal of a hydrogen atom from each of the two terminal carbon atoms of the chain will be ethylene, trimethylene, tetramethylene, etc.

Only saturated radicals are provided for: —CH_2CH_2—, ethylene; —CH_2-CH_2CH_2—, trimethylene, etc.

58. Radicals derived from acids by removal of OH will be named by changing the ending carboxylic to *carbonyl* or, if the Geneva nomenclature is used, oic to *oyl*.

Examples: CH_3CO, ethanoyl or methanecarbonyl (or acetyl).

59. Univalent radicals derived from aromatic hydrocarbons by removal of a hydrogen atom from the ring will in principle be named by changing the ending *ene* to *yl*. However, the radicals C_6H_5 and $C_6H_5CH_2$ will continue provisionally to be named phenyl and benzyl respectively. Moreover, certain abbreviations sanctioned by usage are authorized, as *naphthyl* instead of *naphthalyl*.

Examples: $CH_3C_6H_4$—, tolyl (instead of toluyl), anthryl (instead of anthracyl), phenanthryl, fluoryl.

60. Univalent radicals derived from heterocyclic compounds by removal of hydrogen from the ring will be named by changing their endings to *yl*. In cases where this would give rise to ambiguity, merely the final *e* will be changed to *yl*. Examples: pyridine, pyridyl; indole, indolyl; pyrroline, pyrrolinyl; triazole, triazolyl; triazine, triazinyl.

61. Radicals formed by removal of a hydrogen atom from a side chain of a cyclic compound will be regarded as substituted aliphatic radicals.

Examples: $C_6H_5CH_2CH_2$—, (2-phenylethyl); $C_6H_5CH{:}CHCH_2$—, (3-phenyl-2-propenyl). (For $C_6H_5CH_2$, see rule 59.)

62. In general, special names will not be given to multivalent radicals derived from cyclic compounds by removal of several hydrogen atoms from the ring. In this case prefixes or suffixes will be used. Examples: triaminobenzene or benzenetriamine; dihydroxypyrrole or pyrrolediol.

Comparison with rules 21, 33 and 51 will show that of the names given as examples, "benzenetriamine" and "pyrrolediol" are the ones ordinarily to be preferred (according to the rule of expressing the principal function in the ending of the name where there is a suffix denoting it).

63. The order in which prefixes or radicals are stated (alphabetic order or conventional order) remains optional.

See the comments on rule 7. There is no generally accepted "conventional order" for all prefixes.

VII. Numbering

64. In aliphatic compounds the carbon atoms of the fundamental chain will be numbered from one end to the other with the use of arabic numerals. In case of ambiguity the lowest numbers will be given (1) to the principal function, (2) to double bonds, (3) to triple bonds, (4) to atoms or radicals designated by prefixes. The expression "lowest numbers" signifies those that include the lowest individual number or numbers. Thus, 1, 3, 5 is lower than 2, 4, 6; 1, 5, 5 lower than 2, 6, 6; 1, 2, 5 lower than 1, 4, 5; 1, 1, 3, 4 lower than 1, 2, 2, 4.

Examples: $CH_2{:}CHCH_2CH_3$, 1-butene (not 3-butene); $CH_2{:}CHC{:}CH$, 1-buten-3-yne (not 3-buten-1-yne); $CH_2{:}CH—CH_2OH$, 2-propen-1-ol (not 1-propen-3-ol; the name allyl alcohol may also be used); $CHCl_2—CH_2CH{:}CH_2$, 4, 4-dichloro-1-butene. The principle of "low numbers" also applies to cyclic compounds, with due regard to their different structures (e.g., bridges and hetero atoms are usually given preferred positions). Examples: 1, 3-cyclohexadiene; 3-cyclohexen-1-one or simply 3-cyclohexenone; 4, 4-dichlorocyclohexene.

Position of Numbers.—Where shall position numbers be placed, *before* or *after* the parts of the name to which they refer? Usage varies; some chemists place them before, some place them after, some use a combination. The Committee has left full latitude on this point. The examples in the French version usually show the numbers placed after; the examples in these comments follow the practice of *Chemical Abstracts* in being placed before. Each method has certain advantages. In Beilstein numbers placed after are in parentheses, those placed before are not, e.g., "2-methyl-butanol-(4)."

65. Positions in a side chain will be designated by numerals or letters, starting from the point of attachment. The numerals or letters will be in parentheses with the name of the chain.

Examples: $(CH_3)_2CH$—, (1-methylethyl) or isopropyl; $CH_3CHClCH_2$—, (2-chloropropyl). The rule equally permits Greek letters, ordinary letters, primed numbers (1′, 2′), numbers with indices (4^1, 4^2) or other designations.

66. In case of ambiguity in the numbering of atoms or radicals designated by prefixes, the order will be that chosen for the prefixes before the name of the fundamental compound or side chain of which they are substituents.

Example: $CH_2BrCH_2CH_2Cl$, 1-bromo-3-chloropropane (alphabetic order), or 1-chloro-3-bromopropane (order of increasing radical weight). The purpose of the rule is to decide which prefixes shall have which numbers, when the set of numbers (in the above example 1, 3) for the prefixes has been determined.

67. The prefixes, *di*, *tri*, *tetra*, etc. will be used before simple expressions (for example, diethylbutanetriol) and the prefixes *bis*, *tris*, *tetrakis*, etc., before complex expressions. Examples: bis(methylamino)propane, $CH_3NH(CH_2)_3NHCH_3$; bis-(dimethylamino)ethane, $(CH_3)_2NCH_2CH_2N(CH_3)_2$. The prefix *bi* will be used only to denote the doubling of a radical or compound; for example, biphenyl.

Additional example of the use of *bi*: *p*-$(C_6H_4CO_2H)_2$, 4, 4′-bibenzoic acid or biphenyl-4, 4′-dicarboxylic acid.

68. A catalog of cyclic systems, with their numberings according both to the existing system and to that of Mr. Patterson, is in preparation under the auspices of the National Research Council of the United States and of the American Chemical Society.

This catalog appeared in 1940 as American Chemical Society Monograph No. 84, "The Ring Index" by Austin M. Patterson and Leonard T. Capell.

In order to avoid all confusion the Commission recommends placing a scheme of numbering at the head of each article.

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(Numbers refer to the individual rules)

RULES FOR NAMING ORGANIC COMPOUNDS
(Continued)

PREFIX NAMES OF ORGANIC RADICALS

This list is taken, by permission, from the Introduction to the Subject Index of *Chemical Abstracts*, Volumes 31 and 33, and represents the latest practice of that journal.

acenaphthenyl $C_{12}H_9$— (*from acenaphthene*)
acetamido CH_3CONH—
acetenyl = ethynyl
acetimido $CH_3C(\cdot NH)$—
acetonyl CH_3COCH_2—
acetonylidene CH_3COCH=
acetoxy CH_3COO—
acetyl CH_3CO—
acetylene =CHCH=
acridyl $C_{13}H_8N$— (*from acridine*)
acrylyl CH_2:CHCO—
adipyl —$OC(CH_2)_4CO$—
alanyl CH_3CHNH_2CO—
alkoxy RO— (*R = any alkyl radical*)
allyl CH_2:CHCH_2—
β-allyl = isopropenyl
amidoxalyl = oxamyl
amino (amido) H_2N—
amoxy $CH_3(CH_2)_4O$—
amyl $CH_3(CH_2)_4$—

tert-amyl $(CH_3CH_2)(CH_3)_2C$—

amylidene $CH_3(CH_2)_3CH$=
anilino C_6H_5NH—
anisal = anisylidene
anisoyl *p*-$CH_3OC_6H_4CO$—
anisyl = methoxyphenyl
anisylidene *p*-$CH_3OC_6H_4CH$=
anthranoyl *o*-$H_2NC_6H_4CO$—
anthraquinonyl $C_{14}H_7O_2$—(*from anthraquinone, 2 isomers*)
anthryl $C_{14}H_9$— (*from anthracene, 3 isomers*)
anthrylene —$C_{14}H_8$— (*from anthracene, 14 isomers*)
antimono —Sb:Sb—
antipyryl (*from antipyrine*)

OC.N(C_6H_5).N(CH_3).C(CH_3):C—
5 1 2 3 4

arseno —As:As—
arsenoso O.As—
arsinico (*from arsinic acid*) (HO)OAs=
arsino H_2As—
arso O_2As—
arsono (*from arsonic acid*) $(HO)_2OAs$—
arsylene HAs=
asaryl 2,4,5-$(CH_3O)_3C_6H_2$—
asparagyl $H_2NCOCH_2CHNH_2CO$—
aspartyl —$COCH_2CHNH_2CO$—
auro Au—
azido = triazo
azino = NN=
azo —N:N—
azoxy —N(O)N—
benzal = benzylidene

PREFIX NAMES OF ORGANIC RADICALS (Continued)

benzamido $C_6H_5CONH—$
benzenyl = benzylidyne
benzidino $H_2NC_6H_4C_6H_4NH—$ (*from benzidine*)
benziloyl $(C_6H_5)_2C(OH)CO—$
benzimidazolyl $C_7H_5N_2—$ (*from benzimidazole*)
benzimido $C_6H_5C(\cdot NH)—$
benzofuryl $C_8H_5O—$ (*from benzofuran*)
benzohydryl $(C_6H_5)_2CH—$
benzohydrylidene $(C_6H_5)_2C=$
benzopyranyl $C_9H_7O—$ (2-α-, etc.) (*from benzopyran*)
benzoxazolyl $C_7H_4NO—$ (*from benzoxazole*)
benzoxy $C_6H_5COO—$
benzoyl $C_6H_5CO—$
benzoylene $—C_6H_4CO—$
benzyl $C_6H_5CH_2—$
benzylidene $C_6H_5CH=$
benzylidyne $C_6H_5C\equiv$
biphenylene $—C_6H_4C_6H_4—$
biphenylenedisazo $—N{\cdot}NC_6H_4C_6H_4N{:}N—$
biphenylyl (2-, 3- or 4-) $C_6H_5C_6H_4—$ (*from biphenyl*)
bornyl (*from borneol*)

```
              7
         ┌─C(CH3)2─┐
         │         │
CH2 CH.CH2 CH2 C(CH3).CH—
└──────────────────────────┘
 3   4   5   6    1      2
```

boryl O:B—
bromo Br—
1-butenyl $CH_3CH_2CH{:}CH—$
2-butenyl $CH_3CH{:}CHCH_2—$
3-butenyl $CH_2{:}CH(CH_2)_2—$
butoxy $CH_3(CH_2)_3O—$
butyl $CH_3(CH_2)_3—$

```
                CH3CH2
                      \
sec-butyl              CH—
                      /
                   CH3
```

tert-butyl $(CH_3)_3C—$
butylene (1,4) = tetramethylene
butylidene $CH_3(CH_2)_2CH=$
butyryl $CH_3(CH_2)_2CO—$
camphanyl $C_{10}H_{17}—$ (*from camphane, 3 isomers*)
camphoroyl $C_{10}H_{14}O_2=$ (*from camphoric acid*)
camphoryl $C_{10}H_{15}O—$ (*from camphor*)
camphorylidene $C_{10}H_{14}O=$ (*from camphor*)
caproyl $CH_3(CH_2)_4CO—$
capryl $CH_3(CH_2)_8CO—$
caprylyl $CH_3(CH_2)_6CO—$
carbamido = ureido
carbamyl $H_2NCO—$
carbanilino = phenylcarbamyl
carbazolyl $C_{12}H_8N—$ (*from carbazole, 5 isomers*)
carbethoxy $C_2H_5OOC—$
carbomethoxy $CH_3OOC—$
carbonyl OC=
carbonyldioxy —OCOO—
carboxy HOOC—
carbyl —C—

```
carvacryl  (4)  (CH3)2CH
                        \
                         C6H3—  (2)
                        /
                (1)  CH3
```

cetyl $CH_3(CH_2)_{14}CH_2—$
chloro Cl—
chloromercuri ClHg—
cinnamal = cinnamylidene
cinnamenyl = styryl
cinnamoyl $C_6H_5CH{:}CHCO—$
cinnamyl $C_6H_5CH{:}CHCH_2—$
cinnamylidene $C_6H_5CH{:}CHCH=$
cresotyl 2,3-$HO(CH_3)C_6H_3CO—$ (*from cresotic acid*) (*2,3- shown*)
cresoxy = toloxy
cresyl = *ar*-hydroxytolyl, = tolyl
cresylene = tolylene
crotonyl $CH_3CH.CHCO—$
cumal = *p*-cuminylidene
cumidino $(CH_3)_2CHC_6H_4NH—$
cuminal = *p*-cuminylidene
cuminyl *p*-$(CH_3)_2CHC_6H_4CH_2—$
cuminylidene *p*-$(CH_3)_2CHC_6H_4CH=$
cumoyl (*from cumic acid*) *p*-$(CH_3)_2CHC_6H_4.CO$
cumyl $(CH_3)_2CHC_6H_4—$
cyano NC—
cyclobutyl (*from cyclobutane*) $C_4H_7—$
cyclohexadienyl (2,4- shown)

```
┌───────────────────────┐
CH2.CH·CH.CH:CH.CH—
 6   5   4   3   2   1
```

cyclohexadienylidene (*2,4- or 2,5- 2,5- shown*)

```
┌──────────────────────┐
CH CH.CH2.CH:CH C=
```

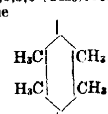
cyclohexenyl $C_6H_9—$ (*from cyclohexene, 3 isomers*)
cyclohexenylidene (2- shown)

```
┌──────────────────────────┐
CH2 CH2.CH2.CH:CH.C=
```

cyclohexyl $C_6H_{11}—$ (*from cyclohexane*)
cyclohexylidene

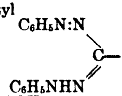
```
CH2.CH2.CH2.CH2 CH2.C=
└───────────────────────┘
```

cyclopentenyl $C_5H_7—$ (*from cyclopentene*)
cyclopentyl $C_5H_9—$ (*from cyclopentane*)
cyclopropyl $C_3H_5—$ (*from cyclopropane*)
cymyl $C_{10}H_{13}—$ (*from cymene*)
2-*p*-cymyl = carvacryl
3-*p*-cymyl = thymyl
desyl $C_6H_5COCH(C_6H_5)—$
diazo —N:N—
diazoamino —N:NNH—
dodecyl $CH_3(CH_2)_{10}CH_2—$
duryl 2,3,5,6-$(CH_3)_4C_6H—$
durylene



epoxy —O— (*to different atoms already united in some other way*)

ethene = ethylene
ethenyl = ethylidyne; = vinyl
ethinyl = ethynyl
ethoxalyl C_2H_5OOCCO—
ethoxy C_2H_5O—
ethyl CH_3CH_2—
ethylene —CH_2CH_2—
ethylenedioxy —$O(CH_2)_2O$—
ethylidene CH_3CH=
ethylidyne CH_3C≡
ethynyl CH⋮C—
ethynylene —C⋮C—
fenchanyl $C_{10}H_{17}$— (*from fenchane*)
fenchyl $C_{10}H_{17}$— (= 2-fenchanyl)
fluorenyl $C_{13}H_9$—(*from fluorene, 5 isomers*)
fluorenylidene $C_{13}H_8$=
fluoro F—
formamido HCONH—
formazyl



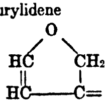
formyl OCH—
furfural = furfurylidene
furfuryl O.CH:CH.CH:CCH$_2$—
furfurylidene (*2 isomers, 2-shown*)

O.CH:CH.CH:CCH=

2-furoyl O.CH:CH.CH:CCO—
3-furoyl CH:CH.O.CH:CCO—
furyl (*2 isomers, 2-shown*)

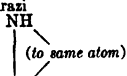
O.CH:CH.CH:C—

furylidene

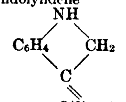


3(2)— (also a 2(3)-form)

geranyl $C_{10}H_{17}$— (*from geraniol*)
glutamyl —$OCCHNH_2(CH_2)_2CO$—
glutaryl —$OC(CH_2)_3CO$—
glyceryl —CH_2CHCH_2—
glycolyl $HOCH_2CO$—
glycyl H_2NCH_2CO—
glyoxylyl OCHCO—
guaiacyl = *o*-methoxyphenyl
guanido $H_2NC(:NH)NH$—
guanyl $H_2NC(:NH)$—
hendecyl $CH_3(CH_2)_{10}$—
heptyl $CH_3(CH_2)_6$—
hexadecyl = cetyl
hexyl $CH_3(CH_2)_5$—
hippuryl $C_6H_5CONHCH_2CO$—
homopiperonyl 3,4-$(CH_2O_2)C_6H_3CH_2CH_2$—
hydrazi

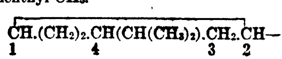


hydrazino H_2NNH—
hydrazo —HNNH— (*to different atoms*)
hydrazono H_2NN=
hydroxamino HONH—
hydroximino = isonitroso
hydroxy (hydroxyl) HO—
-idene *added to any radical usually means a double bond at point of attachment*
imidazolyl $C_3H_3N_2$— (*from imidazole, 4 isomers*)
imino (imido) NH=
indanyl C_9H_9— (*from indan, 4 isomers*)
indenyl C_9H_7— (*from indene, 7 isomers*)
indolyl C_8H_6N— (*from indole, 7 isomers*)
indolylidene



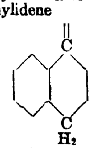
3(2)-, etc.

indyl = indolyl
iodo I—
iodoso OI—
iodoxy O_2I—
isoallyl = propenyl
isoamoxy $(CH_3)_2CHCH_2CH_2O$—
isoamyl $(CH_3)_2CHCH_2CH_2$—
isoamylidene $(CH_3)_2CHCH_2CH$=
isobutenyl = 2-methylpropenyl
isobutoxy $(CH_3)_2CHCH_2O$—
isobutyl $(CH_3)_2CHCH_2$—
isobutyryl $(CH_3)_2CHCO$—
isocyano C:N—
isohexyl $(CH_3)_2CH(CH_2)_3$—
isoindolyl C_8H_6N—(*from isoindole, 4 isomers*
isoleucyl $CH_3CH_2CH(CH_3)CHNH_2CO$—
isonitro HOON=
isonitroso HON=
1-isopentenyl = 3-methyl-1-butenyl
isophthalal = isophthalylidene
isophthaloyl —OCC_6H_4CO— (*m*)
isophthalylidene =HCC_6H_4CH= (*m*)
isopropenyl $CH_2:C(CH_3)$—
isopropoxy $(CH_3)_2CHO$—
isopropyl $(CH_3)_2CH$—
isopropylidene $(CH_3)_2C$=
isoquinolyl C_9H_6N— (*from isoquinoline, 7 isomers*)
isothiocyano S:C:N—
isovaleryl $(CH_3)_2CHCH_2CO$—
isoxazolyl C_3H_2NO— (*from isoxazole, 5 isomers*)
keto = oxo
lauroyl (*from lauric acid*) $CH_3(CH_2)_{10}CO$—
leucyl (*from leucine*) $(CH_3)_2CHCH_2CHNH_2CO$—
malonyl —$OCCH_2CO$—
menthyl CH_3-



—(*from menthane; 2-p- shown*)
mercapto HS—
mercuri —Hg—
α-mesityl 3,5-$(CH_3)_2C_6H_3CH_2$—

2-mesityl 2,4,6-$(CH_3)_3C_6H_2$—
methene = methylene
methenyl = methylidyne
methionyl $CH_2(SO_2)_2$=
methoxy CH_3O—
methyl CH_3—
methylene CH_2=
methylenedioxy —OCH_2O—
methylidyne CH≡
methylol = (hydroxymethyl)
morpholinyl (*from morpholine*) = C_4H_8NO—
myristoyl (*from myristic acid*) $CH_3(CH_2)_{12}$-CO—
naphthal = naphthylmethylene
naphthalimido (*from naphthalic acid*) $C_{10}H_6(CO)_2N$—
naphthenyl = naphthylmethylidyne
naphthoxy $C_{10}H_7O$—
naphthoyl $C_{10}H_7CO$—
naphthyl (1- or 2-) $C_{10}H_7$—
naphthylene $C_{10}H_6$=
naphthylidene



1(4)-, etc.

nitramino O_2NNH—
nitrilo N≡
nitro O_2N—
aci-nitro = isonitro
nitroso ON—
norcamphanyl C_7H_{11}— (*from norcamphane*)
octyl $CH_3(CH_2)_7$—
oleoyl (*from oleic acid*) $C_{17}H_{33}CO$—
oxalyl —OCCO—
oxamido $H_2NCOCONH$—
oxamyl H_2NCOCO—
oximido = isonitroso
oxo O= (*to same atom*)
oxy —O— (*used as a connective; cf.* epoxy *and* oxo)
palmitoyl $CH_3(CH_2)_{14}CO$— (*from palmitic acid*)
pentamethylene —$CH_2(CH_2)_3CH_2$—
pentazolyl N=N—N=N—N— (ring)
pentenyl (*like butenyl*) C_5H_9—
pentyl = amyl
perimidyl $C_{11}H_7N_2$— (*from perimidine, 8 isomers*)
perseleno Se:Se=
perthio (*replacing O only*) S=S=
phenacyl $C_6H_5COCH_2$—
phenacylidene C_6H_5COCH=
phenanthryl $C_{14}H_9$— (*from phenanthrene 5 isomers*)
phenanthrylene —$C_{14}H_8$— (*several isomers*)
phenenyl C_6H_3≡ (*s-*, *as-*, *v-*)
phenethyl $C_6H_5CH_2CH_2$—
phenetidino $C_2H_5OC_6H_4NH$—
phenetyl (*o, m,* or *p*) $C_2H_5OC_6H_4$—
phenoxy C_6H_5O—
phenyl C_6H_5—
phenylazo C_6H_5N:N—
phenylcarbamido = phenylureido
phenylene C_6H_4= (*o, m* or *p*)
phenylenedisazo —N:NC_6H_4N:N—(*o, m, p*)
phenylidene = cyclohexadienylidene
phenylureido $C_6H_5NHCONH$—
phospharseno —P:As—
phosphazo —P:N—
phosphinico HOOP= (*from phosphinic acid*)
phosphino H_2P—
phospho O_2P—
phosphono $(HO)_2OP$—
phosphoro —P:P—
phosphoroso OP—
phthalal = phthalylidene
phthalidene C_6H_4.CO.O.C= (ring) (*from phthalide*)
phthalidyl C_6H_4 CO.O.CH— (ring) (*from phthalide*)
phthalimido $C_6H_4(CO)_2N$— (*o*)
phthaloyl —OCC_6H_4CO— (*o*)
phthalylidene =HCC_6H_4CH= (*o*)
picryl 2,4,6- $(NO_2)_3C_6H_2$—
piperidyl $C_5H_{10}N$— (*from piperidine, 4 isomers*)
piperonyl 3,4-$(CH_2O_2)C_6H_3CH_2$—
piperonylidene 3,4-$(CH_2O_2)C_6H_3CH$=
pivalyl $(CH_3)_3CCO$— (*from pivalic acid*)
prolyl (*from proline*)

NH.CH_2 CH_2.CH_2.CH.CO— (ring)

propargyl = 2-propynyl
propenyl CH_3CH:CH—
propenylidene CH_3CH:C=
propiolyl HC:CCO—
propionyl CH_3CH_2CO—
propoxy $CH_3CH_2CH_2O$—
propyl $CH_3CH_2CH_2$—
propylene —$CH(CH_3)CH_2$—
propylidene CH_3CH_2CH=
1-propynyl CH_3C:C—
2-propynyl CH:CCH_2—
pseudoallyl = isopropenyl
as-pseudocumyl 2,3,5-$(CH_3)_3C_6H_2$—
s-pseudocumyl (2,4,5-)
v-pseudocumyl (2,3,6-)
pseudoindolyl C_8H_6N— (*from pseudoindole, 7 isomers*)
pyranyl C_5H_5O— (2-α, 2-γ, 3-α-, etc.)
pyrazolyl $C_3H_3N_2$— (*from pyrazole, 4 isomers*)
pyridyl C_5H_4N— (*from pyridine, 3 isomers*)
pyridylidene

4(1)-, etc.

pyrimidyl $C_4H_3N_2$— (*from pyrimidine*)
pyromucyl = 2-furoyl
pyrrolidyl C_4H_8N— (*from pyrrolidine, 3 isomers*)
pyrroyl CH:CH.CH:CH.N.CO—
pyrryl C_4H_4N— (*from pyrrole, 3 isomers*)
quinolyl C_9H_6N— (*from quinoline, 7 isomers*)
quinonyl $C_6H_3O_2$— (*from quinone*)
quinoxalyl $C_8H_5N_2$— (*from quinoxaline*)
salicyl = *o*-hydroxyphenyl; = *o*-hydroxybenzyl
salicylidene HOC_6H_4CH= (*o*)
salicyloyl HOC_6H_4CO— (*o*)
selenino (HO)OSe—
seleninyl OSe=
seleno Se=
selenocyano NCSe—
selenono HO_3Se—
selenonyl —SeO_2
selenyl HSe—
semicarbazido $NH_2CONHNH$—
silicono (HO)OSi—
silicyl H_3S—
silicylene H_2Si=
stannyl H_3Sn—
stearoyl $CH_3(CH_2)_{16}CO$—
stibarseno —Sb:As—
stibinico HOOSb=
stibino H_2Sb—
stibo O_2Sb—
stibono $(HO)_2OSb$—
stiboso O:Sb—
stibyl = stibino
stibylene HSb=
styrene —$CH(C_6H_5)CH_2$—
styrolene = styrene
styryl $C_6H_5CH:CH$—
succinamyl $H_2NCOCH_2CH_2CO$—
succinimido $(CH_2CO)_2N$—
succinyl —$OCCH_2CH_2CO$—
sulfamino HO_3SNH—
sulfamyl H_2NO_2S—
sulfhydryl = mercapto
sulfino HO_2S—
sulfinyl OS=
sulfo HO_3S—
sulfonamido —SO_2NH—
sulfonyl —SO_2—
sulfuryl = sulfonyl
tauryl $H_2NCH_2CH_2SO_2$—
telluro Te=
terephthalal = terephthalylidene
terephthaloyl —OCC_6H_4CO— (*p*)
terephthalylidene =HCC_6H_4CH= (*p*)
tetramethylene —$CH_2CH_2CH_2CH_2$—
tetrazolyl CHN_4— (*from tetrazole, 2 isomers*)
thenoyl C_4H_3SCO— (*from thiophenecarboxylic acid, 2 isomers*)
thenyl (*2 isomers*) $C_4H_3SCH_2$—
thenylidene (*2 isomers*) C_4H_3SCH=
thiazolyl C_3H_2NS— (*from thiazole, 3 isomers*)
thienyl C_4H_3S— (*from thiophene, 2 isomers*)
thio —S—
thiocarbonyl SC=
thiocyano NCS—
thiohydroxy = mercapto
thiol (S replacing O in OH)
Used in place of "thio" when required for distinction
thiono (S replacing O in CO)
Used in place of "thio" when required for distinction
thionyl = sulfinyl
thujyl $C_{10}H_{17}$— (*from sabinane, attached at 2-position*)
thymyl (*from thymol*)
HC:C(CH_3).CH:CH.C(CH(CH_3)$_2$).C—
toloxy (*o, m* or *p*) $CH_3C_6H_4O$—
toluino (*o, m* or *p*) $CH_3C_6H_4NH$—
toluyl (*o, m* or *p*) $CH_3C_6H_4CO$—
α-toluyl $C_6H_5CH_2CO$—
tolyl (*o, m* or *p*) $CH_3C_6H_4$—
α-tolyl = benzyl
tolylene (*6 isomers*) $CH_3C_6H_3$=
α-tolylene = benzylidene
triazeno $NH_2N:N$—
triazinyl $C_3H_2N_3$— (*from triazine*)
triazo N_3—
triazolyl $C_2H_2N_3$— (*from triazole*)
trimethylene —$CH_2CH_2CH_2$—
tryptophyl $C_{11}H_{11}N_2O$— (*from tryptophan*)
tyrosyl *p*-$HOC_6H_4CH_2CHNH_2CO$— (*from tyrosine*)
undecyl = hendecyl (in sense $C_{11}H_{23}$—)
uramino = ureido
ureido H_2NCONH— (*by some used synonymously with ureylene*)
ureylene —HNCONH—
valeryl $CH_3(CH_2)_3CO$—
valyl $(CH_3)_2CHCHNH_2CO$— (*from valine*)
vanillal = vanillylidene
vanilloyl 3,4-$(CH_3O)(HO)C_6H_3CO$—
vanillyl 3,4-$(CH_3O)(HO)C_6H_3CH_2$—
vanillylidene 3,4-$(CH_3O)(HO)C_6H_3CH$=
veratral = veratrylidene
veratroyl 3,4-$(CH_3O)_2C_6H_3CO$—
veratryl 3,4-$(CH_3O)_2C_6H_3CH_2$—
veratrylidene 3,4-$(CH_3O)_2C_6H_3CH$=
vinyl $H_2C:CH$—
vinylene —CH:CH—
vinylidene $H_2C:C$=
xanthyl $C_{13}H_9O$— (*from xanthene, 6 isomers*)
xyloyl $(CH_3)_2C_6H_3CO$— (*from xylic acid 7 isomers*)
xylyl $(CH_3)_2C_6H_3$—
xylylene —$H_2CC_6H_4CH_2$—

EXPLANATION OF TABLE

The table presents data for over 5000 compounds. They have been selected to include those of general or commercial importance as well as those commonly met with in the laboratory.

Arrangement. The entries are arranged alphabetically by *parent compounds*, substituting atoms and groups like bromo-, chloro-, ethyl-, methyl-, nitro-, etc. being placed after the rest of the name instead of before it; e.g., Acetic acid, dichloro- (and not Dichloroacetic acid). This practice, which is followed in some of the indexes to journals, makes it possible to bring many derivatives of the same parent together. Radicals such as propyl, butyl and amyl, and also compounds such as butyric acid and valeraldehyde, are assumed to be of normal structure unless otherwise stated.

Nomenclature. Compounds are indexed under their common names wherever these are acceptable, but a large number of *synonyms* and *cross references* are included. In particular, many names formed according to the International Union Rules (see preceding pages) are given and are distinguished by the symbol (*). Trade mark names are in quotations.

An **alphabetic order of substituting radicals** is employed in each name; e.g., Ether, ethyl methyl (not Ether, methyl ethyl). For a table of radicals, see preceding pages.

Acids are entered under their "trivial" names where these exist. Systematic names are derived from trivial names where this is feasible; as, Valeric acid, α-bromo-.

Alcohols. Important alcohols having common names, as Amyl alcohol, Isoamyl alcohol, Propyl alcohol, are so entered. For others the International Union names are used; as, 3-Buten-1-ol.

Aldehydes and **amides** are usually entered under names derived from the acid name; as, Propionaldehyde, Propionamide (from propionic acid).

Amines will be found under their usual names; as, Ethylamine, Triethylamine, Ethylenediamine.

Carbylamines are entered as Ethyl isocyanide, Phenyl isocyanide, etc.

Cyanides. See Nitriles, below.

Esters of organic acids will in general be found under the names of the corresponding acids, but those of glycerol and glycol are under the names of the alcohols. Esters of inorganic acids have independent entries; as, Ethyl sulphate, Ethylsulfuric acid.

Ethers. Simple, unsubstituted ethers occur under their own names; as, Ethyl ether, Phenyl ether. Most other monoethers are under *Ether*; as, Ether, isoamyl phenyl.

Halogen derivatives of hydrocarbons, when simple, are entered under their common names (as, Propyl chloride) or, when more complex, under their International Union names (as, 1-Pentane, 2-chloro-).

Hydrazine derivatives are found under *Hydrazine* or, if monoacyl derivatives, under the name of the corresponding acid (as, Benzoic acid, hydrazide). But **hydrazones** are placed under the corresponding carbonyl compound (as, Acetone, phenylhydrazone).

Hydrocarbons of the aliphatic series are entered under their Geneva (International Union) names; other hydrocarbons, under their commonly accepted names.

Isocyanides (Isonitriles) are named as Ethyl isocyanide, Phenyl isocyanide, etc.

Ketones having simple names are so entered (e.g., Acetone, Acetophenone); others are given International Union names if possible (as, 2-Butanone). Those familiar with "ketone" names will find a number of cross references under *Ketone*.

Mercaptans are named, according to the International Union rule, as Ethanethiol (C_2H_5SH), Benzenethiol (C_6H_5SH), etc.

Metallic salts of organic acids will be found in the preceding table, "Physical Constants of Inorganic Compounds."

Metal-organic compounds should be looked for under the name of the metal; as, Lead, tetraethyl-.

Nitriles (cyanides) are given names derived from the corresponding acid, as, Acetonitrile.

Oximes are entered under the corresponding **carbonyl compound**; as, Formaldehyde, oxime.

Phenols will be found under their usual names; as, Phenol, Resorcinol.

Salts of bases are entered under the names of the bases; as, **Aniline**, hydrochloride. For metal salts of organic acids see the preceding table, "Physical Constants of Inorganic Compounds."

Semicarbazones are placed under the corresponding **carbonyl compound**; as, Acetone, semicarbazone.

Sulfides, sulfones and **sulfoxides** are treated like ethers (see **Ethers**, above); as, **Ethyl** sulfide; **Sulfone**, ethyl phenyl.

Sulfonic acids are named as Ethanesulfonic acid, **Naphthalenedisulfonic** acid, etc.

Boldface type is used to distinguish the parent compounds and their substituting radicals. When a parent compound is followed by derivatives its name is not repeated but is replaced in each succeeding entry by a dash.

Formulas. Structural formulas have been given in most cases, and the structure has been indicated as fully as is feasible without taking undue space.

Numbers have been assigned to all compounds to facilitate identification of data on the right hand page and for use in connection with the formula, melting point and boiling point indexes which immediately follow the table. Since the original numbering, some items have been deleted and many others added resulting in occasional breaks in the succession and the occurrence of letters in combination with the numbers.

Crystalline form and **color** are stated in easily interpreted abbreviations. Other important characteristics are often added. The **index of refraction**, follows. For crystals of two or three indices they are invariably given in the order ω, ϵ or α, β, γ. The **specific rotation**, $[\alpha]$, is given for certain compounds. Temperature and wavelength are indicated by the superior and inferior figures and letters following the numerical value. When not otherwise indicated the index of refraction and specific rotation are understood to be at 20°C. and for sodium light.

For example: 1.5236^{20}_{D} indicates an index of refraction of 1.5236 for sodium light ($\lambda = 589.3$ mμ) at 20°C; $[\alpha] - 65.6^{\circ 20}_{D}$ indicates a negative specific rotation of 65.6° for sodium light and a temperature of 20°C.

Density, is normally given in grams per milliliter, at 20°C, numerically equivalent to the specific gravity at 20° referred to water at 4°C. Specific gravity at other temperatures is shown with superior and inferior figures indicating, respectively, the temperature of the substance and that of water to which it is referred. The density of gases is given in grams per liter at 0°C and 760 mm Hg pressure unless otherwise indicated.

Example: 1.536 indicates a density in grams per milliliter at 20°C; 1.634^{25}_{4} indicates a specific gravity of 1.634 at 25°C referred to water at 4°. 2.143g/l indicates the density of a gas at standard conditions, 0°C and 760 mm pressure, as 2.143 grams per liter.

Melting point and **boiling point** are given in °C. Other effects of temperature elevation such as dehydration, sublimation, decomposition, explosion are recorded in connection with the melting or boiling points. Decomposition on heating is indicated by the abbreviation **d.** If decomposition occurs at a definite temperature, the form d. 120 is used, while 120 d. indicates melting or boiling at 120°C with decomposition. Loss of water of crystallization is indicated by $-H_2O$. The boiling point is stated at normal atmospheric pressure (760 mm of Hg) unless otherwise indicated by a superior figure which shows the pressure in millimeters under which the compound boils at the temperature given.

Example: 125^{720} indicates a boiling point of 125°C at a pressure of 720 mm.

Solubility is stated in grams of substance dissolving in 100 ml of the solvent. Normal room temperatures, 20°C, is assumed unless the temperature is indicated by a superior figure The term insoluble (i.) must usually be interpreted to mean that a negligible quantity of the compound dissolves. Many compounds commonly regarded as insoluble really dissolve to a slight extent. The terms very soluble (v.s.), soluble (s.), slightly soluble

EXPLANATION OF TABLE (Continued)

(sl.s.) are used for lack of definite figures. Conflicting statements are very common in the literature. Quantitative statements of solubility are likewise subject to uncertainty due to inexact statement of conditions. Values may be variously stated as parts by weight of solute in parts by weight or volume of the solvent or of the solution, and values are often given and quoted in the literature without proper designation. In the large number of values given there are many which are uncertain in this respect.

The form s. d. indicates solubility with more or less decomposition. The occurrence of d. alone in the statement of solubility indicates that decomposition is the primary action. The statement of solubility in acids or alkalis is usually understood to be accompanied by decomposition.

The policy has been followed of giving the solubility in water, ethyl alcohol and ethyl ether first, followed by statements in regard to other solvents.

As examples:

23.4^{20} indicates a solubility of 23.4 grams of the substance in 100 ml of solvent at 20°C.

250 cm^3 al. indicates the solubility of a gas in ethyl alcohol as 250 cm^3 or ml of the gas in 100 ml of alcohol.

∞^{35} indicates that the substance is miscible with the solvent above 35°C.

Molecular weights have been computed to the nearest hundredth according to the atomic weights of 1939.

ABBREVIATIONS

[α]	specific rotation	glit	glittering	pr	prisms
a	acid	glyc	glycerin	purp.	purple
abs	absolute	gran	granular	pyr	pyridine
abt.	about	grn	green	pyram	pyramids
ac. a	acetic acid	grnsh	greenish	quad	quadrilateral
acet	acetone	h	hot	*rac*	racemic
al	alcohol	hex	hexagonal	rect	rectangular
alk	alkali	hyd	hydrate or hydrolyses	redsh.	reddish
amor	amorphous	hyg., hygr.	hygroscopic	resin	resinous
anh	anhydrous	*i*	inactive	rhomb	rhombic
arom	aromatic	i	insoluble	rhbdr	rhombohedral
art	artificial	ign	ignites	s	soluble
asym., as.	asymmetric	inflam	inflammable	sc	scales
bi-py	bipyramidal	infus	infuses	*sec*	secondary
bl	blue	irid	iridescent	sh	short
blk	black	*l*	levorotatory	sl	slightly
boil	boiling	leaf. or lf	leaflets	sld	solid
br	brown	lg	large	slend	slender
bz	benzene	lgr.	ligroin	sm	small
brnsh	brownish	liq	liquid	soft	softens
c	cold	lng	long	sol., soln	solutions
ca	about	lt	light	solv	solvents
carb	carbonates	lust	lustrous	st	steel
caust	caustic	lvs	leaves	stab	stable
chl	chloroform	*m*	meta-	subl	sublimes
col	colorless	me., meth	methyl	*sym*	symmetrical
comp	compound	met	metallic	tab., tabl.	tablets
conc	concentrated	micr	microscopic	*tert*	tertiary
cr., cryst	crystals	min	mineral	tetr	tetragonal
d	decomposes	mixt	mixture	tol	toluene
d	dextrorotatory	mod	modification	trans	transparent
deliq	deliquescent	monocl	monoclinic	thk	thick
dil	dilute	need., nd	needles	tricl	triclinic
dist	distillable	*o*	ortho-	trim	trimetric
dk	dark	octahdr	octahedral	*uns*	unsymmetrical
dl	racemic	or	orange	unst	unstable
efflor	efflorescent	ord	ordinary	v	very
et	ethyl	org	organic	var	variable
et. ac	ethyl acetate	orth	orthorombic	*vic*	vicinal
eth	ether	*p*	para-	visc	viscous
exp	explodes	pa	pale	volat	volatile or volatilizes
f	from	pet	petroleum	vlt	violet
feath	feathery	pet. eth.	petroleum ether	w	water
fl	flakes	ph	phenyl	wh	white
fluores	fluorescent	$PHNO_2$	nitrobenzene	yel	yellow
frz	freezes	pl	plates	yelsh., ylsh	yellowish
fum	fuming	pois	poison, poisonous	>	above
gel	gelatinous	powd.	powder	<	below
gen	generally			∞	soluble in all proportions
glac	glacial				

No.	Name	Synonyms	Formula	Mol. Wt.
1	**Abietic Acid**	abietinic acid; sylvic acid	$C_{20}H_{30}O_2$	302.44
2	**Acenaphthene**	naphthyleneethylene	$C_{10}H_6(CH_2)_2$	154.20
2H	**Acenaphthenequinone**	1, 2-acenaphthenedione	$C_{10}H_6(CO)_2$	182.17
2M	**Acenaphthylene**		$C_{10}H_6(CH)_2$	152.18
3	**Acetal**	1, 1-diethoxyethane*; acetaldehyde diethyl acetal; ethylidene diethyl ether.	$CH_3CH(OC_2H_5)_2$	118.17
4	**——, amino-.**	See *Ethylamine, β, β-diethoxy-.**		
5	**——, dichloro-**	1, 1-dichloro-2, 2-diethoxyethane*	$CHCl_2CH(OC_2H_5)_2$	187.07
6	**——, diethylamino-.**	See *Triethylamine, β, β-diethoxy-.*		
7	**——, dimethyl.**	See *Ethane*, 1, 1-*dimethoxy-**.		
8	**——, dimethylamino-.**	See *Ethylamine, β, β-diethoxy-N, N-dimethyl-.*		
9	**——, trichloro-.**	See *Ethane*, 1, 1, 1-*trichloro-2, 2-diethoxy-**.		
10	**Acetaldehyde**	ethanal*; acetic aldehyde; aldehyde	CH_3CHO	44.05
11	——, cyanohydrin.	See *Lactonitrile.*		
12	——, diethyl acetal.	See *Acetal.*		
13	——, dimethyl acetal.	See *Ethane*, 1, 1-*dimethoxy-**.		
13M	——, 2, 4-dinitrophenylhydrazone		$CH_3CH:NNHC_6H_3(NO_2)_2$	224.18
14	——, oxime	ethanal oxime*; acetaldoxime	$CH_3CH:NOH$	59.07
15	——, phenylhydrazone	*N*-ethylidene-*N'*-phenylhydrazine	$CH_3CH:NNHC_6H_5$	134.18
16	——, semicarbazone	ethanal semicarbazone*	$CH_3CH:NNHCONH_2$	101.11
17	**——, butylethyl-.**	See *Caproaldehyde, α-ethyl-.*		
18	**——, dichloro-**	dichloroethanal*; dichloroaldehyde	$CHCl_2CHO$	112.95
19	**——, methyl-.**	See *Propionaldehyde.*		
20	**——, phenyl-.**	See *α-Tolualdehyde.*		
21	**——, thio-**, trimer.	See *s-Trithiane, 2, 4, 6-trimethyl-.*		
22	**——, tribromo-.**	See *Bromal.*		
23	**——, trichloro-.**	See *Chloral.*		
24	**——, trimethyl-.**	See *Pivalaldehyde.*		
25	——, *α*-or ***β*-trithio-.**	See *s-Trithiane, 2, 4, 6-trimethyl-*		
26	——, *γ*-**trithio-**		$(CH_3CHS)_3$	180.34
27	**Acetaldehyde-ammonia**	1-aminoethanol*; α-aminoethyl alcohol; aldehyde-ammonia.	$CH_3CH(NH_2)OH$	61.08
28	**Acetaldoxime.**	See *Acetaldehyde, oxime.*		
29	**——, trimethyl-.**	See *Pivalaldehyde, oxime.*		
30	**Acetalylamine.**	See *Ethylamine, β, β-diethoxy-**		
31	**Acetamide**	ethanamide*	CH_3CONH_2	59.07

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1	yel. amor. powd., 1.510, 1.578, 1.618	.....	137-66 (var.)	....	i.	v. s.	v. s. eth.; s. glac. ac. a., acet., bz., CS_2, me al.
2	wh. lng. need., 1.407, 1.468, 1.620; liq. 1.6048^{100}	$1.024\frac{99}{4}$	95	277.5	i.	$4\ 2^{20}$, 66.7^{70}	s. h eth.; 36.9^{20} chl, 76^{20}, 284.6^{60} tol.; s. h bz.
2H	yel. need......	...	261	subl.	i.	sl s.	.. ..
2M	rhomb.-yel. pl. f. al.	$0.899\frac{16}{4}$	92-93	265-75, sl. d.	i.	v. s.	v. s. eth.
3	col volat. liq., 1.38193	$0.8254\frac{20}{4}$; $0.8461\frac{0}{4}$	....	102-4	4.58^{25}	∞	∞ eth.
4							
5	liq.	1.138^{14}	....	184	...	..	... .
6							
7							
8							
9							
10	col. fum. inflam liq., 1.3316	$0.7834\frac{18}{4}$	-123.5	21	∞	∞	∞ eth, bz.
11							
12							
13							
13M	sm. yel. sc. ...		167	.... ..	....	s.	s eth.
14	need. or col. liq; liq $1.42567^{20.4}$	$0\ 9656\frac{20}{4}$	47; frz. 13	114-5	s.	∞	∞ eth.
15	col. need ..	.	98-101 (57)	$236\text{-}7^{20}$			s. pet. eth.
16	need. f. w. or al.	$1.0300\frac{0}{4}$	162-3	.	3^{17}	s.	....
17							
18	col. liq.	.	.	90.5		....	... ...
19							
20							
21							
22							
23							
24							
25							
26		.	81	100	..	. .	. ...
27	col. rhomb.	..	97 (70-80)	100 sl. d.	v. s.	v. s.	sl. s. eth.
28							
29							
30							
31	col. hex., or rhbdr., deliq. need. f. chl.; 1 54, 1 46 (stable mod); 1 370, 1.485, 1.585 (metastable mod); liq. $1.4274^{78.3}$	$1.159\frac{20}{4}$	81 (69.4)	222	$97\ 5^{20}$, 178^{60}	$25\ 0^{20}$, 257.1^{60}	sl. s. eth.; v. s. glyc.; s. chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
32	**Acetamide, *N*-benzyl-**	*N*-acetylbenzylamine; acetobenzylamide	$C_6H_5CH_2NHCOCH_3$	149 19
33	**——, *N*-bromo-**.......	acetobromamide..	$CH_3CONHBr$..	137.98
34	**——, *α*-chloro-** ..	2-chloroethanamide*.	$ClCH_2CONH_2$...	93 52
35	**——, cyanonitro-.**	See *Fulminuric acid.*		
36	**——, *α*, *α*-dichloro-**	2, 2-dichloroethanamide* .	$CHCl_2CONH_2$.	127 97
37	**——, *N*, *N*-diphenyl-**	*N*-acetyldiphenylamine; *N*-phenylacetanilide	$(C_6H_5)_2NCOCH_3$	211.25
38	**——, *N*-ethyl-** .	acetoethylamide.... ..	$CH_3CONHC_2H_5$..	87.12
39	**——, hydroxy-.**	See *Glycolamide.*		
40	**——, *N*-(2-hydroxy-1-naphthyl)-.** See 2-*Naphthol, 1-acetamido-.*			
41	**——, *N*-(4-hydroxy-1-naphthyl)-.** See 1-*Naphthol, 4-acetamido-.*			
42	**——, isopropyl-.**	See *Isovaleramide.*		
43	**——, *N*-methyl-*N*-1-naphthyl-.** See 1-*Naphthylamine, N-acetyl-N-methyl-.*			
44	**——, *N*-naphthyl-.**	See *Naphthylamine, N-acetyl-.*		
45	**——, *N*-phenyl-.**	See *Acetanilide.*		
46	**——, *N*-2-thienyl-**	*N*-acetyl-2-thiophenine, 2-acetothiophenide	$CH_3CONHC_4H_3S$.	141.18
47	**——, thio-**	ethanethionamide*; acetothioamide	CH_3CSNH_2 . .	75.13
48	**——, *N*-(thiocarbamyl)-.** See *Urea, acetyl-thio-.*			
49	**——, trichloro-**........	2, 2, 2-trichloroethanamide*	CCl_3CONH_2	162 42
50	**Acetamidine**	ethanamidine*	$CH_3C(:NH)NH_2$	58 08
51	**——, *N*, *N'*-diphenyl-** .	ethenyldiphenylamidine	$CH_3C(.NC_6H_5)-NHC_6H_5$	210 27
52	**Acetanilide**.... .	*N*-phenylacetamide; antifebrin	$CH_3CONHC_6H_5$.	135.16
53	**——, *α*-acetyl-.**	See *Acetoacetanilide*		
54	**——, *o*-amino-**	*N*-acetyl-*o*-phenylenediamine	$CH_3CONHC_6H_4-NH_2$	150.18
55	**——, *m*-amino-**	*N*-acetyl-*m*-phenylenediamine	$CH_3CONHC_6H_4-NH_2$	150.18
56	**——, *p*-amino-**	*N*-acetyl-*p*-phenylenediamine	$CH_3CONHC_6H_4-NH_2$	150 18
57	**——, *o*-bromo-**	*N*-acetyl-*o*-bromoaniline	$BrC_6H_4NHCOCH_3$	214 07
58	**——, *m*-bromo-**		$CH_3CONHC_6H_4Br$	214 07
59	**——, *p*-bromo-**	*N*-acetyl-*p*-bromoaniline, antisepsin, asepsin, bromanilid	$BrC_6H_4NHCOCH_3$	214.07
60	**——, *o*-chloro-** . .	*N*-acetyl-*o*-chloroaniline	$CH_3CONHC_6H_4Cl$	169.61
61	**——, *m*-chloro-.** .	*N*-acetyl-*m*-chloroaniline	$CH_3CONHC_6H_4Cl$	169 61
62	**——, *p*-chloro-.**	*N*-acetyl-*p*-chloroaniline	$CH_3CONHC_6H_4Cl$	169 61
63	**——, 2,4-dimethyl-.**	See 2, 4-*Acetoxylide.*		
64	**——, 2,4-dinitro-..** .	.. ..	$CH_3CONHC_6H_3-(NO_2)_2$	225.16
65	**——, *p*-ethoxy-.**	See *p-Acetophenetide.*		
66	**——, *o*-hydroxy-**	*o*-acetamidophenol; *o*-acetylaminophenol	$CH_3CONHC_6H_4-OH$	151.16
67	**——, *m*-hydroxy-**	*m*-acetamidophenol ..	$CH_3CONHC_6H_4-OH$	151.16
68	**——, *p*-hydroxy-** .	*p*-acetamidophenol . .	$CH_3CONHC_6H_4-OH$	151 16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
32	leaf. f. eth.....	..	61	>300	i.	s.	s. eth., lgr.
33	$+1H_2O$, lg. pl	...	$+H_2O$, 70-80; anh. 108		s, d.^{100}	s.	s. eth.
34	monocl. need.		119.5	225 6	10^{24}	s.	v. sl. s. eth.
35							
36	monocl. pr....		98	234 6	v s. h.	v. s.	v. s. eth.
37	ng. need or rhomb. f. w		103 (99-100)	subl	sl. s.	s.	sl s eth.
38	liq	$0.942\frac{4\ 5}{4}$	...	205	∞	∞	s a.; i. dil. alk.
39							
40							
41							
42							
43							
44							
45							
46	wh. pl.		160-1		sl. s.	s	sl s. eth.
47	yel. monocl tab. f eth.		108.5	.	v. s.	s.	s. eth.
48							
49	monocl tab f w.		141	239-40	v sl. s.	v. s.	v. s. eth.
50	unstable. .		166-7 d.		s, d. h	s.	s a.
51	need. f. al.. .	....	131-2	..		sl s c, v s h	v s eth.; s. a.
52	rhomb, wh leaf. f w.	$1\ 21\frac{4}{4}$	114	305	0 563^{25}, 3 5^{80}	36 9^{20}	s eth, glyc.; 13 6^{20}, 44.9^{60} chl, 69.5^{20} me al.
53							
54	sm lust. pl		132 (145)	.	s.		sl. s eth.
55	col need. f. bz.		70	d 86.5-7.5	v.s.	s.	sl s. eth.
56	col need f w	.	161-2	267	sl. s.	v. s.	v. s. eth.
57	need. f. al		99		i.	s.	s eth.
58	need. f. dil al		87 5			s.	s eth.
59	need. or monocl. pr.		168 (165-7)		v sl. s. h.	sl. s.	sl s eth; s. chl, bz.
60	need. f. dil. ac. a.	.	88		sl. s.	s.	v s eth.; s. bz.
61	need. f. dil. ac. a	.	72.5		sl. s.	s.	v s eth; s. CS_2, bz
62	rhomb need or pl.	$1\ 385\frac{22}{4}$	178 4 (176-7)		sl. s.	3 28^{10}; 4.37^{20}	s. eth., CS_2
63							
64	need f al		120		i. c.	v. s. h.	s. eth.
65							
66	col. leaf. f. dil. al.		203	...	sl. s.	s.	s. eth., KOH
67	col. need. f. w.	. ..	149	.....	s.	s.	sl s. eth., chl., bz.
68	col. monocl. f. al.	$1.293\frac{21}{4}$	168	......	v. sl. s.	v. s.	sl s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
69	**Acetanilide, o-hydroxy-*N*-methyl-**	*o*-(acetylmethylamino)-phenol	$CH_3CON(CH_3)C_6H_4OH$	165 19
70	**——, *p*-hydroxy-*N*-methyl-**	. . . .	$CH_3CON(CH_3)C_6H_4OH$	165 19
71	**——, *p*-iodo-**.	. . . .	$CH_3CONHC_6H_4I$	261.07
72	**——, *p*-methoxy-.**	See *p-Acetaniside.*		
73	**——, *N*-methyl-**.	exalgin.	$CH_3CON(CH_3)C_6H_5$	149.19
74	**——, o-methyl-.**	See *o-Acetotoluide.*		
75	**——, *N*-methyl-*p*-nitro-**	. . . .	$CH_3CON(CH_3)C_6H_4NO_2$	194.19
76	**——, o-nitro-**.	. . . .	$CH_3CONHC_6H_4NO_2$	180.16
77	**——, *m*-nitro-**.	. . . .	$CH_3CONHC_6H_4NO_2$	180 16
78	**——, *p*-nitro-**.	. .	$CH_3CONHC_6H_4NO_2$	180 16
80	**——, *N*-phenyl-.**	See *Acetamide, N, N-diphenyl*-.		
81	**——, *α*-phenyl-.**	See *α-Toluanilide.*		
82	**——, *p*-phenylazo-.**	See *Azobenzene, p-acetamido-.*		
83	**——, thio-**.	. . . .	$CH_3CSNHC_6H_5$	151.22
84	***o*-Acetaniside**.	*N*-acetyl-*o*-anisidine; *o*-acetanisidide	$CH_3CONHC_6H_4OCH_3$	165.19
85	***p*-Acetaniside** . . .	*p*-methoxyacetanilide; *p*-acetamidoanisole; *N*-acetyl-*p*-anisidine; methacetin; *p*-acetanisidide	$CH_3CONHC_6H_4OCH_3$	165.19
86	**Acetic acid**.	ethanoic acid* . . .	CH_3COOH.	60 05
87	——, esters.	For esters other than those listed below see also "acetate"		
88	——, allyl ester . .	allyl acetate, 2-propenyl ethanoate*	$CH_3COOCH_2CHCH_2$	100 11
89	——, amyl ester . .	amyl acetate; 1-pentanol acetate; amyl acetic ester	$CH_3COO(CH_2)_4CH_3$	130 18
90	——, benzyl ester	benzyl acetate; benzyl ethanoate*	$CH_3COOCH_2C_6H_5$.	150 17
91	——, butyl ester.	butyl acetate; butyl ethanoate*	$CH_3COO(CH_2)_3CH_3$	116.16
92	——, *sec*-butyl ester .	2-butanol acetate; *α*-methylpropyl ethanoate*	$CH_3COOCH(CH_3)C_2H_5$	116 16
93	——, cetyl ester	cetyl acetate, hexadecylethanoate*; *n*-hexadecylacetate	$CH_3COO(CH_2)_{15}CH_3$	284.47
94	——, ethyl ester.	ethyl ethanoate*; acetic ester	$CH_3COOC_2H_5$. . . .	88.10
95	——, ethylene ester.	See *Glycol, diacetate*		
96	——, furfuryl ester.	See *Furfuryl alcohol, acetate.*		
97	——, heptyl ester	*n*-heptyl acetate.	$CH_3COOC_7H_{15}$	158.24
98	——, hexyl ester	*n*-hexyl acetate.	$CH_3COO(CH_2)_5CH_3$	144.21
99	——, isoamyl ester	isoamyl acetate; 3-methyl-1-butanol acetate; *γ*-methylbutyl ethanoate*	$CH_3COO(CH_2)_2CH(CH_3)_2$	130.18
100	——, isobutyl ester	isobutyl acetate; *β*-methylpropyl ethanoate*.	$CH_3COOCH_2CH(CH_3)_2$	116 16

* Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
69	need.	....	150	....	sl. s.	v. s.	s. eth.
70	cr. . .	......	240	... ..	v. sl. s.	v. s.	s. eth.
71	monocl.	$1.989\frac{15-20}{4}$	183–4	....	s. h.	5.05[21]	i. eth.; v. s. ac. a.
72							
73	col. rhomb. pr. f. al. 1.560, 1.576, 1.647	$0.977\frac{120}{4}$	101–4 (97–99)	254.7 (253[112])	i (sl. s.)	s.	.. ..
74							
75	leaf. f. w....	. ..	152–3	.... .	..	s.	s. eth.
76	yel. monocl. leaf.	$1.419\frac{15}{4}$	93 (90–1)	... .	s. h.	s.	v. s. eth., KOH
77	col.-yel. leaf.	.. .	155 (150.5)	.. . .	s. h.	s.	i. eth.; s. chl., KOH
78	yel. rhomb. pr.	. .	215	. .... .	v. sl. s.	s.	s. eth., KOH
80							
81							
82							
83	need. f. w....	.. . ..	75	d.	i.	.	i. eth.; s. alk., NaOH
84	pearly, wh. cr. f. w.	. .....	87–8 (84)	303–5	v. s. h.	55.3[21]	s. eth.; v. s. ac. a.
85	wh. powd., pr. or pl. f. w.	. . ..	137–38	... .	0.2[15], 8.3[100]	12.7[21]	sl. s. eth.; s. chl., acet.
86	col. liq., 1.37182	$1.049\frac{20}{4}$	16.6	118.1	∞	∞	∞ eth.; i. CS_2
87	under *o-Cresol*,	*Cyclohexanol, etc.*					
88	col. liq., 1.40448	0.928	....	103–4	sl. s.	∞	∞ eth.
89	col. liq., 1.4012	$0.879\frac{20}{20}$	....	148[767] (145–7)	0.18[28]	∞	∞ eth.
90	col. liq., 1.5232	$1.057\frac{16}{4}$	-51.5	213.5[756]	v. sl. s.	∞	∞ eth.
91	col. inflam. liq., 1.3951	$0.882\frac{20}{4}$ $0.9016\frac{0}{0}$	-76.8	126.5 (124–6)	0.5[25]	∞	∞ eth.
92	col. liq., 1.3866[25]	$0.8648\frac{25}{4}$	. . ....	112–3	i.	s.	s. eth.
93	need., 1.4358[22.9]	$0.858\frac{20}{4}$	18.5 (16–9)	200.5[15]	i.	v. sl. s.	v. s. eth.
94	col. inflam. liq., 1.37216[18.9]	$0.901\frac{20}{4}$; $0.90657\frac{15}{4}$	-83.6	77.15	8.6[20], 7.4[85]	∞	∞ eth., chl., oils
95							
96							
97	col. liq., 1.4153	$0.874\frac{16}{16}$	....	191.5	i.	s.	s. eth.
98	col. liq.	$0.8902\frac{0}{0}$	....	169.2	i.	v. s.	v. s. eth.
99	col. liq., 1.40170[17.9]	$0.8699\frac{25}{4}$	-78.5	142.5 (138–40)	0.16[25]	∞	∞ eth.; s. amyl al.
100	col. liq., 1.39114[17.8]	0.8712	-98.9	116.5 (115–7)	0.63[25]	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
101	**Acetic acid,** isopropyl ester	isopropyl acetate.........	$CH_3COOCH(CH_3)_2$	102.13
102	——, methylene diester....	methylene acetate; methylene diacetate; methanediol diacetate	$(CH_3COO)_2CH_2$.	132 11
103	——, methyl ester.........	methyl acetate.... . .	CH_3COOCH_3....	74 08
104	——, β-phenylhydrazide.	See *Hydrazine, 1-acetyl- 2-phenyl-.*		
105	——, piperazinium salt ...	....	$C_4H_{10}N_2.2C_2H_4O_2$.	206 24
106	——, piperidide.	See *Piperidine, 1-acetyl-.*		
107	——, propyl ester..........	*n*-propyl acetate.	$CH_3COOC_3H_7$ ..	102.13
108	——, **acetamido-.**	See *Aceturic acid.*		
109	——, **(p-acetamidoanilino)-.**	See *Glycine, N-(p-acetamidophenyl)-.*		
109M	——, **acetyl-.**	See *Acetoacetic acid.*		
110	——, **allyl-.**	See *4-Pentenoic acid*.*		
111	——, **amino-.**	See *Glycine.*		
112	——, **(p-aminoanilino)-.**	See *Glycine, N-(p-aminophenyl)-.*		
113	——, **anilino-.**	See *Glycine, N-phenyl-.*		
114	——, **anthranilido-.**	See *Anthranilic acid, N-(carboxymethyl)-.*		
115	——, **benzamido-.**	See *Hippuric acid.*		
116	——, **benzoyl-**.........	β-ketohydrocinnamic acid, 3-oxo-3-phenylpropanoic acid	$C_6H_5COCH_2COOH$	164 15
117	——, ——, ethyl ester	ethyl-β-ketohydrocinnamate, benzoylacetic ester	$C_6H_5COCH_2$-$COOC_2H_5$	192 21
118	——, ——, methyl ester ..	... .	$C_6H_5COCH_2$-$COOCH_3$	178 18
119	——, **bromo-**	bromoethanoic acid*.........	$CH_2BrCOOH$.	138 96
120	——, ——, ethyl ester......	ethyl bromoethanoate*	$CH_2BrCOOC_2H_5$..	167 01
121	——, **sec-butyl-.**	See *Valeric acid, β-methyl-.*		
122	——, **butylethyl-.**	See *Caproic acid, α-ethyl-.*		
123	——, **chloro-**	chloroethanoic acid*.........	$CH_2ClCOOH$....	94 50
124	——, ——, butyl ester....	butyl 2-chloroethanoate*...	$CH_2ClCOOC_4H_9$.	150 61
125	——, ——, ethyl ester . .	ethyl chloroacetate; ethyl chloroethanoate*	$CH_2ClCOOC_2H_5$	122 55
126	——, ——, methyl ester....	methyl chloroethanoate* ...	$CH_2ClCOOCH_3$...	108 53
127	——, ——, p-phenylphenacyl ester	....	$CH_2ClCOOCH_2$ $COC_6H_4C_6H_5$	288 72
128	——, ——, piperazinium salt	.. . .	$C_4H_{10}N_2.2CH_2$-$ClCOOH$	275.14
129	——, **cyano-**	cyanoethanoic acid*; malonic mononitrile	$CNCH_2COOH$.	85 06
130	——, ——, ethyl ester	....	$CH_2(CN)COOC_2H_5$	113 11
131	——, ——, methyl ester ..	methyl cyanoethanoate*. .	$CNCH_2COOCH_3$.	99 09
132	——, **diazo-,** ethyl ester.	ethyl diazoethanoate*.......	$N_2CHCOOC_2H_5$...	114 10
133	——, **dibromo-**........	dibromoethanoic acid*	$CHBr_2COOH$. ...	217 87
134	——, ——, ethyl ester ...	ethyl dibromoethanoate*....	$CHBr_2COOC_2H_5$.	245 92

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
101	col. liq.......	$0.877\frac{16}{4}$; $0.8690\frac{25}{4}$	-73.4	89	3.09^{20}	∞	∞ eth.
102	col. liq.	$1.136\frac{20}{4}$	....	170	sl. s.	∞	∞ eth.
103	col. liq., 1.35935	$0.92740\frac{25}{4}$	-98.1	57.1	31.9^{20}	∞	∞ eth.
104							
105	wh. cr.	.	208.5–209	....	s.	s.	i. eth.; s. h. *n*-butanol
106							
107	col. liq., 1.38438	$0.887\frac{20}{4}$	-92.5	101.6	1.89^{20}	∞	∞ eth
108							
109							
109M							
110							
111							
112							
113							
114							
115							
116	col. need. f. bz.	....	103–4 d.	......	sl. s	s.	s. eth.; sl. s. lgr.
117	col. liq., 1.53115^{16}	$1.122\frac{20}{4}$	<0	265–70 d.	v. v. sl. s.	∞	∞ eth.
118	col.-yel. liq., $1.53654^{24.7}$	$1.158\frac{20}{4}$	....	265 d.	i.	∞	∞ eth.
119	col. hex. or rhomb	$1.934\frac{20}{4}$	50	208	∞, deliq.	∞	∞ eth.
120	col. liq., 1.451	$1.514\frac{15}{4}$	....	159; $57\text{–}9^{15}$	i.	∞	∞ eth.
121							
122							
123	col. rhomb., 1.4297^{65}	$1.58\frac{20}{20}$	α 63, β 55–6, γ 50	189	v. s.	s.	s. eth., chl., CS_2, bz.
124	liq.	$1.103\frac{0}{4}$	....	175 (181–3)	.....	......	....
125	col. liq., 1.42274	$1.159\frac{20}{4}$	-26.0	144.2	i.	∞	∞ eth.
126	col. liq. .	$1.227\frac{25}{4}$	-32.7	131.5	v. sl. s.	∞	∞ eth.
127	....	....	116	....	......	......	....
128	wh. cr.. ...	....	145–6	....	s.	s. h.	i. eth.
129	deliq. col. cr.	....	66 (69–70)	108^{15}, d. 160	s.	s.	s. eth.; sl. s. bz., chl.
130	col. liq., $1.41793^{20.5}$	$1.063\frac{20}{4}$	-22.5	206	i.	∞	∞ eth
131	col. liq. ..	1.123^{15}	-22.5	200	i.	∞	∞ eth.
132	yel. oil, $1.4588^{17.6}$	$1.0852\frac{17.6}{4}$; 1.073^{22}	-22	$140\text{–}41^{720}$	sl. s.	s.	s. eth., bz., lgr.
133	col. deliq. cr.	. . . .	48	232; $195\text{–}7^{250}$	sl. s.	s.	s. eth.
134	oil, 1.498	$1.903\frac{20}{20}$	.	194	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
135	**Acetic acid, dichloro-**	dichloroethanoic acid*	$CHCl_2COOH$.....	128.95
136	——, ——, ethyl ester.....	ethyl dichloroethanoate*.....	$CHCl_2COOC_2H_5$..	157.00
137	——, **diethyl-.**	See *Butyric acid, α-ethyl-.*		
138	——, **diethylmethyl-.**	See *Butyric acid, α-ethyl-α-methyl-.*		
138M	——, **difluoro-**	difluoroethanoic acid*........	CHF_2COOH.......	96 04
139	——, **diiodo-**...........	diiodoethanoic acid*........	CHI_2COOH	311.88
140	——, **dimethyl-.**	See *Isobutyric acid.*		
141	——, **di-*n*-octyl-.**	See *Capric acid, α-octyl-.*		
142	——, **diphenyl-**...... .	diphenylmethane-α-carboxylic acid	$(C_6H_5)_2CHCOOH$.	212.24
142M	——, **diureido-.**	See *Allantoic acid.*		
143	——, **ethoxy-**...........	ethoxyethanoic acid*; ethyloglycolic acid; glycolic acid ethyl ether	$C_2H_5OCH_2COOH$	104.10
144	——, **ethyl-.**	See *Butyric acid.*		
145	——, **(ethylamino)-.**	See *Glycine, N-ethyl-.*		
146	——, **ethyldimethyl-.**	See *Butyric acid. α, α-dimethyl-*		
147	——, **ethylene-.**	See *Cyclopropanecarboxylic acid*.*		
148	——, **ethylmethyl-.**	See *Butyric acid, α-methyl-.*		
149	——, **ethylpropyl-.**	See *Valeric acid, α-ethyl-.*		
149M	——, **fluoro-**......... ..	fluoroethanoic acid* .	CH_2FCOOH.	78.04
150	——, **2-fural-.**	See 2-*Furanacrylic acid*		
150M	——, **2-furoyl-** ethyl ester	ethyl pyromucylacetate	$C_4H_3OCOCH_2$-$COOC_2H_5$	182.17
151	——, **guanido-.**	See *Glycocyamine.*		
152	——, **hydroxy-.**	See *Glycolic acid.*		
153	——, **iminodi-**.... ..	diglycolamidic acid; iminoacetic acid (incorrect)	$NH(CH_2COOH)_2$.	133.10
154	——, **iodo-**.... .	iodoethanoic acid*. .	CH_2ICOOH...	185.96
155	——, **isoamyl-.**	See *Caproic acid, δ-methyl-.*		
156	——, **isobutyl-.**	See *Isocaproic acid.*		
157	——, **isopropyl-.**	See *Isovaleric acid.*		
158	——, **isopropylmethyl-.**	See *Butyric acid, α, β-dimethyl-*		
159	——, **isothiocyano-**	mustard oil acetic acid	$SCNCH_2COOH$	117.12
160	——, **mercapto-** ...	2-mercaptoethanoic acid*; thioglycolic acid	$HSCH_2COOH$ ..	92.11
161	——, **methoxy-**.	methoxyethanoic acid*; methyloglycolic acid	CH_3OCH_2COOH	90 08
162	——, **methyl-.**	See *Propionic acid.*		
163	——, **(α-methylguanido)-**	See *Creatine.*		
164	——, **methylpropyl-.**	See *Valeric acid, α-methyl-.*		
165	——, **oxydi-.**	See *Diglycolic acid.*		
166	——, **phenoxy-**.........	glycolic acid phenyl ether	$C_6H_5OCH_2COOH$	152 14
167	——, **phenyl-.**	See *α-Toluic acid*		
168	——, **pyromucyl-.**	See *Acetic acid, 2-furoyl-.*		
169	——, **salicyl-.**	See *Benzoic acid, o-(carboxymethoxy)-.*		
170	——, **silico-.**	See *Methanesiliconic acid.*		
171	——, **sulfo-**	sulfoethanoic acid* . .	HO_3SCH_2COOH.	140 11
172	——, **2-thienyl-.**	See 2-*Thiopheneacetic acid.*		
173	——, **thiol-**.....	ethanethiolic acid*; methanecarbothiolic acid; thioacetic acid	CH_3COSH.......	76 11
174	——, ——, ethyl ester....	....	$CH_3COSC_2H_5$....	104.16
175	——, **tolyl-.**	See *α-Toluic acid, methyl-.*		
176	——, **tribromo-**.. ...	tribromoethanoic acid* .	CBr_3COOH..	296.78
177	——, **trichloro-**. ..	. . . . .	CCl_3COOH..	163 40

* Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
135	col. liq., 1.4659^{22}	$1.5634\frac{20}{4}$	5–6; frz. 11	194	3.68	s.	s. eth.
136	col. liq., 1.43960	$1.2821\frac{20}{4}$	....	158.2	v. sl. s.	∞	∞ eth.
137							
138							
138M	col. liq. . .	1.5359^{16}	0.35	134.2^{766}	v. s.	s.	s. eth.
139	yel. cr.	. .	110 (95–6)	....	sl. s.	s.	s. eth., bz.
140							
141							
142	col. need. f. w. or lf. f. al.	. ..	148	subl.	v. s. h.	v. s.	v. s. eth.; s. chl.
142M							
143	col. liq	$1.102\frac{20}{4}$	. .	206	v. s.	v. s.	v. s. eth.
144							
145							
146							
147							
148							
149							
149M	col. sld. .	. .	33	165	s	s.	....
150							
150M	liq.	....	.	$142\text{–}3^{10}$	i.	s.	s. eth.
151							
152							
153	col. rhomb.	.	*ca.* 225	.	2.43^{5}	i.	i. eth.
154	col. rhomb. pl.	. .	82	d.	s.	s.	s. eth.
155							
156							
157							
158							
159	rhomb. pl.	. .	125–6	subl.	s. h.	.	......
160	liq.	$1.3253\frac{20}{4}$	-16.5	$104\text{–}6^{11}$	s.	s.	s. eth.
161	col. hyg. liq	$1.1768\frac{20}{4}$	......	$89\text{–}91^{7}$	s.	s.	s. eth.
162							
163							
164							
165							
166	col. pl. or need. f. w.	.....	99	285 sl. d.	1.2^{18}	s.	s. eth., ac. a., bz.
167							
168							
169							
170							
171	hyg. tab. f. w.	....	86	*ca.* 245 d.	s.	v. s.	i. eth.
172							
173	col. liq.	$1.074\frac{10}{4}$	<-17	93	s.	∞	∞ eth.
174	liq.	$0.9739\frac{25}{4}$	. ....	115–16	i.	v. s.	v. s. eth.
175							
176	col. monocl. tab.	....	135	245 d.	v. s.	v. s.	v. s. eth.; sl. s. c. lgr.
177	col. rhomb. deliq.	$1.6298\frac{21}{4}$	57.5	197.5	120^{25}	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
178	**Acetic acid, trichloro-** ethyl ester	....	$CCl_3COOC_2H_5$.	191.45
179	——, ——, methyl ester.	....	CCl_3COOCH_3.....	177.43
180	——, ——, piperazinium salt	....	$C_4H_{10}N_2.2CCl_3$-COOH	412 94
180M	——, **trifluoro-**	trifluoroethanoic acid*.......	CF_3COOH.......	114 03
181	——, **triiodo-**........	triiodoethanoic acid* ..	CI_3COOH ..	437.79
182	——, **trimethyl-.**	See *Pivalic acid.*		
183	——, **triphenyl-**.......	....	$(C_6H_5)_3CCOOH$...	288.33
184	——, **ureido-.**	See *Hydantoic acid.*		
185	——, **vinyl-.**	See *3-Butenoic acid*.*		
186	**Acetic aldehyde.**	See *Acetaldehyde.*		
187	**Acetic anhydride.**	ethanoic anhydride*.........	$(CH_3CO)_2O$........	102.09
188	**Acetic ester.**	See *Acetic acid, ethyl ester.*		
189	**Acetin.**	See *diacetate, monoacetate, triacetate,* under *Glycerol.*		
190	**Acetoacetanilide**.....	β-ketobutyranilide, α-acetylacetanilide	CH_3COCH_2-$CONHC_6H_5$	177 20
191	——, **α-bromo-**.....	2-bromo-3-oxo-*N*-phenylbutanamide	$CH_3COCHBr$-$CONHC_6H_5$	256.11
191M	**Acetoacetic acid**......	acetylacetic acid; 3-oxobutanoic acid*	CH_3COCH_2COOH.	102 09
192	——, ethyl ester . . .	ethylacetoacetate; acetoacetic ester; ethyl 3-oxobutanoate*	CH_3COCH_2-$COOC_2H_5$	130.14
193	——, methyl ester	methyl acetoacetate .	CH_3COCH_2-$COOCH_3$	116 11
194	——, **γ-chloro-**, ethyl ester	ethyl 4-chloro-3-oxobutanoate*	$CH_2ClCOCH_2$-$COOC_2H_5$	164 59
195	——, **α, α-diethyl-**, ethyl ester	ethyl 2,2-diethyl-3-oxobutanoate*	$CH_3COC(C_2H_5)_2$-$COOC_2H_5$	186.25
197	——, **α-isopropyl-**, ethyl ester	ethyl 2-isopropyl-3-oxobutanoate*	$CH_3COCH(C_3H_7)$-$COOC_2H_5$	172.22
198	——, **α-methyl-**, ethyl ester	ethyl 2-methyl-3-oxobutanoate*; methylacetoacetic ester	$CH_3COCH(CH_3)$-$COOC_2H_5$	144.17
199	**Acetoacetic ester.**	See *Acetoacetic acid, ethyl ester.*		
200	**Acetobenzylamide.**	See *Acetamide, N-benzyl-*		
201	**Acetobromamide.**	See *Acetamide, N-bromo-.*		
202	**Acetocinnamone.**	See *Acetone, benzylidene-.*		
203	**Acetoethylamide.**	See *Acetamide, N-ethyl-.*		
204	**Acetoethyl nitrate** ..	....	C_2H_4O-$(C_2H_5NO_3)_2$?	226.19
205	**Acetoglyceral**.........	glycerol ethylidene ether .	$C_3H_5(OH)O_2C_2H_4$	118 13
206	**Acetoin**..............	3-hydroxy-2-butanone*; acetylmethylcarbinol	$CH_3COCHOHCH_3$	88.10
207	**Acetol**................	1-hydroxy-2-propanone*; hydroxyacetone; acetylcarbinol	CH_3COCH_2OH...	74 08
207M	——, **fluoro-.**	See *Propane, 2,2-difluoro-*.*		
208	**Acetonaphthalide.**	See *Naphthylamine, N-acetyl-.*		
208M	**1-Acetonaphthone**....	methyl 1-naphthyl ketone	$CH_3COC_{10}H_7$.....	170 20
209	——, **α-phenyl-.**	See *Ketone, benzyl 1-naphthyl.*		
209M	**2-Acetonaphthone**. ..	methyl 2-naphthyl ketone .	$CH_3COC_{10}H_7$ ...	170.20
210	——, **4-bromo-1-hydroxy-**	2-acetyl-4-bromo-1-naphthol..	$CH_3COC_{10}H_5$-BrOH	265.11
211	——, **1-hydroxy-**.......	1-hydroxy-2-naphthyl methyl ketone; 2-acetyl-1-naphthol	$CH_3COC_{10}H_6OH$..	186.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
178	col. liq., 1.45068	$1.383\frac{20}{4}$	....	168	i.	∞	∞ eth.
179	col.	$1.4868\frac{19.2}{4}$	-17.5	153.8	d.	d.	s eth.
180	wh. cr. ...	. .	121-1.5	....	s.	s. h.	i. eth.
180M	col. liq.	1.53514^{6}	-15.25	72.4	v. s.	.....	......
181	yel. leaf.	.... .	150 d.	....	s.	s.	s. eth.
182							
183	monocl. pr...	....	265	....	sl. s.	s.	sl. s. eth.; s. bz
184							
185							
186							
187	col. liq., 1.39038	$1.08712\frac{15}{4}$, $1.0820\frac{20}{4}$	-73.1	140.0	13.6 c., d.	∞	∞ eth; s. chl., bz
188							
189							
190	leaf. .		85	....	sl. s.	s.	s. eth, a, alk, h. bz.
191	col. need.. ..		138 d.	d.	i.	s.	s eth
191M	col. syrup .	.. . .	....	<100, d.	∞	s	s. eth.
192	col. liq., $1.42092^{16.6}$	$1.025\frac{20}{4}$	<-80	180	$14.3^{16.5}$	s	s. eth, bz, chl.
193	col. liq., $1.41837^{20.5}$	1.077	....	170	38.0	∞	∞ eth.
194	col. liq. .	$1.176\frac{25}{4}$	. ...	200	v. sl. s.	∞	∞ eth.
195	wh.-yel. liq., $1.43266^{17.3}$	$0.960\frac{25}{4}$	. .....	211-6 d.	i.	∞	∞ eth.
197	col. liq. . .	$0.957\frac{25}{4}$	. ...	205 d.	v. sl. s.	∞	∞ eth.
198	col. liq., $1.42066^{17.8}$	$1.019\frac{20}{4}$	....	186.8	v. sl. s	s.	s. eth.
199							
200							
201							
202							
203							
204	liq.	$1.045\frac{15}{4}$	. ...	89 exp.	i.	s.	. .. .
205	liq. (mixt.?) .	$1.081\frac{6}{4}$	.....	184-8	sl. s.	s.	....
206	1.4194^{15}	$1.002\frac{15}{4}$	15	148 (144)	s.	v. s.	i. eth., lgr.
207	col. liq., 1.4295	$1.082\frac{20}{20}$	-17	146, d.	∞	∞	∞ eth.
207M							
208							
208M	cr.	1.1336	34	296; $166\text{-}7^{12}$	. ....	s.	s. eth.
209							
209M	need.	....	53 (51.5)	300, 172^{11}	......	s.	. .....
210	yel. need.....	....	127	..... .	i.	s.	s. eth.
211	yel. need.. ...	....	99-101 (103)	325 d.	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
212	**2-Acetonaphthone, 1-hydroxy-4-nitro-**		$CH_3COC_{10}H_5(NO_2)OH$	231 20
213	**Acetone**	2-propanone*; dimethyl ketone	CH_3COCH_3	58 08
	For derivatives see also *2-Propanone*			
215	——, azine	dimethylketazine; diisopropylidenehydrazine	$(CH_3)_2C{:}NN{:}C(CH_3)_2$	112 17
216	——, cyanohydrin.	See *Isobutyronitrile, α-hydroxy-*.		
217	——, dichloride.	See *Propane, 2,2-dichloro-**.		
218	——, oxime.	See *Acetoxime.*		
219	——, phenylhydrazone	2-propanone phenylhydrazone*	$(CH_3)_2C{:}NNHC_6H_5$	148.20
220	——, semicarbazone	2-propanone semicarbazone*	$(CH_3)_2C{:}NNHCONH_2$	115 14
221	——, sodium bisulfite compound		$(CH_3)_2C(OH)SO_3Na$	162 14
222	——, **acetonyl-.**	See *2,5-Hexanedione**.		
223	——, **acetyl-.**	See *2,4-Pentanedione**.		
224	——, **allyl-.**	See *5-Hexen-2-one**.		
225	——, **anisal-.**	See *3-Buten-2-one, 4-p-methoxyphenyl-*		
226	——, **benzal-.**	See *Acetone, benzylidene-*.		
227	——, **benzoyl-.**	1-phenyl-1,3-butanedione*; α-acetylacetophenone; methyl phenacyl ketone; acetylbenzoylmethane	$C_6H_5COCH_2COCH_3$	162 18
228	——, **benzyl-.**	See *2-Butanone, 4-phenyl-**.		
229	——, **benzylidene-**	benzalacetone; methyl styryl ketone; 4-phenyl-3-buten-2-one*; cinnamyl methyl ketone; acetocinnamone	$C_6H_5CH{:}CHCOCH_3$	146 18
230	——, **dibenzal-.**	See *Styryl ketone.*		
231	——, ***sym*-diisopropyl-.**	See *4-Heptanone, 2,6-dimethyl-**.		
232	——, **diisopropylidene-.**	See *Phorone.*		
233	——, ***sym*-dimethyl-.**	See *3-Pentanone**.		
234	——, **diphenyl-.**	See *2-Propanone, 1,3-diphenyl-**.		
235	——, **ethylidene-.**	See *3-Penten-2-one**.		
236	——, ***unsym*-ethylmethyl-.**	See *2-Pentanone, 3-methyl-**.		
237	——, **2-fural-.**	See *Acetone, furfurylidene-*		
238	——, **furfurylidene-.**	furfural acetone; 4-(2-furyl)-3-butene-2-one*	$C_4H_3OCH{:}CHCOCH_3$	136 14
239	——, **hydroxy-.**	See *Acetol.*		
240	——, **isonitroso-.**	See *Pyruvaldehyde, aldoxime.*		
241	——, **isopropylidene-.**	See *Mesityl oxide.*		
242	——, ***p*-methoxybenzal-.**	See *3-Buten-2-one, 4-p-methoxyphenyl-*.		
243	——, **phenacyl-.**	See *Valerophenone, γ-oxo-*		
244	——, **chloride.**	See *Propane, 2,2-dichloro-**.		
245	**Acetone-chloroform.**	See *Chloretone.*		
246	**Acetonediacetic acid**	γ-ketopimelic acid; 4-oxoheptanedioic acid*	$CO(CH_2CH_2COOH)_2$	174 15
247	**Acetonedicarboxylic acid**	β-ketoglutaric acid; 3-oxopentanedioic acid*	$CO(CH_2COOH)_2$	146 10
248	**Acetone diethylsulfone.**	See *Propane, 2,2-bis(ethylsulfonyl)-**		
248M	——, **fluoride.**	See *Propane, 2, 2-difluoro-**.		
249	**Acetonic acid.**	See *Isobutyric acid, α-hydroxy-*.		
250	**Acetonitrile**	ethanenitrile*; methyl cyanide	CH_3CN	41 05
251	——, **allyl-.**	See *4-Pentenenitrile**.		
252	——, **benzoyl-**	β-ketohydrocinnamonitrile; 3-oxo-3-phenylpropanenitrile; α-cyanoacetophenone	$C_6H_5COCH_2CN$	145 15
253	——, **diethyl-.**	See *Butyronitrile, α-ethyl-*.		
254	——, **ethylmethyl-.**	See *Butyronitrile, α-methyl-*.		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
212	yel. need.	. . . .	. . . .	. . .	i.	sl. s.	s. eth.
213	col. inflam. liq., $1.35886^{19.4}$	$0.792\frac{20}{4}$; $0.8186\frac{0}{4}$	-95	56.5	∞	∞	∞ eth.; s. chl.
215	col. liq., 1.45102^{25}	$0.8381\frac{25}{4}$	. . . . . .	131	s.	∞	∞ eth.
216							
217							
218							
219	rhomb. cr. or oil	. . . .	42 (27)	163^{50}	s.	s.	s. eth., dil. min. a.
220	col. need. f. w.	. . . .	187-8	. . . .	sl. s.	s.	s. eth.
221	wh. leaf.	. . . . .	d.	. . . .	v. s.	sl. s.	i. eth.
222							
223							
224							
225							
226							
227	col. pr., $1.56775^{77.8}$	$1.090\frac{60}{4}$	61 (57-8)	261-2 (132^{14})	sl. s. c.	s.	s. eth., conc. alk.
228							
229	col. lustr. pl.	$1.0377\frac{15}{15}$	42	260-2	i.	v. s.	s. eth., chl., bz.
230							
231							
232							
233							
234							
235							
236							
237							
238	wh. nd.	. . . . . .	39-40	229 d.	i.	s.	s. eth.
239							
240							
241							
242							
243							
244							
245							
246	rhomb. f. w.	. .	143	. . . .	s. h.	s.	sl. s. eth.; i. bz
247	need. f. eth.	. . . .	135 d.	d.	v. s.	s.	v. sl. s. eth.; i. bz., chl., lgr.
248							
248M							
249							
250	col. liq., $1.34596^{16.5}$	$0.7828\frac{20}{4}$	-41 to -44	82	∞	∞	∞ eth.
251							
252	leaf.		80-1	. . . .	sl. s. c.	s.	s. eth., chl., bz., alk., KCN
253							
254							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
255	**Acetonitrile, 2-furyl-.**	See *2-Furanacetonitrile.*		
256	**——, iminodi-....**	α,α'-dicyanodimethylamine; iminoacetonitrile (incorrect)	$NH(CH_2CN)_2$	95 10
257	**——, isobutyl-.**	See *Isocapronitrile.*		
258	**——, phenyl-.**	See *α-Tolunitrile.*		
259	**——, trimethyl-.**	See *Propionitrile, α, α-dimethyl-.*		
260	**——, trinitro-... .....**	trinitroethanenitrile*	$(NO_2)_3CCN$.....	176.05
261	**——, vinyl-.**	See *Allyl cyanide.*		
262	**Acetonitrolic acid ...**	ethylnitrolic acid...........	$CH_3(NO_2)C{:}NOH$.	104 07
263	**Acetonylamine.**	See *2-Propanone, 1-amino-.*		
264	**o-Acetophenetide.....**	o-ethoxyacetanilide; N-acetyl-o-phenetidine	$CH_3CONHC_6H_4$-OC_2H_5	179.21
265	**p-Acetophenetide.....**	p-ethoxyacetanilide; p-acetphenetidine; phenacetin	$CH_3CONHC_6H_4$-OC_2H_5	179.21
266	**——, α-amino-.**	See *Phenocoll.*		
267	**Acetophenone........**	methyl phenyl ketone; hypnone; acetylbenzene	$CH_3COC_6H_5$	120.14
268	——, oxime...............	....	$C_6H_5C({:}NOH)$-CH_3	135.16
269	**——, α-acetonyl-.**	See *Valerophenone, γ-oxo-.*		
270	**——, α-acetyl-.**	See *Acetone, benzoyl-.*		
271	**——, o-amino-........**	o-aminophenyl methyl ketone: o-acetylaniline	$CH_3COC_6H_4NH_2$..	135 16
272	**——, m-amino-.......**	m-aminophenyl methyl ketone	$CH_3COC_6H_4NH_2$..	135.16
273	**——, p-amino-.... ...**	p-aminophenyl methyl ketone.	$CH_3COC_6H_4NH_2$	135 16
274	**——, benzal-.**	See *Chalcone.*		
274M	**——, o-bromo- ....**	....	$CH_3COC_6H_4Br$.	199.05
275	**——, p-bromo-... ....**	... .	$BrC_6H_4COCH_3$.	199.05
276	**——, α-bromo- ....**	phenacyl bromide.	$BrCH_2COC_6H_5$.	199.05
277	**——, α-bromo-p-methyl-**	p-methylphenacyl bromide.	$CH_3C_6H_4COCH_2$-Br	213.08
278	**——, α-bromo-p-phenyl-**	p-phenylphenacyl bromide.	$BrCH_2COC_6H_4$-C_6H_5	275.15
279	**——, 4-tert-butyl-2-methyl-3, 6-dinitro-**	musk ketone; musk C	$CH_3COC_6H(C_4H_9)$-$(CH_3)(NO_2)_2$	280.28
279M	**——, o-chloro-.......**	....	$CH_3COC_6H_4Cl$	154.59
280	**——, p-chloro-...... .**	methyl p-chlorophenyl ketone	$CH_3COC_6H_4Cl$	154 59
281	**——, α-chloro-........**	phenacyl chloride..... . ..	$ClCH_2COC_6H_5$...	154.59
282	**——, α-cyano-.**	See *Acetonitrile, benzoyl-.*		
283	**——, p, α-dibromo-...**	p-bromophenacyl bromide. .	$BrCH_2COC_6H_4Br$.	277 96
284	**——, 2,4-dihydroxy-.**	See *Resacetophenone.*		
285	**——, 2,5-dihydroxy-...**	2-acetylhydroquinone; quinacetophenone	$CH_3COC_6H_3(OH)_2$.	152.14
286	**——, α-ethoxy- α-phenyl-.** See *Benzoin, ethyl ether.*			
287	**——, α-hydroxy-.....**	benzoylcarbinol; phenacyl alcohol; acetophenone alcohol	$C_6H_5COCH_2OH$.	136.14
288	**——, 2-hydroxy-4-methoxy-.** See *Paeonol.*			
289	**——, α-hydroxy-p-phenyl-.** See also "*p-phenylphenacyl ester*" under *Acetic Acid,*			

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
255							
256	col. leaf. f. eth.	. ...	75	. ...	s.	s.	sl. s. eth.
257							
258							
259							
260	waxy	. . .	41.5	exp. 220	d.	d.	s. eth.
261							
262	yel. rhomb. f. w. or eth.	.. ..	88	d.	s.	s.	s. eth.
263							
264	leaf.	. . .	79	>250	i.	s.	s. eth.
265	wh. powd or monocl. pr. or leaf.; 1 54, 1.571, 1.59	. .	137–138	d.	.0055^{14}; .11^{25}	7.45^{25}	1.56^{25} eth.; 7.1 chl.
266							
267	col. liq. or pl., 1.53418^{19}	1 026$^{20}_{4}$	19.7	202 3	i.	s.	s. eth., bz. chl., conc. H_2SO_4
268	col. need. f. w.	.... .	58	.	sl. s.	s.	s. eth.
269							
270							
271	yel. oil	.	. . .	252 sl. d.	i.	....	s. eth.
272	yel. leaf. f. dil. al.	....	99.5 (96.5)	290	.		... .
273	yel. need. f. w.	. .	106	295	v. sl s.	s.	s eth., HCl, bz.; sl. s. lgr.
274							
274M	col. liq. .. .	..	.	117–118^{12}		.	s. eth.
275	wh. leaf. f. al.	1 647	50	255.5; 129–30^{15}	v. sl. s.	s.	s. eth , ac. a., bz., lgr.
276	trim. (rhomb.) pr. f. al.	1 647$^{20}_{4}$	50	140^{12}	i.	v. s.	v. s. eth.
277	col. need. or leaf. f. al.		49–51	. ..	i., d	d.	s. eth.
278	lng. col. need.	.	125.5		.	1.3^{25}, 6.7^{78}	. .....
279	. .		136		i	s.	s. eth.
279M	col oil, 1.685^{25}	1 1884	. . .	227–8^{738}; 113^{18}	v. sl. s.		s. eth.
280	cr	1 188$^{20}_{4}$	20 (14–15)	232	i.	∞	∞ eth.
281	col. rhomb.	1 324$^{15}_{4}$	59	247	i.	s.	s. eth.; 31.4 CS_2
282							
283	fine need.	. .	109.7		i.	sl. s.	s. eth.
284							
285	yel. need ..	. .	202	. . ... .	i.	s.	sl s. eth.
286							
287	hex. pl.	1 013	95 (83–84)	119^{11}	v. s. h.	s.	s. eth.
288							
289	*chloro-; Butyric acid; Caproic acid; etc.*						

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
290	**Acetophenone, α-hydroxy-*p*-phenyl-, acetate**	*p*-phenylphenacyl acetate . .	CH_3COOCH_2-$COC_6H_4C_6H_5$	254 27
291	—, —, benzoate	*p*-phenylphenacyl benzoate . .	$C_6H_5COOCH_2$-$COC_6H_4C_6H_5$	316.34
292	—, **α-hydroxy-α-phenyl-.** See *Benzoin.*			
293	—, **5-isopropyl-2-methyl-**	carvacryl methyl ketone; 2-acetyl-*p*-cymene	$CH_3COC_6H_3$-$(CH_3)CH(CH_3)_2$	176.25
294	—, ***p*-methoxy-**.	*p*-anisyl methyl ketone; *p*-acetylanisole	$CH_3OC_6H_4COCH_3$	150.17
295	—, ***p*-methyl-**.	methyl *p*-tolyl ketone.	$CH_3COC_6H_4CH_3$	134.17
296	—, ***m*-nitro-** . .	. . . .	$CH_3COC_6H_4NO_2$	165 14
297	—, **α-phenyl-.**	See *Desoxybenzoin.*		
298	—, **2,3,4-trihydroxy-.**	See *Gallacetophenone.*		
299	—, **α-triphenyl-.**	See *β-Benzopinacolin.*		
300	**o-Acetophenonecarboxylic acid.** See *Benzoic acid, o-acetyl-.*			
301	**Acetophenone pinacol.**	See *2,3-Butanediol, 2,3-diphenyl-.*		
302	**Acetophenone pinacolin.** See *2-Butanone, 3,3-diphenyl-.*			
303	**Acetopropionic acid.**	See *Levulinic acid.*		
304	**α-Acetothienone.**	See *Ketone, methyl 2-thienyl.*		
305	**Acetothioamide.**	See *Acetamide, thio-.*		
306	**2-Acetothiophenide.**	See *Acetamide, N-2-thienyl-.*		
307	**o-Acetotoluide**.	*o*-methylacetanilide; *N*-acetyl-*o*-toluidine; acet-*o*-toluidide	$CH_3CONHC_6H_4$-CH_3	149 19
308	—, ***N*-methyl-**.	*N*-acetyl-*N*-methyl-*o*-toluidine	$(CH_3)(CH_3CO)$-$NC_6H_4CH_3$	163 21
309	***m*-Acetotoluide**.	*N*-acetyl-*m*-toluidine; acet-*m*-toluidide	$CH_3CONHC_6H_4$-CH_3	149.19
310	—, ***N*-methyl-**.	. . . .	$(CH_3)(CH_3CO)$-$NC_6H_4CH_3$	163.21
311	***p*-Acetotoluide**.	*N*-acetyl-*p*-toluidine; acet-*p*-toluidide	$CH_3CONHC_6H_4$-CH_3	149 19
312	—, ***N*-methyl-**.	. . . .	$(CH_3)(CH_3CO)$-$NC_6H_4CH_3$	163 21
313	**Acetoxime**.	2-propanone oxime*; acetone oxime	$(CH_3)_2C{:}NOH$. .	73 09
314	**2,4-Acetoxylide**.	aceto-*as*-*m*-xylidide, 2,4-dimethylacetanilide	$CH_3CONHC_6H_3$-$(CH_3)_2$	163.21
315	**Acetphenetidine.**	See *Acetophenetide.*		
316	**Acettoluidide.**	See *Acetotoluide.*		
317	**Aceturic acid**.	*N*-acetylglycine; acetamidoacetic acid	$CH_3CONHCH_2$-$COOH$	117.10
318	—, ***N*-phenyl-**.	*N*-acetyl-*N*-phenylglycine. . . .	$C_6H_5N(CH_3CO)$-CH_2COOH	193.20
	Acetyl-. For acetyl derivatives, see the parent compounds (e g , for acetylbenzoic acid			
319	**Acetyl bromide**.	ethanoyl bromide*.	CH_3COBr.	122.96
320	—, **bromo-**.	bromoethanoyl bromide*. . . .	$CH_2BrCOBr$.	201.87
321	**Acetyl chloride**	ethanoyl chloride*.	CH_3COCl.	78.50

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
290	....	. .	111	.. .	. .	.. ..	....
291	....	. . .	167	. ...	..	.....	. . ....
292							
293	liq.	$0.956\frac{20}{4}$	....	240; 130–134[15]	.	...	. ...
294	pl. f. eth., 1.54684[41.3]	$1.0493\frac{20}{4}$; $1.0818\frac{41}{4}$	38–9	258; 138–9[15]	sl. s.	s.	s. eth.
295	col. need. or pa. yel. liq., 1.53533[17.4]	$0.9891\frac{22}{4}$, $1.013\frac{13}{4}$	28	222	i.	v. s.	v. s. eth.
296	need.	. .	81 (74–76)	202	i.	s.	v. s. eth.
297							
298							
299							
300							
301							
302							
303							
304							
305							
306							
307	col. monocl., 1.556, 1.587, 1.700	$1.168\frac{15}{4}$	110.4	296	0.86	8.08	s. eth., bz., glyc., v. s. chl., glac. ac. a.
308	cr. ..	. .	56	260		s.	. ...
309	monocl. f. w.	$1.141\frac{15}{4}$	65.5	303	0.44[13]	s.	s. eth.
310	cr.		66 (60–61)			s.	. ...
311	col. monocl or tricl., 1.495, 1.625, 1.807	$1.212\frac{15}{4}$	146–7 .. .	307	0.09	8.05c., v.s.h.	s. h. eth., glac. ac. a.; sl. s. bz., glyc.
312	leaf.		80	283		s.	s. h. lgr.
313	col. pr., 1.4156	$0.97\frac{20}{20}$	61	136.3	v. s.	v. s.	v. s. eth., s. lgr.
314	need. . .		129–30		v sl s	v. s.	. ...
315							
316							
317	need. f. w.	....	206	. . ..	2.17[15]	s.	i. eth.; sl. s. ac. a., acet., chl.; i. bz.
318	....	. ..	172–3.5	. .	. .	.....	.. ..
	see *Benzoic acid, acetyl-*.) See also "acetate" under the names of alcohols and phenols						
319	col. fum. liq.	$1.52\frac{9.5}{4}$	−96.5	76.7	d.	d.	v. sl. s. eth.
320	liq.	$2.317\frac{21.5}{21.5}$	. ..	147–50	d.	d.	....
321	col. inflam. liq., 1.38976	$1.1051\frac{20}{4}$	−112	51–2	d.	d.	∞ eth., bz., chl., acet., glac. ac. a.

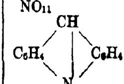
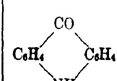
For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
322	**Acetyl chloride, chloro-**	chloroethanoyl chloride*	$CH_2ClCOCl$	112.95
323	**——, dichloro-**	dichloroethanoyl chloride*	$CHCl_2COCl$	147.40
324	**——, phenyl-.**	See *α-Toluyl chloride.*		
325	**——, trichloro-**		CCl_3COCl	181.85
326	**Acetyl cyanide.**	See *Pyruvonitrile.*		
327	**Acetyl disulfide**	diacetyl disulfide	$(CH_3CO)_2S_2$	150.21
328	**Acetylene**	ethyne*; ethine	CH⋮CH	26.04
329	——, dibromide.	See *Ethylene, 1,2-dibromo-*.		
330	——, tetrabromide.	See *Ethane, 1,1,2,2-tetrabromo-*.		
331	——, tetrachloride.	See *Ethane, 1,1,2,2-tetrachloro-*.		
332	**——, amyl-.**	See *1-Heptyne**.		
332M	**——, amylmethyl-.**	See *2-Octyne**.		
333	**——, bromo-**	bromoethyne*; ethynyl bromide	CH⋮CBr	104.94
334	**——, butyl-.**	See *1-Hexyne**.		
334M	**——, butylethyl-.**	See *3-Octyne**.		
335	**——, butylmethyl-.**	See *2-Heptyne**.		
336	**——, chloro-**	chloroethyne*	CH⋮CCl	60.49
336D	**——, decylmethyl-.**	See *2-Dodecyne**.		
336F	**——, di-*n*-amyl-.**	See *6-Dodecyne**.		
336H	**——, dibromo-**	dibromoethyne	BrC⋮CBr	183.85
336M	**——, dibutyl-.**	See *5-Decyne.*		
336R	**——, diiodo-**	diiodoethyne	IC⋮CI	277.86
336T	**——, diethyl-.**	See *3-Hexyne**.		
337	**——, dimethyl-.**	See *2-Butyne**.		
338	**——, diphenyl-**	diphenylethyne; tolan	$C_6H_5C⋮CC_6H_5$	178 22
338M	**——, dipropyl-.**	See *4-Octyne**.		
339	**——, divinyl-.**	See *1,5-Hexadien-3-yne**.		
340	**——, ethyl-.**	See *1-Butyne**.		
341	**——, ethylmethyl-.**	See *2-Pentyne**.		
342	**——, ethylphenyl-.**	See *Benzene, 1-butynyl-*.		
342M	**——, ethylpropyl-.**	See *3-Heptyne**.		
343	**——, *n*-heptyl-.**	See *1-Nonyne**.		
343M	**——, hexadecyl-.**	See *1-Octadecyne.**		
344	**——, *n*-hexyl-.**	See *1-Octyne**.		
345	**——, isopropyl-.**	See *1-Butyne, 3-methyl-**		
346	**——, methyl-.**	See *Propyne**.		
347	**——, methylphenyl-.**	See *Propyne, 1-phenyl-*.		
348	**——, methylpropyl-.**	See *2-Hexyne**.		
349	**——, *n*-octyl-.**	See *1-Decyne**.		
350	**——, phenyl-.**	See *Benzene, ethynyl-*.		
351	**——, *n*-propyl-.**	See *1-Pentyne**.		
352	**——, vinyl-.**	See *3-Buten-1-yne**.		
353	**Acetylenecarboxylic acid, ethyl-.** See *2-Pentynoic acid**.			
354	**Acetylenedicarboxylic acid**	butynedioic acid*	COOHC⋮CCOOH	114 06
355	**Acetylenediurein.**	See *Glycoluril.*		
356	**Acetyl fluoride**	ethanoyl fluoride*	CH_3COF	62.04
357	**Acetyl iodide**	ethanoyl iodide*	CH_3COI	169 96

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
322	col. liq.	$1.495\frac{0}{4}$	. . . . . .	108–10 (105–106)	d.	d.	∞ eth.
323	col. liq.	. . . .	. . . . .	108	d.	d.	∞ eth.
324							
325	col. liq.	1.629	. . . .	118	d.	d.	∞ eth.
326							
327	col. cr.	. . . .	20	d.	i.	s.	v. s. eth.; ∞ CS_2
328	col. inflam. gas	liq. $0.6208\frac{-84}{4}$, solid 0.73^{-85}; gas 1.173^{0} g/l	-81.8	-88.5; -83.6 subl.	100^{18} cm³	600^{18} cm³	2500^{15} cm³ acet.; s. bz., chl.
329							
330							
331							
332							
332M							
333	pois. gas	$4.684\frac{0}{760}$ g/l	. . . .	-2	sl. s.	. .	s. eth., dil. HNO_3
334							
334M							
335							
336	unst. spon. inflam. gas	2	. .	-32 to -30 exp.	s.	s.	. . . .
336D							
336F							
336H	liq. (poison) .	*ca.* 2	explodes w trace of O_2	*ca.* 76	i.	s.	s. eth.
336M							
336R	col. rhomb. .	. .	78–82	80–100 d.	. . . . . .		sl. s. sol. c. lgr.
336T							
337							
338	col. monocl. leaf. f. al.	.	62.5 (60)	300	i.	v. s. h.	v. s. eth.
338M							
339							
340							
341							
342							
342M							
343							
343M							
344							
345							
346							
347							
348							
349							
350							
351							
352							
353							
354	lng. pr.	. . . .	179	. . . .	v. s.	v. s.	v. s. eth.
355							
356	col. liq. or gas	$0.993\frac{20}{4}$	<-60	20.5	5, d.	d.	∞ eth.; s. bz., ac. a., chl.; v. sl. s. CS_2
357	col.-br. fum. liq.	2.067	. . . .	104–6	d.	d	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
358	**Acetyl peroxide** ..	ethanoyl peroxide*; diacetyl peroxide	$(CH_3CO)_2O_2$.....	118.09
358M	**Acetylsalicylic acid.**	See *Aspirin.*		
359	**Achroödextrin**......	....	$C_{36}H_{62}O_{31}$? ..	990 86
360	**Aconic acid**.........	4,5-dihydro-5-keto-3-furan-carboxylic acid; formyl-succinic acid lactone	$OCH{:}C(COOH){-}CH_2CO$	128.08
361	**Aconine**.............	....	$C_{26}H_{41}NO_{11}$.......	523 44
362	——, **acetylbenzoyl-.**	See *Aconitine.*		
363	——, **benzoyl-.**	See *Benzaconine.*		
364	**Aconitic acid**.........	1,2,3-propenetricarboxylic acid*	$C_3H_3(COOH)_3$....	174 11
365	**Aconitine**............	acetylbenzoylaconine	$C_{34}H_{49}NO_{11}$.	647.74
366	——, hydrobromide	... .	$C_{34}H_{49}NO_{11}.HBr.\frac{1}{2}H_2O$	737.68
367	——, hydrochloride (*l*)	... .	$C_{34}H_{49}O_{11}N.HCl.3H_2O$	738.26
368	——, nitrate (*l*).....	.. . . .	$C_{34}H_{49}NO_{11}.HNO_3.5H_2O$	800.84
369	——, sulfate (*l*).	. .... .	$(C_{34}H_{49}NO_{11})_2.H_2SO_4$	1393 57
370	——, **diacetyl-**	aconitine *O*-diacetate	$C_{34}H_{47}(C_2H_3O)_2{-}NO_{11}$	731 82
371	**Acridine**...........	.		179 21
372	——, **2-amino-5-*p*-aminophenyl-.** See *Chrysaniline.*			
373	——, **5, 10-dihydro-**....	*ms*-dihydroacridine	$C_6H_4CH_2C_6H_4NH$	181.23
374	——, **dihydroketo-.**	See *ms-Acridone.*		
375	——, **3-methyl-**... ..	....	$C_{13}H_8N.CH_3$	193 24
376	——, **5-phenyl-**........	*ms*-phenylacridine .	$C_6H_5C_{13}H_8N$.	255.30
377	***ms*-Acridone**..........	dihydroketoacridine. .		195.21
378	**Acrolein**.............	acrylaldehyde; propenal*; acrylic aldehyde	$CH_2{\cdot}CHCHO$ ..	56.06
379	——, **α, β-dimethyl-.**	See *Tiglaldehyde.*		
380	——, **α-ethyl-β-propyl-.** See *2-Hexenal, 2-ethyl-.*			
381	——, **β-2-furyl-** . . .	3-(2-furyl) propenal*, furacrolein	$C_4H_3OCH{:}CHCHO$	122 12
381M	——, **α-methyl-**.......	2-methylpropenal*; methacrolein	$CH_2{:}C(CH_3)CHO$.	70.09
382	——, **β-methyl-.**	See *Crotonaldehyde.*		
383	——, **β-phenyl-.**	See *Cinnamaldehyde.*		
384	**Acrylaldehyde.**	See *Acrolein.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
358	col. leaf......	.. ..	30	63^{21}	sl. s.	......	v. s. eth.; d. NaOH
358M							
359	amor. wh .	.	......	... .	s.	i.	col. with I_2
360	rhomb. f. w., α 1.385, γ 1.530	.	164	d.	18^{15}	......	s. me. al.
361	d. (salts l.) amor. hyg.	....	132	....	v. s.	v. s.	v. sl. s. eth; s. chl.
362							
363							
364	col. leaf. or need. f. w.	....	194–5 (191) d.	.. ...	18^{13}	50^{13}	sl. s. eth.
365	rhomb. pr. f. chl., $[\alpha]+11^{\circ 23}_{D}$ 3% al.	... ..	188–97.8 (204)	....	$.031^{25}$	4.54^{25}	2.27^{25} eth ; 14.3^{25} bz.; s. chl.
366	wh. to ylsh. hex. tab. f w., $[\alpha]-30\ 47^{\circ}_{D}$ in w.	.	163; anh. 176–80	.... .	s.	s.	s. eth.
367	wh. cr. .	.	149	. .... .	s.	s.	s. eth.
368	. .		.. ..	. .	s.	s.	. . ....
369	ylsh. amor. powd	. .... .	.	.... .	s.	s.	. ...
370	cr.		158	.	s.	....	. ...
371	col. leaf. or need., rhomb. f. al.	$1\ 1005\frac{19\ 7}{4}$	108; subl 100	346	v. sl. s.	v. s.	v s eth.; s. bz., CS_2
372							
373	col. cr f al.	. . .	169	subl.; d. 300	i.	s. h.	s. eth.
374							
375	yel need. f. dil al.		134	....	. ..	v. s.	v. s. eth., bz.
376	yel. monocl need. f al.	.	181	404	i.	sl. s.	s. eth.; v. s. bz.
377	yel. need		354	. .	i.	sl s.	sl. s. eth.; s. h. ac. a., KOH; i. bz., chl.
378	col. inflam. liq., unst. 1 39975	$0\ 841\frac{20}{4}$	-87.7	52.5	40	s.	s eth.
379							
380							
381	yel. cr. ...	....	51	200	i.	∞	s eth.
381M	col. liq., 1.4191^{20}	$0\ 830\frac{20}{4}$		73.5	s.	∞	∞ eth.
382							
383							
384							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
384M	**Acrylamide**	propenamide*; acrylic amide	$CH_2:CHCONH_2$	71 08
385	**Acrylic acid**	propenoic acid*; ethylene-carboxylic acid	$CH_2:CHCOOH$	72.06
385F	——, benzyl ester	benzyl acrylate	$CH_2:CHCOOCH_2C_6H_5$	162.18
385K	——, butyl ester	*n*-butyl acrylate	$CH_2:CHCOOC_4H_9$	128 17
385P	——, cyclohexyl ester	cyclohexyl acrylate	$CH_2:CHCOOC_6H_{11}$	154 20
386	——, ethyl ester	ethyl acrylate; ethyl propenoate*	$CH_2:CHCOOC_2H_5$	100 11
387	——, methyl ester	methyl acrylate	$CH_2:CHCOOCH_3$	86 09
388	**——, β-benzoyl-**	4-oxo-4-phenyl-2-butenoic acid	$C_6H_5COCH:CHCOOH$	176.16
389	**——, α-chloro-**	2-chloropropenoic acid*	$CH_2:CClCOOH$	106.51
390	**——, β-chloro-**	3-chloropropenoic acid*	$CHCl:CHCOOH$	106.51
391	**——, α, β-dimethyl-.**	See *Tiglic acid.*		
392	**——, α, β-diphenyl-.**	See *Cinnamic acid, α-phenyl-.*		
393	**——, β-2-furyl-.**	See *2-Furanacrylic acid.*		
394	**——, β-hydroxy-**	3-hydroxypropenoic acid*	$HOCH:CHCOOH$	88 06
395	**——, β-isopropyl-.**	See *2-Pentenoic acid, 4-methyl-*.*		
396	**——, α-methyl-.**	See *Methacrylic acid.*		
397	**——, cis(?)-β-methyl-.**	See *Isocrotonic acid.*		
398	**——, trans(?)-β-methyl-.**	See *Crotonic acid (α or solid)*		
399	**——, β-(3,4-methylenedioxystyryl)-.**	See *Piperic acid.*		
400	**——, α-phenyl-.**	See *Atropic acid.*		
401	**——, β-phenyl-.**	See *Cinnamic acid.*		
402	**——, β-propyl-.**	See *2-Hexenoic acid*.*		
403	**——, β-vinyl-.**	See *2,4-Pentadienoic acid*.*		
404	**Acrylic aldehyde.**	See *Acrolein.*		
404M	**Acrylic amide.**	See *Acrylamide.*		
405	**2-Acrylonaphthone, 1-hydroxy-β-phenyl-.**	1-hydroxy-2-naphthyl styryl ketone; 2-cinnamyl-1-naphthol	$C_6H_5CH:CHCOC_{10}H_6OH$	274 30
406	**Acrylonitrile**	propenenitrile*; vinyl cyanide	$CH_2{\cdot}CHCN$	53 06
406H	**Acrylyl chloride**	propenoyl chloride*	$CH_2\ CHCOCl$	90 51
406R	**Adalin.**	uradal, (α-bromo-α-ethylbutyryl) urea	$(C_2H_5)_2CBrCONHCONH_2$	237.11
407	**Adenine**	6-aminopurine	$C_5H_3N_4{\cdot}NH_2$	135.13
407M	**Adermin.**	See *Vitamin B_6.*		
408	**Adipaldehyde.**	hexanedial*; adipic dialdehyde	$CHO(CH_2)_4CHO$	114 14
408M	**Adipamic acid**	adipic acid monoamide	$NH_2OC(CH_2)_4COOH$	145.16
409	**Adipamide**	hexanediamide*; adipic diamide	$(CH_2CH_2CONH_2)_2$	144.17
410	**Adipic acid.**	hexanedioic acid*; 1,4-butanedicarboxylic acid	$COOH(CH_2)_4COOH$	146.14
411	——, dibutyl ester		$(CH_2CH_2COOC_4H_9)_2$	258.35
412	——, diethyl ester	ethyl adipate	$(CH_2CH_2COOC_2H_5)_2$	202.25
412M	——, monoamide.	See *Adipamic acid.*		
413	——, piperazinium salt.		$C_4H_{10}N_2.C_6H_{10}O_4$	232.28

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
384M	col.	....	84–5	....	......	......	......
385	col. liq., 1.4224	1.062^{16}	12.3	141.9	∞	∞	∞ eth.
385F	col. liq., 1.513^{24}	$1.068\frac{20}{4}$	. .	$113–14^{19}$	i.	∞	∞ eth.
385K	col. liq., 1.41855^{20}	$0.898\frac{20}{4}$	. .	145–6	i.	∞	∞ eth.
385P	col. liq., 1.456^{24}	$0.975\frac{20}{4}$	. . .	88^{28}	i.	∞	∞ eth.
386	col. liq., 1.405^{28}	$0.924\frac{20}{4}$	. ...	99.8	v. sl. s.	∞	∞ eth.
387	col. liq., 1.3984	$0.953\frac{20}{4}$	. .. .	80.5	v. sl. s.	s.	s. eth.
388	leaf. ($+1H_2O$)	.. .	$+1H_2O$, 64, anh. 99	....	s.	s.	s. eth.
389	need.	. .	65	subl.; 176–81 d.	s.	s.	s. eth.
390	leaf. .	. . .	85	.. ..	s.	s.	s. eth.
391							
392							
393							
394	liq. .		. ....	... .	v. s.	v. s.	v. s. eth.
395							
396							
397							
398							
399							
400							
401							
402							
403							
404							
404M							
405	or. leaf.	. . .	126		i.	s.	s. eth.
406	col. liq., 1.393^{20}	$0.797\frac{20}{4}$	-82	78–9	s.	∞	∞ eth.
406H	col. liq.	1.14	.	75–76	d	.	. ...
406R	col. cr.		115–116	.	s. h.	s.	s. bz., acet.
407	$+3H_2O$, need. f. c. w.	....	365	.. . .	0.09 c.	sl. s.	i. eth., chl.; s. h. NH_4OH
407M							
408	oil.	. . .	. . .	$92–94^{9}$	sl s	v s.	v. s. eth.; s. bz.
408M	need. f. w. .	. ...	125–130	.		...	....
409	col. pl. .	.. ..	220 (226–227)	.. ..	0.44^{12}	v. s.	v. sl. s. eth.
410	col. monocl. pr.	1.366	151–3	265^{100}	1.5^{15}	v. s.	0.6^{15} eth.; s. HNO_3
411	....	$0.9652\frac{20}{4}$	-37.5	183^{14}	i.	∞	∞ eth.
412	col. liq. . . .	$1.009\frac{20}{4}$	-21	$239–41^{761}$	0.423^{20}	s.	s. eth.
412M							
413	wh. cr.	....	244–5 d.	. ...	s.	v. sl. s. h.	i. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
414	**Adipic dialdehyde.**	See *Adipaldehyde.*		
415	**Adipic diamide.**	See *Adipamide.*		
416	**Adipic ketone.**	See *Cyclopentanone**.		
416M	**Adipoin**	2-hydroxycyclohexanone	$C_6H_{10}O_2$	114 14
417	**Adipyl chloride**	hexanedioyl chloride*	$ClCO(CH_2)_4COCl$	183 04
417M	**Adonitol, Adonite**		$C_5H_{12}O_5$	152 15
418	**Adrenaline**	3,4-dihydroxy- α-(methylaminomethyl) benzyl alcohol; suprarenine; epinephrine	$(HO)_2C_6H_3$-$CH(CH_2NHCH_3)$-OH	183.20
419	**Aesculetin, Aesculin.**	See *Esculetin, Esculin.*		
420	**Alanine, β, β′-dithiodi-**	See *Cystine.*		
421	**——, β-hydroxy-.**	See *Serine.*		
422	**——, β-p-hydroxyphenyl-.**	See *Tyrosine.*		
423	**——, β-(3-indyl)-.**	See *Tryptophan.*		
424	**——, β-mercapto-.**	See *Cysteine.*		
425	**——, *N*-methyl-**		$CH_3CH(NHCH_3)$-$COOH$	103 12
426	***dl*-Alanine**	*dl*-2-aminopropanoic acid*, *dl*-α-aminopropionic acid	$CH_3CH(NH_2)$-$COOH$	89.09
427	——, ethyl ester hydrochloride	ethyl α-aminopropionate hydrochloride	CH_3CHNH_2-$COOC_2H_5.HCl$	153.61
428	**——, *N*-benzoyl-**	α-benzamidopropionic acid	$CH_3CH(NHCOC_6H_5)COOH$	193.20
429	**——, β-phenyl-**		$C_6H_5CH_2CH$-$(NH_2)COOH$	165.19
430	***d*-Alanine**	*d*-α-aminopropionic acid, *d*-2-aminopropanoic acid*	$CH_3CH(NH_2)$-$COOH$	89.09
431	**——, β-[(3,5-diiodo-4-hydroxy-phenoxy)-3,5-diiodophenyl]-.** See *d-Thyr*			
432	**——, β-phenyl-**	*d*-α-amino- β-phenylpropionic acid	$C_6H_5CH_2$-$CH(NH_2)COOH$	165.19
433	***l*-Alanine**	*l*-α-aminopropionic acid; *l*-2-aminopropanoic acid*	$CH_3CH(NH_2)$-$COOH$	89 09
434	**——, β-phenyl-**	*l*-α-aminohydrocinnamic acid	$C_6H_5CH_2CH$-$(NH_2)COOH$	165 19
435	**β-Alanine**	3-aminopropanoic acid*; β-aminopropionic acid	$NH_2CH_2CH_2COOH$	89 09
435M	**——,(*N*-α,γ-dihydroxy-β,β-dimethylbutyryl)-.** See *Pantothenic acid.*			
436	**Alantolactone.**	See *Helenin.*		
437	**Alcohol.**	See *Ethyl alcohol.*		
438	**Aldehyde.**	See *Acetaldehyde.*		
439	**Aldehyde-ammonia.**	See *Acetaldehyde-ammonia.*		
440	**Aldehydine**	5-ethyl-2-methylpyridine	$(C_2H_5)(CH_3)C_5H_3N$	121.18
441	**Aldol**	3-hydroxybutanal*; β-hydroxybutyraldehyde	$CH_3CHOHCH_2$-CHO	88 10
442	**Alizarin**	1,2-dihydroxyanthraquinone.	$C_6H_4(CO)_2C_6H_2$-$(OH)_2$	240.20
443	**——, 3-methyl-**		$C_6H_4(CO)_2C_6$-$HCH_3(OH)_2$	254 23
444	**——, 3-nitro-**	alizarin orange; β-nitroalizarin	$C_6H_4(CO)_2C_6$-$H(OH)_2NO_2$	285 20
445	**——, 4-nitro-**	α-nitroalizarin	$C_6H_4(CO)_2C_6H$-$(OH)_2NO_2$	285.20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
414							
415							
416							
416M	cr. f. al.	....	113 (92)	....	sl. s. h.	s. h.	i. eth., bz., pet eth.
417	col. liq.	......		$112–15^{10}$ (sl. d.)	d. h.	d. h.	....
417M	pr. f. w.	....	102	....	s.	s. h.	i. eth., lgr.
418	wh.-brnsh. powd.	......	216 d.	....	0.027^{20}	sl. s.	i. eth., chl., acet., oils; s. a., alk.
419							
420							
421							
422							
423							
424							
425	col. rhomb. f. al	.	260 d.	subl. 292 sl. d.	s.	v. sl. s. c.	......
426	need or pr. f. w	.	295	subl. 200	16.6^{25}, 32.2^{75}	0.57^{75} 75%, 0.084^{25} 90%	i. eth.
427	col. need		64–8 (85–7)	d.	v. s.	v. s.	v. s. eth.
428	col. pl. or pr.		163–5	d.	s.	sl. s.	sl. s. eth.
429	monocl. f. w or leaf. f. al.		318–20 d.	subl.	1.42^{25}, 3.70^{75}	sl. s. c.	v. v. sl. s. eth.
430	rhomb. f. w.	.	297 d.		16.65^{25}, 28.5^{75}	0.16	i. eth., acet.
431	*oxine.*						
432	leaf f. w., $[\alpha]^{25}_{D}$ +35.08 in w.	.	283–4 d.		2.83^{16}	i.	i. eth.
433	pr. f. al.	....	295 d.	subl.	2.2^{17}	0.2 c. 80%	i. eth.
434	leaf., 1.600, 1.610, 1.675	. .	283 d.	. .	3^{25}	sl. s. h	i. eth.
435	rhomb. pr. f. al.	...	196 d.	...	v. s.	v. sl. s	i. eth., acet.
435M							
436							
437							
438							
439							
440	liq.	$0.9184\frac{28}{4}$	.... .	174	i.	s.	s. eth., H_2SO_4
441	col. syrupy liq.	$1.103\frac{20}{4}$	......	83^{20}	∞	∞	∞ eth.
442	or. or red tri-cl. or rhomb.	.	290	430	0.034^{100}	v. s.	v. s. eth.; s. me. al., bz., ac. a., CS_2, alk.
443	or. need. ..., .	. .	229	subl. 200	. . . .	s.	s. eth., acet.
444	or. need f. bz.		244 d.	subl. d.	sl. s.	s.	s. chl., bz.
445	yel. need. f. al.	..	289 d.	subl. d.	sl. s.	s.	s. chl., bz., dil. alk., H_2SO_4

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
446	**β-Alizarin amide.**	See *Anthraquinone, 2-amino-1-hydroxy-.*		
447	**Alizarin bordeaux.**	See *Quinalizarin.*		
448	**6 (or 7)-Alizarincarboxylic acid**	5,6 (or 7,8)-dihydroxy-2-anthraquinonecarboxylic acid	$(OH)_2C_6H_2(CO)_2$-C_6H_3COOH	284.21
449	**Alizarin orange.**	See *Alizarin, 3-nitro-.*		
450	**Alizarin yellow A.**	See *Benzophenone, 2,3,4-trihydroxy-.*		
451	**Alkannin**	....	$C_{16}H_{16}O_5$ ...	288 29
452	**Alkargen.**	See *Cacodylic acid.*		
453	**Alkarsin, Alkarsine.**	See *Cacodyl oxide.*		
453M	**Allantoic acid**	diureidoacetic acid.	$C_4H_8O_4N_4$	176.14
454	**Allantoin**	5-ureidohydantoin; glyoxyldiureide	$C_4H_6N_4O_3$	158.12
455	**Allanturic acid**	5-hydroxy-2,4-imidazoledione, glyoxalylurea	NHCONHCOCHOH	116 08
456	**Allene.**	See *Propadiene*.*		
456M	**——, *unsym*-dimethyl-.**	See *1,2-Butadiene, 3-methyl-.*		
457	**——, ethyl-.**	See *1,2-Pentadiene*.*		
458	**——, methyl-.**	See *1,2-Butadiene**		
459	**Allocinnamic acid.**	See allo-*Cinnamic acid.*		
460	**Allocrotonic acid.**	See *Isocrotonic acid.*		
460M	**Allomucic acid**	....	$C_6H_{10}O_8$	210.14
461	**Allophanamide.**	See *Biuret.*		
462	**Allophanic acid,** ethyl ester	ethyl allophanate; ethyl ureacarboxylate	$NH_2CONHCOOC_2H_5$	132 12
462M	***L*-Allose**	....	$C_6H_{12}O_6$	180 16
463	**Alloxan**	pyrimidinetetrone; mesoxalyurea	NHCONHCOCOCO	142 07
464	——, 5-oxime.	See *Violuric acid.*		
465	**Alloxanic acid**	tetrahydro-4-hydroxy-2,5-diketo-4-imidazolecarboxylic acid	NHCONHCOC-(OH)COOH	160.09
466	**Alloxantin**	....	$C_8H_6N_4O_8$	286.16
467	**——, tetramethyl-.**	See *Amalic acid.*		
	Allyl. For allyl derivatives	see the parent compounds (e.g.,	for allylaniline see	*Aniline,*
468	**Allyl alcohol**	2-propen-1-ol*	CH_2:CH.CH_2OH	58.08
469	**Allyl alcohol**	(For derivatives see also *2-Propen-1-ol.**)		
470	——, dibromide.	See *1-Propanol, 2,3-dibromo-*.*		
471	——, dichloride.	See *1-Propanol, 2,3-dichloro-*.*		
472	——, γ-methyl-.	See *2-Buten-1-ol*.*		
473	——, γ-phenyl-.	See *Cinnamic alcohol.*		
474	**Allylamine**	2-propenylamine* . . .	CH_2:$CHCH_2NH_2$ ..	57 09
475	**——, *N*-methyl-**	. ...	CH_2:$CHCH_2$-$NHCH_3$	71.12
476	**Allyl bromide**	3-bromopropene*	CH_2:$CHCH_2Br$ ...	120.99
477	**Allyl bromide, α-bromo-.**	See *Propene, 2,3-dibromo-*.*		
478	**Allyl chloride**	3-chloropropene*	CH_2:$CHCH_2Cl$	76.53
479	**Allyl chloride, α-chloro-.**	See *Propene 2,3-dichloro-*.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
446							
447							
448	red. need.	. . .	305	subl.	v. sl. s.	s.	sl. s. eth.
449							
450							
451	br. red spears f. bz. $[\alpha]^{20}_{Cd}$ -157° (C_6H_6)	....	148	.....	i.	sl. s.	v. sl. s. eth.; sl. s. chl.; s. glac. ac. a., alk.
452							
453							
453M	lf. f. me. al..	.	173 d.	.	sl. s. c.	.	sl. s. org. solv.
454	wh. monocl. f h. w	.	235	d.	0 06[20]	v. sl. s.	i. eth.; s. NaOH
455	hyg. gum				s.	i.	d. h. alk.
456							
456M							
457							
458							
459							
460							
460M	need. f. w....	. .	166–71d.		8[100]	sl. s.	..
461							
462	need. f. w....	.	192	d.	s. h., i c.	0 5[21]	0 1[20] eth.
462M	pr. f. al. $[\alpha]^{20-25}_{D}$ (H_2O) initial -1.90°; final 13.88°.		128–9		s.	sl. s.	.
463	anh. dk. yel.; hyd., col. rhomb. pr.		170 d.		v s	s.	.
464							
465	triol	.	d.	. . .	v. s	15.8	sl. s. eth.
466	rhomb. pr. f. w. with $2H_2O$	. .	170 d.	253–5 d.	sl. s. c	v. sl s	v. sl. s. eth.
467	*allyl-*). For allyl esters of organic acids see the acids.						
468	col. mobile liq.; pungent odor; 1.41345	$0.855\frac{20}{4}$	-129	96–97	∞	∞	∞ eth.
469							
470							
471							
472							
473							
474	col. liq., 1.41943[22]	$0.761\frac{20}{4}$	.	53 2	∞	∞	∞ eth.; s. chl
475	col. liq.......	....	.. ..	65	∞	....	.. ...
476	col. liq.; 1.46545	$1.398\frac{20}{4}$	-119 4	71 3	i.	∞	∞ eth.; s. chl. CS_2, CCl_4
477							
478	liq., 1.41538	$0\ 938\frac{20}{4}$	-136 4	44 6	i.	s.	∞ eth.
479							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
480	**Allyl cyanide**	3-butenenitrile*, vinylacetonitrile, β-butenonitrile	$CH_2:CHCH_2CN$	67 09
481	**Allylene.**	See *Propyne**.		
482	**——, γ-bromo-.**	See *Propyne, 3-bromo-**.		
483	**Allylene dichloride.**	See *Propene, 1,2-dichloro-**.		
484	**Allylene oxide.**	See *Propene, 1,2-epoxy-**		
485	**Allyl ether**	3-(2-propenoxy)propene*; diallyl ether	$(CH_2:CHCH_2)_2O$	98.14
486	**——, thio-.**	See *Allyl sulfide.*		
487	**Allyl fluoride**	3-fluoropropene*	$CH_2:CHCH_2F$	60.07
488	**Allyl iodide**	3-iodopropene*	$CH_2:CHCH_2I$	167 99
489	**Allyl isocyanide**		$CH_2\cdot CHCH_2NC$	67.09
490	**Allyl mercaptan.**	See *2-Propene-1-thiol**.		
491	**Allyl mustard oil.**	See *Isothiocyanic acid, allyl ester.*		
492	**Allyl sulfide**	3-(2-propenylthio)propene*; thioallyl ether; diallyl sulfide; allyl thioether; 2-propenyl sulfide*	$(CH_2:CHCH_2)_2S$	114.20
493	**Allyl sulfocyanide.**	See *Thiocyanic acid, allyl ester.*		
494	**Allyl tribromide.**	See *Propane, 1,2,3-tribromo-**		
495	**Allyl trichloride.**	See *Propane, 1,2,3-trichloro-**.		
496	**Allyl trisufide**	diallyl trisulfide	$(C_3H_5)_2S_3$	178 32
497	**Aloïn**		$C_{20}H_{18}O_9$	402.35
498	**Alstonine**	chlorogenine	$C_{21}H_{20}N_2O_4\cdot 3\frac{1}{2}H_2O$	427.44
498M	**Altrose**		$C_6H_{12}O_6$	180.16
499	**Aluminum, triethoxy-***	aluminum ethoxide	$Al(OC_2H_5)_3$	162.15
500	**——, triethyl-***	aluminum ethyl	$Al(C_2H_5)_3$	114 15
501	**——, trimethyl-***	aluminum methyl	$Al(CH_3)_3$	72 07
502	**Amalic acid**	tetramethylalloxantin	$C_8(CH_3)_4N_4O_7$	324.25
503	**Amanitine.**	See *Choline.*		
504	**Amarine**	4,5-dihydro-2,4,5-triphenylimidazole	$(C_6H_5)CH(C_6H_5)CH$ $NH(C_6H_5)C:N$	298.37
505	**Amaron**	tetraphenylpyrazine; benzoin imide; ditolan azotide	$(C_6H_5)_2(CNC)_2$- $(C_6H_5)_2$	384.46
506	**Amidine, benzenylnaphthyl-.** See *Benzamidine, N-1-naphthyl-.*			
507	**——, ethenyldiphenyl-.** See *Acetamidine, N,N'-diphenyl-.*			
508	**Amidol.** See *Phenol, 2,4-diamino-, dihydrochloride.*			
	Amino-. See the parent compounds (e.g., for aminoacetophenone see *Acetophenone,*			
510	**Amino G acid**	See *2-Naphthylamine-6,8-disulfonic acid.*		
511	**Ammelide**	6-amino-s-triazine-2,4-diol; cyanuramide	$N:C(OH)N.C$- $(OH)N:C(NH_2)$	128 09
512	**Ammeline**	4,6-diamino-s-triazin-2-ol; cyanurodiamide	$N\ C(OH)N:C$- $(NH_2)N:C(NH_2)$	127.11
513	**Ammonium bromide, (β-acetoxyethyl) trimethyl-.** See *Choline, O-acetyl-,*			
514	**——, ethyl-*.**	See *Ethylamine, hydrobromide.*		
515	**——, tetraethyl-***		$(C_2H_5)_4NBr$	210.17
516	**Ammonium chloride,** derivatives of. See also "*hydrochloride*" under the various			
517	**——, tetramethyl-***		$(CH_3)_4NCl$	109.60
518	**Ammonium hydroxide, (carboxymethyl)trimethyl-,** anhydride. See			

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
480	col. liq., 1.40602	$0.8318\frac{20}{4}$	..	116–9	v sl s.	∞	∞ eth.
481							
482							
483							
484							
485	liq .	0.805	.	94 3	sl. s.	∞	∞ eth.
486							
487	col gas	.		–10	2 8[13] cm³	60[13] cm³	90 cm³ eth.
488	yel. liq . .	$1\ 848\frac{12}{12}$	–99 8	103 1	i.	s.	s. eth., chl.
489	liq	$0.794\frac{17}{4}$		106	sl. s.	∞	∞ eth.
490							
491							
492	col. oil w. garlic odor, 1 4877[27]	$0\ 88765\frac{27}{4}$	–83	*ca.* 138; 138.6[758] (140–2)	sl. s.	∞	∞ eth.; s. chl., CCl_4, CS_2
493							
494							
495							
496	liq	1 085[15]	....	140	i	i.	∞ eth.
497	yel. need ..	... .	147.9	. . .	sl s. c.	sl. s. c.	i eth.; s acet., KOH; i. chl.
498	br. amor . .	. .....	<100; 195 anh.	.... .	sl. s.	s.	v. sl. s. eth.; s. chl.
498M	*β-l*, th. pointed pr ; $[\alpha]^{20}_{D}$-28 75°		*l* 107–9.5 *d* 103–5	... .	s.	s.	s me al.
499	. .	$1.1422\frac{20}{4}$	150–60	320	d.		. . . .
500	col. liq., ign. in air, 1.480[6.5]	.	<–18	194	exp.		s eth.
501	col. liq., ign. in air, 1.432[12]	.	0	130	d.	.	s eth.
502	cr .	..	245 d.	. . . .	sl. s h	v. sl. s	s. KOH
503							
504	pr .	. . . ..	129	d.198 (anh.)	i.	s.	s. eth.
505	sm need. f. acet.	... ...	246	subl.	i.	s.	s. eth., chl., h bz.
506							
507							
508							
	amino-).						
510							
511	wh cr. powd	. .	d.	......	v. sl. s.	..... .	s. eth., alk., min. a.
512	wh minute need. dendritic groups	.....	d.	. . .	0.021[23]	i.	i. eth., s. KOH, alk., min. a.
513	*bromide.*						
514							
515	cr. f. al	$1\ 397\frac{20}{4}$	....	... .		v. s.	s. chl.
516	amines.						
517	col. cr	$1\ 169\frac{20}{4}$			s.	s.	i eth.
518	*Betaine*						

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
519	**Ammonium hydroxide, tetraethyl-***	. . . .	$(C_2H_5)_4NOH$.	147 26
520	**——, tetramethyl-*.**	. . . .	$(CH_3)_4NOH{\cdot}5H_2O$.	181.23
521	**——, trimethylvinyl-.**	See *Neurine.*		
522	**Ammonium purpurate**	. See *Murexide.*		
523	**Amygdalic acid**........	amygdalinic acid; mandelic acid gentiobioside	$C_{19}H_{27}O_{11}.COOH$	476.43
524	**Amygdalin**............	mandelonitrile gentiobioside; amygdaloside	$C_{20}H_{27}NO_{11}$ . ..	457 43
524M	**Amygdalose.**	See *Gentiobiose.*		
	Amyl. For (normal) amyl de	rivatives see the parent compou	nds (e.g., for amylbe	nzene
525	***pri-act*-Amyl alcohol.**	See 1-*Butanol, 2-methyl-**.		
526	***pri-n*-Amyl alcohol.**	See 1-*Pentanol**.		
527	***sec-act*-Amyl alcohol.**	See 2-*Pentanol**.		
528	***tert*-Amyl alcohol.**	See 2-*Butanol, 2-methyl-**.		
529	***n*-Amyl aldehyde.**	See *Valeraldehyde.*		
530	**Amylamine**...........	*n*-amylamine; pentylamine*; 1-aminopentane	$CH_3(CH_2)_4NH_2$.	87.16
530M	**——, *N, N*-dimethyl.** . .	. . . .	$CH_3(CH_2)_4N(CH_3)_2$	115 22
531	**——, *α*-methyl-**.......	2-aminohexane	$CH_3(CH_2)_3CH(CH_3)NH_2$	101.19
532	**——, 4-methyl-.**	See *Isohexylamine.*		
533	***sec-n*-Amylamine.**	See *Butylamine, α-methyl-*; *Pr*	*opylamine, α-methyl-*	.
534	***tert*-Amylamine.**	(*α*, *α*-dimethylpropyl) amine; dimethylethylcarbinylamine	$CH_3CH_2C(CH_3)_2NH_2$	87.16
535	**Amyl bromide**..... . .	1-bromopentane*; *n*-amyl bromide	$CH_3(CH_2)_3CH_2Br$.	151.06
536	***pri-act*-Amyl bromide.**	See *Butane, 1-bromo-2-methyl-*	*.	
537	**Amyl chloride**.........	1-chloropentane*; *n*-amyl chloride	$CH_3(CH_2)_3CH_2Cl$.	106 60
538	***pri-act*-Amyl chloride.**	See *Butane, 1-chloro-2-methyl-**	.	
539	***tert*-Amyl chloride.**	See *Butane, 2-chloro-2-methyl-*	*.	
540	***n*-Amyl cyanide.**	See *Capronitrile.*		
541	***α-n*-Amylene.**	See 1-*Pentene**.		
542	***β-n*-Amylene.**	See 2-*Pentene**.		
543	***α-n*-Amylene glycol.**	See 1,2-*Pentanediol**.		
544	***β-n*-Amylene glycol.**	See 2,3-*Pentanediol**.		
545	**Amyl ether**............	pentyloxypentane*; di-*n*-amyl ether	$[CH_3(CH_2)_3CH_2]_2O$	158.28
545M	**Amyl fluoride (*n*)**......	1-fluoropentane*... .. .	$CH_3(CH_2)_3CH_2F$..	90.14
546	**Amylin.**	See *Dextrin.*		
547	**Amyl iodide**...........	1-iodopentane*; *n*-amyl iodide	$CH_3(CH_2)_3CH_2I$...	198.06
548	***pri-act*-Amyl iodide.**	See *Butane, 1-iodo-2-methyl-**.		
549	***tert*-Amyl iodide.**	See *Butane, 2-iodo-2-methyl-**.		
550	**Amyl isocyanide.**	*n*-amylcarbylamine* . .	$CH_3(CH_2)_4NC$	97 16
551	**Amyl mercaptan.**	See 1-*Pentanethiol**.		
552	***pri-act*-Amyl mercapt**	**an.** See 1-*Butanethiol, 2-methy*	*l-**.	
553	***tert*-Amyl mercaptan.**	See 2-*Butanethiol, 2-methyl-**.		
554	***n*-Amyl mustard oil.**	See *Isothiocyanic acid, amyl es*	*ter.*	
555	**Amyl nitrite (*n*)**.......	pentyl nitrite*	$CH_3(CH_2)_4NO_2$...	117.15
556	**Amyl sulfate**..........	di-*n*-amyl sulfate; pentyl sulfate	$[CH_3(CH_2)_4]_2SO_4$..	238.34
557	**Amytal.**	See *Barbituric acid, 5-ethyl-5-i*	*soamyl-.*	
558	***l*-Anabasine**	*l*-2-(3-pyridyl)piperidine ..	$C_{10}H_{14}N_2$	162.23
559	**Anacardic acid**........	. . .	$C_{22}H_{32}O_3$.	344.48

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
519	deliq. need	......	190 d.	.	s.	s.	....
520	hyg. need....	. . ..	anh. 63	d.	∞^{63}	v. s.	i. eth.
521							
522							
523	col. cr.......	....	118	.. .	deliq.	i.	i. eth.
524	rhomb. f. w...	....	214–6	....	8.3^{10}, ∞^{100}	0.11^{10}, 9^{78}	i. eth.
524M	see *Benzene*, amyl-). For amyl esters of organic acids see the acids.						
525							
526							
527							
528							
529							
530	col. liq. .	0.7614^{20}_{4}	-55	104	s.	s.	∞ eth.
530M	col liq., 1.4083^{20}	0.743^{20}_{4}	...	122–3	sl. s.		∞ eth
531	....	$0.767^{20.4}_{4}$	-19	130^{742}	.		...
532							
533							
534	col. liq.....	0.7611^{0}_{4}	-105	78.5	∞	∞	∞ eth.
535	col. liq., 1.444	1.246^{0}_{4}; 1.218^{20}_{4}	-88.0	$128–9^{740}$	i.	s.	∞ eth.
536							
537	col. liq., 1.4119^{18}	0.883^{20}_{4}	-99	108.2 (107^{740})	i.	∞	∞ eth.
538							
539							
540							
541							
542							
543							
544							
545	ylsh. liq....,	0.774^{20}_{4}	-69.3	190	i.	∞	∞ eth.
545M	col. liq., 1.35622	0.7880	<-80	62.8	i.	v. s.	v.s. eth.
546							
547	col. liq., 1.4955	1.517^{20}_{4}	-85.6	156	i.	s.	∞ eth.
548							
549							
550	liq.... . ..	0.806^{20}_{4}	-51.1	155.5	i.	s.	. ....
551							
552							
553							
554							
555	pa. yel. liq., 1.38506	0.8528^{20}_{4}		104	sl. s.	∞	∞ eth.
556	1.4270^{25}.....	1.0265^{25}_{25}		$117.0^{2.5}$	....	.....	... ..
557							
558	col. liq., 1.5430 $[\alpha]^{20}_{D}$-82.20°	1.0481^{20}_{20}	.	28.09	∞	s.	s. eth., bz.
559	cr. . .		26		i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
560	**Anaesthesin.**	See *Benzocaine.*		
561	**Analgen (1)**...........	5-benzamido-8-ethoxyquinoline; quinalgen; chinalgen; labordin; benzanalgen	$C_9H_5N(NHCOC_6H_5)OC_2H_5$	292 33
	Analgen (2).	Formerly, 5-acetamido-8-ethoxyquinoline.		
562	**Analgesine.**	See *Antipyrine.*		
563	**Anethole**..	*p*-propenylanisole; anise camphor; 1-methoxy-4-propenylbenzene	$CH_3CH{:}CHC_6H_4$-OCH_3	148 20
564	**Angelic acid**...........	*cis*-2-methyl-2-butenoic acid*; α-methylisocrotonic acid	$CH_3CH{:}C(CH_3)$-$COOH$	100.11
565	**Anhalonidine**.........	....	$C_{12}H_{17}NO_3$.	223.27
566	**Anhalonine**...........	1,2,3,4-tetrahydro-6-methoxy-1-methyl-7,8-methylene-dioxyisoquinoline	$C_{12}H_{15}NO_3$ . .	221 25
567	——, hydrochloride	....	$C_{12}H_{15}NO_3{\cdot}HCl$.	257 71
568	*dl*-**Anhydroecgonine**...	ecgonidine..................	$C_9H_{13}NO_2$ . .	167 20
569	——,hydrochloride .	....	$C_9H_{13}NO_2$ HCl	203 67
570	**Anhydroformaldehyde aniline.**	See *s-Triazine, hexahydro-1,3,5-triphenyl-.*		
571	**Aniline**	phenylamine; aminobenzene	$C_6H_5NH_2$	93 12
572	——, hydrochloride ..	. . . .	$C_6H_5NH_2{\cdot}HCl$.	129.59
572F	——, nitrate	....	$C_6H_5NH_3NO_3$	156 14
572M	——, oxalate.............	. ...	$(C_6H_5NH_3)_2C_2O_4$	276.29
572T	——, picrate...............	....	$C_6H_5NH_3OC_6H_2$-$(NO_2)_3$	322.23
573	——, sulfate...............	....	$(C_6H_5NH_2)_2H_2SO_4$	284.33
574	——, ***o*-acetyl-.**	See *Acetophenone, o-amino-.*		
575	——, ***N*-acetyl-.**	See *Acetanilide.*		
576	——, ***N*-allyl-**	*N*-(2-propenyl)aniline....	$CH_2{:}CHCH_2$-NHC_6H_5	133 19
577	——, ***o*-amino-.**	See *o-Phenylenediamine.*		
578	——, ***m*-amino-.**	See *m-Phenylenediamine.*		
579	——, ***p*-amino-.**	See *p-Phenylenediamine.*		
580	——, **azodi-.**	See *Azobenzene, diamino-.*		
581	——, ***N*-benzal-.**	See *Aniline, N-benzylidene-.*		
582	——, ***p,p*'-benzalbis-*N,N*-dimethyl-.**	See *Aniline, p,p'-benzylidenebis-N,N-*		
583	——, ***p,p*'-benzaldi-.**	See *Methane, p,p'-diaminotriphenyl-.*		
584	——, ***N*-benzal-*p*-hydroxy-.**	See *Phenol, p-benzylideneamino-.*		
585	——, ***m*-benzohydryl-.**	*m*-aminotriphenylmethane; *m*-aminotritan	$(C_6H_5)_2CHC_6H_4$-NH_2	259.34
586	——, ***p*-benzohydryl-**..	*p*-aminotriphenylmethane	$(C_6H_5)_2CHC_6H_4$-NH_2	259 34
587	——, ***o*, *m*, or *p*-benzoyl-.**	See *Benzophenone, amino-.*		
588	——, ***N*-benzoyl-.**	See *Benzanilide.*		
589	——, ***m*-benzyl-**	*m*-aminodiphenylmethane ..	$NH_2C_6H_4CH_2C_6H_5$	183 24
590	——, ***p*-benzyl-** ...	*p*-aminodiphenylmethane ..	$NH_2C_6H_4CH_2C_6H_5$	183.24
591	——, ***N*-benzyl-.**	See *Benzylamine, N-phenyl-.*		

***Name approved by the International Union of Chemistry.**

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
560							
561	col.-yel. need	....	210	...	i.	v. sl. s.	v. sl. s. eth.; s. a.
562							
563	col leaf. f al., 1.5624^{12}	0.9936$\frac{15}{15}$	22 5, frs. 20-1	235 3	v. sl. s.	20 96%	s. eth., chl., bz, acet, CS_2
564	col. monocl. pr., 1.4434^{47} liq	liq. 0 983$\frac{47}{4}$	45	185	sl. s.	s.	v. s. eth.
565	. .	... ..	160	. .	s.	s.	sl. s. eth.; s. chl.
566	need	....	85	... .	s.	s.	s. eth., chl.
567	wh. cr. powd. $[\alpha]-41.9°^{17}_{D}$ in w	....	>230 d.	.	sl. s. c., v. s h	sl s.	sl. s. eth., chl.
568	wh. cr f. w...	....	226-30 d.; (l, 235 d)	......	s.	sl. s. c.	v. sl. s. eth.
569	rhomb. need. f. al., $[\alpha]$ -61.50°D	.. ..	240-1	.. .	s.	s.	....
570							
571	col. oily liq., 1 5863^{20}	1 022$\frac{20}{4}$	-6 2	184.4	3 4^{20}, 6 4^{90}	∞	∞ eth, bz.
572	wh. leaf. or need	1.222$\frac{4}{4}$	198	245	18^{15}, 107^{25}	s.	i eth
572F	rhomb	1.356	d. >190	. .	v. s.	v s.	v. s eth.
572M	tricl. pr	. . . ..	175 d.	.	v s. c.	sl s	i. eth.
572T	yel. or red monocl. pr	1 558	181 d.	.	374^{18} (c.) d. h.	8 4^{15} 95%	0 078^{20} bz.
573	leaf. f. al	1 377$\frac{4}{4}$	d.	. .	6 6^{15}	sl. s.	i. eth.
574							
575							
576	yel. oil...	0 982$\frac{25}{4}$	. .	217-8^{736} (209)	sl s	s.	∞ eth.
577							
578							
579							
580							
581							
582	*dimethyl-.*						
583							
584							
585	need. f. eth.		120			..	....
586	pr. f. eth		84	248^{11}	i.		s eth., bz., lgr.
587							
588							
589	cr .		46		.	...	s. lgr.
590	col. monocl. f. lgr.	1.038^{55}	34-5 (37)	300	i.	v. s.	v. s. eth.; s. lgr.
591							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
592	**Aniline, *N*-benzylidene-**	benzalaniline	$C_6H_5CH{:}NC_6H_5$	181.23
592M	**——, *p,p'*-benzylidene-bis-*N,N*-dimethyl-**	4,4'-bisdimethylaminotriphenylmethane; leucomalachite green	$C_6H_5CH[C_6H_4N(CH_3)_2]_2$	330 46
593	**——, *o*-bromo-**	1-amino-2-bromobenzene	$BrC_6H_4NH_2$	172 03
594	**——, *m*-bromo-**	1-amino-3-bromobenzene	$BrC_6H_4NH_2$	172 03
595	**——, *p*-bromo-**	1-amino-4-bromobenzene	$BrC_6H_4NH_2$	172.03
596	**——, *p*-bromo-*N,N*-diethyl-**	...	$BrC_6H_4N(C_2H_5)_2$	228 14
597	**——, *p*-bromo-*N,N*-dimethyl-**	...	$BrC_6H_4N(CH_3)_2$	200.09
598	**——, *N*-butyl-**	...	$C_6H_5NHC_4H_9$	149.23
599	**——, *p-tert*-butyl-**	1-amino-4-*tert*-butylbenzene	$(CH_3)_3CC_6H_4NH_2$	149 23
600	**——, *o*-chloro-**	2-chlorophenylamine	$ClC_6H_4NH_2$	127 57
601	**——, *m*-chloro-**	3-chlorophenylamine	$ClC_6H_4NH_2$	127.57
602	**——, *p*-chloro-**	4-chlorophenylamine	$ClC_6H_4NH_2$	127.57
603	**——, *N*-cyano-.**	See *Cyananilide.*		
604	**——, *N, N*-diacetyl-.**	See *Diacetanilide.*		
605	**——, *N, N*-dibenzyl-.**	See *Dibenzylamine, N-phenyl-*		
606	**——, 2, 4-dibromo-6-nitro-**	...	$Br_2(NO_2)C_6H_2NH_2$	295.94
607	**——, 2, 6-dibromo-4-nitro-**	...	$Br_2(NO_2)C_6H_2NH_2$	295.94
608	**——, *N,N*-dibutyl-.**	*N*-phenyldibutylamine	$C_6H_5N(C_4H_9)_2$	205.33
609	**——, 2, 3-dichloro-**		$Cl_2C_6H_3NH_2$	162 02
610	**——, 2, 4-dichloro-**		$Cl_2C_6H_3NH_2$	162 02
611	**——, 2, 5-dichloro-**		$Cl_2C_6H_3NH_2$	162.02
612	**——, 3, 4-dichloro-**	...	$Cl_2C_6H_3NH_2$	162.02
613	**——, 3, 5-dichloro-**	...	$Cl_2C_6H_3NH_2$	162.02
614	**——, *N*-(dichloromethylene)-**	phenyliminophosgene; phenylcarbylamine chloride	$C_6H_5NCCl_2$	174.03
615	**——, 2, 6-dichloro-4-nitro-**	...	$Cl_2(NO_2)C_6H_2NH_2$	207.02
616	**——, *N, N*-diethyl-**	*N*-phenyldiethylamine	$C_6H_5N(C_2H_5)_2$	149.23
617	**——*N, N*-diethyl-*m*-nitro-**	...	$NO_2C_6H_4N(C_2H_5)_2$	194.23
618	**——, *N, N*-diethyl-*p*-nitro-**	...	$NO_2C_6H_4N(C_2H_5)_2$	194.23
619	**——, *N, N*-diethyl-*p*-nitroso-**	...	$NOC_6H_4N(C_2H_5)_2$	178.23
620*	**——, *ar*-dimethyl-.**	See *Xylidine.*		
621	**——, *N, N*-dimethyl-**	...	$C_6H_5N(CH_3)_2$	121.18
621M	——, ——, hydrochloride	...	$C_6H_5N(CH_3)_2HCl$	157.64

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
592	yel. need. f CS_2	1.07^{50}	54 (51-2)	300	i.	s.	s. eth.
592M	monocl. need. f. bz.	....	93; 102	d.	i.	s.	v. s. eth.; s. bz.; sl. s. lgr.
593	cr . . .	...	32,frz.28 7	229	sl. s.	s.	s. eth.
594	$1.62604^{20.4}$ ..	$1.5793\frac{20.4}{4}$	18.5; frz. 16.7	251	v. sl. s.	s.	s. eth.
595	rhomb .	1 799	66.4	d.	i.	v. s.	v. s. eth.
596	need. or pr .	. .	33	270	i.	v s	v s eth.
597	. .	....	55	264	i.	v. s	v. s. eth.
598	col. liq.	. .	. .	240.9	sl s.	v s.	v s. eth.
599	oil .	$0\ 9525\frac{15}{4}$	17	240 9	i	∞	∞ eth.
600	liq , 1.5895	$1.213\frac{20}{4}$	α -14; β -3.5; mixt. 0	208 8	i.	∞	s. eth , most org. solv., a.
601	liq., $1.59424^{20.7}$	$1\ 216\frac{20}{4}$	-10 4	229 8 ($99\text{–}100^{10}$)		∞	∞ eth ; s most org solv , a
602	rhomb. pr	$1\ 427\frac{19}{4}$; liq. $1\ 170\frac{70}{4}$	70-2	231	s. h.	s.	s. eth , a , most org solv.
603							
604							
605							
606	yel. cr..	.	127				. . . .
607	yel. need .	.	203		sl. s.		. ...
608	col. liq .	0 907		262 8 (271)	i.	s.	s. eth.
609	need. f. lgr .	. . . .	24	252		s.	v. sl s. eth.; sl. s. bz., lgr.
610	need. f. dil. me. al.	$1\ 567\frac{20}{4}$	63	245	sl. s.	s.	s. eth.
611	need. f. lgr	.	50	251	sl s.	s.	s. eth., bz., CS_2, sl s lgr.
612	need. f. lgr		71 5	272		s.	s eth , sl. s. lgr.
613	need. . .	. . .	50.5	260	i.	s.	s. eth.
614	col. oil .. .	. . .	....	209		.	.
615	yel.need. f. al.	.. .	189-90 (195)			s.	.
616	col.-yel. or brn inflam. oil, $1.54105^{22.3}$	$.93507\frac{20}{4}$	-38 8	215 5	$1\ 44^{12}$	v. s	v s eth , $CHCl_3$
617	yel. oil.....	....		288-90	...		. . . .
618	yel. monocl. need. f. al.	1 225	77-8	..	. .	v. s h.	sl s. lgr.
619	grn. monocl	1.24^{15}	84	. ....	sl. s.	v. s.	v. s. eth.
620							
621	yel. liq., 1.55819	$0\ 9557\frac{20}{4}$	2 5	192 5-3 5	v. sl. s	s.	s eth , most ord org. solv.
621M	hyg. pl.......	$1\ 1156\frac{18.5}{4}$	90	. . ..	s. c.	s.	i. eth., s. chl.; sl s. bz.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
622	**Aniline, *N*, *N*-dimethyl-*o*-nitro-**	. .	$NO_2C_6H_4N(CH_3)_2$	166.18
623	**——, *N*, *N*-dimethyl-*m*-nitro-**	.. ..	$NO_2C_6H_4N(CH_3)_2$	166.18
624	**——, *N*, *N*-dimethyl-*p*-nitro-**	. .	$NO_2C_6H_4N(CH_3)_2$	166.18
625	**——, *N*, *N*-dimethyl-*p*-nitroso-**	.. ..	$NOC_6H_4N(CH_3)_2$	150.18
626	**——, *N*, *N*-dimethyl-*p*-phenylazo-.** See *Azobenzene, p-dimethylamino-.*			
627	**——, 2, 4-dinitro-**.....	2,4-dinitrophenylamine	$(NO_2)_2C_6H_3NH_2$...	183.12
628	**——, 2, 6-dinitro-**.. ..	2,6-dinitrophenylamine	$(NO_2)_2C_6H_3NH_2$.	183 12
629	**——, *N*, *N*-dipropyl-** .	. . . .	$C_6H_5N(C_3H_7)_2$	177.28
630	**——, ethoxy-.**	See *Phenetidine.*		
631	**——, ethoxyl-.**	See *Ethanol, 2-anilino-.*		
632	**——, *o*-ethyl-**.........	*o*-aminoethylbenzene . .	$C_2H_5C_6H_4NH_2$	121 18
633	**——, *m*-ethyl-**........	*m*-aminoethylbenzene.....	$C_2H_5C_6H_4NH_2$	121 18
634	**——, *p*-ethyl-**	*p*-aminoethylbenzene ...	$C_2H_5C_6H_4NH_2$	121.18
635	**——, *N*-ethyl-.**	*N*-ethylphenylamine .. .	$C_6H_5NHC_2H_5$.. ..	121.18
636	**——, *N*-ethyl-*o*, *m* or *p*-hydroxy-** See *Phenol, ethylamino-.*			
637	**——, *N*-ethyl-*N*-methyl-**	....	$C_6H_5N(CH_3)C_2H_5$	135.20
637K	**——, *o*-fluoro-**.........	1-amino-2-fluorobenzene	$FC_6H_4NH_2$.......	111.12
637M	**——, *m*-fluoro-**	1-amino-3-fluorobenzene .	$FC_6H_4NH_2$......	111.12
637P	**——, *p*-fluoro-**.........	1-amino-4-fluorobenzene	$FC_6H_4NH_2$.....	111.12
638	**——, hexahydro-.**	See *Cyclohexylamine**.		
639	**——, *p*, *p*'-hydrazodi-.**	See *Hydrazobenzene, 4, 4'-diamino-.*		
640	**——, hydroxy-.**	See *Phenol, amino-.*		
641	**——, *m*-hydroxy-*N*, *N*-dimethyl-.** See *Phenol, m-dimethylamino-**			
642	**——, β-hydroxethyl-.**	See *Ethanol, 2-anilino-.*		
643	**——, *p*, *p*'-iminodi-.**	See *Diphenylamine, 4,4'-diamino-*		
644	**——, *o*-iodo-**	....	$IC_6H_4NH_2$	219 04
645	**——, *m*-iodo-**........	....	$IC_6H_4NH_2$	219.04
646	**——, *p*-iodo-**..........	....	$IC_6H_4NH_2$.....	219.04
647	**——, *N*-isoamyl-.** ...	*N*-isoamylphenylamine ..	$C_5H_{11}NHC_6H_5$	163 26
647H	**——, *p*-isobutyl-**.. ...	. .	$C_4H_9C_6H_4NH_2$..	149.23
647M	**——, *N*-isobutyl-..**	*N*-phenylisobutylamine	$C_6H_5NHCH_2CH(CH_3)_2$	149.23
648	**——, *p*-isopropyl-.**	See *Cumidine.*		
649	**——, 2-isopropyl-5-methyl-.** See *Thymylamine.*			
650	**——, 5-isopropyl-2-methyl-.** See *Carvacrylamine.*			
651	**——, mercapto-.**	See *Phenol, aminothio-.*		
652	**——, methenyltri-.**	See *Leucaniline.*		
653	**——, methoxy-.**	See *Anisidine.*		
654	**——, *o*, *m* or *p*-methyl-.** See *Toluidine.*			
655	**——, *N*-methyl-**	....	$C_6H_5NHCH_3$......	107.15

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
622	red. monocl ..	1.179	60–1	154^{24}	sl. s.	s.	s. eth.
623	red. monocl. pr. f. eth.	1.313^{17}	66 (59–60)	285	i.	s.	s. eth.
624	yel. fluores. need. f. al.	......	163		i.	s.	s. conc. HCl, h. ac. a.
625	grn. tricl. leaf	....	85	.	i.	s.	s. eth.
626							
627	yel. monocl. f. dil. acet.	1.615	176 (188)		sl. s. h.	0.7^{21}	sl. s. h. HCl
628	yel. need. f al.	....	138 (141–2)	..	i.	0.40 c.	s eth., h. bz.; i. lgr.
629	yel. oil ..	$0.9104\frac{20}{4}$	. .	245–6 (238–41)	i.	s.	s eth.
630							
631							
632	liq..	$0.983\frac{22}{4}$	–43	215–6	sl. s.	v. s.	v. s. eth.
633	col. liq	$0.990\frac{0}{4}$; $0.9631\frac{20}{4}$	–64	214–5 (205)	sl. s.	v. s.	v. s. eth.
634	glit. leaf. or col. oil	$0.975\frac{22}{4}$	–5	216.5	sl. s.	v. s.	v. s. eth.
635	col. liq., $1.55558^{20.5}$	$0.9631\frac{20}{4}$	–63.5	204.72	i. (v. sl. s.)	∞	∞ eth.
636							
637	col liq......	0.9193^{15}	.	201	i.	∞	∞ eth.
637 K	pa. yel. liq., 1.54672^{18}	1.1437^{18}	–28.95	175	i.	s.	s. eth.
637M	pa. yel. liq., $1.54528^{18.5}$	$1.1561^{18.5}$	.	186.1	i.	s.	s. eth.
637 P	pa. yel. liq., 1.53945	1.1725	–0.82	187.6			....
638							
639							
640							
641							
642							
643							
644	need.	.	56.5	....	v. sl. s.	v. s.	v. s. eth.
645	leaf. or need..	..	33 (27)		i.	s.	s. chl.
646	need. f. w. ..	. .	62.75 (67–8)		i.	s.	s. eth., chl.
647	liq.... .	$0.928\frac{15}{4}$	.	254.5	i.	∞	∞ eth.
647 H	pa. yel. liq. .	. . ..	.	235^{763}	i.	∞	∞ eth.
647M	....	$0.940\frac{18}{4}$	.... .	225–7		......	....
648							
649							
650							
651							
652							
653							
654							
655	yel. liq., $1.57021^{21.3}$	$0.986\frac{20}{4}$	–57.0	195.7	v. sl. s.	s.	∞ eth.; s. chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
655M	**Aniline, *N*-methyl-,** hydrochloride		$C_6H_5NHCH_3{\cdot}HCl$	143.62
656	——, ***p*-methylamino-.**	See *p-Phenylenediamine, N-methyl-.*		
657	——, ***N*-methyl-*o*-nitro-**		$NO_2C_6H_4NHCH_3$.	152.15
658	——, ***N*-methyl-*m*-nitro-**		$NO_2C_6H_4NHCH_3$.	152.15
659	——, ***N*-methyl-*p*-nitro-**		$NO_2C_6H_4NHCH_3$	152.15
660	——, ***N*-methyl-*p*-nitroso-**		$NOC_6H_4NHCH_3$	136.15
661	——, ***N*-methyl-*N*-nitroso-**	methylphenylnitrosamine	$C_6H_5N(CH_3)NO$.	136.15
662	——, ***N*-methyl-*N*, 2, 4, 6-tetranitro-.**	See *Tetryl.*		
663	——, **methylene-.**	See *s-Triazine, hexahydro-1,3,5-triphenyl-.*		
664	——, ***p,p'*-methylene-bis-*N,N*-dimethyl-**	*p,p'*-tetramethyldiamino-diphenylmethane	$CH_2[C_6H_4N(CH_3)_2]_2$	254.36
666	——, ***p, p'*-methylenedi-**	4,4'-diaminodiphenylmethane	$NH_2C_6H_4CH_2C_6H_4NH_2$	198.26
667	——, ***N*-methyl-*N*-nitroso-**	methylphenylnitrosamine	$C_6H_5N(CH_3)NO$	136.15
668	——, ***o*-nitro-.**	1-amino-2-nitrobenzene	$NO_2C_6H_4NH_2$	138.12
669	——, ***m*-nitro-**	1-amino-3-nitrobenzene	$NO_2C_6H_4NH_2$	138.12
670	——, ***p*-nitro-**	1-amino-4-nitrobenzene	$NO_2C_6H_4NH_2$	138.12
671	——, ***N*-nitro-**	phenylnitramine; nitranilide; diazobenzolic acid	$C_6H_5NHNO_2$	138.12
672	——, ***p*-nitroso-**		$NOC_6H_4NH_2$	122.12
673	——, ***ar*-pentabromo-.**		$C_6Br_5NH_2$	487.66
674	——, ***ar*-pentachloro-.**		$C_6Cl_5NH_2$	265.37
675	——, ***ar*-pentamethyl-**	aminopentamethylbenzene	$C_6(CH_3)_5NH_2$	163.26
676	——, ***p*-phenyl-.**	See *Xenylamine.*		
677	——, ***N*-phenyl-.**	See *Diphenylamine*.*		
678	——, **phenylazo-.**	See *Azobenzene, amino-.*		
679	——, ***N*-(2-propenyl)-.**	See *Aniline, N-allyl-.*		
680	——, ***o*-propyl-**	1-amino-2-propylbenzene	$CH_3CH_2CH_2C_6H_4NH_2$	135.20
681	——, ***p*-propyl-**	1-amino-4-propylbenzene	$CH_3CH_2CH_2C_6H_4NH_2$	135.20
682	——, ***N*-propyl-**		$C_6H_5NHC_3H_7$	135.20
683	——, **2, 3, 4, 5-tetrachloro-**		$C_6HCl_4NH_2$	230.92
684	——, **2, 3, 5, 6-tetrachloro-**		$C_6HCl_4NH_2$	230.92
685	——, **2, 3, 4, 5-tetramethyl-**		$(CH_3)_4C_6HNH_2$	149.23
686	——, **2, 3, 4, 6-tetramethyl-.**	See *Isoduridine.*		
687	——, ***p, p'*-thiodi-**	4,4'-diaminodiphenyl sulfide; thioaniline	$S(C_6H_4NH_2)_2$	216.29
688	——, **2, 4, 6-tribromo-.**		$Br_3C_6H_2NH_2$	329.85
689	——, **3, 4, 5-tribromo-.**		$Br_3C_6H_2NH_2$	329.85
690	——, **2, 3, 4-trichloro-.**		$Cl_3C_6H_2NH_2$	196.47
691	——, **2, 4, 5-trichloro-.**		$Cl_3C_6H_2NH_2$	196.47

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
655M	need . .	.	121-122	.	378 8^{25}	v. s.	i. eth., bz.; v. s. chl.
656							
657	red need. f pet. eth.	..	36-7 (34)	d.	sl. s. h.	s.	s. eth.
658	red.-yel. need f. al	....	66 0		i.	s.	s. eth.
659	yel need. f. al	$1.201^{15.5}$	152	d.	i.	sl. s.	sl s. eth.; s. bz.; v. sl. s. lgr.
660	bl fl		118	.	. . .		. ....
661	yel. liq., $1.57602^{22.7}$	$1\ 1277\frac{20}{4}$	15	225 d.	i. (sl. s.)	s	s eth.
662							
663							
664	leaf. or tab	.	91-2	..	i.	sl. s. c., s h.	v. s. eth., bz., CS_2
666	pearly leaf. f. bz	.....	93 (77-84)	232^{11}	sl. s	v s.	v s eth.; s. bz.
667	yel oil	$1.124\frac{20}{4}$	12-5	225, 121^{13}	..	s.	s. eth.
668	or rhomb. need f. al.	$1\ 442\frac{20}{4}$	71 5	284 11 (270 d.)	0 126^{25}	15 8^{15}, 27 87^{25}	v s. eth.
669	yel rhomb need f al.	$1\ 430\frac{20}{4}$	111 8	286,306 35 (270 d.)	0.089^{25}	6 10^{25}	5 67^{20} eth.
670	yel monocl. need. f. al.	1 424	147 5	331 73 (260 d)	0 08^{19}, 2 2^{100}	4 61^{20}	4 39^{20} eth.
671	leaf. f. lgr		46	exp. 98	s.	v. s.	sl. s. lgr.
672	steel bl need f. bz.		174	. .	s	s.	s. bz.
673	need .		222	261-2		s.	....
674	need f al		232	....		v s.	v. s. eth.; sl. s lgr
675	monocl. f. al.	.	152	278	i.	s.	s eth.
676							
677							
678							
679							
680	liq	0 949^{18}	. .....	222-4	i.	s.	s eth.
681	liq.. ...	....	. .	224-6	sl s	...	....
682	pa. yel. oil	$0\ 949\frac{18}{4}$	......	222	i.	v. s.	v. s. eth.
683	need f. al	. .	118	.	.	v. s.	v. s. eth.; s. bz , ac. a.
684	cr f. lgr	. .	90	......	i.	s.	v. s. eth.
685	leaf f. w..	.	64-6	259-60	s. h.	v s.	v. s. eth.; s. pet. eth.
686							
687	need. f. w .	.... .	108-9 (105)	. ...	v. sl. s.	s.	s. eth., h. bz.
688	col rhomb. bi-pyr. need. f. bz.	$2\ 35\frac{20}{20}$	119	300	i.	sl. s.	s eth., chl.
689	need .	. . .	118-9	. .	i.	s.	s. eth.
690	need. f. lgr	.	67 5	291 5	...	v. s.	s lgr
691	need. f. lgr		96	270		v. s.	s CS_2; sl s lgr

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
692	**Aniline, 2, 4, 6-trichloro-**	*sym*-trichloroaniline.	$Cl_3C_6H_2NH_2$	196.47
693	**——, 2, 4, 5-trimethyl-.**	See *Pseudocumidine.*		
694	**——, 2, 4, 6-trimethyl-.**	See *Mesidine.*		
695	**——, 2, 4, 6-trinitro-..**	picramide; "T.N.A.".	$(NO_2)_3C_6H_2NH_2$..	228 12
695M	***p*-Anilinesulfonamide.**	See *Sulfanilamide.*		
696	***o*-Anilinesulfonic acid.**	See *Orthanilic acid.*		
697	***m*-Anilinesulfonic acid.**	See *Metanilic acid.*		
698	***p*-Anilinesulfonic acid.**	See *Sulfanilic acid.*		
699	**Animal starch.**	See *Glycogen.*		
700	**Anisalcohol.**	See *Anisyl alcohol.*		
701	**Anisaldehyde..........**	anisic aldehyde, *p*-methoxybenzaldehyde; *p*-anisaldehyde; aubepine .	$CH_3OC_6H_4CHO$	136 14
702	**——, 3-hydroxy-.**	See *Isovanillin.*	. ... .	. .
703	***o*-Anisaldehyde.**	See *Benzaldehyde, o-methoxy-.*		
703M	**Anisamide............**	*p*-methoxybenzamide . .	*p*-$CH_3OC_6H_4$-$CONH_2$	151 16
704	**Anise camphor........**	See *Anethole.*		
705	**Anisic acid............**	*p*-methoxybenzoic acid; *p*-anisic acid	$CH_3OC_6H_4COOH$	152 14
706	——, ethyl ester..	. ...	$CH_3OC_6H_4COOC_2H_5$	180 20
707	——, methyl ester	methyl anisate	$CH_3OC_6H_4$-$COOCH_3$	166 17
708	——, piperazinium salt	. .. .	$C_4H_{10}N_2.2C_8H_8O_3$.	390 43
709	**——, 2-hydroxy-6-methyl-..**	See *Everninic acid.*		
710	**Anisic aldehyde.**	See *Anisaldehyde.*		
711	**Anisidine, *N*-acetyl-.**	See *Acetaniside*		
712	***o*-Anisidine....... ..**	*o*-methoxyaniline .	$CH_3OC_6H_4NH_2$.	123 15
713	***m*-Anisidine..........**	*m*-methoxyaniline . ..	$CH_3OC_6H_4NH_2$.	123 15
714	***p*-Anisidine...........**	*p*-methoxyaniline	$CH_3OC_6H_4NH_2$	123 15
714M	**Anisoin...............**	*p*, *p'*-dimethoxybenzoin .	$C_{16}H_{16}O_4$	272 29
715	**Anisole...............**	methoxybenzene*; methyl phenyl ether	$C_6H_5OCH_3$.....	108 13
716	**——, *p*-acetamido-. .**	See *p-Acetaniside.*		
717	**——, *p*-acetyl-.**	See *Acetophenone, p-methoxy-*		
718	**——, *p*-allyl-.**	See *Estragole.*		
719	**——, *o*-bromo-. . .**	1-bromo-2-methoxybenzene*, *o*-bromophenyl methyl ether	$BrC_6H_4OCH_3$ ..	187 04
720	**——, *p*-bromo-. ... .**	1-bromo-4-methoxybenzene*, *p*-bromophenyl methyl ether	$BrC_6H_4OCH_3$.	187 04
721	**——, 2,4-dinitro-.....**	2,4-dinitrophenyl methyl ether	$(NO_2)_2C_6H_3OCH_3$	198 13
722	**——, *o*-hydroxy-.**	See *Guaiacol.*		
723	**——, *o*-nitro-........**	1-methoxy-2-nitrobenzene....	$NO_2C_6H_4OCH_3$...	153 13
724	**——, *m*-nitro-......**	1-methoxy-3-nitrobenzene. .	$NO_2C_6H_4OCH_3$...	153.13

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
692	lng. need. f. lgr.	....	77 5	262.4	i.	v. s.	s. eth.; v. s. lgr.
693							
694							
695	yel. monocl. need. f. ac. a.	1 762	188	exp.	0.106	0.127	0.121^{17} eth., s. ac. a.
695M							
696							
697							
698							
699							
700							
701	col. liq., $1.57641^{12.7}$	$1.123\frac{20}{4}$	2 5	247	0.2 c.	∞	∞ eth.
702							
703							
703M	col need. or tab.		166 5–7 5	...	s	v. s.	...
704							
705	col monocl. need. or pr.	$1\ 385\frac{4}{4}$	184 2	280	$0\ 04^{18}$	89^{25}	s. eth., chl., et ac.
706		$1\ 1028\frac{15}{15}$	7	269; $134\text{–}5^{20}$	i.	s.	s. eth.
707	col sc. f. al	...	48	256	i.	s.	s eth.
708	wh. cr......	....	172–4	....	sl. s.	s. h.	i. eth.
709							
710							
711							
712	col. liq., 1.57536^{20}	1.108^{26}; $1\ 0923\frac{20}{4}$	5 2 (3–4)	225 (218)	sl. s.	s.	s. eth., dil. min. a.
713	col. liq....	$1\ 096\frac{20}{4}$	<–12	251	sl s.	s.	s. eth.
714	rhomb. pl., 1.55592^{67}	$1.071\frac{55}{4}$; $1\ 0605^{67}$	59 (57.7)	240 (245)	v. sl. s.	v. s.	v. s. eth.
714M	pr..........	....	113	.....	sl. s. h.	s. h.	sl. s. eth.
715	col. liq., 1.51791^{20}	$0.9988\frac{15}{15}$; $0.9954\frac{20}{4}$	-37 3	155, $42\ 8^{10}$	i.	s.	s. eth.
716							
717							
718							
719	oil, 1.57245....	$1\ 5018\frac{20}{4}$	...	221–3	i.	v. s.	v. s. eth.
720	cr. f. eth., 1.56051^{20}	$1.4569\frac{20}{4}$	11–12	215, 100^{16}	7.1	v. s.	v. s. eth., $CHCl_3$
721	col.-yel. monocl. need. f. w. or al.	$1\ 341\frac{20}{4}$	88–9 (95 2)	subl.	sl. s. h.	$1\ 5^{20}$ s. h.	s. eth.
722							
723	col. liq., 1.56188^{20}	$1.2527\frac{20}{4}$	9.4 (10)	277 (272)	i. c.; 0.169^{90}	∞	∞ eth.
724	need. f. al....	1.373^{18}	38	258	i.	s.	v. s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
725	**Anisole, *p*-nitro-**	1-methoxy-4-nitrobenzene	$NO_2C_6H_4OCH_3$	153 13
726	**——, *p*-propenyl-.**	See *Anethole.*		
727	**——, 2,4,6-trinitro-**	picric acid methyl ether; methyl picrate	$(NO_2)_3C_6H_2OCH_3$	243 13
728	**——, *o*-vinyl**	*o*-methoxystyrene	$CH_2{\cdot}CHC_6H_4OCH_3$	134 17
729	**——, *m*-vinyl-**	*m*-methoxystyrene	$CH_2{\cdot}CHC_6H_4OCH_3$	134 17
730	**——, *p*-vinyl-**	*p*-methoxystyrene	$CH_2{\cdot}CHC_6H_4OCH_3$	134.17
731	**Anisoyl chloride**	*p*-methoxybenzoyl chloride; anisyl chloride	$CH_3OC_6H_4COCl$	170 59
732	**Anisyl alcohol**	*p*-methoxybenzyl alcohol; anisalcohol	$CH_3OC_6H_4CH_2OH$	138 16
732M	**Anisylamine.**	See *Benzylamine, p-methoxy-*		
733	**Anisyl chloride.**	See *Anisoyl chloride.*		
734	**Anol**	*p*-propenylphenol	$CH_3CH.CHC_6H_4OH$	134 17
735	**Anthracene**		$C_6H_4\ (CH)_2\ C_6H_4$	178 22
736	——, *α*-hexahydride.	See *Anthracene, α-hexahydro-.*		
737	**——, amino-.**	See *Anthrylamine*		
738	**——, diamino-.**	See *Anthradiamine.*		
739	**——, 9,10-dibromo-*.**		$C_6H_4(CBr)_2C_6H_4$	336 04
740	**——, 9,10-dichloro-*.**	*ms*-dichloroanthracene	$C_6H_4(CCl)_2C_6H_4$	247 12
741	**——, 9,10-dihydro-*.**	anthracene 9, 10-dihydride.	$C_6H_4.(CH_2)_2{:}C_6H_4$	180 24
742	**——, 9,10-dihydro-9-keto-.**	See *Anthrone.*		
743	**——, dihydroxy-.**	See *Anthracenediol.*		
744	**——, 9,10-dihydroxy-9,10-diketo-.**	See *Anthraquinone*		
744M	**——, 1,3-dimethyl-***		$C_{14}H_8(CH_3)_2$	206 27
745	**——, 2,3-dimethyl-***		$C_{14}H_8(CH_3)_2$.	206 27
746	**——, 2,4-dimethyl-***		$C_{14}H_8(CH_3)_2$	206 27
747	**——, 9-ethyl-*.**		$C_6H_4CHC(C_2H_5)$-C_6H_4	206 27
748	**——, 9-ethyl-9,10-dihydro-**		$C_6H_4C_2H_3(C_2H_5)$-C_6H_4	208 29
749	**——, *α*-hexahydro-**	anthracene *α*-hexahydride	$C_{14}H_{16}$	184 27
750	**——, hydroxy-.**	See *Anthrol.*		
751	**——, 9-hydroxy-.**	See *Anthranol.*		
752	**——, 1-methyl-**	*α*-methylanthracene	$C_6H_4(CH)_2C_6H_3$-CH_3	192 25
753	**——, 2-methyl-**	*β*-methylanthracene	$C_6H_4(CH)_2$-$C_6H_3CH_3$	192 25
754	**——, 9-methyl-**		$C_6H_4C(CH_3)$-CHC_6H_4	192 25
755	**——, 9-nitro-**		$C_{14}H_9NO_2$	223 22
756	**——, 9-phenyl-**		$C_{14}H_9C_6H_5$	254 31
756M	**Anthracenecarboxylic acid.**	See *Anthroic acid.*		
757	**Anthracenediamine.***	See *Anthradiamine.*		
758	**1,2-Anthracenediol***	1,2-anthradiol; 1,2-dihydroxyanthracene	$C_6H_4(CH)_2C_6H_2$-$(OH)_2$	210 22
759	**1,5-Anthracenediol*.**	See *Rufol.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
725	col. monocl. pr. f. al., 1.57072^{80}	$1.233\frac{20}{4}$; $1.2192\frac{60}{4}$	54	260 (274)	0.007^{15}; 0.0589^{85}	s.	v. s. eth.; sl. s. c. pet. eth.
726							
727	col.monocl.pl. f. al.	$1.408\frac{20}{4}$	68.4	......	i.	s.	s. eth., bz., ac a.
728	arom. liq., 1.556	$1.0095\frac{15}{4}$	.	195–200, $83\text{–}4^{12}$	i.	s.	s. eth.
729	oil	. . .	. .	$89\text{–}90^{14}$	i.	s.	s. eth.
730	arom. liq ...	$1.0029\frac{15}{4}$	. .	204^{756}; $90\text{–}1^{13}$	i.	s.	s. eth.
731	need... ..		27 (22–3)	145^{14}	i.	s. d.	s. eth., acet.
732	need.......	$1.109\frac{26}{4}$	25 (19–21)	258.8	i.	v. s.	v. s. eth.
732M							
733							
734	col. leaf. f. h. w.	. ..	93	250 d.	sl. s. h.	s.	s. eth., alk., ord. org. solv.
735	col. monocl	$1.25\frac{27}{4}$	217 (213)	354–5	i.	0.076^{16}, 0.83^{255}	1.189 eth.; 1.767 chl.; 1.500 CS_2; 7.5^{80} bz.
736	.						
737							
738							
739	yel. need. f. xylene or tol.	.	221 (226)	subl.	i.	sl. s.	sl. s. eth., c. bz.; s. chl., h. bz., h. tol.
740	yel. need. f. CCl_4		209–10	.	..	sl. s.	sl. s. eth.; s. bz.
741	col. tricl. or monocl. f. al.	$0.8976\frac{11}{4}$	108.5	305 (313) subl.	i.	v. s.	v. s. eth.; s. bz.
742							
743							
744							
744M	pl	..	202–203		i.	v. s	v. s. eth.
745	col. fluores. leaf f. bz.	.	252 (246)	.		s.	v. s. bz.
746	need. f. al....	...	71			s.	v. s. bz.
747	leaf. f. al., $1.6762^{99.2}$	$1.041\frac{99}{4}$	59	. .	i.	s.	s. eth.
748	oil	$1.049\frac{18}{4}$	..	320 sl. d.	i.	s	s. eth.; ∞ bz.
749	col. leaf... ..	..	63	290	i.	v. s.	v. s. eth., bz.
750							
751							
752	col. leaf. f. al., $1.6803^{99.4}$	$1.047\frac{99}{4}$	86	200	i.	sl. s.	sl. s. eth.; s. bz., CS_2
753	col. sc.......		207	subl.	i.	sl. s.	sl. s. eth.; s. bz., CS_2
754	. ...	$1.066\frac{99}{4}$	80	...	.		.. . ..
755	yel. need. f. al	....	146	>360	.	sl. s.	v. s. bz., CS_2
756	leaf. f. al. .. .	.... .	153	417		v. s.	v.s.eth.;s.h.bz.
756M							
757							
758	grnsh. leaf....	. .	160–2 (131 d.)	.... ..	.....	v. s.	v. s. eth., s. ac. a., alk.
759							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
760	**1,8-Anthracenediol*.**	See *Chrysazol.*		
761	**2,6-Anthracenediol*.**	See *Flavol*		
762	**9,10-Anthracenediol*.**	See *Oxanthranol.*		
763	**Anthrachrysazin.**	See *Anthrachrysone.*		
764	**Anthrachrysone.......**	1,3,5,7-tetrahydroxyanthraquinone; anthrachrysazin	$C_{14}H_4O_2(OH)_4$.	272 20
765	**9,10-Anthradiamine.**	9,10-anthracenediamine*; 9,10-diaminoanthracene	$C_{14}H_8(NH_2)_2$...	208 25
766	**Anthradiol.**	See *Anthracenediol*		
767	**Anthraflavic acid** .	2,6-dihydroxyanthraquinone.	$HOC_6H_3(CO)_2$-C_6H_3OH	240 20
768	**Anthragallol..........**	1,2,3-trihydroxyanthraquinone	$C_6H_4(CO)_2C_6H$-$(OH)_3$	256 20
769	**Anthrahydroquinone.**	See *Oxanthranol.*		
770	**Anthramine.**	See *Anthrylamine.*		
771	**Anthranil ....**	. ...	C_7H_5NO.... .	119 12
772	**Anthranilaldehyde....**	o-aminobenzaldehyde ..	$NH_2C_6H_4CHO$.	121 13
773	**Anthranilic acid.....**	o-aminobenzoic acid .. .	$NH_2C_6H_4COOH$.	137 13
774	——, ethyl ester	ethyl anthranilate; ethyl o-aminobenzoate	$NH_2C_6H_4COOC_2H_5$	165 19
775	——, methyl ester	methyl anthranilate ...	$NH_2C_6H_4COOCH_3$	151 16
776	——, ***N*-acetyl-......**	o-acetamidobenzoic acid.	$CH_3CONHC_6H_4$-COOH	179 17
777	——, ***N*-benzoyl-** . .	o-benzamidobenzoic acid . .	$C_6H_5CONHC_6H_4$-COOH	241 24
778	——, ***N*-carboxy-**, anhydride.	See *Isatoic anhydride.*		
779	——, ***N*-(carboxymethyl)-**	phenylglycine-o-carboxylic acid, anthranilidoacetic acid	$HOOCCH_2NHC_6$-H_4COOH	195 17
780	——, ***N*-ethyl-........**	o-ethylaminobenzoic acid; 2-ethylaminobenzenecarboxylic acid	$C_2H_5NHC_6H_4$-COOH	165 19
781	——, ***N*-methyl-**, methyl ester	. . . .	$CH_3NHC_6H_4$-$COOCH_3$	165 19
782	——, **3-nitro-.........**	2-amino-3-nitrobenzoic acid..	$NO_2(NH_2)C_6H_3$-COOH	182 13
783	——, **4-nitro-.........**	2-amino-4-nitrobenzoic acid..	$NO_2(NH_2)C_6H_3$-COOH	182 13
784	——, **5-nitro-.........**	2-amino-5-nitrobenzoic acid..	$NO_2(NH_2)C_6H_3$-COOH	182 13
785	——, **6-nitro-.........**	2-amino-6-nitrobenzoic acid	$NO_2(NH_2)C_6H_3$-COOH	182 13
786	——, ***N*-phenyl-.......**	o-anilinobenzoic acid.........	$C_6H_5NHC_6H_4$-COOH	213 23
787	**Anthranilonitrile.....**	o-aminobenzonitrile; o-aminophenyl cyanide	$NH_2C_6H_4CN$....	118 13
788	**Anthranol............**	9-anthrol; 9-hydroxyanthracene	$C_{14}H_9OH$........	194 22
789	——, **9,10-dihydro-....**	hydroanthranol	$C_6H_4CHOHC_6H_4C$-H_2	196 24
790	**Anthranylamine.**	See 9-*Anthrylamine.*		
791	**Anthrapurpurin......**	1,2,7-trihydroxyanthraquinone; isopurpurin	$HOC_6H_3(CO)_2$-$C_6H_2(OH)_2$	256 20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
760							
761							
762							
763							
764	silky yel. need ($+2H_2O$)	....	>360	$-H_2O$, 150, subl.	i.	s.	v. sl. s. eth.; s. ac. a., acet., chl., CS_2, bz., lgr.
765	pa. yel. leaf	.... .	160–6	.... .	i.	......	... .
766							
767	yel. need. f. al	....	330	subl.	i.	$1 \cdot 10^{17}$	i. eth ; s conc. H_2SO_4; sl. s. ac. a.; i. bz., chl.
768	or. red need f. dil. ac. a.	.. .. ..	310 d.	subl. 290	v. sl. s.	s.	s. eth., ac. a.; sl. s. chl., CS_2
769							
770							
771	col. oil, 1.5861	$1\ 187\frac{15}{4}$	<-18	215	sl. s h.	s.	s. ord. org. solv.
772	silv. leaf	... .	39–40	d.	sl. s.	v. s.	v. s. eth.; s. chl, bz.; i. lgr.
773	col. trim. rhomb. leaf.	. .	145	subl.	$0\ 35^{14}$	$10\ 7^{9.6}$	$16\ 0^{7}$ eth.
774	cr... ...	1 1174	13	260 (266–8); $135–6^{12}$	v. sl. s.	s.	s. eth.
775	col. liq ...	$1\ 168\frac{15}{4}$	8 2; 24 5	$135\ 5^{15}$	s.	v. s.	v. s. eth.
776	rhomb f. ac a	.	185	..	sl. s. c, s. h.	s. h.	s. eth., bz., h. ac. a.
777	lng. need. f. al.	.. ...	181	....	i.	s.	s. eth.
778							
779	need. f. me. al.	.. ...	215 (218–20)	....	sl. s.	s.	s. eth.; i. bz.
780	pr...... .	....	152–3	... .	..... .	s.	s. eth.
781	..		.	256	i.	s.	s. eth.
782	yel. need. f. w	$1\ 558\frac{15}{4}$	204	.. ..	i.	v. s.	v. s. eth.
783	red need.....	....	264 (269 5)	....	sl. s h.	v. s.	v. s. eth.; s. xylene
784	yel. need... .	....	263 (270–80d.)	....	s. h.	s.	s. eth.
785	yel. leaf. f. w	....	183–4 d	. ...	s h.	v. s.	v. s. eth.
786	need. f. al	... . .	181 (182–3)	>184 d.	v. sl. s. h.	v. s. h.	s. eth.
787	col.-ylsh. pr	....	50	264–6	......	s.	s. eth.
788	pa. yel. need..	....	170 d. (120)	....	i.	s.	v. s. h. bz.; s. alk., ac. a.
789	need. f. pet. eth.	....	76	....	s. h.	s.	s. eth.
790							
791	or. need. f. al.	....	369	462 d.	sl. s. h.	v. s.	sl. s. eth.; s. h. ac. a.; v. sl. s. chl., bz.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
792	**α-Anthraquinoline.**	See *Naphtho*-[2, 3-*f*] *quinoline.*		
793	**Anthraquinonazine, *N*, *N'*-dihydro-.**	See *Indanthrene.*		
794	**Anthraquinone**...	9,10-dihydro-9 10-diketo-anthracene	$C_6H_4\cdot(CO)_2:C_6H_4$.	208 20
795	——, **1-amino-**....	α-anthraquinonylamine	$C_6H_4(CO)_2C_6H_3$-NH_2	223 22
796	——, **2-amino-** ..	β-anthraquinonylamine	$NH_2C_6H_3(CO)_2$-C_6H_4	223 22
797	——, **2-amino-1-hydroxy-**	β-alizarin amide	$C_{14}H_6O_2$ (OH)NH_2	239 22
798	——, **1-bromo-**		$C_6H_4(CO)_2C_6H_3Br$	287 11
799	——, **2-bromo-**		$C_6H_4(CO)_2C_6H_3Br$	287 11
800	——, **1-chloro-**.... ..		$C_6H_4(CO)_2C_6H_3Cl$	242 65
801	——, **2-chloro-**.		$C_6H_4(CO)_2C_6H_3Cl$	242 65
805	——, **1, 2-diamino-**		$C_6H_4(CO)_2C_6H_2$-$(NH_2)_2$	238 24
806	——, **1, 3-diamino-**.		$C_6H_4(CO)_2C_6H_2$-$(NH_2)_2$	238 24
807	——, **1, 4-diamino-**		$C_6H_4(CO)_2C_6H_2$-$(NH_2)_2$	238 24
808	——, **1, 5-diamino-**		$NH_2C_6H_3(CO)_2$-$C_6H_3NH_2$	238 24
809	——, **1, 6-diamino-**		$NH_2C_6H_3(CO)_2$-$C_6H_3NH_2$	238 24
810	——, **1, 7-diamino-**		$NH_2C_6H_3(CO)_2$-$C_6H_3NH_2$	238 24
811	——, **1, 8-diamino-**		$NH_2C_6H_3(CO)_2$-$C_6H_3NH_2$	238 24
812	——, **2, 3-diamino-**		$C_6H_4(CO)_2C_6H_2$-$(NH_2)_2$	238 24
813	——, **2, 6-diamino-**		$NH_2C_6H_3(CO)_2$-$C_6H_3NH_2$	238 24
814	——, **2, 7-diamino-**		$NH_2C_6H_3(CO)_2$-$C_6H_3NH_2$	238 24
815	——, **2, 3-dibromo-**	β-dibromoanthraquinone	$C_6H_4(CO)_2C_6H_2Br_2$	366 02
816	——, **2, 7-dibromo-**		$C_6H_3Br(CO)_2$-C_6H_3Br	366 02
817	——, **1, 2-dihydroxy-.**	See *Alizarin.*		
818	——, **1, 3-dihydroxy-.**	See *Purpuroxanthin.*		
819	——, **1, 4-dihydroxy-.**	See *Quinizarin.*		
820	——, **1, 5-dihydroxy-.**	See *Anthrarufin.*		
821	——, **1, 8-dihydroxy-.**	See *Chrysazin.*		
822	——, **2, 3-dihydroxy-.**	See *Hystazarin.*		
823	——, **2, 6-dihydroxy-.**	See *Anthraflavic acid.*		
824	——, **2, 7-dihydroxy-.**	See *Isoanthraflavic acid.*		
825	——, **1, 3-dinitro-.**		$C_6H_4(CO)_2C_6H_2$-$(NO_2)_2$	298 20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
792							
793							
794	ylsh. rhomb	1.419^{-20}_{4}	286 subl.	379–81	i.	0.05^{10}; 2.3^{70}	v. sl. s. eth.; 6.4^{100} tol.; sl. s. bz.
795	red need.	.	252 (243)	subl.	i.	s.	s. eth., chl., bz., acet.
796	red need f. al	.	302	subl.	i.	s.	sl. s. eth.: s. chl., bz., acet.
797	br. need. f. al		226–7	subl.	i	s.	s. eth.; sl. s. NH_4OH
798	yel. need. f. bz		188	subl.		s	s. conc. H_2SO_4
799	yel. need. f. amyl al.		204–5	subl.	.	sl. s	s. h. bz.
800	yel. need.	.	162	subl	i	sl. s.	i. eth.; s. ac. a., nitro-bz., amyl al., h. bz.
801	pa. yel. need. f. ac. a. or al	.	211(203–5)	subl.	i.	sl. s.	i. eth.; s. h. bz., nitro-bz., conc. H_2SO_4
805	vlt. cr., grn. cast	. .	303 (242–4)				s. pyr., aniline; sl. s. chl., xylene
806	brick red cr. f. $PhNO_2$	.	290				s. h. $PhNO_2$
807	dk. vlt. cr. f. al.		268		sl. s. h.	v. s.	s. bz., pyr., nitro-bz., aniline
808	red need. f. al. or ac. a.		319	subl	v. sl. s	sl. s.	sl. s. eth.; s. h. nitro-bz.; sl. s. bz., chl., acet.
809	red cr..	.	292	.		.	s. h. $PhNO_2$
810	red cr.	.	290	.			s. h. $PhNO_2$
811	red cr. f. al		262		i.	v. s.	sl. s. eth.; s. ac. a., nitro-bz., pyr.
812	red cr.		>320			.	s. nitro-bz., pyr., H_2SO_4; sl. s. chl.
813	redsh.-br. pr. f. h. pyr	.	310–20 d			s. h.	i. chl., xylene
814	or. cr. f. al. or nitro-bz.		>330	subl.	i.	sl. s.	sl. s. eth.; s. conc. a.
815	yel. need.		281 (269–70)	subl.		v. sl. s	s. chl., bz.
816	yel. need. or pl		236.5	subl.	.	v. sl. s. h.	s. bz., h. ac. a.
817							
818							
819							
820							
821							
822							
823							
824							
825	yel. need.	.	240 (246–50)	. . .		. . .	. . . .

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
826	**Anthraquinone, 1, 5-dinitro-**	....	$NO_2C_6H_3(CO)_2$-$C_6H_3NO_2$	298.20
827	**——, 1,2,3,5,6,7-hexahy**	**droxy-.** See *Rufigallic acid*		
828	**——, 1(or α)-hydroxy-.**	erythrohydroxyanthraquinone	$C_6H_4(CO)_2C_6H_3OH$	224.20
829	**——, 2(or β)-hydroxy-.**	....	$C_6H_4(CO)_2C_6H_3OH$	224.20
830	**——, 2-methyl-..**	....	$C_6H_4(CO)_2C_6H_3$-CH_3	222.23
831	**——, 1-nitro-...**	... .	$NO_2C_6H_3(CO)_2$-C_6H_4	253.20
832	**——, 2-nitro-.** .	.	$NO_2C_6H_3(CO)_2$-C_6H_4	253.20
833	**——, 1,2,5,6-tetrahydr**	**oxy-.** See *Rufiopin.*		
834	**——, 1,2,5,8-tetrahydr**	**oxy-.** See *Quinalizarin.*		
835	**——, 1,3,5,7-tetrahydr**	**oxy-.** See *Anthrachrysone.*		
836	**——, 1,2,3-trihydroxy-.**	See *Anthragallol.*		
837	**——, 1,2,4-trihydroxy-.**	See *Purpurin.*		
838	**——, 1,2,5-trihydroxy-.**	2-hydroxyanthrarufin.. ..	$HOC_6H_3(CO)_2$-$C_6H_2(OH)_2$	256.20
839	**——, 1,2,6-trihydroxy-.**	See *Flavopurpurin.*		
840	**——, 1,2,7-trihydroxy-.**	See *Anthrapurpurin.*		
841	**——, 1,2,8-trihydroxy-.**	2-hydroxychrysazin	$HOC_6H_3(CO)_2$-$C_6H_2(OH)_2$	256.20
842	**——, 1,3,8-trihydroxy-**	**6-methyl-.** See *Emodin.*		
843	**2-Anthraquinonecarbo**	**xylic acid, 5,6 (or 7,8)-di**	**hydroxy-.** See 6 (	or 7)-
844	**α-Anthraquinonylami**	**ne.** See *Anthraquinone, 1-amin*	*o-.*	
845	**β-Anthraquinonylami**	**ne.** See *Anthraquinone, 2-amin*	*o-.*	
846	**Anthrarufin**..........	1,5-dihydroxyanthraquinone.	$HOC_6H_3(CO)_2$-C_6H_3OH	240.20
847	**——, 2-hydroxy-.**	See *Anthraquinone, 1,2,5-trihy*	*droxy-.*	
848	**1-Anthroic acid**.......	1-anthracenecarboxylic acid*, α-anthroic acid	$C_{14}H_9COOH$.	222.23
849	**2-Anthroic acid**... ...	2-anthracenecarboxylic acid*; β-anthroic acid	$C_{14}H_9COOH$.	222.23
850	**9-Anthroic acid**......	9-anthracenecarboxylic acid*, *ms*-anthroic acid	$C_{14}H_9COOH$..	222.23
851	**1-Anthrol**...........	1-hydroxyanthracene .	$C_{14}H_9.OH$ ..	194.22
852	**2-Anthrol**........... .	2-hydroxyanthracene......	$C_{14}H_9.OH$.......	194.22
853	**9-Anthrol.**	See *Anthranol.*		
854	**Anthrone**....... ..	9,10-dihydro-9-ketoanthracene	$C_{14}H_{10}O$	194.22
855	**——, 10-hydroxy-.**	See *Oxanthranol.*		
856	**1-Anthrylamine** ...	α-anthramine; 1-aminoanthracene	$C_{14}H_{11}N$...... .	193.24
856M	**2-Anthrylamine**	β-anthramine; 2-aminoanthracene	$C_{14}H_{11}N$...... .	193.24
856T	**9-Anthrylamine**	9-aminoanthracene; *meso*-anthramine, anthranylamine	$C(NH_2)$ C_6H_4 C_6H_4 CH	193.24
857	**Antifebrin.**	See *Acetanilide.*		
858	**Antimony, pentamethyl-***	.. .	$Sb(CH_3)_5$.	196.93

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
826	pa. yel. need. f. nitro-bz. or xylene	.....	384-5	subl.	i.	v. sl. s.	v. sl. s. eth., bz.; s. h. nitro-bz., h. xylene; sl. s. ac. a.
827							
828	or. cr. f. al....	......	190	subl.	i.	s.	s. eth.
829	yel. leaf or need. f. al.	.	302	subl.	v. sl. s.	s.	s. eth.
830	col-ylsh.need. f. al.	. .	175-7	subl.	......	v. sl. s.	s. eth., conc. H_2SO_4; v. s. bz.
831	yel. need. f. ac. a.	.	230	270^7 subl.	i.	sl. s.	sl. s. eth.
832	yel. need. f. al.	. .	181	subl.	i.	sl. s.	sl. s. eth.; v. s. chl.; s. H_2SO_4
833							
834							
835							
836							
837							
838	red need . ..	....	273-4	subl.	i.	.	s. eth.
839							
840							
841	or. need...	....	230	subl.	i.	v. sl. s.	.....
842							
843	*Alizarincarboxy*	*lic acid*					
844							
845							
846	pa. yel. leaf. f. ac. a.	...	280	subl.	v. sl. s.	sl. s.	sl. s. eth., acet.; s. bz., alk.
847							
848	yel. need . .	.....	245	subl.	i.	sl. s.	sl. s. eth., bz., chl.
849	yel. leaf.....	....	281	subl.	i.	sl. s.	sl. s. eth., chl.; s. ac. a.; i. bz., CS_2
850	pa. yel. need. f. al.	....	217 d. (206)	d.	sl. s. h.	s.	....
851	br. need. or leaf. f. a.	....	d. 150-3	200 d.	i.	v. s.	v. s. eth.; s. NaOH, org. solv.
852	brnsh. need..	.. . .	d. 200	..	i.	v. s.	v. s. eth.; s. acet.
853							
854	col. need	...	154-5	....	i.	s.	s. bz., h. NaOH
855							
856	....	....	119 (130)	....	......	......	....
856M	yel. need.... .	....	236-7	....	i.	sl. s.	sl. s. eth.
856T	yel. cr.......	....	145-50	....	......	s.	s. eth., chl., bz.
857							
858	....	....	... . .	96-100	i.	s.	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
859	**Antimony, triethyl-*.**	See *Stibine, triethyl-*		
860	**——, trimethyl-***	See *Stibine, trimethyl-.*		
860M	**Antineuritic vitamin.**	See *Vitamin B_1*		
861	**Antipyrine**..........	1,5-dimethyl-2-phenyl-3-pyrazolone; analgesine; phenazone	$N(CH_3)N(C_6H_5)$-$COCH{:}C(CH_3)$	188 22
862	——, salicylate.	See *Salipyrine.*		
863	**Antipyrine chloral hyd**	**rate.** See *Hypnal.*		
864	**Antiscorbutin.**	See *l-Ascorbic acid.*		
865	**Antisepsin.**	See *Acetanilide, p-bromo-.*		
866	**Aphrodine.**	See *Yohimbine*		
867	**Apiole**............	2,5-dimethoxysafrole; apiol; parsley camphor	CH_2 $CHCH_2C_6H$-$(OCH_3)_2(CH_2O_2)$	222 23
868	**Apoatropine**....	atropamine .	$C_{17}H_{21}NO_2$.	271 35
869	——, hydrochloride	.	$C_{17}H_{21}NO_2.HCl$	307 81
870	**Apocodeine**...		$C_{18}H_{19}NO_2$.	281 34
871	**Apomorphine**..		$C_{17}H_{17}NO_2$ .. .	267 32
872	——, hydrochloride	. .	$C_{17}H_{17}NO_2$ HCl	303.78
873	**Apoquinine**		$C_{19}H_{22}N_2O_2.2H_2O$.	346 42
874	**Aposafranone**....	10-phenyl-2(10)-phenazinone; benzeneindone	$C_6H_4(NC_6H_5)$-$(N)C_6H_3{:}O$	272 29
876	**Arabinose,** diphenylhydrazone	.	$C_5H_{10}O_4NN(C_6H_5)_2$	316 35
877	***dl*-Arabinose**.. ..	pectinose .	$C_5H_{10}O_5$	150 13
878	**α-Arabinose** (*d* or *l*) .		$C_5H_{10}O_5$	150 13
879	***d*-Arabitol**....	arabite;1,2 3,4,5-pentanepentol* (one form)	$C_5H_7(OH)_5$.	152 15
880	**Arabonic acid**	α, β, γ, δ-tetrahydroxyvaleric acid (one form)	$CH_2OH(CHOH)_3$-$COOH$	166 13
881	**Arachic alcohol.**	See 1-*Eicosanol*.*		
882	**Arachidic acid**	eicosanoic acid*, arachic acid; *n*-eicosoic acid	$CH_3(CH_2)_{18}COOH$	312 52
883	——, ethyl ester ..	. .	$C_{19}H_{39}COOC_2H_5$	340 58
884	——, methyl ester .	..	$C_{19}H_{39}COOCH_3$	326 55
885	**Arbutin** ..	arbutoside	$C_{12}H_{16}O_7$	272 25
886	**Arecaidine, arecaine**	1-methylguvacine, 1,2,5,6-tetrahydro-1-methylnicotinic acid	$C_7H_{11}NO_2$ H_2O	159 18
887	——, methyl ester.	See *Arecoline*		
888	**Arecoline**.	arecaidine methyl ester; methyl 1, 2, 5, 6-tetrahydro-1-methylnicotinate	$C_8H_{13}NO_2$	155 19
889	——, hydrobromide		$C_8H_{13}NO_2.HBr$	236.12
890	——, hydrochloride	. .	$C_8H_{13}NO_2.HCl$	191.66

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
859							
860							
860M							
861	leaf. or sc. f. eth., bz. or w., 1.5697, 1.6935, 1.7324	$1.19\frac{20}{4}$	114 (109)	319^{174}	100	100	2.6 eth.; sl. s. lgr.
862							
863							
864							
865							
866							
867	col. need., 1.5380^{14} liq.; α1.583, β1 73 sol.	$1\ 015\frac{20}{4}$	29 5	294	v. sl. s.	s.	s. eth.
868	wh. pr .	. .	62	. . .	sl. s.	v. s.	v. s. eth.; s. chl., CS_2, bz.
869	col. cr . . .	. . . . .	237–9	. .	s.	s.	s. eth.
870	pl. f. al. . .	. . . . .	100–10 d.	. .	v. sl. s	s.	s. eth.
871	wh. pr f. eth., turns grn. in air	. . .	170 d.	. . . . .	sl s.	s.	s. eth., bz.; v. s. chl., sl. s. HCl
872	monocl. pr., grn. on expos. to lt.	. . . . . .	200–10 d.	. . . . .	2^{25}	$2\ 47^{25}$	$0\ 0536^{25}$ eth.; v. sl. s. chl.
873	need. f. eth. .	. .	210 d.	. . . .	s. h.	s.	v. s. eth.; s. chl., bz., CS_2, KOH
874	dk. red met. cr.	. .	242 (248–9)	. . . . . .	sl. s.	s	s. bz.; i. alk.
876	col. need., $[\alpha]$ $+18.5^{\circ 20}_{D}$ in pyr.	.	197–204	. . . .	v. sl. s.	s. h.	. . . . .
877	col. rhomb . . .	$1\ 585\frac{20}{4}$	164.5	. . . . .	$16\ 9^{10}$	0 35 h.	i. eth.
878	rhomb. pr.; *l*, $[\alpha]\ -105^{\circ 20}_{D}$ in w.	$1\ 585\frac{20}{4}$	159.5	.	58.9^{10}	0 5 90%	i. eth.
879	col. warts or pr.	. . . .	103	. . . .	v. s.	2.08^{12} 90%	i. eth.
880	cr. or syrup .	. . . . . .	89	d., $-H_2O$	v. v. s.	. . . . . .	. . . .
881							
882	lust. sc.	$0\ 824\frac{100}{4}$	76.3	328	i.	0.45^{20}	v. s. eth.
883	cr	.	50	$295\text{–}7^{100}$	i.	s.	s. eth.
884	cr .	.	54.5	286^{100}	i.	s.	s. eth.
885	col. silky need		195	. . . . . .	12 5	6 67	i. eth., chl., CS_2
886	. . . .	.	224 d.	. . . . . .	v. s.	i.	i. eth.
887							
888	oily alk. liq . . .	. . . .	. . . .	220	∞	∞	∞ eth.; s. chl.
889	pr. f. al. . .	. . .	168	. . . .	s.	s. h.	sl. s. eth., chl.
890	wh. cr. . . .	. .	158	.	s.	s.	. . . . .

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
891	***dl*-Arginine**	*dl*-α-amino-δ-guanidovaleric acid; *dl*-N^{δ}-guanylornithine	$NH_2C(:NH)NH-(CH_2)_3CH(NH_2)-COOH$	174 21
892	***d*-Arginine**	*d*-α-amino-δ-guanidovaleric acid	$NH_2C(:NH)NH-(CH_2)_3CH(NH_2)-COOH$	174 21
893	——, flavianate		$C_6H_{14}N_4O_2.C_{10}H_6-N_2O_8S$	488 43
893M	——, diflavianate		$C_6H_{14}N_4O_2-(C_{10}H_6N_2O_8S)_2$	802 65
894	——, picrate		$C_6H_{14}N_4O_2 \cdot C_6H_3-N_3O_7 \cdot 2H_2O$	439 35
895	**Arsanilic acid**	*p*-aminobenzenearsonic acid; *p*-aminophenylarsinic acid	$NH_2C_6H_4AsO-(OH)_2$	217 04
897	**Arsenic, bisdiethyl-.**	See *Biarsine, tetraethyl-.*		
898	**——, dimethyl-.**	See *Cacodyl.*		
899	**——, triethyl-.**	See *Arsine, triethyl-.*		
900	**Arsenic dichloride, methyl-.** See *Arsine, dichloromethyl-.*			
901	**Arsenic oxide, bisdimethyl-.** See *Cacodyl oxide.*			
902	**——, methyl**	methyl arsinoxide	CH_3AsO	105 94
903	**Arsenic sulfide, bisdimethyl-.** See *Cacodyl sulfide.*			
904	**Arsenic trichloride, dimethyl-.** See *Cacodyl trichloride*			
905	**Arsenious chloride, diphenyl-.** See *Arsine, chlorodiphenyl-*			
906	**Arsenobenzene, 3,3′-diamino-4,4′-dihydroxy-,** dihydrochloride. See			
907	**Arsenobenzol.**	See *Arsphenamine.*		
908	**Arsine, chlorodimethyl-*.** See *Cacodyl chloride.*			
909	**——, chlorodiphenyl-*.**	diphenylchloroarsine; diphenylarsenious chloride; blue cross; sneezing gas	$(C_6H_5)_2AsCl$	264 57
910	**——, dichloromethyl-*.**	methylarsenic dichloride; methyldichloroarsine	CH_3AsCl_2	160 86
910M	**——, diethyl-*.**		$(C_2H_5)_2AsH$	134 04
911	**——, dimethyl-***	cacodyl hydride	$(CH_3)_2AsH$	105 99
912	**——, ethyl-***	arsinoethane	$C_2H_5AsH_2$	105 99
913	**——, methyl-***		CH_3AsH_2	91 96
914	**——, methyldichloro-*.**	See *Arsine, dichloromethyl-*		
915	**——, triethyl-***	arsenic triethyl	$(C_2H_5)_3As$	162 09
916	**——, trimethyl-***		$(CH_3)_3As$	120 01
917	**Arsinic acid, *p*-aminophenyl-.** See *Arsanilic acid*			
918	**——, dimethyl-.**	See *Cacodylic acid.*		
919	**——, methyl-.**	See *Methanearsonic acid*		
920	**Arsinoxide, methyl**	See *Arsenic oxide, methyl-.*		
921	**Arsphenamine**	3,3′-diamino-4,4′-dihydroxy-arsenobenzene dihydrochloride; salvarsan; arsenobenzol, "606"	$C_{12}H_{12}As_2N_2O_2.2HCl.2H_2O.$	475 02
922	**Asaron.**	See *Benzene, 1,2,4-trimethoxy-5-propenyl-*		
923	**Asaronic acid**	2,4,5-trimethoxybenzoic acid	$(CH_3O)_3C_6H_2-COOH$	212 20
924	***l*-Ascorbic acid**	vitamin C; cevitamic acid, antiscorbutin	$C_6H_8O_6$	176 12
925	**Asepsin.**	See *Acetanilide, p-bromo-*		
926	**Aseptol.**	See 1-*Phenol-2-sulfonic acid.*		
927	**Asparacemic acid.**	See *dl-Aspartic acid*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
891	....	....	217-8 d.	...	..	.....	
892	pr f. w.; pl f al.	.	238 d.	.....	15^{21}	i.	i. eth.
893	or. pl... ..		258-60 d.	.	0 0177^{19}	0 002	i eth.
893M	yel. need		soft. 160, d 228		d.	d.	i. a.
894	yel. need		217-8 d		0 5^{16}	i.	i. eth.
895	wh need		232	... .	sl s	sl s.	s. eth.; sl. s. ac. a., i. bz., chl., acet.
897							
898							
899							
900							
901							
902	pr f CS_2		95	d.	.	s.	s. bz.
903							
904							
905							
906	*Arsphenamine.*						
907							
908							
909	rhomb pl .	1 583^{40}	44 (39)	333 d.	0 2	20	v s eth; s bz.
910	col. liq ...	1 $838\frac{20}{4}$	-59	133-6	sl. s	s	s eth
910M	liq, 1.4709, ign. in air	1 $1338\frac{23}{4}$		105 (96 5-97)			
911	col. liq, ign. in air	1 $213\frac{29}{4}$		36		∞	∞ eth., chl, bz, CS_2
912	col liq	1 $217\frac{22}{4}$		36	0 00013^{19}	s.	s eth.
913	col. liq or gas			2	0 0085	v s	v. s. eth.
914							
915	col. liq., 1.467	1 $150\frac{20}{4}$		141 d	i.	s.	s eth.
916	col liq	1 $124\frac{22}{4}$		52 8	sl s.	s.	∞ eth
917							
918							
919							
920							
921	hyg. yel. powd.	....	.		v v s	sl. s	v. sl. s. eth.
922							
923	need. f. al	.....	144	*ca.* 300	sl s. c., s h.	s.	s. bz., lgr.
924	wh. cr. powd, $[\alpha]_D^{20}+21\text{-}2°$, w.	...	190-2	.	33 3	2;4 95%	i. eth., chl, bz.; 1 g. per 100 glyc.
925							
926							
927							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
928	***l*-Asparagine**	*l*-α-aminosuccinamic acid; *l*-β-asparagine	$NH_2COCH_2CH(NH_2)COOH$	132.12
929	***dl*-Aspartic acid**	*dl*-aminosuccinic acid; asparacemic acid	$COOHCH_2CH(NH_2)COOH$	133 10
930	***d*-Aspartic acid**	*d*-aminosuccinic acid... .	$COOHCH_2CH(NH_2)COOH$	133 10
931	***l*-Aspartic acid**........	*l*-aminosuccinic acid ..	$COOHCH_2CH(NH_2)COOH$	133 10
932	**Aspidospermine**......	....	$C_{22}H_{30}N_2O_2$......	354 48
933	**Aspirin**..............	acetylsalicylic acid, salicylic acid acetate; *o*-acetoxybenzoic acid	$CH_3COOC_6H_4COOH$	180 15
934	**Atisine**...............	.. ..	$C_{22}H_{31}NO_2$......	341 48
935	——, hydrochloride.	.. .. .	$C_{22}H_{31}NO_2\ HCl$	377 94
936	***dl*-Atrolactic acid**...	*dl*-α-phenyllactic acid; *dl*-α-hydroxyhydratropic acid, *dl*-atrolactinic acid	$CH_3C(C_6H_5)(OH)COOH$	166 17
937	**Atropamine.**	See *Apoatropine.*		
938	**Atropic acid**..... ..	α-phenylacrylic acid; α-methylene-α-toluic acid	$CH_2{:}C(C_6H_5)COOH$	148.15
939	**Atropine**............	*dl*-hyoscyamine, *dl*-daturine; tropic acid tropine ester	$C_{17}H_{23}NO_3$.....	289 36
940	——, chloroaurate ..	. . . .	$C_{17}H_{23}NO_3H\ AuCl_4$	629.40
941	——, sulfate	.. ..	$(C_{17}H_{23}NO_3)_2.H_2SO_4$	676 80
942	——, valerate	. ...	$C_{17}H_{23}NO_3.C_5H_{10}O_2.H_2O$	409 51
943	**Atroscine.**	See *i-Scopolamine.*		
944	**Aubepine.**	See *Anisaldehyde.*		
945	**Auramine (base)**.. ...	bis(*p*-dimethylaminophenyl)-methylenimine	$[(CH_3)_2NC_6H_4]_2C{:}NH$	267.36
946	——, hydrochloride.	See *Auramine (dye).*		
947	——, ***N*-methyl-**	.. . .	$[(CH_3)_2NC_6H_4]_2C{:}NCH_3$	281.39
948	**Auramine (dye)**	auramine (base) hydrochloride	$[(CH_3)_2NC_6H_4]_2C\ NH_2Cl\ H_2O$	321 85
949	**Aurin, Aurine**...	rosolic acid; pararosolic acid	$C_{19}H_{14}O_3$... ...	290 30
950	**——, hexamethoxy-.**	See *Eupittone.*		
950M	**Axerophthol.**	See *Vitamin A.*		
951	**Azelaic acid**..........	nonanedioic acid*; 1,7-heptanedicarboxylic acid	$COOH(CH_2)_7COOH$	188 22
952	——, diethyl ester..	ethyl azelate............	$CH_2[(CH_2)_3COOC_2H_5]_2$	244 32
953	**Azete, tetrahydro-.**	See *Trimethylenimine.*		
954	**Azetidine.**	See *Trimethylenimine.*		
955	**Azimethylene.**	See *Methane, diazo-*.*		
956	**Azirine, dihydro-.**	See *Ethylenimine.*		
957	**Azoaniline.**	See *Azobenzene, diamino-.*		
958	**Azobenzene**........ ..	diphenyldiimide, azobenzide	$C_6H_5N{:}NC_6H_5$....	182.22
959	——, ***p*-acetamido-** .	*p*-phenylazoacetanilide .. .	$CH_3CONHC_6H_4N{:}NC_6H_5$	239.27
960	——, ***o*-amino-**	*o*-phenylazoaniline; 2-benzeneazoaniline	$NH_2C_6H_4N{:}NC_6H_5$	197.23

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
928	col. rhomb., 1.549, 1.583, 1.625	$1\ 543^{15}_{4}$	236 d. cl. tube (226)	235 d.	$2\ 46^{25}$ $86\ 6^{100}$	0.0003^{25}	i. eth.; s. NH_3
929	monocl. pr	$1\ 663^{12}_{12}$	278–80 d.	....	$0\ 82^{25}$, $4\ 79^{75}$	$0\ 032^{25}$ 75%	....
930			251				
931	col. rhomb. leaf.	$1\ 6613^{12}_{12}$	269–71	. .	$0\ 39^{18}$, $0\ 54^{25}$, $2\ 71^{75}$	i.	i. eth.; s. dil. HCl
932	need. f. al. or pet. eth.		208	.	$1\ 7^{25}$	2.1^{25}	0.95^{25} eth.; s. chl., bz.
933	col. need. f. w, 1.505, 1.645, 1.655	.	133–5	d 140	0 25	20 90%	3.57 eth ; 5 9 chl, v. sl. s. bz.
934	col. varnish	. .	85	. .	sl s.	v. s.	v.s. eth.; s. chl.
935	pr .		296		v s.	v. s.	i. eth.
936	rhomb	.	$\frac{1}{2}H_2O$ 90, anh. 93	.	s.	. .	.....
937							
938	col. monocl..		106–7	267 d.	$0\ 14^{19}$	s.	s. eth., bz., chl., CS_2, glac. ac. a.
939	col. rhomb. pr. or need.		115 5; 118, subl.		$0\ 11^{25}$	68 5	5 6 eth., 64 chl.; 3.7 glyc.
940	leaf or glist powd		135–7		sl. s.	.....	... .
941	col. need. or wh. cr. powd.	. .	183–4 5 anh.	....	260	27	0.05 eth.; 0 16 chl., s. glyc.
942	wh. crusts	. .	42		v. s.	sl. s.	sl. s. eth.
943							
944							
945	yel. leaf. f. al		136	. .	i.	7^{20} 96%	$2\ 31^{20}$ eth.
946							
947	yel. cr f. al	.	130–3		v. sl. s.	v. s.	v. s. ac. a.
948	yel. fl		....	.	s.	s.	....
949	red rhomb. need.		308–10 d.	.	$0\ 12^{25}$	s.	s. eth., ac. a., alk ; sl. s chl ; i. bz., CS_2
950							
950M							
951	col. leaf. or need, $1\ 4303^{110\ 6}$	$1\ 029^{20}_{4}$	106 5	360 d., 226^{10}	$0\ 24^{20}$, $2\ 2^{65}$	v. s.	2.7 eth.
952		. .		291; $151–3^{14}$	i.	s.	s. eth.
953							
954							
955							
956							
957							
958	or.-red monocl. leaf.	$1\ 203^{20}_{4}$	68	297.4	i.	$8\ 5^{16}$	s. eth.; $8\ 57^{20}$ lgr.; 3.95^{16} me. al.
959	. ..	.	144	..	..	......	... ...
960	golden need	.	123		i	v. s.	s. eth.

For explanations and abbreviations see beginning of table.

Name	Synonyms	Formula	Mol. Wt.
Azobenzene, *m*-amino-	*m*-phenylazoaniline; 3-benzeneazoaniline	$NH_2C_6H_4N{:}NC_6H_5$	197 23
——, *p*-amino-	*p*-phenylazoaniline; 4-benzeneazoaniline	$NH_2C_6H_4N.NC_6H_5$	197.23
——, 4-amino-2,3′-dimethyl-. See *m-Toluidine, 4-m-tolylazo-.*			
——, 4-amino-3,4′-dimethyl-. See *o-Toluidine, 4-p-tolylazo-.*			
——, 4′-amino-2, 3′-dimethyl-. See *o-Toluidine, 4-o-tolylazo-.*			
——, 2, 2′-diamino-	2, 2′-azodianiline	$H_2NC_6H_4N{:}NC_6H_4NH_2$	212 25
——, 2,4-diamino-.	See *Chrysoidine (base).*		
——, 4,4′-diamino-	4,4′-azodianiline	$H_2NC_6H_4N_2C_6H_4NH_2$	212.25
——, diethoxy-.	See *o-Azophenetole.*		
——, dihydroxy-.	See *Azophenol.*		
——, dimethyl.	See *Azotoluene.*		
——, *p*-dimethylamino-	*N, N*-dimethyl-*p*-phenylazoaniline	$(CH_3)_2NC_6H_4N{:}NC_6H_5$	225.29
——, 4,4′-diphenyl-.	See *p,p′-Azobiphenyl.*		
——, *o*-hydroxy-	*o*-phenylazophenol	$HOC_6H_4N{:}NC_6H_5$	198 22
——, *m*-hydroxy-	*m*-phenylazophenol	$HOC_6H_4N{:}NC_6H_5$	198 22
——, *p*-hydroxy-	*p*-phenylazophenol	$HOC_6H_4N{:}NC_6H_5$	198 22
——, *p*-nitro-		$NO_2C_6H_4N{\cdot}NC_6H_5$	227 22
——, 2,4,3′-triamino-.	See *m-Phenylenediamine, 4-(3-aminophenylazo)-.*		
Azobenzenedicarboxylic acid. See *Azobenzoic acid.*			
Azobenzil.	See *Oxazole, triphenyl-.*		
***o*-Azobenzoic acid**	*o,o′*-azobenzenedicarboxylic acid	$COOHC_6H_4N{:}NC_6H_4COOH$	270 24
***m*-Azobenzoic acid**	*m,m′*-azobenzenedicarboxylic acid	$COOHC_6H_4N{\cdot}NC_6H_4COOH$	270 24
***p*-Azobenzoic acid**	*p,p′*-azobenzenedicarboxylic acid	$COOHC_6H_4N.NC_6H_4COOH$	270 24
***p,p′*-Azobiphenyl**	4,4′-diphenylazobenzene, *p*-azodiphenyl; di-*p*-xenyldiimide	$C_6H_5C_6H_4N{:}NC_6H_4C_6H_5$	334.40
Azodicarbonamide	azoformamide	$NH_2CON{:}NCONH_2$	116.08
***p*-Azodiphenyl.**	See *p,p′-Azobiphenyl.*		
Azoformamide.	See *Azodicarbonamide.*		
Azoimide, phenyl-.	See *Benzene, triazo-.*		
Azole.	See *Pyrrole.*		
1,1′-Azonaphthalene	di-1-naphthyldiimide; α, α′-azonaphthalene	$C_{10}H_7N\ NC_{10}H_7$	282 33
——, 4-amino-.	See 1-*Naphthylamine, 4-(1-naphthylazo)-*		
1,2′-Azonaphthalene	α-naphthyl-β-naphthyldiimide	$C_{10}H_7N{:}NC_{10}H_7$	282 33
2,2′-Azonaphthalene	di-β-naphthyldiimide	$C_{10}H_7N{:}NC_{10}H_7$	282 33
***o*-Azophenetole**	*o,o′*-azodiphenetole; *o,o′*-diethoxyazobenzene	$(C_2H_5OC_6H_4)_2N_2$	270 32
***p*-Azophenetole.**	*p,p′*-azodiphenetole, *p,p′*-diethoxyazobenzene	$(C_2H_5OC_6H_4)_2N_2$	270 32
***o*-Azophenol**	*o,o′*-azodiphenol; 2,2′-dihydroxyazobenzene	$HOC_6H_4N{:}NC_6H_4OH$	214 22
***m*-Azophenol**	*m,m′*-azodiphenol; 3,3′-dihydroxyazobenzene	$HOC_6H_4N{:}NC_6H_4OH$	214 22

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
961	or. need	.	57		.	s.	s. eth., bz., chl.
962	yel. monocl	.	126 (122–3)	>360	sl. s. h.	s. h.	s. eth., bz., chl.
963							
964							
965							
966	redsh. pl. f. al. or bz.	. . .	134	. .	v sl s.	s.	s. eth.; v. s. acet.
967							
968	yel. need. f. al	. . . .	241	. . .	sl s	s.	s eth., bz , chl.; sl. s. lgr.
969							
970							
971							
972	yel. leaf. f. al	.	117 (115)	d	i.	v s	s. eth , conc. min. a.
973							
974	or. need. f. eth	. . . .	82.5–3 0	. . .	sl. s.	s.	s. eth , alk.
975	yel pr. f. bz.		114–7	. . . .	0 08 h	s	s. eth.
976	rhomb. pr. f al.	.	152 (155–6)	220–30[20] sl d.	0 002[25]	v s.	v. s. eth
977	or red. leaf. or need.	. . . .	134			v sl s h.	. .
978							
979							
980							
981	dk yel. need. f. al.	. .	245 d. (237)	. . .	v. sl. s	s.	v. s eth.; i bz.
982	amor. powd. or yel need.	.	340	d.	sl. s.	0 24[78] 88%	sl. s. eth.
983	red need		*ca* 330	d	v sl s.	v sl. s.	v. sl. s. eth.
984	or -red pl. f bz.	.	249–50		i.	i.	s. eth.
985	or -red cr		180 d.		s h.	i.	sl. s. eth.; d. h. HCl
986							
987							
988							
989							
990	red need. f. ac a.	. .	190	subl.	i	sl s.	s. bz., ac. a., acet.
991							
992	br. leaf. f. ac. a.	. . .	136	. . .	i.	s.	s. bz., ac a., conc. H_2SO_4
993	red leaf. f. bz. or chl.		208	subl.	i.	sl. s.	sl. s. eth., me. al.; s bz., chl.
994	red pr. f. al. .	. . .	131	240 d.	i.	s.	s. eth., HCl
995	yel. leaf.	. . . .	160.2	d.	i.	s. h.	v. s. eth.
996	yel. leaf. f. bz. or al.	.	172	subl.	i	0 33	v. s. eth.; 1.67 bz.; s. conc. alk.
997	yel. leaf. f. dil. al.	. . . . .	205	.	v. sl. s.	s. h.	sl. s. eth ; s. h. alk.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
998	**p-Azophenol**..........	p,p'-azodiphenol, 4,4'-dihydroxyazobenzene	HOC_6H_4-N:NC_6H_4OH	214 22
999	**o-Azotoluene**........	2,2'-dimethylazobenzene; di-o-tolyldiimide	$CH_3C_6H_4N.NC_6H_4CH_3$	210 27
1000	**m-Azotoluene**.. ..	3,3'-dimethylazobenzene; di-m-tolyldiimide	$CH_3C_6H_4$-N:$NC_6H_4CH_3$	210 27
1001	**p-Azotoluene**.	4,4'-dimethylazobenzene; di-p-tolyldiimide	$CH_3C_6H_4$-N:$NC_6H_4CH_3$	210 27
1002	**Azoxybenzene** (ordinary)	azoxybenzide . .	$C_6H_5(NON)C_6H_5$	198 22
1003	**Azoxybenzenedicarboxylic acid.** See *Azoxybenzoic acid*			
1004	**o-Azoxybenzoic acid**	o,o'-azoxydibenzoic acid, azoxybenzene-2,2'-dicarboxylic acid	C_6H_4COOH-$(NON)C_6H_4$-COOH	286 24
1005	**m-Azoxybenzoic acid**	m,m'-azoxydibenzoic acid .	C_6H_4COOH-$(NON)C_6H_4$-COOH	286.24
1006	**p-Azoxybenzoic acid** .	p,p'-azoxydibenzoic acid	C_6H_4COOH-$(NON)C_6H_4$-COOH	286.24
1007	**1,1'-Azoxynaphthalene**	1,1'-azoxydinaphthalene; α, α'-azoxynaphthalene	$C_{10}H_7(NON)C_{10}H_7$	298 33
1008	**2,2'-Azoxynaphthalene**	β, β'-azoxynaphthalene	$C_{10}H_7(NON)C_{10}H_7$	298 33
1009	**Baeyer's acid.**	See *Croceic acid.*		
1010	**Baphiin**.............	....	$C_{12}H_{10}O_4$ or $C_{24}H_{20}O_8$	218 20 (436.40)
1011	**Baptitoxine.**	See *Cytisine.*		
1012	**Barbital**.............	5,5-diethylbarbituric acid, veronal; barbitone; malourea	NHCONHCOC-$(C_2H_5)_2CO$	184.19
1013	**Barbituric acid**.. . .	malonylurea; pyrimidinetrione	NHCONHCO-CH_2CO	128.09
1014	——, **5-amino-.**	See *Uramil.*		
1015	——, **5,5-diallyl-**.....	dial . .	NHCONHCOC-$(C_3H_5)_2CO$	208 21
1016	——, **5,5-diethyl-.**	See *Barbital.*		
1017	——, **5,5-dipropyl-**. ..	proponal; propytal .	NHCONHCOC-$(C_3H_7)_2CO$	212 25
1018	——, **5-ethyl-5-isoamyl-**	amytal	NHCONHCOC-$(C_2H_5)(C_5H_{11})CO$	226.27
1019	——, **5-ethyl-5-α-methylbutyl-**	. ...	NHCONHCOC-$(C_2H_5)(C_5H_{11})CO$	226 27
1020	——, **5-ethyl-5-phenyl-.** See *Phenobarbital.*			

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
998	cr. (+1H_2O) f. dil. al.; α anh. grn. powd.; β anh. dk. red powd.		216		sl. s.	v. s.	v. s. eth.; s. bz.
999	red monocl. pr. f. eth.	. .	55		i	$6^{14.5}$	147 $7^{18.5}$ eth.; s bz.
1000	or. red rhomb. cr.	.	54–5		i.	v s.	v. s. eth.
1001	or. yel. monocl. need. f. lgr.		144		i	s.	v. s. eth.; s. lgr.
1002	yel. rhomb. need. f. h. al., 1.6644^{26}	$1\ 246\frac{20}{4}$	36	d.	i	17 5^{16}	v. s eth.; 43^{15} lgr.
1003							
1004	pa. yel. tricl leaf. f. al.		250 d	d.	i	sl s.	sl. s. eth.
1005	pa. yel. need or leaf.		345 d (320)		i	sl. s.	sl. s. eth.
1006	yel. amor..		240 d.	d.	i	i.	i. eth.; s. pyr.
1007	yel.-red rhomb. f. al		127		i.	s.	sl. s. eth.; s. conc. H_2SO_4
1008	yel. rhomb. need. f. al.		167–8		i.	s. h	sl. s. eth.; s. bz., chl.
1009							
1010	leaf .		d.	.	i.	s.	s. eth.
1011							
1012	wh. cr. powd		191		0.69^{20}, $8\ 3^{100}$	s.	v. s. eth.; s. acet., alk., pet. eth, ac. a, sl. s chl.
1013	wh. rhomb. pr		245	260 d.	sl. s.	sl. s.	s. eth.
1014							
1015	col. sc	. .	170		sl s.	s.	s. eth.
1016							
1017	col. cr		145	.	0.06c., 1.4^{100}	v. s.	v. s. eth.; s. dil. alk.
1018	col...	. .	135	. . .	sl. s.	s.	s. eth.
1019	col...... ..	.	128 5–130	. .	sl. s.	s.	s. eth.
1020							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
1021	**Barbituric acid, 5-(2-furfurylidene)-2-thio-**	furfuralmalonylthiourea	C_4H_3OCH:-CCONHCSNHCO	222 21
1022	**——, 5-hydroxy-.**	See *Dialuric acid*		
1023	**——, 5-isonitroso-.**	See *Violuric acid.*		
1025	**Bassorin**	tragacanthin	$C_{16}H_{10}O_5$ (?)	282 24
1026	**Bebeerine**.......... .	.. ..	$C_{18}H_{19}NO_3$ . ..	297.34
1027	——, hydrochloride		$C_{18}H_{19}NO_3$·HCl	333.81
1028	**Behenic acid**	docosanoic acid*, *n*-docosoic acid	$CH_3(CH_2)_{20}COOH$	340 58
1029	——, ethyl ester	.	$C_{21}H_{43}COOC_2H_5$.	368 63
1030	——, methyl ester	. .	$C_{21}H_{43}COOCH_3$.	354 60
1031	**Behenolic acid**	13-docosynoic acid* .	$CH_3(CH_2)_7C$:-$C(CH_2)_{11}COOH$	336 54
1032	**Belladonnine** .	.. . .	$C_{17}H_{21}NO_2$.	271 35
1033	**Benzaconine**	benzoylaconine; napelline; picraconitine	$C_{32}H_{43}NO_{10}$	601.68
1033M	**Benzal.**	See *Benzylidene.*		
1034	**Benzalazine.**	See *Benzaldehyde, azine.*		
1035	**Benzal bromide.**	See *Benzylidene bromide*		
1036	**Benzal chloride.**	See *Benzylidene chloride.*		
1037	**Benzaldehyde**	benzenecarbonal*.......	C_6H_5CHO	106 12
1038	——, azine.....	benzalazine; benzylidene-azine; dibenzalhydrazine	C_6H_5CH:NN:-CHC_6H_5	208.25
1039	——, cyanohydrin.	See *Mandelonitrile.*		
1040	——, hydrazone..... .	benzalhydrazine; benzylidenehydrazine	C_6H_5CH:NNH_2	120.15
1041	——, *α-, trans-*, or *anti*-oxime	*trans*-benzaldoxime	C_6H_5CH:NOH	121.13
1042	——, *β-, cis-*, or *syn*-oxime	*cis*-benzaldoxime .	C_6H_5CH:NOH	121.13
1043	——, phenylhydrazone	benzalphenylhydrazine, benzylidenephenylhydrazine	C_6H_5CH:-$NNHC_6H_5$	196.24
1044	**——, 4-acetoxy-3-methoxy-.**	See *Vanillin, acetate*		
1045	**——, o-amino-.**	See *Anthranilaldehyde.*		
1046	**——, *m*-amino-..**	. .	$NH_2C_6H_4CHO$	121 13
1047	**——, *p*-amino-** .		$NH_2C_6H_4CHO$	121 13
1048	**——, o-chloro-** ...	2-chlorobenzenecarbonal*	ClC_6H_4CHO .	140 57
1049	**——, *m*-chloro-...**	3-chlorobenzenecarbonal*	ClC_6H_4CHO.	140.57
1050	**——, *p*-chloro-.** .. .	4-chlorobenzenecarbonal*.	ClC_6H_4CHO .	140.57
1051	**——, diacetyl-.**	See *Benzal diacetate.*		
1052	**——, 2,4-dihydroxy-.**	See *β-Resorcylaldehyde.*		
1053	**——, 3,4-dihydroxy-.**	See *Protocatechualdehyde.*		
1054	**——, 2,4-dimethoxy-** .	2,4-dimethoxybenzenecarbonal*; β-resorcylaldehyde dimethyl ether	$(CH_3O)_2C_6H_3CHO$	166 17
1055	**——, 3,4-dimethoxy-.**	See *Veratraldehyde.*		
1056	**——, *p*-dimethyl-amino-**	4-dimethylaminobenzenecarbonal*	$(CH_3)_2NC_6H_4CHO$	149 19
1057	**——, 2,4-dinitro-** ..	2,4-dinitrobenzenecarbonal*	$(NO_2)_2C_6H_3CHO$	196 12

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1021	yel. flocks....	.	....	. .	i.	.....	....
1022							
1023							
1025	amor., a mucilage		....	.	sl s.	i.	s. alk.; d. h. a.
1026	mixture (?), pr. f. me. al., [α]-298°D	.	214		0 016 c	20	s. eth., chl., a.
1027	hyg. need. or sc.	.	259–60		s.	s.	. ...
1028	col. need.....		80 7 (84)	306^{60}	0 10c.	0.10^{17}	1.92^{16} eth.
1029	need. f. al...	. .	54–4.5	$230–1^{5}$	i.	s.	s. eth.
1030	cr	.	54–4.5	$224–5^{15}$	i.	s.	s. eth.
1031	col. need. f. al	.	57.5	......	i.	v. s.	v.s. eth.; s. chl.
1032	amor. resin..				v sl s	v. s.	v.s. eth.; s. chl.
1033	amor		130	.		.	. . ..
1033M							
1034							
1035							
1036							
1037	col. liq., $1.54629^{17.6}$	$1\ 0504\frac{15}{4}$	-26; frz.-56	179 5; $112.5–13^{100}$	0 33	∞	∞ eth., fixed and vol. oils
1038	lng. yel. lust. pr.	..	93	d.	i.	v. s. h.	v. s. eth.; s. chl., bz.
1039							
1040	col. leaf. or liq.	.	16	140^{14}	d.	s.	d. a., alk.
1041	col. leaf., $1\ 5637^{21.4}$	$1\ 111\frac{20}{4}$	35	200, 134^{20}	sl. s.	v. s.	v. s. eth., bz.
1042	col rhomb. tab. or need.	....	130	.	s. h.	15 5^{20}, 53 6^{70}	v. s. eth.; sl. s. bz.
1043	col.-pink monocl. pr.	..	156			s. h.	sl. s. eth.; s. bz.
1044							
1045							
1046	in solution only						
1047	pl. or leaf. f. w.	....	71		v sl s	s.	s. eth.
1048	liq., $1.56564^{21.7}$	$1.252\frac{20}{4}$	11 (8-9)	208^{748}	sl. s.	v. s.	v. s. eth.; s. bz.
1049	liq. or pr., $1.56500^{20.2}$	$1.2497\frac{15}{4}$	17–8	213–4 (204)	sl. s.	v. s.	v. s. eth.; s. bz.
1050	leaf., 1.55525^{61}	$1.196\frac{61}{4}$	47 5	214 $(144–4.5^{100})$	sl. s.	v. s.	v. s. eth.; s. CS_2, ac. a., bz.
1051							
1052							
1053							
1054	need. f. dil. al.	...	69–70	165^{10}	i.	v. s.	v. s. eth.
1055							
1056	leaf. f. w ..	.	74	$176–7^{17}$	sl. s.	s.	s. eth., ac. a., ord. org. solv.
1057	pa. yel. cr. f. al		72	$190–210^{10–20}$	sl. s.	v. s.	v. s. eth.; s. bz.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1058	**Benzaldehyde, 2,6-dinitro-**	2,6-dinitrobenzenecarbonal*	$(NO_2)_2C_6H_3CHO$	196.12
1059	**——, 4-ethoxy-3-methoxy-**	vanillin ethyl ether; protocatechualdehyde 4-ethyl-3-methyl ether	$C_2H_5O(CH_3O)$-C_6H_3CHO	180.20
1060	**——, o-hydroxy-.**	See *Salicylaldehyde.*		
1061	**——, m-hydroxy-...**	....	HOC_6H_4CHO ...	122.12
1062	**——, p-hydroxy- ...**	....	HOC_6H_4CHO	122.12
1063	**——, 4-hydroxy-3-methoxy-.**	See *Vanillin.*		
1064	**——, p-isopropyl-.**	See *Cumaldehyde.*		
1065	**——, o-methoxy- ....**	salicylaldehyde methyl ether, o-anisaldehyde	$CH_3OC_6H_4CHO$	136.14
1066	**——, p-methoxy-.**	See *Anisaldehyde.*		
1067	**——, methyl-.**	See *Tolualdehyde.*		
1068	**——, 3,4-methylenedioxy-.**	See *Piperonal.*		
1069	**——, o-nitro-.....**	....	$NO_2C_6H_4CHO$...	151.12
1070	**——, m-nitro-. ..**	..	$NO_2C_6H_4CHO$	151.12
1071	**——, p-nitro-....**	......	$NO_2C_6H_4CHO$	151.12
1072	**——, 2,4,6-trinitro- .**	.	$(NO_2)_3C_6H_2CHO$	241.12
1073	**——, trithio-.**	See *s-Trithiane, triphenyl-.*		
1074	**o-Benzaldehydesulfonic acid.**	See *Benzenesulfonic acid,o-formyl-.*		
1075	**Benzal diacetate......**	benzylidene diacetate; diacetylbenzaldehyde, α, α-diacetoxytoluene	C_6H_5CH-$(OOCCH_3)_2$	208.21
1075M	**Benzaldoxime.**	See *Benzaldehyde, oxime.*		
1076	**Benzaldoximecarboxylic anhydride.**	See 2,3,1-*Benzoxaz-1-one.*		
1076M	**Benzal fluoride ....**	α,α-difluorotoluene; benzylidene fluoride	$C_6H_5CHF_2$	128.12
1077	**Benzalimine, N-ethyl-.**	See *Ethylamine, N-Benzylidene.*		
1078	**Benzamarone.... .**	1,2,3,4,5-pentaphenyl-1, 5-pentanedione (one form); α, α′-benzalbisdesoxybenzoin	$C_6H_5CH[CH$-$(C_6H_5)COC_6H_5]_2$	480.58
1079	**Benzamide . ..**	benzenecarbonamide, benzoic amide	$C_6H_5CONH_2$	121.13
1080	——, oxime...	benzamidoxime; benzenylaminoxide	$C_6H_5C(:NOH)NH_2$	136.15
1081	**——, o-amino-**	.	$NH_2C_6H_4CONH_2$.	136.15
1082	**——, m-amino- .**	....	$NH_2C_6H_4CONH_2$	136.15
1083	**——, p-amino- ..**		$NH_2C_6H_4CONH_2$	136.15
1084	**——, o-chloro-.. ...**	2-chlorobenzenecarbonamide*	$ClC_6H_4CONH_2$	155.58
1085	**——, m-chloro-... ..**	3-chlorobenzenecarbonamide*	$ClC_6H_4CONH_2$	155.58
1086	**——, p-chloro- . .**	4-chlorobenzenecarbonamide*	$ClC_6H_4CONH_2$	155.58
1087	**——, o-hydroxy-.**	See *Salicylamide.*		
1088	**——, m-hydroxy-.....**	....	$HOC_6H_4CONH_2$.	137.13
1089	**——, p-hydroxy-. ....**	....	$HOC_6H_4CONH_2$.	137.13
1089M	**——, p-methoxy-.**	See *Anisamide.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1058	leaf. f. dil ac a.	. ..	123	....	s. h.	s.	s. eth., bz., ac. a., chl.; sl. s. CS_2, lgr.
1059	monocl. pr ..	.	64–5 (73–4)	subl.	sl. s h.	sl. s.	s. eth.
1060							
1061	col. need. f. w	. ..	106 (101–3)	240	2 78[43]	v. s.	s. eth.; 6.31[61] bz.
1062	col. need. f w	$1\ 129\frac{130}{4}$	116	subl.	1 38[80.5]	v. s.	v. s. eth.; 3 68[65] bz.
1063							
1064							
1065	pr, 1 5597	$1\ 133\frac{20}{4}$	35	243	i.	s.	v. s. eth.
1066							
1067							
1068							
1069	yel. need. f. w		α40, β37 9	156[15]	0 23[25], 1 53[103]	v s.	v. s eth., s. bz.
1070	lt. yel. need. f. w.		58	164[23]	0 16[25], 1 95[112]	s	v s eth.; s. chl.
1071	col. pr. f. w	$1\ 496\frac{0}{4}$	106 5	subl.	0 97[90]	v s.	sl s. eth.; 5 01[18] bz.
1072	pl. f bz	.	119		i.	s.	s eth.
1073							
1074							
1075		$1\ 11\frac{20}{4}$	44–6	220. 154[20]		s.	s. eth.
1075M							
1076							
1076M	col liq ..	1 13696[19]	.. .	132	i.	s.	. . . .
1077							
1078	col cr	.	217–8		0 63 h	sl s.	1 6[12] bz.
1079	col monocl.	$1\ 341\frac{4}{4}$	130 (125–6)	290	0 58[12], 1 35[25]	17[25]	v. s. eth.
1080	monocl pr. f w.	.	79–80		sl s. c.	v. s.	v. s. eth.; s. chl., bz., i. lgr.
1081	leaf f chl	.	109–11 5 (108)	300 d.	s h	v. s.	sl. s. eth., bz.
1082	yel need (+1H_2O) f. w.	.	113–4 anh.; +H_2O 79	d. 300; -H_2O, 100–20	sl. s.	s.	s. eth.; sl s. c. chl., c. bz.
1083	yel. cr.... .	. . . . . .	183 (anh.)	.. .	sl. s.	s.	sl. s. eth.
1084	lng. rhomb. need. f w	$1.34\frac{18}{4}$	142 (139)		sl s	v. s.	v. s. eth.
1085	need	...	134 5		sl s.	v. s.	s. eth.
1086	need. f. eth..	. .	179 (170)	.	v sl. s.	v. s.	v. s. eth.
1087							
1088	col. leaf. f. w	...	170 5	......	sl. s. c., s h.	v. s.	v. s. eth.; i. chl., CS_2
1089	need. f. w. .		162 anh	-H_2O, 100	sl. s.	v. s.	sl. s. eth.; i. chl., CS_2
1089M							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1090	**Benzamide,** ***o, m*** **or** ***p*-**	**methyl-.** *See Toluamide.*		
1091	——, **o-nitro-**...... .	....	$NO_2C_6H_4CONH_2$	166.13
1092	——, ***m*-nitro-**	....	$NO_2C_6H_4CONH_2$	166.13
1093	——, ***p*-nitro-**	. ...	$NO_2C_6H_4CONH_2$	166 13
1094	——, ***N*-phenyl-.**	See *Benzanilide.*		
1095	**Benzamidine.**	benzenecarbonamidine*, benzenylamidine	$C_6H_5C(:NH)NH_2$	120 15
1096	——, ***N*-1-naphthyl-**	benzenylnaphthylamidine	$C_6H_5C(:NH)-NHC_{10}H_7$	246 30
1097	**Benzamidoxime.**	See *Benzamide, oxime.*		
1098	**Benzamine.**	See *β-Eucaine.*		
1099	**Benzanalgen.**	See *Analgen.*		
1100	**Benzanilide** .	*N*-phenylbenzamide; *N*-benzoylaniline	$C_6H_5CONHC_6H_5$	197.23
1100M	——, ***p*-amino-**	. . .	$p-H_2NC_6H_4-CONHC_6H_5$	212 24
1101	——, **o-nitro-** .		$NO_2C_6H_4-CONHC_6H_5$	242 23
1102	——, ***o'*-nitro-**		$C_6H_5CONHC_6H_4-NO_2$	242 23
1103	——, ***m*-nitro-**		$NO_2C_6H_4-CONHC_6H_5$	242 23
1104	——, ***m'*-nitro-**		$C_6H_5CONHC_6H_4-NO_2$	242 23
1105	——, ***p*-nitro-.**		$NO_2C_6H_4CONHC_6-H_5$	242.23
1106	——, ***p'*-nitro-**		$C_6H_5CONHC_6H_4-NO_2$	242 23
1107	——, **thio-** ..	.	$C_6H_5CSNHC_6H_5$	213 29
1108	——, **3,4,5-trihydroxy-.**	See *Gallanilide.*		
1109	**Benzaurin** .. .	*p,p'*-dihydroxytriphenyl-carbinol	$C_6H_5(C_6H_4OH)_2COH$ or $C_6H_5(OHC_6H_4)-C\ C_6H_4.O$	292 32 (274 30)
1110	**Benzazide.**	See *Benzoyl azide*		
1111	**1-Benzazine.**	See *Quinoline.*		
1112	**2-Benzazine.**	See *Isoquinoline.*		
1113	**Benzene**[4]	benzol, benzole; phene*	C_6H_6	78.11
1114	——, hexabromide.	See *Cyclohexane,* 1,2,3,4,5,6-*he*	*xabromo-**.	
1115	——, hexachloride.	See *Cyclohexane,* 1,2,3,4,5,6-*he*	*xachloro-**.	
1116	——, **acetyl-.**	See *Acetophenone.*		
1117	——, **acetylenyl-.**	See *Benzene, ethynyl-.*		
1118	——, **1-allyl-3,4-methy**	**lenedioxy-.** See *Safrole.*		
1119	——, **amino-.**	See *Aniline.*		
1120	——, **aminodimethyla**	**mino-.** See *Phenylenediamin*	*e,N, N-dimethyl-.*	
1121	——, **amoxy-.**	See *Ether, amyl phenyl.*		
1122	——, **amyl-**....... ..	1-phenylpentane.. ..	$C_6H_5(CH_2)_4CH_3$.	148.24
1123	——, **sec-*n*-amyl-.**	See *Benzene, (α-methylbutyl)-.*		
1124	——, ***tert*-amyl-** ...	2-methyl-2-phenylbutane...	$C_6H_5C(CH_3)_2C_2H_5$	148 24
1125	——, **1-amyl-2,4-dihyd**	**roxy-.** See *Resorcinol, 4-amyl*	-.	
1126	——, **anilino-.**	See *Diphenylamine**.		
1127	——, **azimino-.**	See 1,2,3-*Benzotriazole.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1090							
1091	need. f dil. al	$1\ 462\frac{32}{4}$	176 6	317	s h	s.	s. eth.
1092	yel. monocl. need f. w.	. .	142 7	315	s. h.	s.	s. eth.
1093	need. f w		201 4	.	v sl s.	s.	s. eth.
1094							
1095	col. cr		80	d	s	v. s	sl. s eth.
1096	pl f al		141	. . .	i.	s.	s. eth
1097							
1098							
1099							
1100	col. leaf. f. al .	$1\ 321\frac{4}{4}$	161	$117–9^{10}$	v sl s.	$3\ 16^{30}$	sl. s. eth.
1100M	col. cr		135–6		.	s	... .
1101	wh. need f. al	.	155		v. sl. s	v. s	sl. s. eth.
1102	yel. need f. al		94–8		sl. s h	s.	v. s. eth.
1103	leaf f. w. or al.	.	153–4	subl	v. sl. s c.	s.	s. eth., bz.
1104	leaf. f. amyl al		157		i.	sl. s.	v. s. chl.
1105	leaf f. eth		210–11		v sl. s.	s.	s eth
1106	yel need		199		i.	sl s h	...
1107	yel. pr. f. al		100–2	d	i.	s.	v s eth
1108							
1109	brick red powd		100		v sl s.	s.	s eth , sl s h. bz
1110							
1111							
1112							
1113	col. rhomb. pr or inflam. liq.; 1.50142^{20}	$0\ 8794^{20}$	5 51; 5 48– 49	80.093– 094	$0\ 082^{22}$	∞	∞ eth., ac. a., acet., tol., s. chl
1114							
1115							
1116							
1117							
1118							
1119							
1120							
1121							
1122	col liq , 1.4751^{15}	$0\ 860\frac{22}{4}$	-78 25	202 1	i.	s.	∞ eth.
1123							
1124	liq., $1\ 49154^{23}$	$0\ 8736^{15}$		189–91	i.	∞	∞ eth
1125							
1126							
1127							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
1128	**Benzene, benzoyl-.**	See *Benzophenone.*		
1229	**——, benzyl-.**	See *Methane, diphenyl-.*		
1130	**——, 1-benzyl-4-etnyl-**	*p*-ethyldiphenylmethane .	$C_6H_5CH_2C_6H_4C_2H_5$	196 28
1130M	**——, 1-benzyloxy-2-methoxy-4-propenyl-.**	See *Isoeugenol, benzyl ether*		
1131	**——, benzylphenyl-.**	See *Biphenyl, benzyl-.*		
1132	**——, bromo-***	phenyl bromide	C_6H_5Br...	157 02
1133	**——, 1-bromo-4-(4-bromophenoxy)-.**	See *Ether, bis-p-bromophenyl*		
1134	**——, 1-bromo-3-chloro-***	*m*-bromochlorobenzene .	BrC_6H_4Cl.	191 47
1135	**——, 1-bromo-4-chloro-***	*p*-bromochlorobenzene	BrC_6H_4Cl. .	191 47
1136	**——, (α-bromoethyl-)** .	1-bromo-1-phenylethane	$CH_3CHBrC_6H_5$	185 07
1137	**——, 1-bromo-4-fluoro-***	.	BrC_6H_4F.	175 01
1138	**——, 1-bromo-2-iodo-***		BrC_6H_4I. .	282 93
1139	**——, 1-bromo-3-iodo-***		BrC_6H_4I. .	282 93
1140	**——, 1-bromo-4-iodo-***		BrC_6H_4I.	282 93
1141	**——, 1-bromo-2-nitro-***		$BrC_6H_4NO_2$	202 02
1142	**——, 1-bromo-3-nitro-***		$BrC_6H_4NO_2$	202 02
1143	**——, 1-bromo-4-nitro-***	.	$BrC_6H_4NO_2$	202 02
1144	**——, (β-bromovinyl)-.**	See *Styrene, β-bromo-*		
1145	**——, butoxy-*.**	See *Ether, butyl phenyl.*		
1146	**——, butyl-**	1-phenylbutane .	$C_6H_5CH_2CH_2CH_2$-CH_3	134 21
1147	**——, *sec*-butyl-** . .	2-phenylbutane ...	$C_6H_5CH(CH_3)C_2H_5$	134 21
1148	**——, *tert*-butyl-** ...	2-methyl-2-phenylpropane	$C_6H_5C(CH_3)_3$	134 21
1149	**——, 1-*tert*-butyl-3,5-dimethyl-2,4,6-trinitro-**	musk xylene....... .	$(NO_2)_3C_6C(CH_3)_3$-$(CH_3)_2$	297.27
1150	**——, butylmethyl-.**	See *Toluene, butyl-.*		
1151	**——, 1-butynyl-**	1-phenyl-1-butyne, ethylphenylacetylene	$C_6H_5C{:}CCH_2CH_3$	130 18
1151H	**——, butyryl-.**	See *Butyrophenone.*		
1152	**——, chloro-*.**.... ...	phenyl chloride	C_6H_5Cl	112.56
1153	**——, 1-chloro-2,4-dinitro-***	4-chloro-1,3-dinitrobenzene	$(NO_2)_2C_6H_3Cl$	202 56
1154	**——, 1-chloro-3,5-dinitro-***	5-chloro-1,3-dinitrobenzene	$(NO_2)_2C_6H_3Cl$	202 56
1155	**——, 2-chloro-1,3-dinitro-***	. .	$(NO_2)_2C_6H_3Cl$	202 56
1156	**——, 3-chloro-1,2-dinitro-***	. .	$(NO_2)_2C_6H_3Cl$	202 56
1157	**——, 4-chloro-1,2-dinitro-***	. .. .	$(NO_2)_2C_6H_3Cl$.	202.56
1157M	**——, 1-chloro-4-fluoro-***	. .	ClC_6H_4F .	130 55
1158	**——, 1-chloro-4-iodo-***		ClC_6H_4I .	238 47

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1128							
1129							
1130	liq .	0.985^{19}	..	294.5		s.	s. eth., chl.
1130M							
1131							
1132	col. oily liq., 1.55977	$1.4991\frac{15}{15}$	-30.6	155-6	0.0446^{30}	10.4^{25}	71.3 eth.; s. bz.
1133							
1134	....	$1.6302\frac{20}{4}$	-21.2	196	i	v. s.	v. s. eth.
1135	col. rhomb or monocl. pr.	....	67.4	196.3	i.	s.	s. eth.
1136	liq	$1.3108\frac{23}{4}$	. .	200-10 d., $105\text{-}7^{30}$	i.	s.	s. eth.
1137	col. liq., 1.5310^{15}	1.593^{15}	-17.4	151.6	i.	s.	s. eth.
1138	col. liq ..	$2.257\frac{25}{4}$	2.1	257^{754} $(124\text{-}7^{17})$	i.	v. sl. s	v. sl. s. ac. a.
1139	col. oily liq.		-9.3	252^{754}	i.	v. sl. s.	v. sl. s. ac. a.
1140	col. need. or pl.	....	92	251.5^{754}	i.	sl. s	s. eth.
1141	pa. yel. cr. f. al.	$1.6245\frac{80}{4}$	42 (36-9)	261	i.	v. s	s. eth., bz.
1142	rhomb. cr., 1.5979	$1.7036\frac{20}{4}$	56	256.5	v. sl. s	s	s. eth., bz.
1143	col. rhomb. pr	$1.934\frac{22}{4}$	127	256	i	1.38 c	s. eth., bz.
1144							
1145							
1146	col. liq., 1.494^{18}	0.862	-81.2	180 (181-3)	i.	∞	∞ eth.
1147	col. liq., 1.4894^{21}	$0.8634\frac{21}{4}$	-82.7	173.5	i.	∞	∞ eth.
1148	col. liq., 1.4960^{20}	$0.867\frac{20}{4}$	-58.1	168.7	i.	v. s	v. s. eth.
1149		.	113		i.	sl. s.	s. eth.
1150							
1151	.	0.923^{21}		203	i.	s.	s. eth.
1151H							
1152	col. liq., 1.52479	$1.1066\frac{20}{4}$	-45, frz. -55	132	0.0488^{30}	∞	∞ eth.; s. chl., CS_2, bz.
1153	yel. rhomb. f. eth.	$\alpha 1.697^{22}$, $\beta 1.680\frac{20}{4}$	α 53.4 (51), β43, γ27	315	i.	s.	s. eth.
1154	col. need. f. al	..... .	55 (59)	volat. in steam	i.	s.	s. eth.
1155	yel. need. f. al.	$1.6867^{16.5}$	87	315	i	v. s.	s. eth.
1156	pr. f. et. al	.... .	78 (86.8)	...	i.	s.	s. eth.
1157	yel. monocl. rhomb. f. eth	$\alpha 1.697\frac{20}{4}$; $\beta 1.6867\frac{20}{4}$	α36.3; β37.1; γ38.8; δ28	315 d.	i.	s.	v. s. eth.; s. bz., CS_2
1157M	col. liq., 1.4990^{15}	.	-27.7	130.1	i.	s.	s. eth.
1158	col. leaf. f. al	.	57	226-7	i.	s	.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1159	**Benzene, chloromercuri-.** See *Mercury chloride, phenyl-**.			
1160	——, **1-chloro-2-nitro-***	*o*-chloronitrobenzene.	$ClC_6H_4NO_2$	157 56
1161	——, **1-chloro-3-nitro-***	*m*-chloronitrobenzene	$ClC_6H_4NO_2$	157 56
1162	——, **1-chloro-4-nitro-***	*p*-chloronitrobenzene	$ClC_6H_4NO_2$	157 56
1163	——, **1-chloro-2,4,5-trinitro-***		$(NO_2)_3C_6H_2Cl$.	247 56
1164	——, **1-chloro-2,4,6-trinitro-*.** See *Picryl chloride*			
1165	——, **2-chloro-1,3,5-trinitro-*.** See *Picryl chloride*			
1166	——, **cyclohexyl-.**	See *Cyclohexane, phenyl-.*		
1167	——, **1,4-diacetamido-.**	See *o-Phenylenediamine, N, N'-diacetyl-.*		
1168	——, **diamino-.**	See *Phenylenediamine.*		
1169	——, **diazoamino-.**	See *Diazoaminobenzene.*		
1170	——, **1,2-dibromo-***	*o*-dibromobenzene .	$C_6H_4Br_2$..	235 92
1171	——, **1,3-dibromo-*.**	*m*-dibromobenzene .	$C_6H_4Br_2$..	235.92
1172	——, **1,4-dibromo-*** .	*p*-dibromobenzene	$C_6H_4Br_2$.	235 92
1173	——, **1,2-dibutoxy-***	pyrocatechol dibutyl ether	$C_6H_4[O(CH_2)_3CH_3]_2$.	222 32
1173M	——, **1,4-di-*tert*-butyl-**	....	$C_6H_4[C(CH_3)_3]_2(p)$	190 32
1174	——, **1,2-dichloro-***	*o*-dichlorobenzene	$C_6H_4Cl_2$	147 01
1175	——, **1,3-dichloro-*** .	*m*-dichlorobenzene	$C_6H_4Cl_2$	147 01
1176	——, **1,4-dichloro-*** .	*p*-dichlorobenzene	$C_6H_4Cl_2$ . ..	147 01
1177	——, **1,3-dicyano-.**	See *Isophthalonitrile.*		
1178	——, **1,2-diethoxy-*...**	pyrocatechol diethyl ether, catechol diethyl ether	$C_6H_4(OC_2H_5)_2$.	166 21
1179	——, **1,3-diethoxy-***	resorcinol diethyl ether	$C_6H_4(OC_2H_5)_2$	166 21
1180	——, **1,4-diethoxy-***	hydroquinone diethyl ether	$C_6H_4(OC_2H_5)_2$	166 21
1181	——, **1,2-diethyl-*** .	*o*-diethylbenzene	$C_6H_4(C_2H_5)_2$	134 21
1182	——, **1,3-diethyl-*.** .	*m*-diethylbenzene...	$C_6H_4(C_2H_5)_2$. .	134 21
1183	——, **1,4-diethyl-*** . .	*p*-diethylbenzene.........	$C_6H_4(C_2H_5)_2$. .	134 21
1184	——, **(diethylamino)methyl-.** See *Toluidine, N, N-diethyl-.*			
1185	——, **1,3-diethyl-5-methyl-*.** See *Toluene, 3,5-diethyl-*			
1186	——, **dihydro-.**	See *Cyclohexadiene.**		
1187	——, **1,2-dihydroxy-.**	See *Pyrocatechol.*		
1188	——, **1,3-dihydroxy-.**	See *Resorcinol.*		
1189	——, **1,4-dihydroxy-.**	See *Hydroquinone.*		
1190	——, **1,2-diiodo-*.** ...	*o*-diiodobenzene..........	$C_6H_4I_2$	329.93
1191	——, **1,3-diiodo-*.....**	*m*-diiodobenzene... . . .	$C_6H_4I_2$ . .	329 93
1192	——, **1,4-diiodo-*..** ..	*p*-diiodobenzene	$C_6H_4I_2$	329.93
1193	——, **1,3-diisoamoxy-**	resorcinol diisoamyl ether	$C_6H_4[OCH_2CH_2CH(CH_3)_2]_2$	250 37

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1159							
1160	monocl. need	$1.368\frac{22}{4}$; $1.305\frac{80}{4}$	32.5	245.7	i.	s.	s. eth., bz.
1161	pa. yel rhomb pr f. al.	$1.534\frac{20}{4}$	unst. 23.7; stab. 44.4 (46)	235-6	i.	v. s. h.	s. eth., bz., ac. a., chl., CS_2
1162	monocl pr	$1.520\frac{18}{4}$	83.5	242	i.	s	s. eth., CS_2
1163	yel cr f. al		116		i.	v. s. h	s. h. bz.
1164							
1165							
1166							
1167							
1168							
1169							
1170	col. liq., $1.6117^{17.5}$	$1.9557\frac{20.5}{4}$	1.8 (5.6); frz. 6-7	221 (224)	i	s	∞ eth.
1171	col. liq., $1.6083^{17.5}$	$1.9523\frac{20.5}{4}$	-6.9	219.5 (217)	i.	s	s. eth.
1172	col. monocl. f. al., 1.57425	$2.261\frac{17}{4}$; liq. 1.841^{89}	86.9	218-19	i	10^{25}	71^{25} eth.; $90 CS_2$; s. acet., lgr.
1173	pa. yel. liq. .	..	.	$135-8^{12}$			....
1173M	wh. cr	...	75	236.5	i.	v. s.	s. eth.
1174	col. liq., 1.5518^{22}	$1.3048\frac{20}{4}$	-17.5	180-3	0.0145^{25}	s.	s. eth.
1175	col. liq., $1.54570^{20.9}$	$1.288\frac{20}{4}$	-24.8	172	0.0123^{25}	s.	s. eth., bz.
1176	monocl. lf. f. al., 1.52104^{80}	$1.4581\frac{20.5}{4}$	53	173.4	0.0079^{25}	sl. s. c., v. s. h	v. s. eth.; s. bz., chl., CS_2
1177							
1178	cr. f. pet. eth		43-5	.....	..	....	....
1179	pr .		12.4	234-5	i	s	s. eth.
1180	leaf	.	71-2	246	..	v. s.	v. s. eth., chl.
1181	col. liq.....	$0.8662\frac{18}{4}$	<-20	184.0-4.5	i.	s.	s. eth.
1182	col. liq., 1.4955^{20}	$0.8602\frac{20}{4}$	<-20	181-2	i.	s.	s. eth.
1183	col. liq., 1.4978^{14}	$0.8675\frac{14}{4}$, $.865\frac{20}{4}$	-35	182-3	i.	s.	s. eth.
1184							
1185							
1186							
1187							
1188							
1189							
1190	monocl. pl. or pr. f. lgr.	...	27; frz. 23.4	286-7	v. sl. s.	s.	v. s. eth.
1191	rhomb. pl. f. al.-eth		40, frz. 34.2	284.8	i.	s.	s. eth., chl.
1192	rhomb. lf. f. al.	.	129.4	285, subl.	i.	s.	v. s. eth.
1193	cr. f. w		47	..	. ...	......	.. ..

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
1194	**Benzene, 1,2-dimethoxy-*.** See *Veratrole*			
1195	**——, 1,3-dimethoxy-***	resorcinol dimethyl ether .	$C_6H_4(OCH_3)_2$	138 16
1196	**——, 1,4-dimethoxy-***	hydroquinone dimethyl ether.	$C_6H_4(OCH_3)_2$.	138 16
1197	**——, 1,2-dimethyl-*.**	See *o-Xylene.*		
1198	**——, 1,3-dimethyl-*.**	See *m-Xylene.*		
1199	**——, 1,4-dimethyl-*.**	See *p-Xylene.*		
1200	**——, 1,2-dinitro-***	*o*-dinitrobenzene...	$C_6H_4(NO_2)_2$ . .	168 11
1201	**——, 1,3-dinitro-***.....	*m*-dinitrobenzene.... ...	$C_6H_4(NO_2)_2$.	168 11
1202	**——, 1,4-dinitro-***.....	*p*-dinitrobenzene .	$C_6H_4(NO_2)_2$	168 11
1203	**——, 1,3-diphenyl-**	*m*-phenylbiphenyl, *m*-terphenyl	$(C_6H_5)_2C_6H_4$	230 29
1204	**——, 1,4-diphenyl-.**	See *Terphenyl.*		
1205	**——, 1,2-dipropoxy-***	pyrocatechol dipropyl ether	$C_6H_4(OCH_2CH_2CH_3)_2$	194 27
1206	**——, 1,3-dipropoxy-***	resorcinol dipropyl ether	$C_6H_4(OCH_2CH_2CH_3)_2$	194 27
1207	**——, ethenoxy-*.**	See *Ether, phenyl vinyl.*		
1208	**——, ethoxy-*.**	See *Phenetole*		
1209	**——, 1-ethoxy-2-methoxy-4-propenyl-.** See *Isoeugenol, ethyl ether*			
1210	**——, ethyl-**...... ...	phenylethane.	$C_2H_5C_6H_5$	106 16
1211	**——, 1-ethyl-4-isobutyl-**	. ...	$C_2H_5C_6H_4CH_2CH(CH_3)_2$	162 27
1212	**——, 1-ethyl-3-isopropyl-**	. . .	$C_2H_5C_6H_4CH(CH_3)_2$.	148 24
1213	**——, 1-ethyl-4-isopropyl-**	. ... . .	$C_2H_5C_6H_4CH(CH_3)_2$	148 24
1214	**——, ethylmethyl-.**	See *Toluene, ethyl-.*		
1215	**——, 1-ethyl-2-nitro-**	. . . .	$NO_2C_6H_4C_2H_5$.	151 16
1216	**——, 1-ethyl-3-nitro-**	. .	$NO_2C_6H_4C_2H_5$	151 16
1217	**——, 1-ethyl-4-nitro-**	. . . .	$NO_2C_6H_4C_2H_5$	151 16
1218	**——, 1-ethyl-4-propyl-**	. . . .	$C_2H_5C_6H_4(CH_2)_2CH_3$	148 24
1219	**——, ethylsulfonyl-*.**	See *Sulfone, ethyl phenyl.*		
1220	**——, ethynyl-.** ..	phenylacetylene; acetylenylbenzene	$C_6H_5C:CH$	102 13
1221	**——, fluoro-***...... ..	phenyl fluoride .	C_6H_5F	96 10
1222	**——, *p*-fluorobromo-.**	See *Benzene, 1-bromo-4-fluoro-*.*		
1223	**——, 1-fluoro-4-iodo-***	. ..	FC_6H_4I . .	222 01
1223H	**——, 1-fluoro-2-nitro-***	.. . . .	$FC_6H_4NO_2$ ..	141 10
1223K	**——, 1-fluoro-3-nitro-***	. . . . .	$FC_6H_4NO_2$ ..	141 10
1223M	**——, 1-fluoro-4-nitro-***	. .	$FC_6H_4NO_2$....	141 10
1224	**——, hexabromo-***. ..	perbromobenzene .	C_6Br_6. .	551 56

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1194							
1195	col liq	1 0803 $\frac{0}{4}$	-52	216 5-217 7	v sl. s.	s.	s. eth.
1196	col leaf. f. w	1 053$\frac{55}{55}$	56	212 6, 109^{20}	i	v. s.	v. s. eth.; s. bz.
1197							
1198							
1199							
1200	col -yel. monocl. pl. f. al.	1 565$\frac{17}{4}$	118 (116-7)	319^{773}	0 01 c, 0.38^{100}	3 8^{25}	27 1^{18} chl.; 5 0^{18} bz.; s. me. al.
1201	col.-yelsh. rhomb. need or pl. f. al	1 571$\frac{0}{4}$, 1 5656$\frac{30}{4}$	89 57	302 8^{770} (291)	0 0469^{15}, 0 32^{100}	2 60^{20}	6 7^{15} eth.; 34 7^{18} bz.; s. tol., chl., ethyl acet.
1202	col -yel monocl need f. al	1 625$\frac{20}{4}$	173 4	299^{777}, subl.	0 18^{100}	0 4^{20}	1 82^{18} chl ; 2 3^{18} bz.; s. ac. a.
1203	need. f. al		86-7	363	i	s.	s eth., ac. a., bz.
1204							
1205				117-20^{12}			. . . ..
1206	liq., 1.5138^{33}	1 035$\frac{20}{21}$		251, 127-8^{12}			. . . . . .
1207							
1208							
1209							
1210	col. liq, 1 $49828^{14.5}$	0 8669$\frac{20}{4}$	-93 9 (-92 8)	136 15 (134-6)	0 014^{15}	∞	∞ eth.
1211	liq			209-13	i.		s. eth.
1212	liq	.	<-20	190-2	i.		s eth.
1213	liq	0 8606$\frac{16}{4}$	<-20	197-8	i		s eth.
1214							
1215	col liq	1 126$\frac{24.5}{4}$	-23	223-4	i	v s.	v. s. eth.
1216	col liq	1 135$\frac{20}{4}$		242-3	i	v. s.	v. s. eth.
1217	col liq	1 124$\frac{25}{4}$	-32	241-2	i	v. s.	v. s. eth.
1218	liq	0 867$\frac{14}{4}$	.	202-5^{765}	i	.	s eth.
1219							
1220	col liq, 1 $5524^{12.5}$	0 9295$\frac{20}{4}$	-40 to -48 (-56)	143	i.	∞	∞ eth.
1221	col liq., 1.464$^{22.8}$	1 024$\frac{20}{4}$	-41 9	84 85	0 154^{30}	∞	∞ eth.
1222							
1223	col. liq . . .	.	-27 2, (-19 3)	183 2	i.	s.	s. eth.
1223 H	yel liq, 1.54886	1 $3375^{17.2}$	-6	214 8	i	s.	s. eth.
1223 K	yel liq, 1.53622^{19}	1 3254^{19}	3 6	200 15	i.	s.	s eth.
1223M	sld, 1 53156	1 330	27	205 3	i.	s.	s. eth.
1224	monocl need. f bz	.	306	.	i.	i.	i. eth.; sl. s. bz.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
1225	**Benzene, hexachloro-***	perchlorobenzene	C_6Cl_6	284 80
1226	——, **hexaethyl-**		$C_6(C_2H_5)_6$	246 42
1227	——, **hexahydro-.**	See *Cyclohexane.*		
1228	——, **hexahydroxy-**	benzenehexol	$C_6(OH)_6$	174 11
1229	——, **hexaiodo-***	periodobenzene	C_6I_6	833 58
1230	——, **hexamethyl-**		$C_6(CH_3)_6$	162 27
1231	——, **hexyloxy-.**	See *Ether, hexyl phenyl*		
1232	——, **hydroxy-.**	See *Phenol.*		
1233	——, **iodo-***	phenyl iodide	C_6H_5I	204 02
1234	——, **1-iodo-2-nitro-***		$NO_2C_6H_4I$	249 02
1235	——, **1-iodo-3-nitro-***		$NO_2C_6H_4I$	249 02
1236	——, **1-iodo-4-nitro-***		$NO_2C_6H_4I$	249 02
1237	——, **iodoso-**		C_6H_5IO	220 02
1238	——, **iodoxy-**		$C_6H_5IO_2$	236 02
1239	——, **isoallyl-.**	See *Benzene, propenyl-*		
1240	——, **isoamoxy-.**	See *Ether, isoamyl phenyl*		
1241	——, **isoamyl-**	3-methyl-1-phenylbutane	$C_6H_5(CH_2)_2$-$CH(CH_3)_2$	148 24
1242	——, **isobutoxy-.**	See *Ether, isobutyl phenyl*		
1243	——, **isobutyl-**	2-methyl-1-phenylpropane	$C_6H_5CH_2$-$CH(CH_3)_2$	134 21
1244	——, **isohexyl-**	4-methyl-1-phenylpentane	$C_6H_5(CH_2)_3$-$CH(CH_3)_2$	162 27
1245	——, **isopropenyl-**	2-phenylpropene, *uns*-methylphenylethylene	$CH_3C(C_6H_5){:}CH_2$	118 17
1246	——, **isopropoxy-†.**	See *Ether, isopropyl phenyl*		
1247	——, **isopropyl-.**	See *Cumene.*		
1248	——, **isopropylmethyl-.**	See *Cymene*		
1249	——, **methoxy-*.**	See *Anisole*		
1250	——, **1-methoxy-4-propenyl-.** See *Anethole*			
1251	——, **methyl-.**	See *Toluene*		
1252	——, (**α-methylbutyl**)-	2-phenylpentane, *sec-n*-amylbenzene	$C_6H_5CH(CH_3)$-$CH_2CH_2CH_3$	148 24
1253	——, **3,4-methylenedioxy-1-propenyl-.** See *Isosafrole.*			
1254	——, (**β-methylpropoxy**)-†. See *Ether, isobutyl phenyl.*			
1255	——, **methylpropyl-.**	See *Toluene, propyl-.*		
1256	——, **nitro-***		$C_6H_5NO_2$	123 11
1257	——, **nitroso-***		C_6H_5NO	107 11
1258	——, **pentaamino-.**	See *Benzenepentamine**.		
1259	——, **pentabromo-***		C_6HBr_5	472 65
1260	——, **pentachloro-***		C_6HCl_5	250 35
1261	——, **pentaethyl-*.**		$(C_2H_5)_5C_6H$	218 37

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1225	monocl or rhomb pr	1.569^{236}; 2.044^{25}	227 (224-6)	326	i.	i. c., v. sl s h.	v. sl. s eth., s. h. bz.
1226	col monocl. f al, $1.480^{130.4}$	0.831^{130}	129	298	i.	s.	v. s. eth., bz.
1227							
1228	need. f. HCl.		d 200		sl s.	sl. s	sl. s. eth, bz.
1229	red-br. need f. bz.		350 d.		i	i.	i eth.
1230	col rhomb. pl f. al, 1.8012, 1.745, 1.5032 (587 m μ)		166 (159-62)	265	i	0.16^{0}	v s. bz.
1231							
1232							
1233	col liq, $1.62145^{18.5}$	1.832_{4}^{20}	-31.4	188.6	0.034^{30}	s	∞ eth.; s. chl.
1234	yel. rhomb need	1.810_{4}^{16}	49.4	290	i.	sl. s	sl. s. eth.
1235	col. cr .	1.804_{4}^{16}	36	280	i	sl. s	sl. s. eth.
1236	col. need	1.8090_{4}^{15}	171.5	288.1	i	sl s	sl s eth
1237	yel. powd		exp abt 210		s	s	i. c, s. h eth; s h chl.
1238	need. f. w		exp 236-7	.	v sl s	i.	v s bz., chl.; s h ac. a.
1239							
1240							
1241	col. liq.	0.885_{4}^{20}		194 (198-9)	i	∞	∞ eth.
1242							
1243	col liq, $1.4957^{14.5}$	0.8673_{4}^{20}		171.1	i	∞	∞ eth.
1244	liq .	0.857		214-5	i	sl s.	s eth.
1245	col liq .	0.91939_{4}^{20}		160.5-1.5	i	s	s. eth.
1246							
1247							
1248							
1249							
1250							
1251							
1252	liq... ..	0.874_{4}^{15}		189.3 (191-3)	i.	s.	s. eth.
1253							
1254							
1255							
1256	yel liq., 1.55291	1.19867_{4}^{25}	5.7	210.9	0.19^{20}, 0.8^{80}	v. s. c	v. s. eth.; s. bz., oils
1257	col. rhomb. or monocl. f. eth.		68	59^{18}	i.	s.	s. eth., chl.; sl. s. lgr.
1258							
1259	need. f. al .	.	293	subl.		sl s	sl. s. eth.; s. bz.
1260	need f. al	1.8342_{4}^{16}	86	277	i.	v. sl. s	v. s. eth.; s. bz., CS_2
1261	col liq, 1.516	0.896	<-20	277	i.		... .

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1262	**Benzene, pentaiodo-***		C_6HI_5	707.67
1263	**——, pentamethyl-***		$(CH_3)_5C_6H$	148.24
1264	**——, perbromo-.**	See *Benzene, hexabromo-**.		
1265	**——, perchloro-.**	See *Benzene, hexachloro-**.		
1266	**——, periodo-.**	See *Benzene, hexaiodo-**.		
1267	**——, phenoxy-*.**	See *Phenyl ether.*		
1268	**——, phenyl-.**	See *Biphenyl.*		
1269	**——, phenyldithio-*.**	See *Phenyl disulfide.*		
1270	**——, phenylsulfonyl-*.**	See *Phenyl sulfone.*		
1271	**——, phenylthio-*.**	See *Phenyl sulfide*		
1272	**——, (2-propenoxy)-*.**	See *Ether, allyl phenyl*		
1273	**——, propenyl-** ...	1-phenylpropene, 1-propenylbenzene; isoallylbenzene	$CH_3CH{:}CHC_6H_5$	118.17
1275	**——, propoxy-*.**	See *Ether, phenyl propyl*		
1276	**——, propyl-**	1-phenylpropane	$C_6H_5CH_2CH_2CH_3$	120.19
1277	**——, 1-propynyl-.**	See *Propyne, 1-phenyl-*		
1278	**——, 1,2,3,5-tetrabromo-***	.	$C_6H_2Br_4$	393.74
1279	**——, 1,2,4,5-tetrabromo-***		$C_6H_2Br_4$	393.74
1280	**——, 1,2,3,4-tetrachloro-***		$C_6H_2Cl_4$	215.90
1281	**——, 1,2,3,5-tetrachloro-***		$C_6H_2Cl_4$	215.90
1282	**——, 1,2,4,5-tetrachloro-***		$C_6H_2Cl_4$	215.90
1283	**——, 1,2,3,4-tetraethyl-**	.	$(C_2H_5)_4C_6H_2$	190.32
1284	**——, 1,2,4,5-tetraethyl-**	. .	$(C_2H_5)_4C_6H_2$	190.32
1285	**——, tetrahydro-.**	See *Cyclohexene.*		
1286	**——, tetrahydroxy-.**	See *Benzenetetrol*		
1287	**——, 1,2,3,4-tetraiodo-***	. ..	$C_6H_2I_4$	581.76
1288	**——, 1,2,3,5-tetraiodo-***	...	$C_6H_2I_4$	581.76
1289	**——, 1,2,4,5-tetraiodo-***	. . .	$C_6H_2I_4$	581.76
1290	**——, 1,2,3,4-tetramethyl-.**	See *Prehnitene.*		
1291	**——, 1,2,3,5-tetramethyl-.**	See *Isodurene.*		
1292	**——, 1,2,4,5-tetramethyl-.**	See *Durene*		
1293	**——, triamino-.**	See *Benzenetriamine*		
1294	**——, triazo-** . ..	diazobenzene imide; phenyl azoimide	$C_6H_5N_3$	119.12
1295	**——, 1,2,3-tribromo-***	*v*-tribromobenzene .	$C_6H_3Br_3$	314.83
1296	**——, 1,2,4-tribromo-***	*as*-tribromobenzene	$C_6H_3Br_3$	314.83
1297	**——, 1,3,5-tribromo-***	*sym*-tribromobenzene	$C_6H_3Br_3$	314.83
1298	**——, 1,2,3-trichloro-***	*v*-trichlorobenzene . .	$C_6H_3Cl_3$	181.46
1299	**——, 1,2,4-trichloro-***	*as*-trichlorobenzene . ..	$C_6H_3Cl_3$	181.46
1300	**——, 1,3,5-trichloro-***	*sym*-trichlorobenzene .	$C_6H_3Cl_3$	181.46
1301	**——, 1,3,5-triethoxy-***	phloroglucinol triethyl ether	$C_6H_3(OC_2H_5)_3$	210.27

***Name approved by the International Union of Chemistry**

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1262	need. f. al		172	subl.	i.	v. sl. s.	v. sl. s. eth.; s. chl., h ac. a.
1263	col. pr. f. dil. al, $1.50489^{72.8}$	liq 0.847^{107}	53	230	i.	v s.	. .
1264							
1265							
1266							
1267							
1268							
1269							
1270							
1271							
1272							
1273	col liq.	$0.914\frac{20}{4}$; $0.924\frac{16}{4}$		175, (176–7)	i	s	∞ eth.
1275							
1276	col liq., $1.49549^{12.25}$	$0.862\frac{20}{4}$	-101.6	159.45 (153–7)	0.006^{15}	s.	s. eth.
1277							
1278	need. f. al	. .	98.5	329	i	v. sl. s.	v. s eth., bz.
1279	monocl pr. f CS_2	$3.027\frac{20}{4}$	178		i.	v. sl. s	v. s. eth.
1280	need		47.5	254	i.	sl. s.	v. s. eth., CS_2
1281	need f. al	.	51	246	sl. s. c., s. h.	v sl. s.	s eth.; v. s. CS_2
1282	monocl need f eth	$1.734\frac{16}{4}$; $1.858\frac{21}{4}$	138	246	i	sl. s h	s. eth., bz., CS_2
1283	liq, 1.5083 . .	0.887		254	i	sl. s	s. eth.
1284	col liq. or cr, 1.5025	$0.888\frac{16}{4}$	13	250	i	v s.	v. s. eth.
1285							
1286							
1287	pr. f. CS_2.		136	subl.		v s.	v. s. eth.; s. chl.
1288	pr f. eth		148	subl.	i.	v. sl s	v. sl. s. eth.; v. s. h. ac. a.
1289	need f. eth.		254	subl.	i	v sl s	v. sl. s eth.; v s. CS_2
1290							
1291							
1292							
1293							
1294	yel. oil, $1.56421^{22.5}$	$1.078^{22.5}$	. . .	59^{12}, exp.	i.	sl. s.	sl. s. eth.
1295	col monocl. pr. f. al.	2.658	87.4	. . .	i.	sl. s. h.	v. s. eth.
1296	need f. al .	. . .	44	276	i.	sl s.	s. eth., CS_2; v. s. bz.
1297	need f. al .	. . . . .	119–21	278	i.	sl s. h.	s. eth., bz., chl.
1298	pl. f al	. . . .	52	219	i.	sl. s.	v. s. eth.
1299	col. rhomb., 1.5671	$1.574\frac{10}{4}$	17	213	i.	sl s.	v. s. eth.
1300	lng. need	. . .	63	208.5	i.	s.	v. s. eth.
1301	col cr	.	43	175^{24}	i.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
1302	**Benzene, 1,2,4-triethyl-**	*as*-triethylbenzene	$(C_2H_5)_3C_6H_3$	162.27
1303	**——, 1,3,5-triethyl-.**	*sym*-triethylbenzene	$(C_2H_5)_3C_6H_3$	162.27
1304	**——, 1,3,5-trihydroxamino-.**	See 1,3,5-*Cyclohexanetrione, trioxime.*		
1305	**——, 1,2,3-trihydroxy-.**	See *Pyrogallol.*		
1306	**——, 1,2,4-trihydroxy-.**	See 1,2,4-*Benzenetriol.*		
1307	**——, 1,3,5-trihydroxy-.**	See *Phloroglucinol.*		
1308	**——, 1,2,3-triiodo-***	*v*-triiodobenzene	$C_6H_3I_3$	455.84
1309	**——, 1,2,4-triiodo-***	*as*-triiodobenzene	$C_6H_3I_3$	455.84
1310	**——, 1,3,5-triiodo-***	*sym*-triiodobenzene	$C_6H_3I_3$	455.84
1311	**——, 1,2,3-trimethoxy-***	pyrogallol trimethyl ether	$C_6H_3(OCH_3)_3$	168.19
1312	**——, 1,3,5-trimethoxy-***	phloroglucinol trimethyl ether	$C_6H_3(OCH_3)_3$	168.19
1313	**——, 1,2,4-trimethoxy-5-propenyl-**	asaron	$CH_3CH{:}CHC_6H_2(OCH_3)_3$	208.25
1314	**——, 1,2,3-trimethyl-.**	See *Hemimellitene*		
1315	**——, 1,2,4-trimethyl-.**	See *Pseudocumene.*		
1316	**——, 1,3,5-trimethyl-.**	See *Mesitylene*		
1317	**——, 1,2,3-trinitro-**	*v*-trinitrobenzene	$C_6H_3(NO_2)_3$	213.11
1318	**——, 1,2,4-trinitro-***	*as*-trinitrobenzene	$C_6H_3(NO_2)_3$	213.11
1319	**——, 1,3,5-trinitro-***	*sym*-trinitrobenzene	$C_6H_3(NO_2)_3$	213.11
1320	**——, 1,3,5-triphenyl-**	*sym*-triphenylbenzene	$(C_6H_5)_3C_6H_3$	306.39
1321	**——, vinyl-.**	See *Styrene*		
1322	**Benzenearsonic acid, *p*-amino-.**	See *Arsanilic acid*		
1323	**Benzene azimide.**	See 1,2,3-*Benzotriazole*		
1324	**Benzeneazoaniline.**	See *Azobenzene, amino-.*		
1325	**Benzeneazoethane**	ethaneazobenzene, ethylphenyldiimide	$C_6H_5N{:}NC_2H_5$	134.18
1326	**Benzeneazomethane**	methaneazobenzene, methylphenyldiimide	$C_6H_5N{:}NCH_3$	120.15
1327	**Benzeneazo-β-naphthol, *p*-nitro-.**	See 2-*Naphthol,* 1-*p-phenylazo-*		
1328	**4-Benzeneazo-α-naphthylamine.**	See 1-*Naphthylamine,* 4-*phenylazo-.*		
1328H	**Benzeneboronic acid.**	See *Boric acid, phenyl-.*		
1328R	**Benzeneboronic acid, *o* and *m*-chloro.**	See *Boric acid, o* (and *m*)-*chlorophenyl-.*		
1329	**Benzenecarbonal.***	See *Benzaldehyde*		
1330	**Benzenecarbonamide.**	See *Benzamide.*		
1331	**Benzenecarbonamidine.***	See *Benzamidine.*		
1332	**Benzenecarbonitrile.***	See *Benzonitrile*		
1333	**Benzenecarbonyl bromide***, etc.	See *Benzoyl bromide* etc.		
1334	**Benzenecarbothioic acid***.	See *Benzoic acid, thio-*		
1335	**Benzenecarboxylic acid***.	See *Benzoic acid.*		
1336	**1,2-Benzenediacetonitrile**	*o*-xylylene cyanide	$C_6H_4(CH_2CN)_2$	156.18
1337	**1,3-Benzenediacetonitrile**	*m*-xylylene cyanide	$C_6H_4(CH_2CN)_2$	156.18
1338	**1,4-Benzenediacetonitrile**	*p*-xylylene cyanide	$C_6H_4(CH_2CN)_2$	156.18
1339	**Benzenediamine.**	See *Phenylenediamine.*		
1340	**Benzenediazoanilide.**	See *Diazoaminobenzene**.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1302	arom liq, 1 4972	0.8819^{17}_{4}		218	i.	s.	s. eth
1303	col liq, 1 4939	0.863^{20}_{4}		218	i.	v s.	v s. eth.
1304							
1305							
1306							
1307							
1308	need f al		116	subl.	i	v s.	v. s eth.
1309	need f al		91 (84)	subl.	i	s	s. eth, chl
1310	need f ac a		184 (180)	subl.	i.	v sl s	v. sl s eth.; s. ac. a
1311	col rhomb need f dil al	1.0087^{7}_{7}	47	241 (235)		v s	v s. eth., bz.
1312	col pr f al		54–5 (52)	255 5	i	v. s	v. s eth., bz.
1313	monocl need f w, 1 5719[11]	1 105	67	296, subl d	sl s h.	v s.	v s. eth; s ac. a., chl, CCl_4
1314							
1315							
1316							
1317	lt grn pr f al		127 5		i	10 h	. . . ..
1318	col-yel cr	1.73^{16}_{4}	61 0		sl s.	5 45[15]	7 13[15] eth.
1319	col-yel rhomb pl f bz	1.688^{20}_{4}	61, 121	d	0 04[16]	1 9[16]	1 07[17.5] eth.; v. s. bz.
1320	rhomb tab f eth, 1 524, 1 867, 1 873	1.206^{20}_{4}	170			sl. s	sl. s. eth.; s. bz.
1321							
1322							
1323							
1324							
1325	lt yel oil, $N^{21.9}_{\alpha}$ 1 53133	0 9628[21.9]		175–85 d	sl s	v. s	v s. eth.
1326	yel oil			150		s	s. eth.
1327							
1328							
1328 H							
1328 R							
1329							
1330							
1331							
1332							
1333							
1334							
1335							
1336	col cr f eth		59–60		.	s.	s. eth.
1337	cr		28–9	305 10[300] sl d	i	s.	s eth., chl.
1338	lng pr f. eth or need f. w		98	.	sl. s. h.	s.	s. eth., chl.
1339							
1340							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
1341	**Benzenediazonium chloride***	diazobenzene chloride	$C_6H_5N(\vdots N)Cl$	140 57
1342	**Benzenediazonium cyanide***	diazobenzene cyanide	$C_6H_5N(\vdots N)CN$	131 13
1343	**Benzenediazonium nitrate***	diazobenzene nitrate	$C_6H_5N(\vdots N)NO_3$	167 12
1344	**Benzenediazonium tribromide***	diazobenzene perbromide	$C_6H_5N(\vdots N)Br_3$	344 86
1345	**Benzenedicarbinol.**	See *Xylylene glycol*		
1346	**1,2-Benzenedicarbonal**	*****. See *Phthalaldehyde*		
1347	**1,3-Benzenedicarbonal**	*****. See *Isophthalaldehyde.*		
1348	**1,4-Benzenedicarbonal**	*****. See *Terephthalaldehyde*		
1349	**1,3-Benzenedicarbonit**	**rile***. See *Isophthalonitrile*		
1350	**1,4-Benzenedicarbonit**	**rile***. See *Terephthalonitrile*		
1351	**1,2-Benzenedicarbonyl**	**chloride***. See *Phthalyl chlo*	*ride.*	
1352	**1,3-Benzenedicarbonyl**	**chloride***. See *Isophthalyl ch*	*loride*	
1353	**1,4-Benzenedicarbonyl**	**chloride***. See *Terephthalyl c*	*hloride.*	
1354	**1,2-Benzenedicarboxyl**	**ic acid***. See *Phthalic acid*		
1355	**1,3-Benzenedicarboxyl**	**ic acid***. See *Isophthalic acid*		
1356	**1,4-Benzenedicarboxyl**	**ic acid***. See *Terephthalic aci*	*d*	
1357	**1,2-Benzenediol*.**	See *Pyrocatechol.*		
1358	**1,3-Benzenediol*.**	See *Resorcinol*		
1359	**1,4-Benzenediol*.**	See *Hydroquinone*		
1360	**1,3-Benzenedithiol*.**	See *Resorcinol, dithio-*		
1361	**1,4-Benzenedithiol*.**	See *Hydroquinone, dithio-*		
1362	**Benzenehexacarboxylic**	**acid***. See *Mellitic acid.*		
1363	**Benzenehexol*.**	See *Benzene, hexahydroxy-*		
1364	**Benzeneindone.**	See *Aposafranone*		
1365	**Benzenepentacarboxylic acid***		$C_6H(COOH)_5$	298 16
1366	**Benzenepentamine***	pentaaminobenzene	$C_6H(NH_2)_5$	153 19
1367	**Benzenepropionic acid**	. See *Hydrocinnamic acid*		
1368	**Benzenesiliconic acid**	silicobenzoic acid	C_6H_5SiOOH	138 17
1369	**Benzenesulfanilide.**	See *Benzenesulfonanilide*		
1370	**Benzene sulfide.**	See *Phenyl sulfide.*		
1371	**Benzenesulfinic acid***		$C_6H_5SO_2H$	142 17
1372	**Benzenesulfonamide**	benzenesulfonic amide	$C_6H_5SO_2NH_2$	157 18
1372M	**Benzenesulfonamide,**	***p*-amino-.** See *Sulfanilamid*	*e*	
1372T	**Benzenesulfonamide,**	***p*-amino-*N*-2-pyridyl-.** S	ee *Sulfapyridine*	
1373	**Benzenesulfonanilide**	benzenesulfanilide	$C_6H_5SO_2NHC_6H_5$	233 28
1374	**Benzene sulfone.**	See *Phenyl sulfone*		
1375	**Benzenesulfone chlori**	**de.** See *Benzenesulfonyl chlori d*	*e* *	
1376	**Benzenesulfonic acid***		$C_6H_5SO_3H$	158 17
1377	——, sodium salt		$C_6H_5SO_3Na$	180 16
1378	——, ***o*-amino-.**	See *Orthanilic acid*		
1379	——, ***m*-amino-.**	See *Metanilic acid*		
1380	——, ***p*-amino-.**	See *Sulfanilic acid.*		
1381	——, ***p*-(4-amino-1-naphthylazo)-**		$SO_3HC_6H_4N.NC_{10}H_6NH_2$	327 35
1382	——, ***o*-bromo-**		$BrC_6H_4SO_3H$	237 08
1383	——, ***p*-bromo-**		$BrC_6H_4SO_3H$	237 08
1384	——, ***p*-chloro-**		$ClC_6H_4SO_3H$	192 62
1385	——, ***p*-(*p*-dimethylam**	**inophenylazo)-,** sodium sa	lt See *Methyl orang*	*e*
1386	——, ***o*-formyl-**	*o*-benzaldehydesulfonic acid	$C_6H_4(CHO)SO_3H$	186 18
1387	——, **methyl-.**	See *Toluenesulfonic acid.*		
1388	——, ***o*-nitro-**		$NO_2C_6H_4SO_3H$	203 17

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1341	col. need .		d	exp.	v. s.	s.	i. eth., bz., lgr.; s acet.
1342	yel. pr.....	. .	69		sl. s.	.	... ...
1343	col. need ...	1 37$^{20}_{4}$	exp at 90		v s	s.	i. eth., chl., bz.
1344	or. yel. tab. f. al.	.	63 5 d.		i.	sl. s.	i. eth.
1345							
1346							
1347							
1348							
1349							
1350							
1351							
1352							
1353							
1354							
1355							
1356							
1357							
1358							
1359							
1360							
1361							
1362							
1363							
1364							
1365	rhomb		238;+5H_2O d 238		s.	s.	sl. s. eth.; i. bz.
1366	need .				v s	i	i. eth.
1367							
1368	glassy f. eth		92		i		v. s. eth.; s. KOH
1369							
1370							
1371	pr f w .		84	100 d.	sl s	v s	v s. eth.
1372	monocl. need f w. or pl. f al.		156		0 43^{16}	v. s h	v. s. eth.
1372M							
1372 T							
1373	tetr pr., 1 600, 1.649		110		4 3^{16}	v s	v s. eth.
1374							
1375							
1376	col leaf. or need.		+1 5H_2O 43–4; anh 50–1	d.	v. s.	v s	i. eth ; sl. s. bz.
1377	need f w		450 d.	.	47	sl. s h	.. ..
1378							
1379							
1380							
1381	vlt need .	.		.	i.	v. sl s.	. ....
1382	deliq. need	. . . .		....	v s.	s.	. ... .
1383	deliq. need	.	102-3	155^{25}	s	s.	. .
1384	deliq. need	.	68	147–8^{25}	s	s	i eth., bz.
1385							
1386		.	114		s.	.	... .
1387							
1388	leaf		70	d	v. s.	s.	i eth ; s alk.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1389	**Benzenesulfonic amide.** See *Benzenesulfonamide**.			
1390	**Benzenesulfonyl chloride***	benzenesulfonic chloride; benzenesulfone chloride	$C_6H_5SO_2Cl$	176 62
1391	----, ***p*-bromo-**		$BrC_6H_4SO_2Cl$	255 53
1392	**1,2,3,4-Benzenetetracarboxylic acid*.** See *Mellophanic acid.*			
1393	**1,2,3,5-Benzenetetracarboxylic acid*.** See *Prehnitic acid*			
1394	**1,2,4,5-Benzenetetracarboxylic acid*.** See *Pyromellitic acid.*			
1395	**1,2,3,5-Benzenetetrol***	1,2,3,5-tetrahydroxybenzene.	$C_6H_2(OH)_4$	142 11
1396	**1,2,4,5-Benzenetetrol***	... ...	$C_6H_2(OH)_4$	142 11
1397	**Benzenethiol*.**	See *Phenol, thio-.*		
1398	**1,2,3-Benzenetriamine***	*vic*-triaminobenzene	$C_6H_3(NH_2)_3$	123 16
1399	**1,2,4-Benzenetriamine***	*asym*-triaminobenzene	$C_6H_3(NH_2)_3$ ...	123 16
1400	**1,2,3-Benzenetricarboxylic acid*.** See *Hemimellitic acid.*			
1401	**1,2,4-Benzenetricarboxylic acid*.** See *Trimellitic acid.*			
1402	**1,3,5-Benzenetricarboxylic acid*.** See *Trimesic acid*			
1403	**1,2,3-Benzenetriol*.**	See *Pyrogallol.*		
1404	**1,2,4-Benzenetriol***	hydroxyquinol, hydroxyhydroquinone	$C_6H_3(OH)_3$	126 11
1405	**1,3,5-Benzenetriol*.**	See *Phloroglucinol.*		
1406	**1,3,5-Benzenetrisulfonic acid***	.	$C_6H_3(SO_3H)_3$	318 29
1407	**Benzenyl amidine.**	See *Benzamidine.*		
1408	**Benzenyl aminoxime.**	See *Benzamide oxime.*		
1409	**Benzenylphenyleneamidine.** See *Benzimidazole, 2-phenyl-.*			
1410	**Benzhydrol.**	See *Benzohydrol.*		
1411	**Benzidine**	*p,p'*-bianiline, 4,4'-diaminobiphenyl	$NH_2C_6H_4C_6H_4NH_2$	184 23
1412	----, **2-amino-**	*o*-amino-*p,p'*-diaminobiphenyl	$(NH_2)_2C_6H_3C_6H_4$-NH_2	199 25
1413	----, ***N,N'*-diacetyl-**	*p,p'*-biacetanilide	$(CH_3CONHC_6H_4)_2$	268 31
1415	----, **3,3'-dimethyl-.**	See *o-Tolidine.*		
1416	----, ***N,N'*-diphenyl-**	...	$[C_6H_4NHC_6H_5]_2$	336 42
1417	----, **3-ethoxy-**	4,4'-diamino-3-ethoxybiphenyl	$NH_2C_6H_4C_6H_3$-$(OC_2H_5)NH_2$	228 29
1418	**2,2'-Benzidinedisulfonic acid** $(NH_2=1)$	4,4'-diamino-2,2'-biphenyldisulfonic acid	$(NH_2)_2C_{12}H_6$-$(SO_3H)_2$	344 35
1419	**Benzidine sulfone**	dibenzothiophene-2,7-diamine 9-dioxide, 2,7-diaminobiphenylene sulfone	$(NH_2C_6H_3)_2SO_2$.	246 28
1420	**Benzil**	diphenylglyoxal, bibenzoyl, dibenzoyl, diphenyl diketone	$C_6H_5COCOC_6H_5$.	210 22
1421	----, *α*-dioxime		$(C_6H_5C:NOH)_2$	240 25
1422	----, *β*-dioxime..		$(C_6H_5C:NOH)_2$.	240 25
1423	----, *γ*-dioxime		$(C_6H_5C:NOH)_2$	240 25

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1389							
1390	rhomb cr or col oily liq	1 378[25]	14 5: frz 0	246-7d	i	v. s.	s. eth
1391	tricl. or monocl f. eth.		75	153[15]	i	d.	v. s. eth.
1392							
1393							
1394							
1395	need f. w	.	165		v s	v s	i. chl., bz.
1396	leaf f. ac a		220		v. s	v. s.	v. s. eth ; sl. s. HCl
1397							
1398	cr		103	336	v s	v s	v. s. eth
1399	leaf. f. chl		100	340	v s	v s	v. sl. s. eth ; s. chl.
1400							
1401							
1402							
1403							
1404	col monocl leaf. f. w or eth		140 5		v s	v s	v. s eth ; sl s. bz.
1405							
1406	deliq. cr +3H_2O	.	d >100		s		.. ..
1407							
1408							
1409							
1410							
1411	wh or sl'ly redsh cr powd.or leaf f. H_2O	1 $250\frac{20}{4}$	116.5-117, 120.5-121, 125, 129	401 7	0 04[12], 0 94[100]	s	2 2 eth.
1412	need		134				. ..
1413	need. f ac a		331 (314-6)	subl. d.	i	v. sl. s.	v. sl. s. eth.
1415							
1416	leaf. f. tol	.	242		i	sl. s.	s. h. tol.; sl. s. bz., acet.
1417	glit flat need f w		134 (139)		v sl s.	v. s. h.	v. sl. s. eth.
1418	monocl pr. f. w.		d. >175		0.0791[22]	v. sl. s.	v. sl. s. eth.
1419	yel pl .		327-8 (>350)	.	i	i.	i. eth., h. bz.
1420	yel. rhomb. need. f. al	1 $521\frac{13.5}{4}$	95	346-8 d.	i	v s	v s. eth.
1421	leaf .		237 d.	.	i	0 05[17]	v. sl. s. eth., ac. a.; s. conc. NaOH
1422	need. (+C_2H_6O) f. al	.	206-7 d.		sl s h	15 26[17]	s. eth., ac. a., NH_3, conc. NaOH
1423	need. (+al.) f al.	.	-al. 100; 164-5		i.	>15 3[17]	s. conc. alk.; i. lgr.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1424	**Benzil,** α-mono-oxime	....	$C_6H_5COC(:NOH)-C_6H_5$	225.24
1425	——, β-mono-oxime	....	$C_6H_5COC(:NOH)-C_6H_5$	225 24
1426	——, *syn* (or α)-osazone...	benzil *syn*-bisphenylhydrazone	$(C_6H_5C:NNHC_6H_5)_2$	390 47
1427	——, *anti* (or β)-osazone	benzil bisphenylhydrazone	$(C_6H_5C:NNHC_6H_5)_2$	390 47
1428	**Benzilam.**	See *Oxazole, triphenyl-.*		
1429	**Benzilic acid**..........	diphenylglycolic acid	$(C_6H_5)_2COHCOOH$	228 24
1430	**Benzimidazole**........	benzoglyoxaline .	$C_6H_4NHCH\ N$	118 13
1431	——, **2-phenyl-**.... ...	2-phenylbenzoglyoxaline, benzenylphenyleneamidine	$C_6H_4NHC(C_6H_5)\cdot N$	194 23
1432	**2(3)-Benzimidazolone**	phenyleneurea . . .	$C_6H_4NHCONH$	134 13
1433	**Benzocaine**...........	ethyl *p*-aminobenzoate; anaesthesin	$NH_2C_6H_4COOC_2-H_5$	165.19
1434	**1,3-Benzodiazine.**	See *Quinazoline.*		
1435	**1,4-Benzodiazine.**	See *Quinoxaline.*		
1436	**Benzodifluorochloride.**	See *Toluene, α-chloro-α, α-difluoro-.*		
1436M	**Benzofluoride dichloride.**	See *Toluene, α, α-dichloro-α-fluoro-.*		
1437	**Benzofuran**.. .	coumarone, benzfuran	$C_6H_4OCH:CH$...	118.13
1438	**2-Benzofurancarboxylic acid.**	See *Coumarilic acid*		
1439	**Benzoglyoxaline.**	See *Benzimidazole.*		
1440	**Benzohydrazide.**	See *Benzoic acid, hydrazide*		
1441	**Benzohydrol**..........	diphenylcarbinol; benzhydrol	$(C_6H_5)_2CHOH$	184 23
1442	——, ***p*-amino-**........	*p*-aminodiphenylcarbinol	$C_6H_5CHOHC_6H_4-NH_2$	199 24
1443	——, ***p,p'*-bisdimethylamino-**	Michler's hydrol; tetramethyl-4,4'-diaminobenzohydrol	$HOCH[C_6H_4N-(CH_3)_2]_2$	270.36
1444	***p*-Benzohydrolcarboxylic acid.**	See *Benzoic acid, p-(α-hydroxybenzyl)-.*		
1445	**Benzohydrol ether.**	See *Benzohydryl ether.*		
1446	**Benzohydroxamic acid**	. . . .	$C_6H_5C(:NOH)OH$	137 13
1447	**Benzohydrylamine** .	α-aminodiphenylmethane	$(C_6H_5)_2CHNH_2$	183 24
1448	**Benzohydryl ether** .	benzohydrol ether ..	$[(C_6H_5)_2CH]_2O$	350 44
1449	**Benzoic acid**...... ..	benzenecarboxylic acid*; phenylformic acid	C_6H_5COOH. .	122 12
1450	——, allyl ester..	allyl benzoate...	$C_6H_5COOC_3H_5$	162 18
1451	——, anhydride.	See *Benzoic anhydride.*		
1452	——, benzyl ester...	benzyl benzoate; benzyl benzenecarboxylate	$C_6H_5COOCH_2C_6H_5$	212 24
1453	——, butyl ester.....	butyl benzoate; butyl benzenecarboxylate*	$C_6H_5COOC_4H_9$	178 22
1454	——, ethyl ester	ethyl benzoate; ethyl benzenecarboxylate*	$C_6H_5COOC_2H_5$.	150 17
1455	——, ethylene ester.	See *Glycol, dibenzoate.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1424	lust. pl. f. al.	. .	137–8	d 200	sl. s.	v. s.	v. s. eth.; s. chl., ac. a.; sl. s. c. bz., lgr.
1425	need. f. bz...	.	113–4		sl s.	v. s.	v. s. eth.; s. most org. solv, i. lgr.
1426	yel. need......	. ..	208	.		sl. s. c.	s. eth., 1 7[19] acet.
1427	need........	.. ..	225	d.	i.	sl. s.	sl s. eth.; 2 4[19] acet.; v. s. h. chl., bz.
1428							
1429	monocl. need. f w.		150	d 180	v s. h	v. s	v s eth.; s. H_2SO_4
1430	rhomb. pl. f. al.		170	>360	s.	s	s. eth, a., alk.
1431	tab. f. ac. a., need. f. w.		280 (291)	.	sl. s.	v. s.	sl. s. bz., chl.
1432	plates .. .		305		sl s	s.	sl s bz; i. dil. a.
1433	col pr f al or rhomb. f. eth		91–2 (88–90)		0 04	20	14 3 eth.; s. chl.
1434							
1435							
1436							
1436M							
1437	liq, $1.56450^{22.7}$	$1\ 0776^{15}_{15}$	<-18	174 (169)	i	s.	s eth, i alk.
1438							
1439							
1440							
1441	silky need. f lgr.		68–69	298 5	0 05 c	v s	v s eth., s ac. a, chl., CCl_4
1442	need f. bz. or h. w.		121	.	s	v s	sl s eth, pet. eth., lgr; s. me. al., acet., glac ac a.
1443	col tricl. pr. f. bz.	.	96	..	i.	s.	s eth, bz.
1444							
1445							
1446	rhomb. lvs..	.....	131–132	exp.	$2\ 25^{0}$	s.	sl. s. eth.; i. bz.
1447	hex. pl. or liq., $1\ 5963^{22}$	$1\ 0635^{22}_{0}$	34	288 (301^{746})	sl s	.....	... .
1448	monocl. f. bz.	. .	109–11	315^{745} d	....	sl. s.	sl. s. eth., s. bz.
1449	col. monocl. leaf. or need., 1.53974^{15}	1.2659^{15}_{4}	122	249	$0\ 18^{4}$, $0\ 27^{15}$, 2.2^{75}	$47\ 1^{15}$	40^{15} eth.; s. chl, CCl_4, acet., me. al., bz., CS_2
1450	yel. liq....	$1\ 058^{15}_{15}$	....	230	i.	s.	∞ eth.
1451							
1452	col. oily liq., or need. or leaf, 1.5681^{21}	$1\ 114^{18}$	21 (18.5)	323-4 (316–7)	i.	s.	s. eth, chl.; i. glyc.
1453	thick col. oil..	$1\ 000^{20}_{4}$	-22 4	250 3	i.	∞	∞ eth.
1454	col. liq., $1.50682^{17.3}$	$1\ 0509^{15}_{4}$, $1\ 047^{20}_{4}$	-34 6	212 6	0.08^{20}	s.	∞ eth.; s. chl, pet. eth.
1455							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
1456	**Benzoic acid**, hydrazide.	benz(o)hydrazide; benzoylhydrazine	$C_6H_5CONHNH_2$.	136 15
1457	——, isoamyl ester	3-methyl-1-butanol benzoate	$C_6H_5COOC_5H_{11}$	192 25
1458	——, isobutyl ester	isobutyl benzoate; β-methylpropyl benzenecarboxylate*	$C_6H_5COOCH_2$-$CH(CH_3)_2$	178 22
1459	——, isopropyl ester		C_6H_5COOCH-$(CH_3)_2$	164 20
1460	——, methylene diester ..	methylene dibenzoate, methylene benzoate, methanediol dibenzoate	$(C_6H_5COO)_2CH_2$	256 25
1461	——, methyl ester..	methyl benzoate; niobe oil	$C_6H_5COOCH_3$...	136 14
1462	——, phenyl ester....	phenyl benzoate ..	$C_6H_5COOC_6H_5$	198 21
1463	——, phenylhydrazide	1-benzoyl-2-phenylhydrazine	$C_6H_5CONHNHC_6$-H_5	212 24
1464	——, propyl ester	n-propyl benzoate .	$C_6H_5COOC_3H_7$	164 20
1465	——, **o-acetamido-**.	See *Anthranilic acid, N-acetyl-*		
1466	——, ***m*-acetamido-**	. .	$CH_3CONHC_6H_4$-$COOH$	179 17
1467	——, ***p*-acetamido-**	.	$CH_3CONHC_6H_4$-$COOH$	179 17
1468	——, **o-acetoxy-**.	See *Aspirin*.		
1469	——, **o-acetyl-**.......	o-acetophenonecarboxylic acid	$CH_3COC_6H_4$-$COOH$	164 15
1470	——, ***p*-acetyl-**. ..		$CH_3COC_6H_4COOH$	164 15
1471	——, **o-amino-**.	See *Anthranilic acid*.		
1472	——, ***m*-amino-** .		$NH_2C_6H_4COOH$	137 13
1473	——, ***p*-amino-** ..	. . . .	$NH_2C_6H_4COOH$	137 13
1474	——, ——, butyl ester.	See *Butesin*.		
1475	——, ——, β-diethylaminoethyl ester, hydrochloride.	See *Procaine hydrochloride*		
1476	——, ——, ethyl ester.	See *Benzocaine*.		
1477	——, ——, methyl ester		$NH_2C_6H_4COOCH_3$	151 16
1478	——, **3-amino-2-nitro-**	.	$NH_2(NO_2)C_6H_3$-$COOH$	182 13
1479	——, **3-amino-4-nitro-**	.	$NH_2(NO_2)C_6H_3$-$COOH$	182 13
1480	——, **3-amino-5-nitro-**	. . .	$NH_2(NO_2)C_6H_3$-$COOH$	182 13
1481	——, **4-amino-2-nitro-**	. ...	$NH_2(NO_2)C_6H_3$-$COOH$	182 13
1482	——, **4-amino-3-nitro-**	. ..	$NH_2(NO_2)C_6H_3$-$COOH$	182 13
1483	——, **5-amino-2-nitro-**	3-amino-6-nitrobenzoic acid	$NH_2(NO_2)C_6H_3$-$COOH$	182 13
1484	——, **o-anilino-**.	See *Anthranilic acid, N-phenyl-*.		
1485	——, **azodi-**.	See *Azobenzoic acid*.		
1486	——, **azoxydi-**.	See *Azoxybenzoic acid*		
1487	——, **o-benzamido-**.	See *Anthranilic acid, N-benzoyl-*		
1488	——, ***m*-benzamido-**	m-benzoylaminobenzoic acid	$C_6H_5CONHC_6H_4$-$COOH$	241 24
1489	——, ***p*-benzamido-**	p-benzoylaminobenzoic acid	$C_6H_5CONHC_6H_4$-$COOH$	241 24
1490	——, **o-benzohydryl-**	triphenylmethane-o-carboxylic acid	$(C_6H_5)_2CHC_6H_4$-$COOH$	288 33

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1456	pl f w	.	112 5	267 d	s	s.	sl s eth., chl., bz.
1457	col liq	0 9925[19]		262	i.	s	∞ eth.
1458	col liq .	$1\ 002\frac{15}{4}$		237	i.	∞	∞ eth.
1459	col liq	$1\ 0162\frac{15}{4}$		218 5	i	s.	s. eth.
1460	need.	. . . .	97 8		sl s	s.	s. eth.
1461	col liq., 1 51810[16]	$1\ 0937\frac{15}{4}$; $1\ 088\frac{20}{4}$	-12 5	199 6	0 0157[30]	∞	∞ eth.
1462	col monocl	$1\ 235\frac{31}{4}$	70	314	v. sl s	s	s eth.
1463	col pl f al		168		sl s h	s h	sl s. eth.
1464	col liq.	$1\ 0271\frac{1}{1}$	-51 6	231 2	v. sl. s.	∞	∞ eth.
1465							
1466	need f. al		249–50	subl.	v. sl. s.	sl. s h	sl s. eth.
1467	need		250 2		sl. s.	s.	sl s. eth.
1468							
1469	cr f w		114–15		s. h.		
1470	need f. h w		200	subl	sl. s.	sl. s.	sl. s eth.; i. lgr.
1471							
1472	yel need	$1\ 511\frac{20}{4}$	174 (179 5)	subl.	0 59[15]	2 2[18]	1 81[5 6] eth.
1473	yelsh -red monocl		187		0 34[9.6]	11 3[9 6]	8 21[5 8] eth.
1474							
1475							
1476							
1477	col leaf		112		. . . .		.
1478	yel need f w		156–7	195 d.	v. s. h.	v s.	v s eth
1479	red leaf f al		298 d.		sl. s.	s.	s eth.
1480	yel pr. f w		208		sl. s.	v s. h	s ac. a.
1481	red need f w		239 5 d.		s. h.	v s	. .
1482	red-yel need f al.		284		i	sl s h.	
1483	yel. need. or pr		235 d.		sl s h	s h	sl s. eth.
1484							
1485							
1486							
1487							
1488	red pr. f al	$1\ 5105\frac{4}{4}$	248 (174)	subl.	sl s	s	s. eth.
1489	sm. need f al		278	. .	sl s.	s.	s eth., ac. a.
1490	need. f. al		161–2	subl	i.	s.	s eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
1491	**Benzoic acid, *o*-benzoyl-**	benzophenone-*o*-carboxylic acid	$C_6H_5COC_6H_4$-COOH	226 22
1492	——, ***m*-benzoyl-**.. .	benzophenone-*m*-carboxylic acid	$C_6H_5COC_6H_4$-COOH	226 22
1493	——, ***p*-benzoyl-**....	benzophenone-*p*-carboxylic acid	$C_6H_5COC_6H_4$-COOH	226 22
1494	——, **benzoylamino-.**	See *Benzoic acid, benzamido-*		
1495	——, ***o*-benzyl-**.....	diphenylmethane-*o*-carboxylic acid	$C_6H_5CH_2C_6H_4$-COOH	212 24
1496	——, ***m*-benzyl-**......		$C_6H_5CH_2C_6H_4$-COOH	212 24
1497	——, ***p*-benzyl-**......	.	$C_6H_5CH_2C_6H_4$-COOH	212 24
1498	——, ***o*-bromo-**.. ...	.. ....	BrC_6H_4COOH	201 03
1499	——, ***m*-bromo-** .	. ...	BrC_6H_4COOH	201 03
1500	——, ***p*-bromo-** . . .	... ..	BrC_6H_4COOH	201 03
1501	——, ***p,p'*-carbonyldi-**	*p,p'*-benzophenonedicarboxylic acid	$CO(C_6H_4COOH)_2$	270 23
1502	——, ***o*-(carboxymethoxy)-**	salicylic-*O*-acetic acid, salicylacetic acid	$HOOCCH_2OC_6H_4$-COOH	196 15
1503	——, ***o*-chloro-** . .		ClC_6H_4COOH	156 57
1504	——, ***m*-chloro-**.. .	.	ClC_6H_4COOH	156 57
1505	——, ***p*-chloro-** . ..	.	ClC_6H_4COOH	156 57
1506	——, ***p*-cyano-**......	terephthalic mononitrile	CNC_6H_4COOH	147 13
1507	——, **2,3-diamino-**		$C_6H_3(NH_2)_2COOH$	152 15
1508	——, **2,4-diamino-.**	.	$C_6H_3(NH_2)_2COOH$	152 15
1509	——, **2,5-diamino-.**		$C_6H_3(NH_2)_2COOH$	152 15
1510	——, **3,4-diamino-.**	. . .	$C_6H_3(NH_2)_2COOH$	152 15
1511	——, **3,5-diamino-**...	. ...	$C_6H_3(NH_2)_2COOH$	152 15
1512	——, **2,3-dibromo-.**	. ... .	$C_6H_3Br_2COOH$	279 93
1513	——, **2,4-dibromo-**		$C_6H_3Br_2COOH$	279 93
1514	——, **2,5-dibromo-** .	. ..	$C_6H_3Br_2COOH$	279 93
1515	——, **2,6-dibromo-**	..	$C_6H_3Br_2COOH$	279 93
1516	——, **3,4-dibromo-**	.	$C_6H_3Br_2COOH$	279 93
1517	——, **2,3-dichloro-**	. .. .	$Cl_2C_6H_3COOH$	191 02
1518	——, **2,4-dichloro-**	.	$Cl_2C_6H_3COOH$	191 02
1519	——, **2,5-dichloro-**	. ...	$Cl_2C_6H_3COOH$.	191 02
1520	——, **2,6-dichloro-**		$Cl_2C_6H_3COOH$	191 02
1521	——, **3,4-dichloro-**	. .	$Cl_2C_6H_3COOH$	191 02
1522	——, **3,5-dichloro-.**	..	$Cl_2C_6H_3COOH$	191 02
1523	——, **2,3-dihydroxy-** .	*o*-pyrocatechuic acid, pyrocatechol-*o*-acid	$(HO)_2C_6H_3COOH$	154 12
1524	——, **2,4-dihydroxy-**	See *β-Resorcylic acid.*		
1525	——, **2,5-dihydroxy-.**	See *Gentisic acid.*		
1526	——, **2,6-dihydroxy-.**	See *γ-Resorcylic acid.*		
1527	——, **3,4-dihydroxy-.**	See *Protocatechuic acid*		

***Name approved by the International Union of Chemistry.**

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1491	tricl. need. ($+1H_2O$) f. h w.	. ..	$+H_2O$, 93; anh. 127	.	s. h.	v s.	v. s. eth.
1492	need. f. dil. al.	. . . .	161–2	subl.	sl s.	s.	s. eth.
1493	monocl. leaf. f. w.	. ...	194	subl.	sl. s.	s.	s. eth., ac. a.; sl. s. chl., bz.
1494							
1495	need. f. dil. al	. .	114	subl.	sl s	s.	s. eth., chl., bz.
1496	need. or leaf f. dil al.	. . .	107–8	subl.	v. sl s	s.	s. eth., chl.
1497	need. f. w. or leaf. f. dil al.	. .	157–8	subl.	sl s	s.	s eth., chl., bz.
1498	col. monocl. need. f. w.	$1\ 929\frac{25}{4}$	147–50	subl	0 18[25]	s.	s. eth., chl.
1499	col monocl. need.	$1\ 845\frac{25}{4}$	155	280	0 04[25]	s	s. eth.
1500	col. monocl need. or leaf. f. w.	$1\ 894\frac{25}{4}$	251–3	. .	0 0056[25]	s.	s. eth.
1501	gel	.	subl. <360	.. .	i.	sl s	sl s. eth, bz., acet ; s ac. a.
1502	need. f. w....	. .	190	. .. .	s.	s.	s eth., ac. a., acet.
1503	col. monocl	$1\ 544\frac{20}{4}$	142	subl.	0 21[25]	v s	v. s. eth.
1504	col. pr....	$1\ 496\frac{25}{4}$	158 (154–5)	subl.	0 04[0]	s	s. eth.
1505	col tricl....	$1\ 541\frac{24}{4}$	243 (235)	subl	0 0077[25]	v s	v. s. eth.
1506	leaf f. w.....		213–4 (219)	. .	v sl s c., s h	v. s	v s eth.; s. h. ac. a.
1507	lng. need...		190–1	d.	sl s	v v. s	v. s. ac. a.
1508	cr	.	ca. 140		s h.	s.	v. s. ac. a.
1509	sm. pr.......	. .		d	v sl s	v. sl. s.	v. sl. s. eth.
1510	leaf	. .	210–1 d.		sl s c, s h.		. ...
1511	need. ($+1H_2O$) f. w.	.	($-H_2O$, 110) anh. 228–36	d.	1 1[8]	v. s.	v. s. eth.
1512	need. f. w ...	...	149–50	. .. .	sl s h.	.. ..	s. h. lgr.
1513	leaf. f. w ..	.	172–3	subl	sl s h.	s.	s. eth.
1514	need. f. w. or al	.	153		0 084[11]	s.	s. eth., ac. a.
1515	need. f. w.		146 5 (151–2)	209–10[16]	s h.	s.	s. eth., chl.
1516	need. f. w....	.	232–3	subl.	sl s h.	s.	s. eth.
1517	need.......	.	164 (160)		sl s. h.	s.	s. eth.
1518	need. f. w. or bz.	. .	164 (160, 158)	subl	s. h.	s.	s. eth., chl., bz.
1519	col. need. f. w	. .	154 4	301	0 084[11]	s.	s. eth., alk.
1520	col. need. f al		139 (132)	subl.	i.	s.	s. eth , bz., alk.
1521	col need. f. w., al. or bz		208–9 (201–2)	subl	sl. s.	s.	s eth., alk.
1522	need f. al	. .	182–3	subl.	sl s. c.	v. s.	s. eth., sl. s lgr.
1523	col need. f w	. ..	anh. 204	d.	s.	s.	s. eth.
1524							
1525							
1526							
1527							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
1528	**Benzoic acid, 3,5-dihydroxy-.**	See *α-Resorcylic acid*		
1529	**——, 3,4-dimethoxy-.**	See *Veratric acid.*		
1530	**——, 2,3-dimethyl-.**	See *Hemellitic acid*		
1531	**——, 2,4-dimethyl-.**	See 2,4-*Xylic acid.*		
1532	**——, 2,5-dimethyl-.**	See *Isoxylic acid*		
1533	**——, 2,6-dimethyl-.**	See 2,6-*Xylic acid*		
1534	**——, 3,4-dimethyl-.**	See 3,4-*Xylic acid.*		
1535	**——, 3,5-dimethyl-.**	See *Mesitylenic acid*		
1536	**——, 2,4-dinitro-**	......	$(NO_2)_2C_6H_3COOH$	212.12
1537	**——, 2,5-dinitro-**		$(NO_2)_2C_6H_3COOH$	212.12
1538	**——, 2,6-dinitro-**		$(NO_2)_2C_6H_3COOH$	212.12
1539	**——, 3,4-dinitro-**		$(NO_2)_2C_6H_3COOH$	212.12
1540	**——, 3,5-dinitro-**		$(NO_2)_2C_6H_3COOH$	212.12
1540M	——, ——, isobutyl ester		$(NO_2)_2C_6H_3CO_2$-$CH_2CH(CH_3)_2$	268.22
1541	**——, o-ethoxy-**	salicylic acid ethyl ether	$C_2H_5OC_6H_4COOH$	166 17
1542	**——, m-ethoxy-**		$C_2H_5OC_6H_4COOH$	166 17
1543	**——, p-ethoxy-**		$C_2H_5OC_6H_4COOH$	166 17
1544	**——, o-ethyl-**	.....	$C_2H_5C_6H_4COOH$	150 17
1545	**——, m-ethyl-**		$C_2H_5C_6H_4COOH$	150 17
1546	**——, p-ethyl-**		$C_2H_5C_6H_4COOH$	150 17
1547	**——, o-ethylamino-.**	See *Anthranilic acid, N-ethyl-*		
1548	**——, m-ethylamino-**		$C_2H_5NHC_6H_4$-$COOH$	165 19
1549	**——, p-ethylamino-**		$C_2H_5NHC_6H_4$-$COOH$	165 19
1550	**——, o-fluoro-**		FC_6H_4COOH	140 11
1551	**——, m-fluoro-**		FC_6H_4COOH	140 11
1552	**——, p-fluoro-..**		FC_6H_4COOH	140 11
1553	**——, o-formyl-.**	See *Phthalaldehydic acid*		
1554	**——, m-formyl-.**	See *Isophthalaldehydic acid.*		
1555	**——, p-formyl-.**	See *Terephthalaldehydic acid*		
1556	**——, hexahydro-.**	See *Cyclohexanecarboxylic acid*	*	
1557	**——, hydrazodi-.**	See *Hydrazobenzoic acid*		
1558	**——, o-hydroxy-.**	See *Salicylic acid.*		
1559	**——, m-hydroxy-**		HOC_6H_4COOH	138 12
1560	**——, p-hydroxy-**		HOC_6H_4COOH	138 12
1561	**——, p-(α-hydroxybenzyl)-**	p-benzohydrolcarboxylic acid	$C_6H_5CH(OH)C_6$-H_4COOH	228 24
1562	**——, 4-hydroxy-3-methoxy-.**	See *Vanillic acid*		
1563	**——, o-β-hydroxyvinyl-**, lactone	See *Isocoumarin.*		
1564	**——, o-iodo-**	...	IC_6H_4COOH	248 03
1565	**——, m-iodo-...**		IC_6H_4COOH	248 03

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
1528							
1529							
1530							
1531							
1532							
1533							
1534							
1535							
1536	col rhomb. pr. f. w.		182–3, frz. 180 9	subl.	1 85^{25}	v s	0 71^{30} bz.
1537	col need. or monocl pr f w		177		sl s h	s	s eth.
1538	col need f w		202 3	d	s h	s.	s eth.
1539	col. need		163	165 subl.	0 67^{25}	v. s	v s. eth.
1540	yel. monocl. tab f w		204–5	subl	1 9^{100}	v s	sl s eth, bz., CS_2; s. ac. a.
1540M	monocl. pl. or need.		87				. .. .. .
1541	col oil . .		19 3– 5 (22)	d ca. 300	sl s. c., s h.	.	....
1542	col need f. w		137	subl.	sl s h	s	s eth.
1543	col. need . .		195		v sl. s. h.		....
1544	col need f h w., $1.51012^{99\,6}$		68	259	v. sl s	v. s.	v. s. eth.
1545	col need. f. dil al., 1.5345^{100}	1 042^{100}	47		v. sl s	s	v. s. eth.
1546	col leaf. or pr f al.		113		s h.	v. s.	v. s. eth.
1547							
1548	pr		101	subl.	v sl s	s.	s. eth.
1549	.. . .		178			s	s. eth.
1550	need f. w	1 $460\frac{25}{4}$	122		0 722^{25}	v s	v. s. eth.
1551	leaf f. w ...	1 $474\frac{25}{4}$	124		0 150^{25}		. ...
1552	monocl pr f w	1 $479\frac{25}{4}$	182 (184–6)		0 127^{25}	s	s. eth.
1553							
1554							
1555							
1556							
1557							
1558							
1559	col. rhomb f w. or al.	1.473 $\frac{4}{4}$	201 3 (199–200)	. .	0.92^{18}	s. h.	9 7^{17} eth.; 0 01^{25} bz.
1560	col monocl. f. w.	1 $443\frac{20}{4}$	213 (214 5–5 5)	subl. 76	0 79^{15}, 2 6^{75}	39 34^{15}	9 4^{17} eth.; 0 01^{11} bz.
1561	need. f. w...	. .	164-5	d.	s. h.	s.	s. eth.; sl. s. chl.
1562							
1563							
1564	col. need. f. w	2 $249\frac{25}{4}$	162	.	0 095^{25}	sl. s.	sl. s. eth.
1565	need. f. acet	2 $171\frac{25}{4}$	185–7	subl. d.	0 0117^{25}	sl. s.	sl s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
1566	**Benzoic acid, *p*-iodo-**		IC_6H_4COOH	248 03
1567	—, ***o*-isopropyl-**		$(CH_3)_2CHC_6H_4$-$COOH$	164 20
1568	—, ***p*-isopropyl-.**	See *Cumic acid.*		
1569	—, ***o*-mercapto-**	thiosalicylic acid, *o*-sulfhydrylbenzoic acid	HSC_6H_4COOH	154 18
1570	—, ***o*-methoxy-**	salicylic acid methyl ether	$CH_3OC_6H_4COOH$	152 14
1571	—, ***m*-methoxy-**		$CH_3OC_6H_4COOH$	152 14
1572	—, ***p*-methoxy-.**	See *Anisic acid*		
1573	—, **methyl-.**	See *Toluic acid*		
1574	—, **3,4-methylenedioxy-.**	See *Piperonylic acid*		
1575	—, ***o*-nitro-**		$NO_2C_6H_4COOH$	167 12
1576	—, —, ethyl ester		$NO_2C_6H_4COOC_2H_5$	195 17
1577	—, —, methyl ester		$NO_2C_6H_4COOCH_3$	181 14
1578	—, ***m*-nitro-**		$NO_2C_6H_4COOH$	167 12
1579	—, —, ethyl ester		$NO_2C_6H_4COOC_2H_5$	195 17
1580	—, —, methyl ester		$NO_2C_6H_4COOCH_3$	181 14
1581	—, ***p*-nitro-**		$NO_2C_6H_4COOH$	167 12
1582	—, —, ethyl ester		$NO_2C_6H_4COOC_2H_5$	195 17
1583	—, —, methyl ester		$NO_2C_6H_4COOCH_3$	181 14
1584	—, ***o*-nitroso-**		NOC_6H_4COOH	151 12
1585	—, ***m*-nitroso-**		NOC_6H_4COOH	151 12
1586	—, ***p*-nitroso-**		NOC_6H_4COOH	151 12
1587	—, **pentamethyl-**		$(CH_3)_5C_6COOH$	192 25
1588	—, ***o*-phenoxy-**	salicylic acid phenyl ether	$C_6H_5OC_6H_4COOH$	214 21
1589	—, ***o*-phenyl-**	*o*-biphenylcarboxylic acid	$C_6H_5C_6H_4COOH$	198 21
1590	—, ***m*-phenyl-**	*m*-biphenylcarboxylic acid	$C_6H_5C_6H_4COOH$	198 21
1591	—, ***p*-phenyl-**	*p*-biphenylcarboxylic acid	$C_6H_5C_6H_4COOH$	198 21
1592	—, ***p*-phosphono-**	*p*-benzophosphinic acid	$(HO)_2POC_6H_4$-$COOH$	202 11
1593	—, ***o*-propyl-**		$C_3H_7C_6H_4COOH$	164 20
1594	—, ***p*-propyl-**		$C_3H_7C_6H_4COOH$	164 20
1595	—, **silico-.**	See *Benzenesiliconic acid.*		
1596	—, ***o*-sulfamyl-**	*o*-sulfamidobenzoic acid	$NH_2O_2SC_6H_4$-$COOH$	201 19
1597	—, ***m*-sulfamyl-**		$NH_2O_2SC_6H_4$-$COOH$	201 19
1598	—, ***p*-sulfamyl-**		$NH_2O_2SC_6H_4$-$COOH$	201 19

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
1566	pl. or leaf	2.184^{25}_{4}	269–70	subl. d.	0.0035^{25}	sl. s.	sl. s. eth.
1567	col. pr. f. w.		51		s. h.	s.	s. eth., bz.
1568							
1569	lt. yel. need. f. al.		164	subl.	v. sl. s.	v. s.	s. eth., ac. a.
1570	monocl. tab. f. w.	1.180	98 (100–1)	200	0.5^{30}	v. s.	v. s. eth.
1571	col. need. f. w.		107.8	$170–2^{10}$ subl.	sl. s. c., v. s. h.	v. s.	v. s. eth.
1572							
1573							
1574							
1575	tricl. need. f. w.	1.575^{1}_{4}	147.5 (144.5)		0.68^{20}	28^{10}	21.6^{11} eth.; s. alk., v. sl. s. bz., chl.; i. lgr.
1576	col. tricl. ...		30	$148–50^{10}$	i.	s.	s. eth.
1577	yel. oil ...	1.286^{20}_{1}, 1.284^{25}_{25}	-8	275 (269)	i.	∞	∞ eth.; i. pet. eth.
1578	monocl. leaf. f. w.	1.494^{4}_{4}	141.4		0.31^{20}	33^{10}	25.1^{11} eth.; s. alk.; v. sl. s. bz., chl., i. lgr.
1579	monocl. pr.		47 (40–1)	298, 171^{25}	i.	v. s.	v. s. eth.
1580	col. need. .		78.5 (70)	279	i.	sl. s.	s. eth.; sl. s. me. al.
1581	monocl. leaf f. w.	1.550^{32}_{4}	242.4	subl.	0.024^{25}	0.9^{10}	2.2^{11} eth.; s. acet., alk.; v. sl. s. c. bz., chl.; i. lgr.
1582	col. tricl. leaf f. al.		57		i.	s.	s. eth.
1583	yel. monocl. leaf		96		i.	s.	s. eth.
1584	col. f. al. ...		210 d.			s.	v. sl. s. eth., bz.; s. ac. a.
1585	col. cr.		230 d.			s.	v. sl. s. eth., bz.
1586	yel. powd.		250 d.			s.	v. sl. s. eth., bz.; sl. s. ac. a.
1587	need. f. w.		210.5	subl.	v. sl. s.	s.	
1588	rhomb. leaf f. dil. al.		114.5	355 d.	0.01	v. s.	v. s. eth.; s. chl., glyc.
1589	col. monocl. need. f. al.	1.458^{20}_{4}	114 (111)	343–4	sl. s. h., i. c.	v. s.	v. s. bz., s. ac. a.
1590	col. leaf. f. al.		160–2		i. (sl. s.)	v. s.	v. s. eth., bz., ac. a., lgr.
1591	col. need. f. al. or bz.		219 (224)	subl.	v. sl. s. h.	v. s.	v. s. eth.
1592	need. f. w. ...		>300		s.	s.	sl. s. HCl
1593	leaf. f. al.		58	273	s.	v. s.	v. s. eth.
1594	col. leaf. f. w.		141		sl. s. h.	v. s.	v. s. eth.; s. bz.
1595							
1596	rhomb. f. al.		165–7		v. s.	v. s.	v. s. eth.
1597	need. or pl. f. w.		238		v. sl. s.	v. s.	v. s. eth.
1598	need. or pr. f. w.	...	280 d.		v. v. sl. s.	v. s.	sl. s. eth.; v. sl. s. bz.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
1599	**Benzoic acid, *o*-sulfhydryl-.**	See *Benzoic acid, o-mercapto-.*		
1600	——, ***o*-sulfo-.**		$HO_3SC_6H_4COOH \cdot 3H_2O$	256 23
1601	——, ——, imide.	See *Saccharin.*		
1602	——, ***m*-sulfo-.**		$HO_3SC_6H_4COOH \cdot 2H_2O$	238 21
1603	——, ***p*-sulfo-**		$HO_3SC_6H_4COOH \cdot 3H_2O$	256 23
1604	——, **2,3,4,5-tetrahydro-.**	See 1-*Cyclohexene-1-carboxylic acid*.*		
1605	——, **2,3,4,5-tetrahydroxy-**		$(HO)_4C_6HCOOH$	186 12
1606	——, **thio-**	benzenecarbothioic acid*	C_6H_5COSH	138 18
1607	——, ***p*-(*p*-toluyl)-**		$CH_3C_6H_4COC_6H_4$-$COOH$	240 25
1608	——, **2,3,5-triamino-.**		$(NH_2)_3C_6H_2COOH$	167 17
1609	——, **3,4,5-triamino-**		$(NH_2)_3C_6H_2COOH$	167 17
1609M	——, **3,4,5-tribromo-**		$Br_3C_6H_2COOH$	358 84
1610	——, **2,3,4-trichloro-.**		$Cl_3C_6H_2COOH$	225 47
1611	——, **2,4,5-trichloro-**		$Cl_3C_6H_2COOH$	225 47
1612	——, **3,4,5-trichloro-**		$Cl_3C_6H_2COOH$	225 47
1613	——, **2,3,4-trihydroxy-**	4-pyrogallolcarboxylic acid	$(HO)_3C_6H_2COOH$	170 12
1614	——, **2,4,5-trihydroxy-**	4-hydroxygentisic acid	$(HO)_3C_6H_2COOH$	170 12
1615	——, **2,4,6-trihydroxy-**	phloroglucinolcarboxylic acid	$(HO)_3C_6H_2COOH$	170 12
1616	——, **3,4,5-trihydroxy-.**	See *Gallic acid.*		
1617	——, **2,3,4-trimethoxy-**		$(CH_3O)_3C_6H_2$-$COOH$	212 20
1618	——, **2,4,5-trimethoxy-**	See *Asaronic acid*		
1619	——, **3,4,5-trimethoxy-**	gallic acid trimethyl ether	$(CH_3O)_3C_6H_2$-$COOH$	212 20
1620	——, **2,3,4-trimethyl-.**	See *Prehnitylic acid*		
1621	——, **2,3,5-trimethyl-.**	See γ *Isodurylic acid*		
1622	——, **2,3,6-trimethyl-**		$(CH_3)_3C_6H_2COOH$	164 20
1623	——, **2,4,5-trimethyl-.**	See *Durylic acid*		
1624	——, **2,4,6-trimethyl-.**	See *β-Isodurylic acid*		
1625	——, **3,4,5-trimethyl-.**	See *α-Isodurylic acid*		
1626	——, **2,4,6-trinitro-.**	*sym*-trinitrobenzoic acid	$(NO_2)_3C_6H_2COOH$	257 12
1627	**Benzoic amide.**	See *Benzamide*		
1628	**Benzoic anhydride**	benzoic acid anhydride	$(C_6H_5CO)_2O$	226 22
1629	**Benzoic sulfinide.**	See *Saccharin*		
1630	**Benzoin**	benzoylphenylcarbinol, α-hydroxy-α-phenylacetophenone	$C_6H_5CHOHCOC_6H_5$	212 24
1631	——, ethyl ether	α-ethoxy-α-phenylacetophenone, 2-ethoxy-1,2-diphenyl-1-ethanone	$C_6H_5CH(OC_2H_5)$-COC_6H_5	240 29
1632	——, imide	See *Amaron.*		
1633	——, *l*-oxime	....	$C_6H_5CH(OH)C(.NOH)C_6H_5$	227 25
1633M	——, ***p,p'*-dimethoxy-.**	See *Anisoin*		
1634	**Benzol, Benzole.**	See *Benzene*.*		
1635	**Benzonitrile**	benzenecarbonitrile*; phenyl cyanide	C_6H_5CN	103 12
1636	——, ***o*-amino-.**	See *Anthranilonitrile.*		
1637	——, ***m*-amino-**	*m*-aminophenyl cyanide	$NH_2C_6H_4CN$	118 13
1638	——, ***p*-amino-**	*p*-aminophenyl cyanide	$NH_2C_6H_4CN$	118 13

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1599							
1600	rhomb. need f. w.	.	68 9; -3H_2O, 105, anh. 141		50	v. s.	i. eth.
1601							
1602	deliq. cr		98; anh. 141		s	s.	v. s. eth.; i. bz.
1603	need. f. w ..		94, anh 260		v s	v s.	v s. eth.
1604							
1605	cr . .		148		v s		i lgr.
1606	yel oil or cr		24	d	i	∞	∞ eth.
1607	need f. acet		130 (224)		v sl s	v. s.	v. s. acet.; sl. s. bz
1608	cr f w .				v s h	v sl s.h.	i. eth.
1609	need f. w		-H_2O, >100	d	s h.	i.	i. eth.
1609M	col need		240		i	s	s h. bz.
1610	need f al		186-7 (129)	.	sl s.	s.	s. eth.
1611	sm need f. w		163	subl	s. h.	s	s eth.
1612	need f al		203	subl	s h	v s.	v s. eth.
1613	need f w		200 d	subl.	0 13^{12}	s	v s. eth.
1614	need f w		217-8		v s h.	v s.	. . .
1615	cr f w		100 d		s h	s	v s. eth ; i. bz.
1616							
1617	cr f eth		97-9		s	s.	s. eth.
1618							
1619	monocl need f w		168	$225\text{-}7^{10}$	v sl s	v s	v s eth., chl.
1620							
1621							
1622	need f w		84, 105-6		s	s	s. eth.
1623							
1624							
1625							
1626	yel rhomb need f w.		228 7 (220-3)	subl d	2 05^{23}	26 6^{25}	14 7^{25} eth.
1627							
1628	col rhomb pr, 1 57665^{15}	1 1989^{15}_{4}	42	360	i	s	s. eth.
1629							
1630	col hex pr. f al	1 310^{20}_{4}	137	344, 194^{12}	0 03^{25}	s.	sl. s. eth.
1631	need f. lgr	. .	62	184-6		s.	s. eth.; v. s. bz.
1632							
1633	wh amor. powd or pr f. bz.		163-4 (149-51)		i.	s	s eth., acet.
1633M							
1634							
1635	col liq, 1.52892	1 0102^{15}_{15}	13	190 7	1^{100}	∞	∞ eth.
1636							
1637	need		53-4	288-90	sl. s.	s	s eth.
1638	col. monocl. pr		86	d	v. s. h.	v s.	v. s eth.; i. HCl

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1639	**Benzonitrile, *p*-bromo-**	*p*-bromophenyl cyanide	BrC_6H_4CN	182 03
1640	**——, *p*-chloro-**	4-chlorobenzenecarbonitrile*, *p*-chlorophenyl cyanide	ClC_6H_4CN	137.57
1641	**——, methyl-.**	See *Tolunitrile.*		
1642	**——, *o*-nitro-**	2-nitrobenzenecarbonitrile*; *o*-nitrophenyl cyanide	$NO_2C_6H_4CN$	148.12
1643	**——, *m*-nitro-**		$NO_2C_6H_4CN$	148.12
1644	**——, *p*-nitro-**		$NO_2C_6H_4CN$	148 12
1645	**Benzo[*a*]phenanthrene.**	See *Chrysene*		
1646	**Benzo[*def*]phenanthrene.**	See *Pyrene*		
1647	**Benzo[*l*]phenanthrene.**	See *Triphenylene*		
1648	**Benzo[*a*]phenazine**	α-benzophenazine, αβ-naphthophenazine	$C_{10}H_6 N_2 C_6H_4$	230.26
1649	**Benzo[*b*]phenazine, 5,8-dihydro-8-imino-5-phenyl-.**	See *Rosinduline*		
1650	**Benzophenone**	phenyl ketone, diphenyl ketone, benzoylbenzene, α-oxodiphenylmethane	$(C_6H_5)_2CO$	182 21
1651	——, oxime		$(C_6H_5)_2C{:}NOH$	197 23
1652	——, phenylhydrazone		$(C_6H_5)_2C{:}NNHC_6H_5$	272 34
1653	**——, 2-amino-**	*o*-aminodiphenylketone, *o*-benzoylaniline	$C_6H_5COC_6H_4NH_2$	197 23
1654	**——, 3-amino-**	*m*-aminophenyl phenyl ketone, *m*-benzoylaniline	$C_6H_5COC_6H_4NH_2$	197 23
1655	**——, 4-amino-**	*p*-aminophenyl phenyl ketone, *p*-benzoylaniline	$C_6H_5COC_6H_4NH_2$	197 23
1656	**——, 4,4′-bisdimethylamino-**	Michler's ketone, tetramethyl-4,4′-diaminobenzophenone	$CO[C_6H_4N(CH_3)_2]_2$	268 35
1657	**——, 2,2′-diamino-**	bis-*o*-aminophenyl ketone	$NH_2C_6H_4COC_6H_4NH_2$	212.24
1658	**——, 3,3′-diamino-**	bis-*m*-aminophenyl ketone	$NH_2C_6H_4COC_6H_4NH_2$	212 24
1659	**——, 4,4′-diamino-**	bis-*p*-aminophenyl ketone	$NH_2C_6H_4COC_6H_4NH_2$	212 24
1660	**——, 2,2′-dihydroxy-**	bis-*o*-hydroxyphenyl ketone	$HOC_6H_4COC_6H_4OH$	214 21
1661	**——, 2,3′-dihydroxy-**	*m*-hydroxyphenyl *o*-hydroxyphenyl ketone	$HOC_6H_4COC_6H_4OH$	214 21
1662	**——, 2,4-dihydroxy-**	4-benzoylresorcinol, 4-benzoresorcin	$C_6H_5COC_6H_3(OH)_2$	214 21
1663	**——, 2,4′-dihydroxy-**	*o*-hydroxyphenyl *p*-hydroxyphenyl ketone, *p*-salicyloylphenol	$HOC_6H_4COC_6H_4OH$	214 21
1664	**——, 2,5-dihydroxy-**	2,5-dihydroxyphenyl phenyl ketone	$(HO)_2C_6H_3COC_6H_5$	214 21
1665	**——, 3,3′-dihydroxy-**	bis-*m*-hydroxyphenyl ketone	$HOC_6H_4COC_6H_4OH$	214 21
1666	**——, 3,4′-dihydroxy-**	*m*-hydroxyphenyl *p*-hydroxyphenyl ketone	$HOC_6H_4COC_6H_4OH$	214 21
1667	**——, 4,4′-dihydroxy-**	bis-*p*-hydroxyphenyl ketone	$HOC_6H_4COC_6H_4OH$	214.21
1668	**——, 2,4-dihydroxy-6-methoxy-.**	See *Isocotoin*		
1669	**——, 2,6-dihydroxy-4-methoxy-.**	See *Cotoin*		
1670	**——, 4,4′-dimethyl-**	di-*p*-tolyl ketone	$CH_3C_6H_4COC_6H_4CH_3$	210.26

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1639	need. f. w.	.....	113	235–7	s h.	s.	v. s. eth.
1640	need. f. al...	.....	92 (93–4)	223	sl s.	s.	s. eth., bz.
1641							
1642	silky need. f. w.	..	109	.....	s. h	s.	s. eth., ac. a.
1643	need f w .	...	118 (115–6)	subl	sl s.	s	s. eth.
1644	yel. leaf. f. al	.	147	...	sl s. c.	sl s. c, s h.	s. chl., ac. a.
1645							
1646							
1647							
1648	yel. need. f. bz.	......	142 5	>360	i.	v sl. s.	v. sl. s. eth.; sl. s. c. bz.
1649							
1650	α(stab) col rhomb. pr.; β col monocl. pr	α1 0976$\frac{50}{50}$; β1 108$\frac{23}{4}$	α49; β 26; γ45–8; δ–51	306	i.	13 5[18]	17 5[13] eth.; s. chl.
1651	need		144 (141–2 5)		v. sl s	s	v.s. eth., acet.; s. alk.
1652	need		137 (105)				......
1653	pa yel. leaf.		108			s	s. eth.
1654	yel need		86		sl s w.	s	s. eth.
1655	leaf f dil. al		124 (110–5)	. .	sl. s.	s	s. eth.
1656	glit leaf. f. al		174	>360 sl d	0 04[25]	v. s.	v. s eth., bz.
1657	pa yel leaf. f. dil al.		132–3	....	i	s.	....
1658	yel need f. al		173–4 (171)	285[11]	s. h.	s.	s. eth.
1659	hex or rhomb need. f dil al		244 (237)		s h, d by boil	s	s. eth.
1660	leaf or pr. f. lgr		59–60	340	i.	s.	s. eth., chl.
1661	need f. w.		126	.	.	s.	s. eth.
1662	.		144	. ...	i.	s.	s. eth.
1663	yel. pyram f bz or pl. f. h w		150–1 (147–8)	..	s h.	s. h.	v. s. eth.; s. bz., alk.
1664	yel need. f. dil. al.		125	...	s. h.	s.	s. eth., bz.
1665	sm. need. f. w		170 (162–3)	.	s.	s.	s. alk.
1666	need f. w .	...	206 (197–200)	.....	s. h.	s.	s. eth.
1667	yel. need. f. lgr.	.....	210	subl.	v. s. h.	v. s.	v. s. eth.; s. me. al., acet.; i. bz., chl., CS_2
1668							
1669							
1670	rhomb. f. al	.	95 (91–2)	333–4[725]	i.	v. s.	v. s. eth.; s. chl., CS_2

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1671	**Benzophenone, *p*-hydroxy-**	....	$HOC_6H_4COC_6H_5$	198.21
1672	**——, *o*-nitro-**	*o*-nitrophenyl phenyl ketone	$NO_2C_6H_4COC_6H_5$	227.21
1673	**——, *m*-nitro-**	...	$NO_2C_6H_4COC_6H_5$	227.21
1674	**——, *p*-nitro-**	...	$NO_2C_6H_4COC_6H_5$	227.21
1675	**——, 2,4,6,3′,4′-pentahydroxy-.** See *Maclurin.*			
1676	**——, 2,2′,6-trihydroxy-**	2-salicylylresorcinol .	$(HO)_2C_6H_3COC_6H_4OH$	230.21
1677	**——, 2,3,4-trihydroxy-**	4-benzoylpyrogallol; alizarin yellow A	$C_6H_5COC_6H_2(OH)_3$	230.21
1678	**Benzophenonecarboxylic acid.** See *Benzoic acid, benzoyl-.*			
1679	***p,p′*-Benzophenonedicarboxylic acid.** See *Benzoic acid, p,p′-carbonyldi-.*			
1680	**2,3-Benzophenonedicarboxylic acid.** See *Phthalic acid, 3-benzoyl-.*			
1681	**2,5-Benzophenonedicarboxylic acid.** See *Terephthalic acid, benzoyl-.*			
1682	**3,4-Benzophenonedicarboxylic acid.** See *Phthalic acid, 4-benzoyl-*			
1683	***p*-Benzophosphinic acid.** See *Benzoic acid, p-phosphono-*			
1684	**Benzopinacol**	1,1,2,2-tetraphenyl-1,2-ethanediol*, tetraphenylethylene glycol; benz(o)-pinacone	$(C_6H_5)_2COHCOH(C_6H_5)_2$	366.44
1685	**β-Benzopinacolin....**	α-triphenylacetophenone; benzoyltriphenylmethane, phenyl trityl ketone	$(C_6H_5)_3CCOC_6H_5$	348.42
1686	**Benzopinacone.**	See *Benzopinacol.*		
1687	**Benzopyrazine.**	See *Quinoxaline.*		
1688	**Benzo[*b*]pyridine.**	See *Quinoline*		
1689	**Benzo[c]pyridine.**	See *Isoquinoline.*		
1690	**Benzo[a]pyrimidine.**	See *Quinazoline.*		
1691	**1,2-Benzopyrone.**	See *Coumarin.*		
1692	**1,4-Benzopyrone, γ-Benzopyrone.** See *Chromone.*			
1693	**2,1-Benzopyrone.**	See *Isocoumarin.*		
1694	**Benzo[*b*]pyrrole**	See *Indole.*		
1695	**Benzoquinhydrone.**	See *Quinhydrone*		
1696	**Benzo[*f*]quinoline**	5,6-benzoquinoline, β-naphthoquinoline	$C_{13}H_9N$.	179.21
1697	**——, 3-methyl-** .	3-methyl-5,6-benzoquinoline, β-naphthoquinaldine	$C_{13}H_8NCH_3$	193.24
1698	**Benzo[*h*]quinoline**	7,8-benzoquinoline, α-naphthoquinoline	$C_{13}H_9N$	179.21
1699	**——, 2-methyl-** .	2-methyl-7,8-benzoquinoline, α-naphthoquinaldine	$C_{13}H_8NCH_3$	193.24
1700	***p*-Benzoquinone.**	See *Quinone.*		
1701	**4-Benzoresorcin.**	See *Benzophenone, 2,4-dihydroxy-*		
	Benzothiazole. (Numbered beginning S=1).			
1702	**Benzothiazole, 2-(2,4-dinitrophenylthio)-**	2-benzothiazyl 2,4-dinitrophenyl sulfide	$C_6H_4SC[SC_6H_3(NO_2)_2]N$	333.33
1703	**——, 2,2′-dithiobis-**	2,2′-dibenzothiazyl disulfide	$C_{14}H_8N_2S_4$	332.46
1704	**——, mercapto-.**	See *Benzothiazolethiol.*		
1705	**——, 2-methyl-**	μ-methylbenzothiazole, ethenylaminothiophenol	$SC(CH_3)NC_6H_4$	149.20
1706	**——, 2-phenyl-** .	benzenylaminothiophenol	$C_6H_4SC(C_6H_5)N$	211.27
1707	**2-Benzothiazolethiol**	2-mercaptobenzothiazole; *o*-thiocarbamidothiophenol	$C_6H_4SC(SH)N$	167.24
1708	——, benzoate	..	$C_{14}H_9NOS_2$	271.34

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1671	rhomb. leaf. f. dil al		134		s h	v. s.	v. s. eth.
1672	col monocl. f al.		105	. . .		sl. s.	. . . .
1673	col need f al	.	94–5	234^{15}		s.	. . . .
1674	col leaf f. al	.	138	. . . . .	v sl s	s.	sl. s. bz., CS_2
1675							
1676	yel leaf. f. al	. .	133	. . . .	sl s h.	s. h.	s eth., bz., alk.
1677	yel. need. f. dil. al.	. . . . . .	140	. . .	sl. s.	s.	s eth., alk., H_2SO_4; sl s. bz.
1678							
1679							
1680							
1681							
1682							
1683							
1684	pr		186 d			2 02 h	s eth.
1685	need		182 5	.	i	v sl s c, s h.	s. eth.; v. s. bz., chl., CS_2
1686							
1687							
1688							
1689							
1690							
1691							
1692							
1693							
1694							
1695							
1696	sm leaf f. h w	.	93	351	s h	v s	v. s. eth., bz.
1697	need f. dil. al	.	82	>300	sl s	s	s. eth.
1698	monocl. f. eth		52	351 (223^{47})	v sl s	v s	v. s. eth.; s bz.
1699	liq .	.		>300	i	s.	. .
1700							
1701							
1702	yel cr	$1\ 24^{20}_{4}$	160-2		i	sl s c, s h	sl. s. eth.
1703	lt yel cr .	$1\ 50\frac{20}{4}$	180 0	d	i.	v sl s h	v sl. s. chl.
1704							
1705	liq . .	. . . . .	. .	238	i.	s.	. . . . .
1706	need f al	. . .	115	360	i.	s.	s. eth, CS_2, dil HCl
1707	wh-yel cr	$1\ 42^{20}_{4}$	179 5	d.	i.	s h	v sl. s eth s alk
1708	yel cr		132		i.	sl. s c, s h	sl s eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
1709	**2-Benzothiazolethiol,** mercaptide with α, β-diphenylguanidine	.	$C_{20}H_{18}N_4S_2$	378 50
1710	——, **6-nitro-,** diethylthio	lthionocarbamic ester......	$C_{12}H_{13}N_3O_2S_3$	327 43
1711	**Benzothiofuran.**	See *Thionaphthene.*		
1712	**Benzothiophene.**	See *Thionaphthene.*		
1713	**o-Benzotoluide**..... .	*N*-benzoyl-*o*-toluidine ..	$C_6H_5CONHC_6H_4$-CH_3	211.25
1714	**m-Benzotoluide** . ..	*N*-benzoyl-*m*-toluidine, *m*-benzotoluidide	$C_6H_5CONHC_6H_4$-CH_3	211 25
1715	**p-Benzotoluide**. ..	*N*-benzoyl-*p*-toluidine .	$C_6H_5CONHC_6H_4$-CH_3	211 25
1716	**1,2,3-Benzotriazole**	aziminobenzene, benzene azimide	$C_6H_4NHN.N$	119 12
1717	**Benzotrichloride.**	See *Toluene, α-trichloro-.*		
1718	**Benzotrifluoride.**	See *Toluene, α-trifluoro-.*		
1719	**Benzoxazole, 2-methyl**-(O=1)	μ-methylbenzoxazole, ethenylaminophenol	$OC(CH_3)\ NC_6H_4$	133 14
1720	**2(3)Benzoxazolone** (O=1)	*o*-hydroxycarbanilic acid lactone	C_6H_4OCONH	135 12
1721	**2,3,1-Benzoxaz-1-one**	benzaldoximecarboxylic anhydride	$C_6H_4COON\ CH$	147 13
	Benzoyl-. For benzoyl deri	vatives see the parent compoun	ds (e.g , for benzoyla	cetic
1722	**Benzoyl azide**	benzazide	$C_6H_5CON_3$.	147.13
1723	**Benzoyl bromide**	benzenecarbonyl bromide*	C_6H_5COBr	185 03
1724	**Benzoyl chloride.**	benzenecarbonyl chloride*	C_6H_5COCl	140 57
1725	——, **p-bromo-**	.. ..	BrC_6H_4COCl	219 48
1726	——, **3,5-dinitro-**		$(NO_2)_2C_6H_3COCl$	230 57
1727	——, **p-methoxy-.**	See *Anisoyl chloride.*		
1728	——, **m-nitro-** .	..	$NO_2C_6H_4COCl$	185 57
1729	——, **p-nitro-**		$NO_2C_6H_4COCl$	185 57
1730	**Benzoyl cyanide**	α-keto-α-tolunitrile, 2-oxo-2-phenylethanenitrile	C_6H_5COCN	131 13
1731	**Benzoyl disulfide**	dibenzoyl disulfide.	$(C_6H_5CO)_2S_2$	274 34
1732	**Benzoyl fluoride**	benzenecarbonyl fluoride*	C_6H_5COF	124 11
1734	**Benzoyl hydroperoxide**	. See *Perbenzoic acid*		
1735	**Benzoyl iodide**	benzenecarbonyl iodide*	C_6H_5COI	232 03
1736	**Benzoyl peroxide** .	dibenzoyl peroxide .	$(C_6H_5CO)_2O_2$	242 22
1737	**Benzpinacone.**	See *Benzopinacol*		
	Benzyl-. For benzyl deriva	tives see the parent compounds	(e.g., for benzylbenz	oic acid
1738	**Benzyl alcohol**.......	phenylcarbinol, α-hydroxytoluene	$C_6H_5CH_2OH$ ...	108.13
1739	——, esters	See "benzyl ester" under the c	orresponding acids.	
1740	——, **o-chloro-**.......		$ClC_6H_4CH_2OH$	142 58
1741	——, **3,4-dihydroxy-α-**	**(methylaminomethyl)-.**	See *Adrenaline.*	
1742	——, **α,α-dimethyl-.**	See *2-Propanol, 2-phenyl-.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1709	yel. cr	1 00	173		i.	s.	i. eth.
1710	fine yel. cr...		122		i.	s. h.	s. eth., bz.
1711							
1712							
1713	rhomb. need., 1.621, 1.654, 1.691	$1\ 205\frac{15}{4}$	146 (135-6 5)		sl s h.	s.	s. eth.
1714	monocl. pr. f. dil al	$1\ 170\frac{15}{4}$	125			$10\ 02^{15}$	....
1715	rhomb need f. al.	$1\ 202^{15}_{4}$	158	232	i.	$3\ 3^{18}$	s. eth.
1716	need. f. bz.		100	$201\text{-}4^{15}$ mm	i	s.	s. bz.
1717							
1718							
1719	liq	$1\ 136\frac{0}{4}$		201	i	s.	∞ eth.
1720	col. need. f. h dil. HCl		141-2 (138)	.	sl s c	v. s.	v. s. eth.
1721	cr f. bz . .		d 120	......			... ..
	acid see *Acetic acid, benzoyl-*) See also "benzoate" under names of alcohols and phenols.						
1722	col pl. f. acet		32	exp.	i.	s.	s. eth.
1723	col. fum liq	$1\ 570^{15}_{4}$	O, frz., -24	218-19	d.	s d.	∞ eth.
1724	col fum liq., 1 55369	$1\ 2187\frac{15}{15}$	-1	$197\ (194^{742})$	d	s d	∞ eth.; s. bz., CS_2, oils
1725	col. need		42	245-7 sl. d	d.	v s	v. s. eth.; s. bz., lgr.
1726	yel. need. f. bz.		68-9	196^{12}	d.	d	s. eth.
1727							
1728	yel pr		34	278	d.	d	s. eth.
1729	yel. need. f. lgr		72	154^{15}	d.	d.	s. eth.
1730	col. tab .		32-3	206-8	i.	v. s.	v s. eth.
1731	pr f. h. al, eth. or CS_2		133 (128)	d.	i.	sl s	sl. s. eth.; s. CS_2; i. NH_4OH
1732	col. fum. liq	>1		159 (156)	hyd. h	v s	v. s. eth.
1734							
1735	need. or leaf		3	135^{25}	d.	s	∞ eth.
1736	col rhomb. f. eth ; 1 545, 1.546, 1.837		103 5 (106-8)	exp	sl. s.	s.	s. eth., bz., olive oil; 2.53^{15} CS_2
1737	see *Benzoic acid, benzyl-*).						
1738	col. liq., 1.53955	$1\ 050^{15}_{15}$	15 3	$205\ 2;\ 93^{10}$	4^{17}	66 7 50%, ∞ abs.	∞ eth., chl., me. al.; s. acet.
1739							
1740	need. or leaf. f dil al.		72	230	sl. s.	s.	s. eth.
1741							
1742							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
1743	**Benzyl alcohol, *o*-hydr**	**oxy-.** See *Saligenin*		
1744	——, ***m*-hydroxy-**	α,3-toluenediol	$HOC_6H_4CH_2OH$	124 13
1745	——, ***p*-hydroxy-**	α,4-toluenediol	$HOC_6H_4CH_2OH$	124 13
1746	——, **4-hydroxy-3-met**	**hoxy-.** See *Vanillyl alcohol*		
1747	——, ***p*-isopropyl-.**	See *Cumic alcohol*		
1748	——, ***o*-methoxy-**	saligenin 2-methyl ether	$CH_3OC_6H_4CH_2OH$	138 16
1749	——, ***p*-methoxy-.**	See *Anisyl alcohol*		
1750	——, ***o*, *m* or *p*-methyl**	**-.** See *Carbinol, tolyl-*		
1751	——, **α-methyl-**	methylphenylcarbinol, 1-phenylethanol	$C_6H_5CH(CH_3)OH$	122 16
1752	——, **3,4-methylenedio**	**xy-.** See *Piperonyl alcohol.*		
1753	——, ***o*-nitro-**		$NO_2C_6H_4CH_2OH$	153 13
1754	——, ***m*-nitro-**		$NO_2C_6H_4CH_2OH$	153 13
1755	——, ——, benzoate	*m*-nitrobenzyl benzoate	$C_6H_5COOCH_2$-$C_6H_4NO_2$	257 24
1756	——, ***p*-nitro-**		$NO_2C_6H_4CH_2OH$	153 13
1757	——, **thio-.**	See *α-Toluenethiol.*		
1758	**Benzylamine**	α-aminotoluene	$C_6H_5CH_2NH_2$	107 45
1759	——, ***N*-acetyl-.**	See *Acetamide, N-benzyl-*		
1760	——, ***N*,*N*-diphenyl-.**	See *Diphenylamine, N-benzyl-*		
1760M	——, ***p*-methoxy-**	anisylamine, ac[illegible] to some	*p*-$CH_3OC_6H_4CH_2$-NH_2	137 18
1761	——, **α-methyl-**	α-phenylethylamine, 1-amino-1-phenylethane	$C_6H_5CH(CH_3)NH_2$	121 18
1762	——, ***N*-methyl-*N*-phenyl-**	*N*-benzyl-*N*-methylaniline	$C_6H_5CH_2N(CH_3)$-C_6H_5	197 27
1763	——, ***N*-nitroso-*N*-phenyl-**	*N*-phenylbenzylnitrosamine	$C_6H_5CH_2N(NO)$-C_6H_5	212 24
1764	——, ***N*-phenyl-**	*N*-benzylaniline	$C_6H_5CH_2NHC_6H_5$	183 24
1765	**Benzyl azide.**	See *Toluene, α-triazo-*		
1766	**Benzyl bromide**	α-bromotoluene	$C_6H_5CH_2Br$	171 04
1767	**Benzyl chloride**	α-chlorotoluene	$C_6H_5CH_2Cl$	126 58
1768	——, ***o*-bromo-**	*o*-bromo-α-chlorotoluene	$BrC_6H_4CH_2Cl$	205 49
1769	——, ***p*-bromo-**	*p*-bromo-α-chlorotoluene	$BrC_6H_4CH_2Cl$	205 49
1770	——, ***p*-chloro-**	α,4-dichlorotoluene	$ClC_6H_4CH_2Cl$	161 03
1771	**Benzyl cyanide.**	See *α-Tolunitrile.*		
1772	**Benzyl disulfide**	dibenzyl disulfide, α-(benzyldithio) toluene	$(C_6H_5CH_2)_2S_2$	246 37
1773	**Benzyl ether**	dibenzyl ether	$(C_6H_5CH_2)_2O$	198 25
1773M	**Benzyl fluoride**	α-fluorotoluene	$C_6H_5CH_2F$	110 13
1774	**Benzyl hydrosulfide.**	See *α-Toluenethiol*		
	Benzylidene-. For benzyl	idene derivatives see the parent	compounds (e g for	
1774H	**Benzylidene bromide**	benzal bromide; α, α-dibromotoluene	$C_6H_5CHBr_2$	249 95
1774R	**Benzylidene chloride**	benzal chloride; α, α-dichlorotoluene	$C_6H_5CHCl_2$	161 03
1775	**Benzyl iodide**	α-iodotoluene	$C_6H_5CH_2I$	218 05
1776	**Benzyl mercaptan.**	See *α-Toluenethiol*		
1777	**Benzyl mustard oil.**	See *Isothiocyanic acid, benzyl*	*ester*	
1778	**Benzylnitrosamine, *N*-**	**phenyl-.** See *Benzylamine, N*	*-nitroso-N-phenyl-*	

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1743							
1744	need f bz		67	300 d	v s h	v s	v. s eth
1745	col. need. f. w		124 (110)	252	s	v. s.	v s. eth.
1746							
1747							
1748	liq., 1.549^{17}	$1.0495\frac{15}{15}$	.	248-50; $131\text{-}2^{15}$	v sl s	s.	∞ eth.
1749							
1750							
1751	col. liq. .	$1.013\frac{20}{4}$, $1.000\frac{25}{4}$		205 ($105\text{-}7^{12}$)	i	∞	∞ eth.
1752							
1753	need f w		74	168^{20}	sl s c	s	s eth.
1754	rhomb		27	180^{5}	sl s	s	v s. eth.
1755	. .		69 0- 5		i	s	s. eth.
1756	need. f. w		93	185^{12}	sl s c, s h	v s	v s. eth.
1757							
1758	col liq, 1.5401	$0.9826\frac{19}{4}$		185	∞	∞	∞ eth.
1759							
1760							
1760M	col liq	1.050^{15}		236-237, $122\text{-}4^{14}$	s.	∞	∞ eth.
1761	arom oil .	0.9395^{15}		187 4	4.2^{20}	∞	∞ eth.
1762	liq		9 2	306	i	v s	v s eth.
1763	yel need f al		57 8		i	s	s eth., chl, lgr.
1764	col monocl. pr. f al	$1.0618\frac{25}{4}$, $1.038\frac{55}{4}$	37-8 (32)	306-7	i.	s.	s. eth., h meth. al
1765							
1766	col. pois. liq	$1.438\frac{22}{0}$	-4 0	198	i	∞	∞ eth.
1767	col liq., 1.5415^{15}	$1.1026\frac{18}{4}$	-43 (-48)	179	i c, d h	∞	∞ eth.
1768				124.6^{20}	i	v s	v. s. eth.
1769	need f al or pet. eth		41	236	i.	v s. h.	v. s. eth.
1770	need		29	222 (214) d.	i	s c., v. s h.	s. eth., ac. a., CS_2, bz.
1771							
1772	leaf. f al	. .	(1) 71-2, (2) 69 70		v sl s	s. h.	s. eth., bz, h. me al.
1773	col oil	$1.0428\frac{20}{4}$	4-5	295-8 ($157\text{-}60^{15}$)	i.	v s h	s. eth.
1773M	col. liq	$1.02278^{25.3}$	-35	139 9	d.		...
1774	benzylidenemalonic acid see *Malonic acid benzylidene*						
1774H	fum. oily liq, 1.541	1.51^{15}	.	140^{20}	i.	∞	∞ eth.
1774R	col. oily liq., 1.5502^{20}	1.2557^{14}	-16; frz. -17	207 (203.5^{756})	i.	∞	∞ eth.
1775	col cr	$1.733\frac{25}{4}$	24	93^{10}	i	s.	s eth, CS_2
1776							
1777							
1778							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1779	**Benzyloxyamine***	α (or O)-benzylhydroxylamine	$C_6H_5CH_2NHOH$	123 15
1780	**Benzyl sulfide**	dibenzyl sulfide	$(C_6H_5CH_2)_2S$	214 31
1781	**Benzyl sulfone**	dibenzyl sulfone	$(C_6H_5CH_2)_2SO_2$	246 31
1782	**Benzyl sulfoxide**	dibenzyl sulfoxide	$(C_6H_5CH_2)_2SO$	230 31
1783	**Berbamine**	....	$C_{18}H_{19}NO_3 \cdot 2H_2O$	333 37
1784	**Berberine**		$C_{20}H_{17}NO_4 \cdot 6H_2O$	443 44
1785	—, compd. with chloroform		$C_{20}H_{19}NO_5 \cdot CHCl_3$	472 75
1786	—, hydrochloride		$C_{20}H_{19}NO_5 \cdot HCl \cdot 2H_2O$	425 86
1787	—, nitrate		$C_{20}H_{19}NO_5 \cdot HNO_3$	416 38
1788	—, sulfate		$C_{20}H_{19}NO_5 \cdot H_2SO_4$	451.44
1789	**—, tetrahydro-.**	See *Canadine, Hydroberberine*		
1790	**Berberonic acid**	2,4,5-pyridinetricarboxylic acid*	$C_5H_2N(COOH)_3 \cdot 1\frac{1}{2}H_2O$	238 15
1791	**Betacaine.**	See *β-Eucaine*		
1792	**Betaine**	lycine, oxyneurine, trimethylglycocoll, (carboxymethyl)-trimethylammonium hydroxide anhydride	$COCH_2N(CH_3)_3O$	117 15
1793	**Betel phenol.**	See *Chavibetol*		
1794	**Betol**	2-naphthyl salicylate, β-naphthyl salicylate	$HOC_6H_4COOC_{10}H_7$	264 27
1795	**Betorcinol.**	See *Resorcinol, 2,5-dimethyl-.*		
1796	**Betulinic acid**		$C_{36}H_{54}O_6$	582 80
1797	**Betulinol**	betulin, betula camphor, birch camphor	$C_{36}H_{60}O_3(?)$	540 85
1798	***p,p'*-Biacetanilide.**	See *Benzidine, N,N'-diacetyl-*		
1799	**Biacetyl.**	See 2,3-*Butanedione**		
1800	**Biacetylene.**	See *Butadiyne*		
1801	**Biallyl.**	See 1,5-*Hexadiene**		
1802	***o,p'*-Bianiline.**	See 2,4'-*Biphenyldiamine*		
1803	***p,p'*-Bianiline.**	See *Benzidine*		
1803M	**Bianisal.**	See *Stilbene, 4,4'-dimethoxy-*		
1804	**4,4'-Bi-*o*-anisidine**	4,4'-diamino-2,2'-dimethoxybiphenyl	$[CH_3O(NH_2)C_6H_3]_2$	244 29
1805	**Biarsine, tetraethyl-**	ethyl cacodyl, bis(diethylarsenic)	$(C_2H_5)_2AsAs(C_2H_5)_2$	266 06
1806	**—, tetramethyl-.**	See *Cacodyl*		
1807	***o,o'*-Bibenzoic acid.**	See *Diphenic acid*		
1808	**Bibenzoyl.**	See *Benzil.*		
1809	**Bibenzyl**	*sym*-or 1,2-diphenylethane, dibenzyl	$C_6H_5CH_2CH_2C_6H_5$	182 25
1810	**—, 4,4'-diamino-.**	See *α, α'-Bi-p-toluidine*		
1811	**Bi-sec-butyl.**	See *Hexane, 3,4-dimethyl-**		
1812	**Bi-*tert*-butyl.**	See *Butane, 2,2,3,3-tetramethyl-**.		
1813	**2,2'-Bicamphane-2,2'-diol.** See *Camphor pinacol*			
1814	**Bicyclo [4,4,0] decane.**	See *Naphthalene, decahydro-**		
1815	**Bicyclo [2,2,1] heptane.**	See *Norcamphane*		
1816	**Bicyclo-[2,2,1]hept-2-ene, 1,7,7-trimethyl-.** See *Bornylene.*			

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1779	oil . .	.	. . . .	118–9[30]	s		. . . .
1780	col rhomb pl f eth or chl	1 0712$^{50}_{50}$	49	. . . .	i.	s.	s. eth.
1781	need f al +bz.		151	290 sl. d	s h	sl. s	v. s. acet.; s. bz., ac a.
1782	leaf f al. or w		134 (130)	d. 210	i c, s. h.	s.	s. eth.
1783	leaf. f. al., [α] 108 6$^{25}_{D}$		anh. 200			s	s eth.
1784	yel anh.need f eth, cr (+6H_2O) f w		anh 145		22[21]	1 c.	v. sl. s. eth.; sl. s. chl., bz.
1785	tricl tab f chl		179				. .
1786	or need or yel powd.				s.	s	. . .
1787	yel. need				sl s		. . . . . .
1788	yel. need				1[21]	sl s	. .
1789							
1790	tricl pr .		235; anh 243		v sl s	v sl s	i eth, bz., chl.; s dil a.
1791							
1792	col. monocl. pr. or leaf		293 d		157[19]	8 6[18]	v. sl. s. eth.
1793							
1794	cr f al		95		i.	s	s. h. eth., h. bz.
1795							
1796	wh powd		195	. . . .	sl s	v. s.	. . . . .
1797	need f al [α] + 19 96$^{21.5}_{D}$ in pyr		258	subl, d	i	0 85 c, 4 27 h	0 4 c, 3 07 h. eth.
1798							
1799							
1800							
1801							
1802							
1803							
1803M							
1804	col need or leaf.	. .	131 5	.	sl s h.	s	v. s. eth.; s acet., chl, bz
1805	liq, ign in air, 1.4709	1 1388$^{23.7}_{4}$		185-90	i	s.	s. eth.
1806							
1807							
1808							
1809	col monocl. need f. al.	0 995$^{20}_{4}$, 0 942$^{80}_{4}$	52 5	284	i.	s	v. s. eth.; s. CS_2
1810							
1811							
1812							
1813							
1814							
1815							
1816							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
1817	**Bicyclo[3,1,1]hept-2-ene, 2,6,6-trimethyl-.** See *Pinene.*			
1818	**Bicyclo[3,1,0]hexane, 1-isopropyl-4-methylene-.** See *Sabinene*			
1819	**Biethylene.**	See 1,3-*Butadiene**.		
1820	**Biformyl.**	See *Glyoxal.*		
1821	**Biguanide**	guanylguanidine, diguanide	$NH_2C(:NH)NHC(:NH)NH_2$	101 12
1822	——, **α-o-tolyl-**		$C_7H_7NHC(:NH)NHC(:NH)NH_2\ \frac{1}{2}H_2O$	200 24
1823	**Bihexyl.**	See *Dodecane**		
1824	**Biisoamyl.**	See *Octane 2,7-dimethyl-**		
1825	**Biisobutyl.**	See *Hexane, 2,5-dimethyl-**		
1826	**Biisopropenyl.**	See 1,3-*Butadiene, 2,3-dimethyl-**.		
1827	**Biisopropyl.**	See *Butane, 2,3-dimethyl-**.		
1828	**Bikhaconine, acetylveratryl-.** See *Bikhaconitine*			
1829	**Bikhaconitine**	acetylveratrylbikhaconine	$C_{36}H_{51}NO_{11}$	673 78
1830	**Bilifuscin**		$C_{16}H_{20}N_2O_4$	304 34
1831	**Bilineurine.**	See *Choline*		
1832	**Bilirubin**		$C_{32}H_{36}N_4O_6$	572 64
1833	**Biliverdin**		$C_{32}H_{36}N_4O_8$	604 64
1834	**1,1′-Bi-2-naphthol**	β-dinaphthol, 2,2′-dihydroxy-1,1′-binaphthyl	$HOC_{10}H_6C_{10}H_6OH$	286 31
1835	**4,4′-Bi-1-naphthol**	α-dinaphthol, 4,4′-dihydroxy-1,1′-binaphthyl	$HOC_{10}H_6C_{10}H_6OH$	286 31
1836	**1,1′-Binaphthyl***	α, α′-dinaphthyl	$C_{10}H_7C_{10}H_7$	254 31
1837	——, **2,2′-dihydroxy-.**	See 1,1′-*Bi-2-naphthol.*		
1838	——, **4,4′-dihydroxy-.**	See 4,4′-*Bi-1-naphthol*		
1839	**2,2′-Binaphthyl***	β, β′-dinaphthyl	$C_{10}H_7C_{10}H_7$	254 31
1840	**Bindschedler green, leuco base** See *Diphenylamine, p,p′-bisdimethylamino-*			
1841	**Bioctyl.**	See *Hexadecane**		
1842	**Bioxirane.**	See *i-Erythritol, anhydride*		
1843	***o,o′*-Biphenol**	2,2′-dihydroxybiphenyl	$HOC_6H_4C_6H_4OH$	186 20
1844	***o,p′*-Biphenol**	2,4′-dihydroxybiphenyl	$HOC_6H_4C_6H_4OH$	186 20
1845	***m,m′*-Biphenol**	3,3′-dihydroxybiphenyl	$HOC_6H_4C_6H_4OH$	186 20
1846	***p,p′*-Biphenol**	4,4′-dihydroxybiphenyl	$HOC_6H_4C_6H_4OH$	186 20
1847	***p,p′*-Biphenol, 2,2′,6,6′-tetramethoxy-.** See *Hydrocerulignone*			
1848	***p,p′*-Biphenol, 3,3′,5,5′-tetranitro-**		$[C_6H_2(NO_2)_2OH]_2$	366 20
1849	**Biphenyl**	diphenyl, phenylbenzene	$C_6H_5C_6H_5$	154 20
1850	——, **2-amino-.**	See *o-Biphenylamine*		
1851	——, **3-amino-.**	See *m-Biphenylamine.*		
1852	——, **4-amino-.**	See *Xenylamine.*		
1853	——, **2-amino-4,4′-diamino-.** See *Benzidine, 3-amino-*			
1854	——, **2-benzyl-**	1-benzyl-2-phenylbenzene	$C_6H_5CH_2C_6H_4C_6H_5$	244 32

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1817							
1818							
1819							
1820							
1821	amor or pr f. al.		130		s	s	
1822	wh cr		$\frac{1}{2}H_2O$ 140–4, anh. 145–6		s h	s	s. eth.
1823							
1824							
1825							
1826							
1827							
1828							
1829	cr . .		113			s	s eth.
1830	br powd..		183		sl s	s	sl s. eth.; s. glac ac a., alk.
1831							
1832	br rhomb. cr		192–2 5		i	sl s	v sl s eth.; s. CS_2, chl., bz, a., alk
1833	grn.-blk powd				i	s	sl s eth.; s. bz, alk; i. chl.
1834	need. f al or tol		218	subl	i	s	v s. eth ; sl s. chl.
1835	rhomb f. al..		300	subl	i	s	v s. eth ; s. alk ; sl. s. chl., bz.
1836	col rhomb leaf f al.		160 5 (156)	ca 360, $240–4^{12}$	i	s h	s eth., bz., CS_2
1837							
1838							
1839	col pl ..		187–8 (181)	452	i	sl s	sl s eth ; s. h. bz., CS_2
1840							
1841							
1842							
1843	pr f tol, leaf (hyd) f w.		hyd 73–5, anh 109–10	326	s h	s.	s eth., ac a., bz., alk.
1844	monocl pr or need		162–3	342	sl s h	s	s. eth.
1845	need. f. w		123–4	247^{18}	v. sl s	s.	s. eth., chl, bz, alk
1846	rhomb need or pl. f al.	$1\ 25\frac{20}{4}$	274–5 (270–2)	subl	sl s	s	s eth, sl s bz.
1847							
1848	yel. need		222 5		i	s.	....
1849	col. monocl., α1 56841, β1.59441, γ1.61158, $1.58822^{77.1}$	$1\ 180\frac{0}{4}$, $0\ 9919\frac{73}{4}$	69–71	254–5	i	10 c.	s. eth ; $6\ 57^{19.5}$ me al.
1850							
1851							
1852							
1853							
1854	monocl need .		54	$283–7^{110}$	i	s	s eth.; v s. bz.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
1855	**Biphenyl, 4-benzyl-**	1-benzyl-4-phenylbenzene	$C_6H_5CH_2C_6H_4C_6H_5$	244 32
1856	**——, 2-bromo-***	2-bromodiphenyl	$C_6H_5C_6H_4Br$	233 11
1857	**——, 4-bromo-***	4-bromodiphenyl	$C_6H_5C_6H_4Br$	233 11
1858	**——, 2-chloro-***	*o*-chlorodiphenyl	$ClC_6H_4C_6H_5$	188 65
1859	**——, 3-chloro-***	*m*-chlorodiphenyl	$ClC_6H_4C_6H_5$	188 65
1860	**——, 4-chloro-***	*p*-chlorodiphenyl	$ClC_6H_4C_6H_5$	188 65
1861	**——, 2,4′-diamino-.**	See *2,4′-Biphenyldiamine*		
1862	**——, 4,4′-diamino-.**	See *Benzidine.*		
1862M	**——, 4,4′-diamino-2,2′-dimethoxy-.** See *4,4′-Bi-o-anisidine*			
1863	**——, 4,4′-dibromo-***	*p,p′*-dibromodiphenyl	$BrC_6H_4C_6H_4Br$	312 02
1864	**——, 4,4′-dichloro-***	4,4′-dichlorodiphenyl	$ClC_6H_4C_6H_4Cl$	223 10
1865	**——, 4,4′-dichloro-2,2′-dinitro-***		$Cl(NO_2)C_6H_3C_6H_3(NO_2)Cl$	313 10
1866	**——, 2,2′-dihydroxy-.**	See *o,o′-Biphenol*		
1867	**——, 2,4′-dihydroxy-.**	See *o,p′-Biphenol*		
1868	**——, 3,3′-dihydroxy-.**	See *m,m′-Biphenol*		
1869	**——, 4,4′-dihydroxy-.**	See *p,p′-Biphenol*		
1870	**——, 2,2′-dimethyl-.**	See *o,o′-Bitolyl*		
1871	**——, 2,3′-dimethyl-.**	See *o,m′-Bitolyl*		
1872	**——, 3,3′-dimethyl-.**	See *m,m′-Bitolyl*		
1873	**——, 4,4′-dimethyl-.**	See *p,p′-Bitolyl*		
1874	**——, 2,2′-dinitro-***	*o,o′*-dinitrodiphenyl	$NO_2C_6H_4C_6H_4NO_2$	244 20
1875	**——, 2,4′-dinitro-***	*o,p′*-dinitrodiphenyl	$NO_2C_6H_4C_6H_4NO_2$	244 20
1876	**——, 3,3′-dinitro-***	*m,m′*-dinitrodiphenyl	$NO_2C_6H_4C_6H_4NO_2$	244 20
1877	**——, 4,4′-dinitro-***	*p,p′*-dinitrodiphenyl	$NO_2C_6H_4C_6H_4NO_2$	244 20
1878	**——, 2-ethoxy-***	..	$C_6H_5C_6H_4OC_2H_5$	198 25
1879	**——, 3-ethoxy-***		$C_6H_5C_6H_4OC_2H_5$	198 25
1880	**——, 1,2,3,4,5,6-hexahydro-.** See *Cyclohexane, phenyl-*			
1881	**——, hydroxy-.**	See *Phenol, phenyl-*		
1882	**——, 4-iodo-***		$C_6H_5C_6H_4I$	280 11
1883	**——, 2-methoxy-***		$C_6H_5C_6H_4OCH_3$	184 23
1884	**——, 4-methoxy-***		$C_6H_5C_6H_4OCH_3$	184 23
1885	**——, 2-methyl-**	*o*-phenyltoluene	$C_6H_5C_6H_4CH_3$	168 23
1886	**——, 3-methyl-**	*m*-phenyltoluene	$C_6H_5C_6H_4CH_3$	168 23
1887	**——, 4-methyl-.**	*p*-phenyltoluene	$C_6H_5C_6H_4CH_3$	168 23
1888	**——, 2-nitro-***		$C_6H_5C_6H_4NO_2$	199 20
1889	**——, 3-nitro-***		$C_6H_5C_6H_4NO_2$	199 20
1890	**——, 4-nitro-***		$C_6H_5C_6H_4NO_2$	199 20
1891	**——, 3-phenyl-.**	See *Benzene, 1,3-diphenyl-.*		
1892	**——, 4-phenyl-.**	See *Terphenyl.*		
1893	**——, 3,3′,5,5′-tetrahydroxy-.** See *5,5′-Biresorcinol.*			
1894	**——, 2,2′,4,4′-tetranitro-***		$(NO_2)_2C_6H_3C_6H_3(NO_2)_2$	334 20

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1855	leaf		85	285-6[100]	i	s	s. eth., v s. bz.
1856	liq		<-20	296-8	i	s	s eth.
1857	col. pl. f. al		89-90	310	i	s	s. eth
1858	monocl		32	273-4	i	s	v. s eth.; s. lgr, CCl_4
1859	cr		89	284-5	i	s	s eth
1860	leaf f lgr. or al		77 (66-75)	291 2[745] (282)	i	s	s eth., lgr.
1861							
1862							
1862M							
1863	monocl pr	1.897^{20}_{4}	164	355-60	i	v sl s h	s bz.
1864	monocl pr or need. f tol	1.439^{20}_{4}	148.9 (130-43)	315-9	i		
1865	yel. need. f. al		138		i	sl s c, s h	
1866							
1867							
1868							
1869							
1870							
1871							
1872							
1873							
1874	yelsh monocl need.	1.45^{20}_{4}	124		i	s h	s eth, h. ac. a, h bz.; sl. s. lgr.
1875	col monocl need or pr	1.474^{20}_{4}	93.5		i	s. h	s. eth., h. ac a., h. bz.
1876	or-yel need		200		i	sl s.	sl. s eth, s h. ac. a., h. bz
1877	need f al	1.445^{20}_{4}	233 (237-43)		i.	v sl s c, s h	v. s. eth.; s h. bz, h. ac a
1878	pr		34	276		v s	v. s. eth.
1879	cr		34	305		s	s eth
1880							
1881							
1882	col cr f ac a		113.4 (109-11)	320 d.	i	s h	s eth., bz, ac a
1883	pr		29	274, 159-60[18]			
1884	leaf		90 (84.5)			s h.	
1885	col liq	1.010^{20}_{4}		260	i	s	s. eth
1886	col liq	1.031^{0}_{4}		277	i	s	s. eth
1887	col liq	1.015^{27}	[illegible]	267	i	s	s. eth.
1888	rhomb bi-py leaf f al	1.44^{20}_{4}	37 (31.3)	320	i	v s	v s eth
1889	yel leaf. f. w. + al		58.5-61		i	v s.	v s. ac. a.; s. lgr.
1890	col rhomb bi-py need f. al.	1.328^{20}_{4}	113	340	i.	sl s c	s eth; v s chl
1891							
1892							
1893							
1894	yel. pr. f. bz.		164.5	d.	i	sl s	sl. s. eth.; s. bz., ac. a.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
1895	**o-Biphenylamine....**	2-aminobiphenyl..	$NH_2C_6H_4C_6H_5$	169 22
1896	**m-Biphenylamine....**	3-aminobiphenyl	$NH_2C_6H_4C_6H_5$	169 22
1897	**p-Biphenylamine.**	See *Xenylamine.*		
1898	**Biphenylcarboxylic acid.** See *Benzoic acid, phenyl-.*			
1899	**2,4′-Biphenyldiamine**	o,p′-bianiline; diphenyline, 2,4′-diaminobiphenyl	$NH_2C_6H_4C_6H_4NH_2$	184 23
1900	**2,2′-Biphenyldicarbonyl chloride.** See *Diphenoyl chloride.*			
1901	**2,2′-Biphenyldicarboxylic acid.** See *Diphenic acid*			
1902	**2,2′-Biphenyldisulfonic acid, 4,4′-diamino-.** See *2,2′-Benzidinedisulfonic*			
1903	**Biphenylene oxide.**	See *Dibenzofuran.*		
1904	**Biphenylene sulfone, 2,7-diamino-.** See *Benzidine sulfone.*			
1905	**p-Biphenylyl mustard oil.** See *Isothiocyanic acid, xenyl ester.*			
1906	**Bipropargyl.**	See 1,5-*Hexadiyne.**		
1907	**Bipropenyl.**	See 2,4-*Hexadiene*.*		
1908	**4,4′-Bipyridyl......**	4,4′- or γ,γ′-dipyridyl	$(C_5H_4N)_2$	156 18
1909	**Bipyromucyl.**	See *Furil.*		
1910	**2,3′-Biquinoline ..**	2,3′-biquinolyl, 2,3′-diquinolyl	$(C_9H_6N)_2$	256 29
1911	**2,7′-Biquinoline.**	2,7′-diquinolyl.	$(C_9H_6N)_2$	256 29
1912	**6,6′-Biquinoline**	6,6′-diquinolyl	$(C_9H_6N)_2$	256 29
1913	**Birch camphor.**	See *Betulinol.*		
1914	**5,5′-Biresorcinol ..**	3,3′,5,5′-tetrahydroxybiphenyl	$(HO)_2C_6H_3C_6H_3(OH)_2\,2H_2O$	254 23
1915	**Bismuth, triethyl-*.**	triethylbismuthine; bismuth triethyl	$Bi(C_2H_5)_3$	296 18
1916	**——, trimethyl-* .**	trimethylbismuthine	$(CH_3)_3Bi$	254 10
1917	**——, triphenyl-***	triphenylbismuthine	$(C_6H_5)_3Bi$	440 30
	Bismuthine. For derivatives see under *Bismuth.*			
1918	**2,2′-Bithienyl.**	See 2,2′-*Bithiophene.*		
1919	**2,2′-Bithiophene ...**	2,2′-bithienyl, α, α-dithienyl	$(C_4H_3S)_2$.	166 25
1920	**——, hexabromo- ..**	perbromo-α, α-dithienyl	$(C_4Br_3S)_2$.	639 70
1921	**4,4′-Bi-o-toluidine**	$(NH_2=1)$. See *o-Toluidine*		
1922	**α,α′-Bi-p-toluidine .**	4,4′-diaminobibenzyl, 4,4′-diamino-s-diphenylethane	$H_2NC_6H_4C_2H_4C_6H_4NH_2$	212 29
1923	**o,o′-Bitolyl.... .**	2,2′-dimethylbiphenyl	$CH_3C_6H_4C_6H_4CH_3$	182.25
1924	**o,m′-Bitolyl...**	2,3′-dimethylbiphenyl	$CH_3C_6H_4C_6H_4CH_3$	182 25
1925	**m,m′-Bitolyl**	3,3′-dimethylbiphenyl, m,m′-ditolyl	$CH_3C_6H_4C_6H_4CH_3$	182 25
1926	**p,p′-Bitolyl... .**	4,4′-dimethylbiphenyl .	$CH_3C_6H_4C_6H_4CH_3$	182 25
1927	**Biuret .**	allophanamide, carbamylurea; ureidoformamide	NH_2CONH_2-$CONH_2\,H_2O$	122 11
1928	**——, acetyl-..... . .**	acetylallophanamide..	$CH_3CONHCONHCONH_2$	145 12
1929	**Bivinyl.**	See 1,3-*Butadiene*.*		
1930	**——, α-methyl-.**	See 1,3-*Pentadiene*.*		
1931	**——, β-methyl-.**	See *Isoprene.*		
1932	**Blue cross.**	See *Arsine, chlorodiphenyl-*		
1933	**Boric acid, benzyl- .**	benzylboron dihydroxide, α-tolueneboronic acid	$C_6H_5CH_2B(OH)_2$	135 96

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1895	col. leaf.		49 3 (45 5)	299	i.	s	...
1896	col. leaf. or need		30	254^{135}	sl s.	s	s. eth.
1897							
1898							
1899	need. f dil al		45	363	v sl. s.	s	s eth.
1900							
1901							
1902	*acid*						
1903							
1904							
1905							
1906							
1907							
1908	need ($+2H_2O$) f w.		$2H_2O$, 73, anh 114	304 8	v sl s.	v s	v. s. eth.; s. chl., bz.
1909							
1910	yel pl. or need f. bz		176–7	>400	i.	v. s	s eth., h. chl., h bz.
1911	monocl pl f al		193	subl.	i	v. sl s	sl. s. eth.; s. chl, h bz.
1912	monocl leaf f. al		181 (178)	dist	v sl s. h	v sl s.	s eth, bz.
1913							
1914	pl, need or wh cr powd		anh 310		s h	s.	s eth, i. ac. a, acet.
1915	col liq..	$1\ 82\frac{20}{4}$		107^{79} exp	i	s	s eth.
1916	.	$2\ 300\frac{18}{4}$		110	.		...
1917	monocl	$1\ 585\frac{20}{4}$	77–8	242^{14}	i	sl s	s eth.; v s. chl., acet.
1918							
1919	col leaf... .		33	260	i	v s	v s eth.; s. ac. a.
1920	need.. .		255			i	s h bz.
1921							
1922	lust pl f. w		134–5 (132)	subl.	s h	v s	.. ... .
1923	col liq. or cr f al	$0\ 955\frac{10}{4}$	17 8	272, 258^{738}	i	s	s eth, bz.
1924	col liq	.		270 (287 5)	i	v s	v s eth., s bz.
1925	col visc. liq	$0\ 9993\frac{16}{4}$	5–7	$286–7^{713}$	i	s	s eth, bz
1926	col monocl pr. f eth	$1\ 102\frac{20}{4}$; liq $0\ 917^{121}$	121	273–6 (295)	i	s	s eth., bz, CS_2
1927	col. need ($+1H_2O$); anh f al.		190 (193) d		$1\ 54^{15}$; $45\ 5^{100}$	v s	v. sl. s. eth.
1928	col. need ...		193	.	s.	v s.	sl. s eth, s. bz.
1929							
1930							
1931							
1932							
1933	wh cr		$-H_2O$, 104, anh 140	d	sl. s. c.	. .	s eth, bz

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
1934	**Boric acid, *p*-bromophenyl-**		$BrC_6H_4B(OH)_2$	200 84
1934M	**——, *o*(and *m*)-chlorophenyl-**	*o*-and *m*-chlorobenzeneboronic acid	$ClC_6H_4B(OH)_2$	156 39
1935	**——, *p*-chlorophenyl-**		$ClC_6H_4B(OH)_2$	156 39
1936	**——, ethyl-**	ethaneboronic acid	$C_2H_5B(OH)_2$	73 90
1937	**——, isoamyl-**	3-methyl-1-butaneboronic acid	$(iso\text{-}C_5H_{11})B(OH)_2$	115 98
1938	**——, isobutyl-**		$(CH_3)_2CHCH_2B(OH)_2$	101 95
1939	**——, phenyl-**	phenylboron dihydroxide, benzeneboronic acid	$C_6H_5B(OH)_2$	121 94
1940	**——, propyl-**	1-propaneboronic acid	$n\text{-}C_3H_7B(OH)_2$	87 92
1940M	**——, *o*-(and *m*)-tolyl-**	*o*-and *m*-tolueneboronic acid	$CH_3C_6H_4B(OH)_2$	135 96
1941	**——, *p*-tolyl-**	*p*-tolylboron dihydroxide	$CH_3C_6H_4B(OH)_2$	135 96
1942	**Borine, difluorophenyl-**	boron phenyl difluoride, phenylboron difluoride	$C_6H_5BF_2$	125 92
1943	**——, difluoro-*p*-tolyl-**	boron *p*-tolyl difluoride	$CH_3C_6H_4BF_2$	139 95
1944	**——, triethyl-**	triethylboron, boron triethyl	$(C_2H_5)_3B$	98 00
1945	**——, triisoamyl-**	triisoamylboron	$(C_5H_{11})_3B$	224 24
1946	**——, triisobutyl-**	triisobutylboron	$(C_4H_9)_3B$	182 16
1947	**——, trimethyl-**	trimethylboron, boron trimethyl	$(CH_3)_3B$	55 92
1948	**——, triphenyl-**	boron triphenyl, triphenylboron	$(C_6H_5)_3B$	242 12
1949	**——, tripropyl-**	tripropylboron	$(C_3H_7)_3B$	140 08
1950	**Borneo camphor.**	See *d-Borneol*		
1951	***dl*-Borneol**	*dl-exo*-2-camphanol, *dl*-bornyl alcohol; *dl*-α-camphol	$C_{10}H_{17}OH$	154 25
1952	——, acetate	*dl*-bornyl acetate	$C_{10}H_{17}OOCCH_3$	196 28
1953	***d*-Borneol**	*d*-exo-2-camphanol, *d*-bornyl alcohol, Borneo camphor, Malay camphor, Sumatra camphor, *d*-α-camphol	$C_{10}H_{17}OH$	154 25
1954	——, acetate		$CH_3COOC_{10}H_{17}$	196.28
1955	***l*-Borneol**	*l-exo*-2-camphanol, ngai camphor	$C_{10}H_{17}OH$	154 25
1956	——, acetate	*l*-bornyl acetate	$C_{10}H_{17}OOCCH_3$	196 28
1957	**Bornyl acetate.**	See *Borneol, acetate*		
1958	**Bornyl alcohol.**	See *Borneol*		
1959	**Bornylamine**		$C_{10}H_{17}NH_2$	153 26

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1934	need ...		266				s. eth.
1934M	wh. cr. .		indef (de-hyd.)	d	sl s	s	s. eth., bz., lgr.
1935	need. or sheafs		275				s. eth.
1936	wh leaf. or pl		subl 40(?), indef; (d)	d.	s	s	s. eth.
1937	col. sq. tab doub. refractive		169 (101) d	d.	s c, v s h	s	s. eth., all org. solv.
1938	lng. pointed doubly re-fracting pl		112 (104)		s	s	s. eth.
1939	wh. need		214 6 (d)	d	sl s	s	s. eth., bz.
1940	wh thick rect pl.		107 (74-5) d	d.	s	s	s. eth., dichlo-roethane
1940M	wh need. or pl		indef (d)	d	sl s	s	s. eth, bz.
1941	need		240				s. eth.
1942	col. oil	.		70-5	d		s. eth., bz.
1943	col oil . .			95-7	d		s. eth, bz.
1944	col. fum. liq	0.6961^{23}_{4}		95	v sl s	s	s eth.
1945	liq., 1.43207	$0.7600\frac{23.4}{4}$		119^{14}			s. eth.
1946	liq, $1.42445^{22.8}$	0.7380^{25}_{4}		188, 86^{20}			s. eth.
1947	col gas . .	1 9108 g/l	-161 5	-20	v sl s.	v s	v. s. eth.
1948	hex columns, d in air	. .	136	245-50. (203^{15})	i	d	s eth, bz.
1949	liq, $1.42354^{22.5}$	$0.7204\frac{24.7}{4}$		156 (60^{20})			s. eth.
1950							
1951	col hex. leaf f lgr., $[\alpha]$-44 2°D	1.011^{20}_{4}	210 5	subl	v sl s	v s	v. s. eth.; 25^{20} bz.
1952	col, 1.4630	0.985^{20}_{4}	27-8	114^{23}			. ...
1953	col hex leaf, $[\alpha]$ +37 44°$^{20}_{D}$ in al.	1.011^{20}_{4}	208	212 subl.	0 074^{25}	s	s. eth, lgr.; 22 2^{20} bz.
1954	col rhomb, 1.46635^{15}, liq $[\alpha]$ +44 45°$^{20}_{D}$	liq. 0.9855^{20}_{4}	20	223-4 (225 6)	v sl s	v s	s eth.
1955	col. hex. pl, $[\alpha]$ 37 74°$^{20}_{D}$ in al.	1.011^{20}_{4}	208 6	210^{760} subl	0 0740^{25}	s	v s eth; 22 2^{20} bz.
1956	col, 1.46635^{15}	0.9855^{20}_{4}	20	223 4			. .
1957							
1958							
1959	col cr, $[\alpha]$ +47 2°$^{20}_{D}$ in al		163	200 subl	v sl s.	v s	v s eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
1960	**Bornyl chloride**. . .	2-chlorocamphane (one form), pinene hydrochloride; artificial camphor	$C_{10}H_{17}Cl$	172 69
1961		See also *Isobornyl chloride*.		
1962	***l*-Bornylene**.......	*l*-1,7,7-trimethylbicyclo-[2,2,1]-2-heptene	$C_{10}H_{16}$ ..	136 23
1963	**Bornyl esters.**	See under *Borneol.*		
1964	**Boron.** (For other derivatives see under *Boric acid* and *Borine*)			
1965	——, **triethoxy-.**	See *Ethyl borate*		
1966	——, **trimethoxy-.**	See *Methyl borate*		
1967	——, **tripropoxy-.**	See *Propyl borate.*		
1968	**Brasilein.**	See *Brazilein*		
1969	**Brasilin.**	See *Brazilin*		
1970	**Brassidic acid, Brassic acid**	*trans*-13-docosenoic acid*, isoerucic acid, *trans*-erucic acid	$C_8H_{17}CH{\cdot}CHC_{11}H_{22}COOH$	338 56
1971	**Brassidic anhydride** .		$(C_{21}H_{41}CO)_2O$.	659 10
1972	**Brazileïn**....	brasilein	$C_{16}H_{12}O_5$.	284 26
1973	**Brazilin** . .	brasilin .	$C_{16}H_{14}O_5{\cdot}1\frac{1}{2}H_2O$	313 30
1974	**British gum.**	See *Dextrin.*		
1975	**Bromacetol.**	See *Propane, 2,2-dibromo-**		
1976	**Bromal**.......	2,2,2-tribromoethanal*, tribromoacetaldehyde, tribromoaldehyde	CBr_3CHO	280 78
1977	——, hydrate .	2,2,2-tribromo-1,1-ethanediol*, tribromoethylidene glycol	$CBr_3CH(OH)_2$.	298 79
1978	**Bromanilid.**	See *Acetanilide, p-bromo-.*		
1979	**Bromelia.**	See *Ether, ethyl 2-naphthyl*		
1980	**Bromine cyanide.**	See *Cyanogen bromide*		
	Bromo- See the parent compounds (e g , for bromoacetic acid see *Acetic acid, bromo-*)			
1981	**Bromoform**.......	tribromomethane	$CHBr_3$.	252 77
1982	——, **nitro-.**	See *Bromopicrin*		
1983	**Bromopicrin**	tribromonitromethane*; nitrobromoform	NO_2CBr_3	297 77
1984	**Brönner's acid.**	See 2-*Naphthylamine-6-sulfonic acid.*		
1985	**Brucine**	.	$C_{23}H_{26}N_2O_4{\cdot}4H_2O$.	466 52
1986	——, hydrochloride . . .	. .	$C_{23}H_{26}N_2O_4\ HCl$.	430 92
1987	——, nitrate....		$C_{23}H_{26}N_2O_4\ HNO_3\ 2H_2O$	493 51
1988	——, sulfate	.	$(C_{23}H_{26}N_2O_4)_2\ H_2SO_4\ 7H_2O$	1013 10
1989	**Bulbocapnine**.. . .		$C_{19}H_{19}NO_4$.	325 35
1990	**1,2-Butadiene***	methylallene	$CH_2{:}C{:}CHCH_3$	54 09
1990M	——, **3-methyl-**	*unsym*-dimethylallene...	$CH_2{:}C{:}C(CH_3)_2$	68 11
1991	**1,3-Butadiene***	bivinyl, erythrene; pyrrolylene; vinylethylene; divinyl, biethylene	$CH_2.CHCH{\cdot}CH_2$	54 09

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
1960	col. cr .		131-2 (128)	207 4	i	26 04	s eth.
1961							
1962	col. cr. f me al, $[\alpha]_D^{20}$ −22 27° in bz		113	146^{750}	i	s	s eth, tol, me al.
1963							
1964							
1965							
1966							
1967							
1968							
1969							
1970	col leaf f. al, 1 4317^{100}	0 $8585\frac{57}{4}$	61 5	282^{50}	0 74^{14}	v sl s c	s. eth.
1971	need	0 $835\frac{70}{4}$	64		i	sl s	s eth
1972	dk red rhomb leaf.				sl s h.	s.	s eth, alk.
1973	wh or pa yel rhomb need f al		250		sl s	s	s eth, alk.
1974							
1975							
1976	yel liq ..	2 30^{15}		174	d	s	s eth.
1977	col monocl pr	2 $566\frac{40}{4}$	53 5	d	s	s	s. eth.
1978							
1979							
1980							
1981	col liq or hex cr, 1 $5980^{19.0}$	2 $890\frac{20}{4}$	6 7	149 5	0 319^{80}	∞	∞ eth., s bz., chl, pet. eth. and oils
1982							
1983	pr, 1 5831^{13}	2 $811\frac{12}{4}$	10	127^{118}	i	s	s. eth.
1984							
1985	monocl pr f al $[\alpha]$ 119°D		$4H_2O$, 105, anh 178		0 1 c, 0 67^{100}	81 8^{25}	0 75 eth; 13 1^{25} chl; s. bz; i alk.
1986	wh. need .				s	s	. .
1987	wh pr .		anh 230 d		s	s	. . .
1988	lng need				s.	s	.
1989	rhomb pr f. eth, $[\alpha]$ +237 1°D		199		i	s	s eth., chl.
1990	col liq .			19	i	∞	∞ eth.
1990M	liq	0 $683\frac{20}{4}$	−120	40 5-41 5	..		....
1991	gas .	0 $650\frac{-6}{4}$	−113	−3	i.	v s	∞ eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
1992	**1, 3-Butadiene, 2-chloro-*.** See *Chloroprene.*			
1993	**——, 2,3-dimethyl-***	biisopropenyl	$CH_2{:}C(CH_3)$-$C(CH_3){:}CH_2$	82.14
1994	**——, 2-methyl-*.**	See *Isoprene*		
1995	**Butadiyne***	butadiine, biacetylene	$CH{:}CC{:}CH.$	50.06
1996	**Butanal*.**	See *Butyraldehyde*		
1997	**Butanamide*.**	See *Butyramide*		
1998	**Butane...**	*n*-butane, methylethylmethane	$CH_3(CH_2)_2CH_3$	58.12
1999	**——, 1-amino-.**	See *Butylamine (n)*		
2000	**——, 2-amino-.**	See *sec-Butylamine*		
2000H	**——, 2-amino-2,3-dimethyl-.** See *Propylamine α, α β-trimethyl-*			
2000R	**——, 1-amino-2-ethyl-.** See *Butylamine, β-ethyl-*			
2001	**——, 1-amino-3-methyl-.** See *Isoamylamine*			
2001F	**——, 3-amino-2-methyl-.** See *Propylamine α, β-dimethyl-.*			
2002	**——, 1-benzyloxy-.**	See *Ether, benzyl butyl.*		
2003	**——, 2,2-bis(ethylsulfonyl)-*.** See *Trional.*			
2004	**——, 1-bromo-*.**	See *Butyl bromide (n)*		
2005	**——, 2-bromo-*.**	See *sec-Butyl bromide*		
2006	**——, 1-bromo-2-methyl-*** (*d*)	*d-pri-act*-amyl bromide	$CH_3CH_2CH(CH_3)$-CH_2Br	151.06
2007	**——, 1-bromo-3-methyl-*.**	See *Isoamyl bromide.*		
2008	**——, 1-butoxy-*.**	See *Butyl ether*		
2009	**——, 1-butyldithio-*.**	See *Butyl disulfide*		
2009H	**——, 1-(butylsulfinyl)*-.** See *Butyl sulfoxide*			
2009R	**——, 1-(butylsulfonyl)-*.** See *Butyl sulfone*			
2010	**——, butylthio-*.**	See *Butyl sulfide (n)*		
2011	**——, 1-chloro-*.**	See *Butyl chloride (n).*		
2012	**——, 2-chloro-*.**	See *sec-Butyl chloride*		
2013	**——, 1-chloro-2-methyl-***	*pri-act*-amyl chloride	$CH_3CH_2CH(CH_3)$-CH_2Cl	106.60
2014	**——, 1-chloro-3-methyl-*.** See *Isoamyl chloride*			
2015	**——, 2-chloro-2-methyl-***	*tert*-amyl chloride	$CH_3CH_2CCl(CH_3)$-CH_3	106.60
2016	**——, 1,2,3,4-diepoxy-.**	See *i-Erythritol, anhydride*		
2017	**——, 1,4-dihydroxy-.**	See *1,4-Butanediol**		
2018	**——, 2,2-dimethyl-**	ethyltrimethylmethane, neohexane	$(CH_3)_3CCH_2CH_3$	86.17
2019	**——, 2,3-dimethyl-***	isopropyldimethylmethane, biisopropyl	$(CH_3)_2CHCH$-$(CH_3)_2$	86.17
2020	**——, 1-ethoxy-*.**	See *Ether, butyl ethyl*		
2021	**——, 1-ethoxy-3-methyl-*.** See *Ether, ethyl isoamyl*			
2021M	**——, 1-fluoro-*.**	See *Butyl fluoride (n).*		
2022	**——, 1-iodo-*.**	See *Butyl iodide*		
2023	**——, 2-iodo-*.**	See *sec-Butyl iodide.*		
2024	**——, 1-iodo-2-methyl-***	*pri-act*-amyl iodide	$CH_3CH_2CH(CH_3)$-CH_2I	198.06
2025	**——, 1-iodo-3-methyl-*.** See *Isoamyl iodide*			
2026	**——, 2-iodo-2-methyl-***	*tert*-amyl iodide	$CH_3CH_2CI(CH_3)$-CH_3	198.06
2027	**——, 1-methoxy-*.**	See *Ether, butyl methyl*		
2028	**——, 2-methyl-***	ethyldimethylmethane, isopentane	$(CH_3)_2CHCH_2CH_3$	72.15
2029	**——, 3-methyl-1-(γ-methylbutoxy)-*.** See *Isoamyl ether.*			
2030	**——, 2-methyl-1-(β-methylbutylthio)-*.** See *Sulfide, bis(β-methylbutyl)*			
2031	**——, 3-methyl-1-(γ-methylbutylthio)-*.** See *Isoamyl sulfide.*			
2032	**——, 3-methyl-1-phenoxy-.** See *Ether, isoamyl phenyl.*			
2033	**——, 2-methyl-2-phenyl-.** See *Benzene, tert-amyl-.*			
2034	**——, 3-methyl-1-phenyl-.** See *Benzene, isoamyl-.*			
2035	**——, 3-methyl-1-(2-propenoxy)-*.** See *Ether, allyl isoamyl.*			

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
1992							
1993	col liq, 1.437717	$0.7446\frac{0}{0}$, 0.727^{20}_{20}	-65	69.6			. .
1994							
1995	gas	2.233	36.4	10.3	460 cm³	s	v. s. eth
1996							
1997							
1998	col gas or hex	liq 0.60^{0}_{4}	135	-0.6 to -0.3	$15\frac{17}{772}$ cm³	1813^{17}_{775} cm³	$2980\frac{18}{773}$ cm³ eth
1999							
2000							
2000 H							
2000 R							
2001							
2001 F							
2002							
2003							
2004							
2005							
2006	liq	$1.221\frac{20}{4}$		120-1	i	s	s. eth.
2007							
2008							
2009							
2009 H							
2009 R							
2010							
2011							
2012							
2013	liq	$0.881\frac{18}{4}$		97-9	i	s	s. eth.
2014							
2015	liq, 1.407^{18}	0.871^{20}_{4}	73	86	i	s	s eth
2016							
2017							
2018	liq, 1.3675	$0.6487\frac{20}{4}$	-98.2	49.7	i	s	s. eth.
2019	liq, 1.3783	$0.668\frac{17}{4}$	-135.1	58.1	i	s	s. eth.
2020							
2021							
2021 M							
2022							
2023							
2024	liq, 1.4981^{16}.	1.524		148	i	s	s eth
2025							
2026	liq	1.497^{13}		125-8	i	∞	∞ eth
2027							
2028	col liq, 1.355	0.621^{19}	160.5	28 (27-31)	i.	∞	∞ eth.
2029							
2030							
2031							
2032							
2033							
2034							
2035							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
2036	**Butane, (α-methylpropoxy)-*.** See *sec-Butyl ether.*			
2037	**——, 1-nitro-*.**		$CH_3CH_2CH_2CH_2$-NO_2	103.12
2038	**——, 1-phenyl-.**	See *Benzene, butyl-.*		
2039	**——, 2-phenyl-.**	See *Benzene, sec-butyl-*		
2040	**——, 2,2,3,3-tetramethyl-***	*tert*-butyltrimethylmethane, bi-*tert*-butyl, hexamethylethane	$CH_3C(CH_3)_2$-$C(CH_3)_2CH_3$	114.23
2041	**——, 2,2,3-trimethyl-***	isopropyltrimethylmethane	$CH_3C(CH_3)_2$-$CH(CH_3)CH_3$	100.20
2042	**1-Butanearsonic acid**	*n*-butylarsonic acid	$CH_3(CH_2)_3$-$AsO(OH)_2$	182.04
2042M	**1-Butaneboronic acid, 3-methyl-.** See *Boric acid, isoamyl-.*			
2043	**Butanedial*.**	See *Succinaldehyde*		
2044	**Butanediamide*.**	See *Succinamide*		
2045	**——, 2-hydroxy-*.**	See *Malamide.*		
2046	**1,4-Butanediamine*.**	See *Putrescine*		
2047	**1,1-Butanedicarboxylic acid*.** See *Malonic acid, propyl-*			
2048	**1,2-Butanedicarboxylic acid.** See *Succinic acid, ethyl-*			
2049	**1,4-Butanedicarboxylic acid.** See *Adipic acid*			
2050	**2,3-Butanedicarboxylic acid, 2,3-dimethyl-.** See *Succinic acid, tetramethyl-.*			
2051	**Butanedinitrile*.**	See *Succinonitrile*		
2052	**Butanedioic acid*.**	See *Succinic acid*		
2053	**Butanedioic anhydride*.** See *Succinic anhydride*			
2054	**1,1-Butanediol, 2,2,3-trichloro-*.** See *Butyraldehyde, α, α, β-trichloro-,*			
2055	**1,2-Butanediol*.**	α-butylene glycol, ethylethylene glycol	$CH_3CH_2CH(OH)$-CH_2OH	90.12
2056	**——, 3-methyl-***	isopropylethylene glycol, α-isoamylene glycol	$(CH_3)_2CHCH$-$(OH)CH_2OH$	104.15
2057	**1,3-Butanediol***	β-butylene glycol, α-methyltrimethylene glycol	$CH_3CH(OH)CH_2$-CH_2OH	90.12
2058	**——, 3-methyl-***	γ-isoamylene glycol	$(CH_3)_2COHCH_2$-CH_2OH	104.15
2059	**1,4-Butanediol***	tetramethylene glycol, 1,4-dihydroxybutane	$CH_2OH(CH_2)_2$-CH_2OH	90.12
2060	**2,3-Butanediol***	pseudobutylene glycol, *sym*-dimethylethylene glycol	$CH_3CH(OH)CH$-$(OH)CH_3$	90.12
2061	**——, 2,3-dimethyl-*.**	See *Pinacol*		
2062	**——, 2,3-diphenyl-**	α, α'-dimethylhydrobenzoin, acetophenone pinacol	$CH_3COH(C_6H_5)$-$COH(C_6H_5)CH_3$	242.31
2063	**——, 2-methyl-***	trimethylethylene glycol, β-isoamylene glycol	$(CH_3)_2C(OH)CH$-$(OH)CH_3$	104.15
2064	**1,3-Butanedione, 1-phenyl-*.** See *Acetone, benzoyl-*			
2065	**2,3-Butanedione***	dimethylglyoxal, biacetyl, dimethyl diketone, diacetyl	$CH_3COCOCH_3$	86.09
2066	——, dioxime*.	See *Glyoxime, dimethyl-*		
2067	——, mono-oxime	biacetyl mono-oxime, α-isonitrosoethyl methyl ketone	$CH_3COC(NOH)$-CH_3	101.10
2068	**Butanedioyl chloride*.**	See *Succinyl chloride.*		
2069	**Butanenitrile*.**	See *Butyronitrile*		
2070	**——, 3-methyl-*.**	See *Isovaleronitrile*		
2071	**1,2,3,4-Butanetetrol***	(*anti*). See *i-Erythritol*		
2072	**1-Butanethiol***	butyl mercaptan	$CH_3(CH_2)_2CH_2SH$	90.18
2073	**——, 2-methyl-***	*pri-act*-amyl mercaptan	$CH_3CH_2CH(CH_3)$-CH_2SH	104.21
2074	**——, 3-methyl-***	isoamyl mercaptan	$(CH_3)_2CH(CH_2)_2$-SH	104.21
2075	**2-Butanethiol, 2-methyl-***	*tert*-amyl mercaptan	$CH_3CH_2C(CH_3)_2$ SH	104.21

*Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2036							
2037	liq			151–2	v. sl. s	∞	∞ eth.
2038							
2039							
2040	leaf f eth		104 (98–9)	106.8	i		s eth.
2041	col liq., 1.390	0.6900^{20}_{4}	25.0	80.9	i	s	s eth
2042			158.9		v s	s	s eth.
2042M							
2043							
2044							
2045							
2046							
2047							
2048							
2049							
2050							
2051							
2052							
2053							
2054	*hydrate*						
2055	liq	1.019^{0}_{4}		192	sl s	∞	
2056	liq	0.9987^{0}_{4}		206		s	s. eth
2057	visc liq	1.0259^{20}_{4}		204	s	s	i eth.
2058	thick syrup	0.9892^{20}_{4}		202–3	s	s	
2059	need or oil	1.020^{20}_{4}	16	230	∞	s	sl s eth.
2060	liq	1.048^{0}_{4}		184	∞	s	∞ eth
2061							
2062	need		121–2, 116–7		i	v s	v.s.eth, sl. s pet eth.
2063	thick oil	0.9893^{0}_{0}		177	∞	∞	∞ eth.
2064							
2065	grnsh yel liq, 1.39331^{18}	0.9904^{15}_{15}		88	25^{15}	∞	∞ eth.
2066							
2067	pr f chl, leaf. f w		74–5	186	sl s	v s	v s. eth, s. alk
2068							
2069							
2070							
2071							
2072	col. liq	0.858^{0}_{4}, 0.8365^{25}_{4}	−115.9	98	sl s.	v s	v s eth
2073	liq	0.8415^{23}_{4}		119–21			
2074	col. liq., 1.44118	0.835^{20}_{4}		119	i	∞	∞ eth
2075							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
2076	**1,2,3-Butanetricarboxylic acid, 1,2,3-dimethyl-*.** See *l-Camphoronic acid.*			
2077	**Butanimide*.**	See *Succinimide*		
2078	**Butanoic acid*.**	See *Butyric acid.*		
2079	**——, 3-methyl-*.**	See *Isovaleric acid.*		
2079M	**——, 3-oxo-*.**	See *Acetoacetic acid.*		
2080	**Butanoic anhydride*.**	See *Butyric anhydride.*		
2081	**1-Butanol*.**	See *Butyl alcohol (n).*		
2081M	**——, 2-amino-......**	....	$CH_3CH_2CH(NH_2)CH_2OH$	89.14
2082	**——, 2-ethyl-*.....**	3-methylolpentane; pseudohexyl alcohol	$(C_2H_5)_2CHCH_2OH$	102.17
2083	——, ——, acetate...	*β*-ethylbutyl acetate...	$(C_2H_5)_2CHCH_2OOCCH_3$	144.21
2084	**——, 2-methyl-*(*d*).**	*d-sec*-butylcarbinol; *d-pri-act*-amyl alcohol	$CH_3CH_2CH(CH_3)CH_2OH$	88.15
2085	**——, 3-methyl-*.**	See *Isoamyl alcohol.*		
2086	**——, 3-methyl-1-phenyl-***	isobutylphenylcarbinol .	$(CH_3)_2CHCH_2CHOHC_6H_5$	164.24
2086M	**——, 2-nitro-* ...**	....	$CH_3CH_2CH(NO_2)CH_2OH$	119.12
2086R	**——, 2-nitro-2-methylol-.** See *1,3-Propanediol 2-ethyl-2-nitro-*.*			
2087	**2-Butanol*.**	See *sec-Butyl alcohol*		
2088	**——, 2,3-dimethyl-***	isopropyldimethylcarbinol	$(CH_3)_2COHCH(CH_3)_2$	102.17
2089	**——, 3,3-dimethyl- .**	See *Pinacolyl alcohol*		
2090	**——, 2-methyl-*..**	dimethylethylcarbinol; *tert*-amyl alcohol	$CH_3CH_2C(CH_3)OHCH_3$	88.15
2091	**——, 3-methyl-*...**	methylisopropylcarbinol, *sec*-isoamyl alcohol	$(CH_3)_2CHCHOHCH_3$	88.15
2092	**——, 2,3,3-trimethyl-**	*tert*-butyldimethylcarbinol pentamethylethyl alcohol	$(CH_3)_3CC(CH_3)_2OH$	116.20
2093	**Butanolide.**	See *Butyrolactone.*		
2094	**1-Butanone, 3-methyl-1-phenyl-.** See *Isovalerophenone*			
2095	**2-Butanone*......**	ethyl methyl ketone	$CH_3COC_2H_5$	72.10
2096	——, oxime . .	methyl ethyl ketoxime	$CH_3C{:}NOH(C_2H_5)$	87.12
2097	**——, 3,3-dimethyl-*.**	See *Pinacolin.*		
2098	**——, 3,3-diphenyl-**	acetophenone pinacolin	$CH_3COC(C_6H_5)_2CH_3$	224.29
2098M	**——, 1-hydroxy-... .**	ethylketol	$CH_3CH_2COCH_2OH$	88.10
2099	**——, 3-hydroxy-*.**	See *Acetoin.*		
2100	**——, 3-methyl-*....**	isopropyl methyl ketone	$CH_3COCH(CH_3)_2$	86.13
2101	——, ——, oxime......	methyl isopropyl ketoxime	$CH_3C{:}NOHCH(CH_3)_2$	101.15
2102	**——, 1-phenyl-......**	benzyl ethyl ketone..	$C_2H_5COCH_2C_6H_5$	148.20
2103	**——, 4-phenyl-.....**	benzylacetone......	$C_6H_5CH_2CH_2COCH_3$	148.20
2105	**Butanoyl bromide*.**	See *Butyryl bromide.*		
2106	**Butanoyl chloride*.**	See *Butyryl chloride*		
2107	**——, 3-methyl-*.**	See *Isovaleryl chloride.*		
2108	**2-Butenal*.**	See *Crotonaldehyde.*		
2109	**——, 2-methyl-*.**	See *Tiglaldehyde.*		
2109M	**2-Butenamide*.**	See *Crotonamide.*		
2110	**1-Butene*.........**	*α*-butylene; ethylethylene.	$CH_3CH_2CH{:}CH_2$	56.10
2111	**——, 4-bromo-* ..**	*δ*-bromo-*α*-butylene; vinylethyl bromide	$CH_2BrCH_2CH{:}CH_2$	135.01

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2076							
2077							
2078							
2079							
2079M							
2080							
2081							
2081M	1.453^{20}.....	0.944	-2	178: $79\text{-}80^{10}$	∞		.. .
2082	col. liq., 1.421	$0.8328\frac{20}{20}$		149.5	0.63^{24}, 0.43^{20}	s	s eth
2083	col. liq., 1.410	$0.879\frac{20}{4}$	<-100	162.4	0.06	. .	.
2084	col. liq., [α] $-5.90°^{20}_{D}$	$0.816\frac{20}{4}$		128	sl. s.	∞	∞ eth.
2085							
2086	thick oil	$0.9537\frac{19}{4}$		$235\text{-}6^{746}$	i	s	s. eth.
2086M			-47 to -48	105^{10}	20^{20}		. .
2086R							
2087							
2088	col. liq. w. odor of camphor	0.8232^{19}_{4}	-14	120.1	v. sl. s.	s	∞ eth.
2089							
2090	col. liq., 1.4052	0.809	11.9	101.8	12.5, 14^{30}	∞	∞ eth.; s. bz., chl., glyc., oils
2091	col. liq.....	$0.819\frac{20}{4}$		114 (112)	sl. s.	∞	∞ eth.
2092	col. liq.; $+1H_2O$ need		17; frz. 15	131.2	i.	s.	s. eth.
2093							
2094							
2095	col. liq., $1.38071^{15.9}$	$0.805\frac{20}{4}$	-86.4	79.6	35.3^{10}, 19^{90}	∞	s. eth.
2096	col. liq., 1.4428	0.923^{20}_{4}	-29.5	152	10	∞	∞ eth.
2097							
2098	pr	..	41-1.5	310.1	i	s. c., v. s. h	v. s. eth., bz., chl.
2098M	1.4250^{21}....	1.020^{21}_{4}		51.5[illegible], 48[illegible]			.... .
2099							
2100	col. liq., 1.38788^{16}	$0.815\frac{16}{4}$	-92	93	v. sl. s.	∞	∞ eth.
2101	col. liq....			157-8	s	∞	∞ eth.
2102	col. liq....	$1.002\frac{0}{4}$		230.2	i.	∞	∞ eth.
2103	liq.	0.989^{23}_{17}		235, 115^{18}		s.	s. eth
2105							
2106							
2107							
2108							
2109							
2109M							
2110	gas	0.668^{0}_{4}	130	5	i.	v. s.	v. s. eth.
2111	.	1.33^{17}_{4}		165-6 (99)	.	s.	s eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2112	**1-Butene, 2,3-dimethyl-***	1-isopropyl-1-methylethylene	$CH_2{:}C(CH_3){-}CH(CH_3)_2$	84.16
2113	**——, 3,3-dimethyl-***	*tert*-butylethylene, pseudobutylethylene	$CH_2{:}CHC(CH_3)_3$	84.16
2114	**——, 2-ethyl-***	3-methylenepentane; *uns*-diethylethylene	$CH_2{:}C(C_2H_5){-}CH_2CH_3$	84.16
2115	**——, 2-ethyl-3-methyl-***	1-ethyl-1-isobutylethylene; 2-methyl-3-methylene-pentane*	$CH_2{:}C(C_2H_5){-}CH(CH_3)_2$	98.18
2116	**——, 2-methyl-***	*uns*-ethylmethylethylene	$CH_2{:}C(CH_3)CH_2{-}CH_3$	70.13
2117	**——, 3-methyl-***	isopropylethylene; α-isoamylene	$(CH_3)_2CHCH{:}CH_2$	70.13
2118	**2-Butene***	*sym*-dimethylethylene, β-butylene; pseudobutylene	$CH_3CH{:}CHCH_3$	56.10
2119	**——, 2,3-dimethyl-***	tetramethylethylene	$(CH_3)_2C{:}C(CH_3)_2$	84.16
2120	**——, 3-methyl-***	trimethylethylene, β-isoamylene	$(CH_3)_2C{:}CHCH_3$	70.13
2121	**3-Butene-1, 1-dicarboxylic acid.** See *Malonic acid, allyl-*.			
2122	***cis*-Butenedioic acid*.** See *Maleic acid*.			
2123	***trans*-Butenedioic acid*.** See *Fumaric acid*.			
2123M	**3-Butene-1,2-diol*.** See *Erythrol*			
2123N	**2-Butenenitrile*.** See *Crotononitrile*.			
2124	**3-Butenenitrile*.** See *Allyl cyanide*			
2125	**2-Butenoic acid, *cis*(?)-*.** See *Isocrotonic acid*.			
2126	**——, *trans*(?)-*.** See *Crotonic acid*.			
2127	**——, 2-methyl-*.** See *Tiglic acid*			
2128	**——, 4-oxo-4-phenyl-.** See *Acrylic acid, β-benzoyl*			
2129	**3-Butenoic acid***	vinylacetic acid, β-butenoic acid	$CH_2{:}CHCH_2COOH$	86.09
2130	**——, 2-hydroxy-4-phenyl-**	benzallactic acid, styrylglycolic acid	$C_6H_5CH{:}CHCH(OH)COOH$	178.18
2131	**——, 4-phenyl-**	β-benzalpropionic acid	$C_6H_5CH{:}CHCH_2COOH$	162.18
2132	**2-Buten-1-ol***	propenylcarbinol, crotyl alcohol, crotonyl alcohol, γ-methylallyl alcohol	$CH_3CH{:}CHCH_2OH$	72.10
2133	——, acetate	2-butenyl ethanoate*; crotyl acetate, crotonyl acetate	$CH_3COOC_4H_7$	114.14
2134	**3-Buten-1-ol***	allylcarbinol, 1-buten-4-ol	$CH_2{:}CHCH_2CH_2OH$	72.10
2135	**3-Buten-2-ol***	methylvinylcarbinol	$CH_2{:}CHCHOHCH_3$	72.10
2136	**3-Buten-2-one, 4-*p*-anisyl-.** See *3-Buten-2-one, 4-p-methoxyphenyl-*			
2137	**——, 4-(2-furyl)-*.** See *Acetone, furfurylidene-*			
2137M	**——, 4-*p*-methoxyphenyl-**	anisylideneacetone, *p*-methoxybenzylideneacetone	$CH_3OC_6H_4CH{:}CHCOCH_3$	176.21
2138	**——, 4-phenyl-*.** See *Acetone, benzylidene-*.			
2139	**——, 4-(2,6,6-trimethyl-1-cyclohexenyl)-.** See *β-Ionone*.			
2140	**——, 4-(2,6,6-trimethyl-2-cyclohexenyl)-.** See *α-Ionone*			
2141	**——, 4-(2,2,6-trimethyl-3-cyclohexenyl)-.** See *β-Irone*			
2142	**β-Butenonitrile.** See *Allyl cyanide*.			
2143	**3-Buten-1-yne***	vinylacetylene	$CH{:}CCH{:}CH_2$	52.07
2144	**Butesin**	butyl *p*-aminobenzoate	$H_2NC_6H_4COO(CH_2)_3CH_3$	193.24
2145	——, picrate		$(H_2NC_6H_4COOC_4H_9)_2C_6H_2(NO_2)_3OH$	615.50

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2112		0.6803^{20}_{4}		56.0–6.5			
2113		0.6549^{15}_{4}		41.2			.
2114		0.6914^{20}_{4}		66.2–6.7			
2115		0.7186^{20}_{4}		88.7–9.1			
2116	col. liq	.		31.0			.
2117	col. liq	0.648^{20}_{4}	-135	25 (21)	i	∞	∞ eth
2118	col. gas	0.635		(*cis*) 1 (*trans*) 2.5	i	v. s	v. s. eth., i. H_2SO_4
2119	liq, 1.4128	0.712^{20}_{4}		73			.
2120	col. inflam. liq	0.668^{13}	-124	38.4	v. sl. s	s	∞ eth
2121							
2122							
2123							
2123M							
2123X							
2124							
2125							
2126							
2127							
2128							
2129	col. liq, 1.4257^{15}	1.013^{15}_{15}	-39	163	s	∞	∞ eth.
2130	need. f. w	.	46	98	s. h		sl. s. eth.; i. bz., CS_2, lgr.
2131	need. f. w	....	88 (83–4)	302 sl. d	sl. s. h	v. s	v. s. eth.
2132	col. liq, 1.4240	0.8726^{0}_{4}, 0.854^{20}_{4}	<-30	118 (117–20)	16.6	∞	∞ eth.
2133	col. liq	0.934^{0}_{4}		129	sl. s	s	s. eth.
2134	col. liq, $1.4146^{17.5}$	0.864^{0}_{4}; 0.848^{17}_{0}		113	s	∞	∞ eth.
2135	col. liq			96.7			
2136							
2137							
2137M	leaf	.	72–4		i	v. s.	v. s. eth.
2138							
2139							
2140							
2141							
2142							
2143	col. liq	0.6867^{20}_{0}		5^{757}			
2144	wh. cr. powd		55.7	147^{2}	0.00014	s.	s. eth., bz., chl., dil. a.
2145	yel. amor. powd		109-10		0.07	s.	s. eth., bz., chl.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
2146	**Butine.**	See *Butyne**.		
	Butyl-. For butyl derivatives see the parent compounds (e g , for butylbenzene see			
2147	**Butyl acetate, α,γ-dimethyl-.**	See 2-*Pentanol, 4-methyl-*, acetate*		
2148	**——, β-ethyl-.**	See 1-*Butanol, 2-ethyl-*, acetate*		
2149	**Butyl alcohol (*n*)** .	1-butanol*, propylcarbinol	$CH_3(CH_2)_2CH_2OH$	74.12
2150	***sec*-Butyl alcohol** . . .	2-butanol*; ethylmethylcarbinol	$CH_3CH_2CHOH\text{-}CH_3$	74.12
2151	***tert*-Butyl alcohol** .	2-methyl-2-propanol*; trimethylcarbinol	$(CH_3)_3COH$	74.12
2152	**——, trichloro-.**	See *Chloretone.*		
2153	**Butylamine (*n*)**	1-aminobutane	$CH_3(CH_2)_2CH_2\text{-}NH_2$	73.14
2153H	**——, *N*-ethyl-**		$CH_3(CH_2)_3NHC_2H_5$	101.19
2153R	**——, β-ethyl-**	1-amino-2-ethyl-*n*-butane	$(C_2H_5)_2CHCH_2\text{-}NH_2$	101.19
2154	**——, *N*-methyl-**		$CH_3NHC_4H_9$	87.16
2155	**——, α-methyl-**	methylpropylcarbinylamine, *sec-n*-amylamine, 2-aminopentane	$CH_3(CH_2)_2\text{-}CH(CH_3)NH_2$	87.16
2156	**——, γ-methyl-.**	See *Isoamylamine.*		
2157	***sec*-Butylamine**	(α-methylpropyl)amine, 2-aminobutane	$CH_3CH(NH_2)\text{-}CH_2CH_3$	73.14
2157M	**——, *N*-ethyl-**		$CH_3CH_2CH(CH_3)\text{-}NHC_2H_5$	101.19
2158	***tert*-Butylamine**	α α-dimethylethyl)amine, trimethylcarbinylamine	$(CH_3)_3CNH_2$	73.14
2159	***n*-Butylarsonic acid.**	See 1-*Butanearsonic acid*		
2160	**Butyl bromide (*n*)**	1-bromobutane*	$CH_3(CH_2)_2CH_2Br$	137.03
2161	***sec*-Butyl bromide**	2-bromobutane*, methylethylbromomethane	$C_2H_5CH(CH_3)Br$	137.03
2162	***tert*-Butyl bromide**	2-bromo-2-methylpropane*, trimethylbromomethane	$(CH_3)_3CBr$	137.03
2163	**Butyl carbitol.**	See *Diethylene glycol monobutyl ether.*		
2164	**Butyl cellosolve.**	See *Ethanol, 2-butoxy-**		
2165	**Butyl chloral.**	See *Butyraldehyde, α, α, β-trichloro-*		
2166	**Butyl chloride (*n*)**	1-chlorobutane*	$CH_3(CH_2)_2CH_2Cl$	92.57
2167	***sec*-Butyl chloride**	2-chlorobutane*, methylethylchloromethane	$C_2H_5CH(CH_3)Cl$	92.57
2168	***tert*-Butyl chloride** .	2-chloro-2-methylpropane*, trimethylchloromethane	$(CH_3)_3CCl$	92.57
2169	**Butyl cyanide (*n*).**	See *Valeronitrile*		
2170	***sec*-Butyl cyanide.**	See *Butyronitrile, α-methyl-.*		
2171	***tert*-Butyl cyanide.**	See *Propionitrile, α, α-dimethyl-*		
2172	**Butyl disulfide (*n*)** . .	1-butyldithiobutane* .	$[CH_3(CH_2)_3]_2S_2$	178.35
2173	**α-Butylene.**	See 1-*Butene**.		
2174	**β-Butylene.**	See 2-*Butene**		
2175	**γ-Butylene.**	See *Propene, 2-methyl-**.		
2176	**α-Butylene glycol.**	See 1, 2-*Butanediol**.		
2177	**β-Butylene glycol.**	See 1,3-*Butanediol**.		

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2146							
	Benzene, butyl-)	For butyl	esters of or	ganic acids s	ee the ac	ids.	
2147							
2148							
2149	col liq, 1.39931	0.80978^{20}_{4}	-89.2 to -89.8 (-79.9)	117.71	7.9^{20}	∞	∞ eth.
2150	col liq, 1.397	0.808^{20}_{4}	-89	99.5-100	12.5^{20}	∞	∞ eth.
2151	col liq or rhomb pr or pl., 1.38779	0.7887^{20}_{4}	25.5	82.8	∞	∞	∞ eth
2152							
2153	col. liq, 1.401	0.7401^{20}_{4}	50.5	77.8 (76-8)	∞	s	s eth
2153H				108-109			
2153R				125			
2154	col liq, $1.40180^{18.1}$	0.737^{20}_{4}		91			
2155	col liq	0.73839^{20}_{0}		92	∞	∞	∞ eth.
2156							
2157	col liq, $1.39501^{16.7}$ $[\alpha]$ 7.4^{20}_{D}	0.724^{20}_{4} (0.718^{20}_{4})	104.5	63	∞	∞	∞ eth
2157M	.	0.7358^{20}_{0}		$97-98^{741}$			
2158	col liq, 1.37940^{18}	0.696^{20}_{4}	67.5	46.4 (43.8)	∞	∞	∞ eth
2159							
2160	col liq, 1.4398	1.296^{20}_{4}	112.1	101.6	i	∞	∞ eth.
2161	col liq, 1.4344^{25}	1.2580^{20}_{4}		91.3	i		
2162	col liq, 1.428	1.222^{21}_{4}	20	73.3	i		
2163							
2164							
2165							
2166	col. liq, 1.4015	0.884 0.9074^{0}_{4}	123.1	78	$0.066^{12.5}$	∞	∞ eth.
2167	col liq, 1.3953^{25}	0.8707^{20}_{4}	131.3	68	v. sl s	∞	∞ eth.
2168	col liq, 1.38686^{18}	0.847^{15}_{4}	28.5	51-2	v. sl s	∞	∞ eth.
2169							
2170							
2171							
2172				100.3^{15}	i	∞	∞ eth.
2173							
2174							
2175							
2176							
2177							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
2178	**Butyl ether** (*n*) .	1-butoxybutane*, di-*n*-butyl ether	$CH_3(CH_2)_3O(CH_2)_3CH_3$	130 23
2179	**sec-Butyl ether**.	2-(α-methylpropoxy)butane*, di-*sec*-butyl ether	$[CH_3CH_2CH(CH_3)]_2O$	130 23
2179M	**Butyl fluoride** (*n*)	1-fluorobutane*	$CH_3(CH_2)_3F$	76 11
2180	**Butyl hydrogen sulfate**.	See *Butylsulfuric acid*		
2181	**Butyl iodide** (*n*)	1-iodobutane*	$CH_3(CH_2)_2CH_2I$.	184 03
2182	**sec-Butyl iodide**	2-iodobutane*, methylethyliodomethane	$C_2H_5CH(CH_3)I$	184 03
2183	***tert*-Butyl iodide**	2-iodo-2-methylpropane*, trimethyliodomethane	$(CH_3)_3CI$	184 03
2184	**Butyl isocyanide** (*n*)	butylcarbylamine*	$CH_3(CH_2)_3NC$	83 13
2185	**Butyl isocyanide, γ-methyl-**.	See *Isoamyl isocyanide*		
2186	***tert*-Butyl isocyanide**	(α, α-dimethylethyl)carbylamine*	$(CH_3)_3CNC$ . . .	83 13
2186M	***n*-Butyl ketone.**	See 5-*Nonanone**.		
2187	**Butyl mercaptan** (*n*).	See 1-*Butanethiol**.		•
2187M	***n*-Butylmercuric chloride.**	See *Mercury chloride, n-butyl-*		
2188	**Butyl mustard oils.**	See the butyl esters under *Isothiocyanic acid*		
2189	**Butyl nitrate*** (*n*)		$CH_3(CH_2)_3ONO_2$	119 12
2190	**sec-Butyl nitrate**	α-methylpropyl nitrate*	$C_2H_5CH(CH_3)ONO_2$	119 12
2191	**Butyl nitrite*** (*n*)		$CH_3(CH_2)_3ONO$	103 12
2192	**sec-Butyl nitrite**	α-methylpropyl nitrite*	$C_2H_5CH(CH_3)ONO$	103 12
2193	***tert*-Butyl nitrite**	α, α-dimethylethyl nitrite*	$(CH_3)_3CONO$	103 12
2194	**Butyl sulfate** (*n*)	di-*n*-butyl sulfate	$(CH_3CH_2CH_2CH_2)_2SO_4$	210 29
2195	**Butyl sulfide** (*n*)	dibutyl sulfide; butylthiobutane*	$(CH_3CH_2CH_2CH_2)_2S$	146 29
2196	**sec-Butyl sulfide**	di-*sec*-butyl sulfide, 1-methyl-1-(α-methylpropylthio)propane*	$[C_2H_5CH(CH_3)]_2S$	146 29
2196H	**Butyl sulfone** .	1-(butylsulfonyl)butane*, di-*n*-butyl sulfone	$[CH_3(CH_2)_3]_2SO_2$	178 29
2196R	**Butyl sulfoxide**	1-(butylsulfinyl)butane*, di-*n*-butyl sulfoxide	$[CH_3(CH_2)_3]_2SO$	162 29
2197	**Butylsulfuric acid** (*n*)	butyl hydrogen sulfate	$C_4H_9OSO_2OH$	154 18
2198	**1-Butyne*** . .	1-butine, ethylacetylene	$CH{:}CCH_2CH_3$	54 09
2199	——, **3-methyl-***	isopropylacetylene	$(CH_3)_2CHC{:}CH$	68 1[illegible]
2200	**1-Butyne, 1-phenyl-**.	See *Benzene*, 1-*butynyl*-.		
2201	**2-Butyne***	2-butine, dimethylacetylene, crotonylene	$CH_3C{:}CCH_3$	54 09
2202	**Butynedioic acid***.	See *Acetylenedicarboxylic acid*		
2203	**2-Butynoic acid***.	See *Tetrolic acid*.		
2204	**Butyraldehyde** .	butanal*, butyric aldehyde	$CH_3(CH_2)_2CHO$	72 10
2205	——, oxime	butanal oxime*; butyraldoxime	$CH_3(CH_2)_2CH.NOH$	87 12
2206	——, phenylhydrazone	*N*-butylidene-*N′*-phenylhydrazine	$CH_3(CH_2)_2CH{:}NNHC_6H_5$	162 23

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2178	col. liq	$0.7841\frac{0}{4}$; $0.769\frac{20}{20}$	-95.2 (-98)	142	sl. s.	∞	∞ eth
2179		$0.756\frac{21}{4}$		121	sl. s	∞	∞ eth.
2179M	col liq, 1.3419^{15}	0.7761		31.95	i.	v. s	...
2180							
2181	liq, 1.50006	$1.617\frac{20}{4}$	-103.5	131	$0.0202^{17.5}$	∞	∞ eth
2182	col liq	$1.595\frac{20}{4}$	-104.0	117.5 (119-22)	i	s.	∞ eth.
2183	liq	$1.571\frac{0}{4}$	-33.65	100 d	i, d	∞	∞ eth.
2184	liq			118	i	∞	∞ eth.
2185							
2186	lt oil			$91^{37.5}$		s	..
2186M							
2187							
2187M							
2188							
2189	liq, $1.40130^{23.2}$	$1.048\frac{0}{4}$		136	i	s	s. eth.
2190	liq	$1.0382\frac{0}{4}$		124		∞	∞ eth.
2191	liq	$0.9114\frac{0}{4}$		75 (77-9)		∞	∞ eth.
2192	liq	$0.8981\frac{0}{4}$		68		∞	∞ eth.
2193	lt yel liq	$0.8941\frac{0}{4}$		63	sl s	v s	v. s eth ; s. chl., CS_2
2194	col liq, 1.4210^{25}	$1.0591\frac{25}{25}$		97.4^{5}	i		..
2195	liq	$0.852\frac{0}{4}$; $0.839\frac{16}{0}$	-79.7	182 (186.9)	i	v s	v s eth.
2196	liq	$0.8317\frac{23}{4}$		165	i.	v. s	v s eth.
2196H	pl		43		i	s	s. eth.
2196R	need		32	d	i.	s.	s. eth.
2197	syrup			d	v s	s.	s. eth.
2198	col liq, 1.3962	$0.668\frac{0}{4}$	-130	8.6	i	s	s. eth.
2199	col liq	$0.6854\frac{0}{4}$		29.3	i	∞	∞ eth.
2200							
2201	liq, 1.3893^{25}.	0.688^{25}		27.2 (28.9)	i	s.	s. eth.
2202							
2203							
2204	col liq, 1.38433	$0.817\frac{20}{4}$	-99.0	75.7	3.7	∞	∞ eth.
2205	col liq	$0.923\frac{20}{4}$	-29.5	152^{715}	10.8	∞	∞ eth.
2206							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
2207	**Butyraldehyde**, sodium bisulfite compound	.	$C_3H_7CHOHSO_3Na$	176.17
2208	—, ***α*-ethyl-** . .	2-ethylbutanal*	$CH_3CH_2CH(C_2H_5)CHO$	100.16
2209	—, ***β*-hydroxy-.**	See *Aldol.*		
2210	—, ***β*-methyl-.**	See *Isovaleraldehyde*		
2211	—, ***α*,*α*,*β*-trichloro-**	2,2,3-trichlorobutanal*; butyl chloral	$CH_3CHClCCl_2CHO$	175.45
2212	—, —, hydrate	2,2,3-trichloro-1,1-butanediol*; butyl chloral hydrate	$CH_3CHClCCl_2CH(OH)_2$	193.47
2213	**Butyraldoxime.**	See *Butyraldehyde, oxime*		
2214	**Butyramide**	butanamide*, butyric amide	$CH_3CH_2CH_2CONH_2$	87.12
2215	—, ***β*-bromo-*γ*-oxo-*N*-phenyl-.** See *Acetoacetanilide, α-bromo-.*			
2216	—, ***β*-methyl-.**	See *Isovaleramide*		
2217	—, ***N*-phenyl-.**	See *Butyranilide*		
2218	**Butyranilide** .	*N*-phenylbutyramide	$CH_3(CH_2)_2CONHC_6H_5$	163.21
2219	—, ***β*-keto-.**	See *Acetoacetanilide*		
2220	**Butyric acid**	butanoic acid*, ethylacetic acid	$CH_3CH_2CH_2COOH$	88.10
2221	—, allyl ester.	allyl butyrate; 2-propenyl butanoate*	$C_3H_7COOCH_2CH:CH_2$	128.17
2222	—, amyl ester	amyl butyrate, pentyl butanoate*	$C_3H_7COO(CH_2)_4CH_3$	158.24
2223	—, benzyl ester .	.	$CH_3(CH_2)_2CO_2CH_2C_6H_5$	178.22
2224	—, butyl ester	butyl butyrate, butyl butanoate*	$CH_3CH_2CH_2COOC_4H_9$	144.21
2225	—, ethyl ester .	ethyl butyrate, ethyl butanoate*	$CH_3CH_2CH_2COOC_2H_5$	116.16
2226	—, ethylene ester.	See *Glycol, dibutyrate*		
2227	—, furfuryl ester	See *Furfuryl alcohol, butyrate*		
2228	—, geranyl ester	See *Geraniol, butyrate.*		
2229	—, glyceryl ester	See *Glycerol, tributyrate*		
2230	—, isoamyl ester .	*γ*-methylbutyl butanoate*	$CH_3(CH_2)_2COOC_5H_{11}$	158.24
2231	—, isobutyl ester	*β*-methylpropyl butanoate*	$CH_3(CH_2)_2COOCH_2CH(CH_3)_2$	144.21
2232	—, methyl ester	methyl *n*-butyrate.	$CH_3CH_2CH_2COOCH_3$	102.13
2233	—, *α*-methylisoamyl ester	See *2-Pentanol, 4-methyl- butyrate.*		
2234	—, *p*-phenylphenacyl ester		$CH_3(CH_2)_2COOCH_2COC_6H_4C_6H_5$	282.33
2235	—, propyl ester. .	*n*-propyl butyrate	$CH_3CH_2CH_2COOC_3H_7$	130.18
2236	—, piperazinium salt	.. .	$C_4H_{10}N_2 \cdot 2C_3H_7COOH$	262.35
2237	—, ***α*-amino-** ...	2-aminobutanoic acid*	$CH_3CH_2CH(NH_2)COOH$	103.12
2238	—, ***β*-amino-**	3-aminobutanoic acid*	$CH_3CH(NH_2)CH_2COOH$	103.12
2239	—, ***γ*-amino-**	4-aminobutanoic acid*, piperidic acid	$NH_2CH_2CH_2CH_2COOH$	103.12
2240	—, ***α*-amino-*α*-methyl-.** See *Isovaline*			
2241	—, ***α*-amino-*γ*-methylmercapto-.** See *Methionine*			
2242	—, ***α*-bromo-** .	2-bromobutanoic acid*	$CH_3CH_2CHBrCOOH$	167.01

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2207	leaf		d		v. s.	sl. s.	i. eth.
2208	col. liq.	0.814^{20}_{4}		116-7	sl. s.	∞	∞ eth.
2209							
2210							
2211	col. oily liq., 1.47554	1.3956^{20}_{4}		$164\text{-}5^{760}$	s.	s.	s. eth.
2212	rhomb. leaf f. w.	1.693^{20}_{4}	78	d.	sl. s.	v. s.	s. eth.
2213							
2214	rhomb. f. bz.	1.032^{20}_{4}	116 (108-10)	216	16.28^{15}	s.	sl. s. eth.
2215							
2216							
2217							
2218	monocl. leaf	1.134^{20}_{4}	91-2	189^{15}	i.	v. s.	v. s. eth.
2219							
2220	col. liq., 1.39906	0.9587^{20}_{4}	-7.9, frz. 19	163.5^{767}	$5.62^{-1.1}$	∞	∞ eth.
2221	liq.			143	i.	∞	∞ eth.
2222	liq., 1.4110	0.8713^{10}_{4}	-73.2	185	0.054^{50}	v. s.	v. s. eth.
2223		$1.016^{17.5}$		240	i.	v. s.	v. s. eth.
2224	col. liq., 1.4049	0.8721^{20}_{20}	-91.5	166.4	sl. s.	∞	∞ eth.
2225	col. liq., 1.39302^{18}	0.879^{20}_{4}	-93.3	121.3 (119-21)	0.68^{20}	s.	s. eth.
2226							
2227							
2228							
2229							
2230	col. liq.	0.882^{0}_{4}, 0.860^{15}_{4}	73.2	159.79 (184.8)	0.054^{50}	v. s.	v. s. eth.
2231	col. liq., 1.4035	0.8606^{25}_{4}		156.9	v. sl. s.	∞	∞ eth.
2232	col. liq., 1.3879	0.808	< 95	102.3	1.56^{21}	∞	∞ eth.
2233							
2234			97				. . .
2235	col. liq., 1.4095	0.879^{15}_{4}, 0.8710^{2}_{4}	95.2	143	0.167^{17}	∞	∞ eth.
2236	wh. cr.		89.5-90		s.	s.	i. eth.; s. h. dioxane
2237	col. leaf		d. 285	subl.	28	0.182^{78}	i. eth.
2238	need.		184		100	i.	i. eth.
2239	leaf or need. f. dil. al.		193 (183.4, 202 d.)		v. s.	i.	i. eth., bz.
2240							
2241							
2242	col. oily liq.	1.567^{20}_{20}	4	212-7 d., $181\text{-}2^{250}$	6.7 c.	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2243	**Butyric acid, α-bromo-**, ethyl ester	ethyl 2-bromobutanoate*	$CH_3CH_2CHBrCOOC_2H_5$	195.07
2244	——, **α,β-dibromo-**	2,3-dibromobutanoic acid*	$CH_3CHBrCHBrCOOH$	245.92
2245	——, **α,α-dimethyl-**	2,2-dimethylbutanoic acid*; ethyldimethylacetic acid	$CH_3CH_2C(CH_3)_2COOH$	116.16
2246	——, **α,β-dimethyl-**	2,3-dimethylbutanoic acid*; isopropylmethylacetic acid	$CH_3CH(CH_3)CH(CH_3)COOH$	116.16
2247	——, **α-ethyl-**. .	2-ethylbutanoic acid*, 3-pentane carboxylic acid, diethylacetic acid	$(C_2H_5)_2CHCOOH$	116.16
2248	——, **α-ethyl-α-methyl-**	diethylmethylacetic acid	$CH_3CH_2C(C_2H_5)(CH_3)COOH$	130.18
2249	——, **α-hydroxy-**	2-hydroxybutanoic acid*	$CH_3CH_2CHOHCOOH$	104.10
2250	——, **β-hydroxy-**	3-hydroxybutanoic acid*	$CH_3CHOHCH_2COOH$	104.10
2251	——, **γ-hydroxy-**	4-hydroxybutanoic acid*	$CH_2OHCH_2CH_2COOH$	104.10
2252	——, **γ-hydroxy-**, lactone	See *Butyrolactone*		
2253	——, **α-isonitroso-**.	See *Butyric acid, α-oxo-, oxime*		
2254	——, **α-keto-**.	See *Butyric acid, α-oxo-*		
2256	——, **γ-keto-γ-phenyl-**.	See *Propionic acid, β-benzoyl-*		
2257	——, **α-methyl-**	2-methylbutanoic acid*, ethylmethylacetic acid, active valeric acid	$CH_3CH_2CH(CH_3)COOH$	102.13
2257M	——, **α-oxo-**	2-oxobutanoic acid*, α-ketobutyric acid	$CH_3CH_2COCOOH$	102.09
2257R	—— ——, oxime	α-isonitrosobutyric acid	$C_2H_5C(NOH)COOH$	117.10
2258	**Butyric aldehyde.**	See *Butyraldehyde*		
2259	**Butyric amide.**	See *Butyramide*		
2260	**Butyric anhydride**	butanoic anhydride*	$(CH_3CH_2CH_2CO)_2O$	158.19
2261	**Butyrin.**	See *Glycerol, tributyrate.*		
2262	**Butyrolactone**	4-hydroxybutanoic acid lactone*, γ-hydroxybutyric acid lactone, butanolide	$CH_2CH_2CH_2COO$	86.09
2263	**2-Butyronaphthone, 1-hydroxy-**	1-hydroxy-2-naphthyl propyl ketone, 2-butyryl-1-naphthol	$CH_3(CH_2)_2COC_{10}H_6OH$	214.25
2264	**Butyrone.**	See *4-Heptanone**		
2266	**Butyronitrile**	butanenitrile*, *n*-propyl cyanide	$CH_3(CH_2)_2CN$	69.10
2267	——, **β,γ-epoxy-**.	See *Epicyanohydrin*		
2268	——, **α-ethyl-**	3-cyanopentane, 2-ethylbutanenitrile*; diethylacetonitrile	$(C_2H_5)_2CHCN$	97.16
2269	——, **α-methyl-**	2-methylbutanenitrile*, *sec*-butyl cyanide, methylethylacetonitrile	$CH_3CH_2CH(CH_3)CN$	83.13
2270	**Butyrophenone**	butyrylbenzene, phenyl propyl ketone	$CH_3CH_2CH_2COC_6H_5$	148.20
2271	**Butyryl bromide**	butanoyl bromide*	$CH_3(CH_2)_2COBr$	151.01
2272	**Butyryl chloride**	butanoyl chloride*	$CH_3(CH_2)_2COCl$	106.55
2273	**C acid.**	See *2-Naphthylamine-4, 8-disulfonic acid*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2243	col. liq	$1.321\frac{25}{4}$		179 d (58–62[10])	i	s.	s. eth.
2244	(1) long need f eth.		87		sl s	v s.	v. s eth.
	(2) sm. need f lgr	.	59		sl s	v. s.	v. s. eth.
2245	col liq		-14	187	v sl s	s.	s. eth
2246	liq	$0.928\frac{15}{4}$	....	189–91	s	s.	s. eth.
2247	col liq, 1.4178[10]	$0.9195\frac{18}{4}$, $0.9331\frac{10}{4}$	<-15	190 (195–7)	sl s	∞	∞ eth.
2248	arom oil		<-20	203–4	i	s	.
2249	col hyg cr		42.5	260 d, subl 60–70	s	s.	s. eth.
2250	monocl, syrup		48–50	130[12]	v s	v s.	v s eth.; i bz
2251	liq		-17	sl d ord temp.			
2252							
2253							
2254							
2256							
2257	col liq, 1.4051	$0.941\frac{20}{4}$	<-80	174	sl s.	∞	∞ eth
2257M	hyg pl or oil	$1.200\frac{17}{4}$	32	85[21]	v s	v s	sl s eth.
2257R	need f w	.....	151 (169–70)		v sl s.	v s.	v. sl. s. eth.
2258							
2259							
2260	col liq	$0.9946\frac{20}{4}$	-75.0 (-56.1)	198	d	d.	∞ eth.
2261							
2262	oil	$1.1286\frac{15}{0}$		206	∞	s.	s. eth.
2263	yel-grn need		78		i	s	s. eth.
2264							
2266	col liq, 1.3816[24]	0.796[15]	-112.6	118	sl s	∞	∞ eth.
2267							
2268	oil			144–6		∞	∞ eth.
2269	liq	$0.8061\frac{0}{4}$		125		s.	s. eth.
2270	col liq, 1.52016[18.25]	$0.988\frac{20}{4}$	11	232.3	i	∞	∞ eth.
2271	liq	$1.4162\frac{17}{4}$	.	128	..		..
2272	col liq, 1.41209	$1.028\frac{20}{4}$	-89.0	102 (99–102)	d.	d.	∞ eth.
2273							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt
2274	**Cacodyl**	tetramethylbiarsine; diarsenic tetramethyl, arsenic dimethyl	$(CH_3)_2AsAs(CH_3)_2$	209 96
2275	**——, ethyl-.**	See *Biarsine, tetraethyl-*.		
2276	**Cacodyl chloride**	dimethylarsenic monochloride, chlorodimethylarsine	$(CH_3)_2AsCl$	140 44
2277	**Cacodyl hydride.**	See *Arsine, dimethyl-*.		
2278	**Cacodylic acid**	dimethylarsinic acid, alkargen	$(CH_3)_2AsOOH$	137 99
2279	**Cacodyl oxide**	bisdimethylarsenic oxide; alkarsin, alkarsine	$[(CH_3)_2As]_2O$	225 96
2280	**Cacodyl sulfide**	bisdimethylarsenic sulfide	$[(CH_3)_2As]_2S$	242 02
2281	**Cacodyl trichloride**	dimethylarsenic trichloride	$(CH_3)_2AsCl_3$	211 35
2282	**Cadaverine**	1,5-pentanediamine*; pentamethylenediamine	$H_2N(CH_2)_5NH_2$	102 18
2283	**Cadmium, diethyl-***	cadmium ethyl	$(C_2H_5)_2Cd$	170 53
2284	**——, dimethyl-***		$(CH_3)_2Cd$	142 48
2285	**Caffeic acid**	3,4-dihydroxycinnamic acid	$(HO)_2C_6H_3CH$ CHCOOH	180 15
2286	**Caffeine**	1,3,7-trimethylxanthine; theine	$C_8H_{10}N_4O_2$	194 19
2287	——, benzoate		$C_8H_{10}N_4O_2 \cdot C_7H_6O_2$	316 31
2288	——, citrate		$C_8H_{10}N_4O_2\ C_6H_8O_7$	386 32
2289	——, hydriodide diiodide		$C_8H_{10}N_4O_2\ HI\ I_2 \cdot 1\frac{1}{2}H_2O$	602 99
2290	——, hydrobromide		$C_8H_{10}N_4O_2\ HBr \cdot 2H_2O$	311 15
2291	——, hydrochloride		$C_8H_{10}N_4O_2\ HCl\ 2H_2O$	266 69
2292	——, isovalerate		$C_8H_{10}N_4O_2 \cdot C_5H_{10}O_2$	296 32
2293	——, mercurichloride		$C_8H_{10}N_4O_2\ HgCl_2$	465 72
2294	——, salicylate		$C_8H_{10}N_4O_2\ C_7H_6O_3$	332 31
2295	——, sulfate		$C_8H_{10}N_4O_2\ H_2SO_4$	292 27
2296	**Cajeputole.**	See *Cineole*		
2296M	**Calciferol**	vitamin D_2, irradiated ergosterol	$C_{28}H_{43}OH$	396 64
2296T	**Calcium pantothenate**		$[C_9H_{16}NO_5]_2Ca$	476 54
2297	**Camphane**	1,7,7-trimethylnorcamphane, hydrocamphene; 1,7,7-trimethylbicyclo(2,2,1)heptane	$C_{10}H_{18}$	138 25
2298	**——, 2-chloro-.**	See *Bornyl chloride, Isobornyl chloride*		
2299	**2-Camphanol.**	See *Borneol*		
2300	**2-Camphanone.**	See *Camphor*		
2301	***dl*-Camphene**	*dl*-2,2-dimethyl-3-methylenenorcamphane	$C_{10}H_{16}$	136 23
2302	***d* or *l*-Camphene**		$C_{10}H_{16}$	136 23
2303	**α-Camphol.**	See *Borneol*.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2274	col oil	>1	-6	170	sl s.	s	s. eth.
2275							
2276	col liq. .	>1	<-45	106 5	i	∞	i. eth.
2277							
2278	col. tricl		200	. .	83^{22}	$28\ 5^{15}$ 90%	i. eth.
2279	col. liq. .	$1\ 486^{15}$	-25	149-51	sl. s	s	s. eth.
2280	oil .		<-40 d.	211	sl s.	s	s eth.
2281	cr. f. eth .	.	d. 50	.. .	d	d	s. eth., CS_2
2282	syrupy fum. liq	$0\ 9174\frac{0}{4}$	9	178-80	s	s.	sl. s. eth.
2283	col liq	$1\ 653\frac{22}{4}$	-21	$64^{19.5}$			∞ eth.
2284	col liq	$1\ 9846^{17.9}$	-4 5	$105\ 5^{7.8}$	d		s eth.
2285	yel. monocl f w		195	d	s	v s	sl s eth.
2286	wh need f al, cr ($+1H_2O$) f w	$1\ 23\frac{19}{4}$	anh 235-7	subl 180	$1\ 35^{16}$ $45\ 5^{65}$	$2\ 3^{16}$ 85%	$0\ 044^{16}$ eth.; 14 2 chl, s acet, bz.
2287	wh cr				s	s	
2288	monocl				s	s d.	
2289	dk grn pr		182 4		i	s	sl s chl
2290	col trans cr				s	s d	
2291	monocl. col				s d	s d	
2292	fatty glist need				s		
2293	col need		246		s		
2294	cr masses				s	s	
2295	wh need. .				s d	s d	
2296							
2296M	col lng pr		115-17		i	s	v. s. eth.
2296T	wh odorless cryst powd		198-200		$14\ 4^{25}$	$1\ 95\%$	
2297	hex pl or pr		152-4	160 subl	i	s h	s eth, et acetate, h me. al
2298							
2299							
2300							
2301	feathery need, $1\ 4402^{80}$	$0\ 879\frac{40}{4}$. $0\ 822^{78}$	50	159-60	i	v s	v. s eth.
2302	*d*: featn. need., $[\alpha]_D$ $+103\ 9°^{17}$ in eth		51 (48)	$160\ 2\ 5^{21}$	i.	sl s	s. eth.
	l: cr., 1.45514^{45}, $[\alpha]$-52°$_D$		42 52	158-60			s. eth
2303							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2304	***dl*-Campholic acid**	*dl*-1,2,2,3-tetramethylcyclopentanecarboxylic acid*	$C_5H_5(CH_3)_4COOH$	170 25
2305	**Camphor, 3-amino-**	α-aminocamphor, 3-camphorylamine	$C_{10}H_{15}O\,NH_2$	167 25
2306	**——, artificial.**	See *Bornyl chloride.*		
2307	**——, Borneo.**	See *d-Borneol*		
2308	**——, parsley.**	See *Apiole*		
2309	***d*-Camphor**	*d*-2-camphanone, Japan camphor, laurel camphor, Formosa camphor, *d*-2-keto-1,7,7-trimethylnorcamphane	$C_{10}H_{16}O$	152 23
2310	——, oxime		$C_{10}H_{16}NOH$	167 25
2311	**——, α-bromo-**	3-bromo-*d*-camphor (one form)	$C_{10}H_{15}BrO$	231 14
2312	**——, α′ (or β)-bromo-**	3-bromo-*d*-camphor (one form)	$C_{10}H_{15}BrO$	231 14
2313	**——, α-chloro-**	3-chloro-*d*-camphor (one form)	$C_{10}H_{15}ClO$	186 68
2314	**——, 3-nitro-.**	α-nitrocamphor	$C_{10}H_{15}O\,NO_2$	197 23
2315	**α-Camphoramic acid**	α-camphoramidic acid, 3-carbamyl-1,2,2-trimethylcyclopentanecarboxylic acid, camphoric acid 3-monoamide	$C_5H_5(CH_3)_3$-$(CONH_2)COOH$	198 24
2316	**β-Camphoramic acid.**	β-camphoramidic acid, 3-carbamyl-2,2,3-trimethylcyclopentanecarboxylic acid, camphoric acid 1-monoamide	$C_5H_5(CH_3)_3$-$(CONH_2)COOH$	198 24
2317	**Camphoric acid,** 1-monoamide. See *β-Camphoramic acid*			
2318	——, 3-monoamide	See *α-Camphoramic acid*		
2319	***dl*-Camphoric acid**	*dl-cis*-1,2,2-trimethyl-1,3-cyclopentanedicarboxylic acid*, paracamphoric acid	$C_8H_{14}(COOH)_2$	200 23
2320	***d*-Camphoric acid**		$C_8H_{14}(COOH)_2$	200 23
2321	***l*-Camphoric acid**	*l-cis*-1,2,2-trimethyl-1,3-cyclopentanedicarboxylic acid*	$C_8H_{14}(COOH)_2$	200 23
2322	***dl*-Camphoric anhydride**	*dl-cis*-1,2,2-trimethyl-1,3-cyclopentanedicarboxylic anhydride*	$C_8H_{14}(CO)_2O$	182 21
2323	***d*-Camphoric anhydride**		$C_{10}H_{14}O_3$	182 21

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2304	*dl*: col tricl pr *d*: [α] $+49.8^{\circ 15}_{D}$ in al *l*: [α] $-49.1^{\circ 15}_{D}$ in al.		109 106 106-7	 255 250	0.016^{19}	51.29 c	s eth
2305	waxy		110	244	i.	s	s eth, a
2306							
2307							
2308							
2309	col. trig, hex., 1.532 (1.5462), [α] $44.26^{\circ 20}_{D}$ in al	1.000^{0}_{0}, 0.990^{25}_{4}	176-7	204 subl	0.1	100	173 eth; 300 chl.; s CS_2, bz., me al, ac. a, acet
2310	monocl need or pr f dil al, [α] $+42.4^{20}_{D}$ in al	1.01^{116}_{4}	118 (114.6)	249-54 d	i	v s	s eth, min a
2311	col monocl, 1.5535, 1.5787, 1.5912, $[\alpha]_{5461}+165°$	1.449^{20}_{4}	78	274 sl d	i	12.1^{15}, 130^{78}	s eth, chl, CCl_4, bz
2312			61	130^{10}	i	s.	s eth
2313	(α) leaf [α] $+97^{\circ 20}_{D}$ in al		93.4	244-7 part d	s h	s h	s eth, chl, CS_2, bz.
2314	monocl pr f bz		100.1		i	s	s. eth, chl, v. s bz
2315			176-7		s h	s h	s eth, h me al
2316			182.3		s h	s	s eth, acet.; sl s bz
2317							
2318							
2319	col monocl need.	1.228^{20}_{4}	202 (208)		0.76^{25}, 10^{100}	s	v s eth.
2320	col monocl pr or leaf [α] $47.7^{\circ 20}_{D}$ in al.	1.186^{20}_{4}	187		0.62^{12}, 8.3^{100}	112	91.4^{25} eth.; s. acet., i. chl.
2321			187		sl. s.	s.	s. eth., me al.
2322	rhomb f al	1.194^{20}_{4}	221 (216-7)	270	v sl. s	0.63 c.	1.00 eth; v s chl., et. ac, s. bz, CS_2
2323	rhomb pr. f al	1.194^{20}_{4}	221	270 d	v sl. s.	v. s	37.5^{5} bz

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2324	**l-Camphoronic acid**...	l-2,3-dimethyl-1,2,3-butanetricarboxylic acid*, l-α, α, β-trimethyltricarballylic acid	$(CH_3)_2C(COOH)$-$C(CH_3)(COOH)$-CH_2COOH	218.20
2325	**Camphor pinacol** (l) ..	l-2,2′-bicamphane-2,2′-diol	$C_9H_{16}COHCO$-HC_9H_{16}	306 48
2326	**3-Camphorylamine.**	See *Camphor, 3-amino-*.		
2327	**β-Camphylamine**. .	2,3,3-trimethyl-1-cyclopentene-1-ethylamine	$C_8H_{13}CH_2CH_2NH_2$	153 26
2328	**Canadine**...........	l-tetrahydroberberine	$C_{20}H_{21}NO_4$. .	339 38
2329	**Cane sugar.**	See *Sucrose.*		
2330	**Cantharene**.........	dihydro-o-xylene	$C_6H_6(CH_3)_2$.....	108 18
2331	**Cantharidin**..........	2,3-dimethyl-7-oxabicyclo-(2,2,1) heptane-2,3-dicarboxylic anhydride	$C_{10}H_{12}O_4$. .	196 20
2332	**Capraldehyde**.........	decanal*; capric aldehyde; caprinaldehyde, n-decyl aldehyde	$CH_3(CH_2)_8CHO$	156 26
2333	——, oxime .	decanal oxime*, caprinaldoxime	$CH_3(CH_2)_8CH$: NOH	171 28
2334	**Capramide**	decanamide*, n-decylic amide; capric amide	$CH_3(CH_2)_8CONH_2$	171 28
2335	**Capric acid**.........	decanoic acid*, n-capric acid, n-decoic acid, n-decylic acid	$CH_3(CH_2)_8COOH$	172 26
2336	——, ethyl ester.....	ethyl caprate; ethyl decanoate*	$CH_3(CH_2)_8COOC_2$-H_5	200 31
2337	——, methyl ester.. .	methyl decanoate*, methyl caprate	$CH_3(CH_2)_8$-$COOCH_3$	186 29
2338	——, **α-octyl-** ..	2-octyldecanoic acid*, 9-heptadecanecarboxylic acid*, di-n-octylacetic acid	$[CH_3(CH_2)_7]_2$-$CHCOOH$	284 47
2339	**Capric aldehyde.**	See *Capraldehyde.*		
2340	**Capric amide.**	See *Capramide*		
2341	**Capric anhydride** .	decanoic anhydride*; n-decylic anhydride	$[CH_3(CH_2)_8CO]_2O$	326 51
2342	**Caprinaldehyde.**	See *Capraldehyde.*		
2343	**Caprinaldoxime.**	See *Capraldehyde, oxime.*		
2344	**Caprinitrile**	decanenitrile*; capric nitrile n-nonyl cyanide	$CH_3(CH_2)_8CN$.	153 26
2345	**Caproaldehyde** .	hexanal*; n-caproic aldehyde; n-hexoic aldehyde	$CH_3(CH_2)_4CHO$..	100 16
2346	——, oxime	hexanal oxime*, capronaldoxime	$CH_3(CH_2)_4$-$CH{:}NOH$	115 17
2347	——, **α-ethyl-** .. .	2-ethylhexanal*, butylethylacetaldehyde	$C_4H_9CH(C_2H_5)$-CHO	128.21
2348	——, **α, β, γ, δ-tetrahydroxy-*.**	See *Fucose.*		
2349	**Caproamide**	hexanamide* .. .	$CH_3(CH_2)_4CONH_2$	115 17
2350	**Caproic acid** (*n*).......	hexanoic acid*; n-hexoic acid	$CH_3(CH_2)_4COOH$	116 16
2351	——, amyl ester ..	amyl caproate, pentyl hexanoate*	$CH_3(CH_2)_4$-$COOC_5H_{11}$	186 29

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2324	hyg. need. f. w, [α] −26 9°$^{19}_{D}$ in w.	....	164–5 (158)	195–210^{13}	12 5^{16}	59.8^{16}	5 28^{16} eth ; 42 9 chl ; s acet ; v. sl s bz., CS_2
2325	rhomb. bisphenoidal	....	157.8	....	i.	s.	s. eth.
2326							
2327	liq., 1.47284^{18} [α] +6°$_D$	0.8736$\frac{18}{4}$	....	194–6	......	......	. . .
2328	silky need. f. al., [α] −299°$_D$ in chl.	....	133–4	....	i.	s.	v. s. eth., chl., bz.
2329							
2330	col. oily liq., 1 4895	0 8521$\frac{20}{4}$	....	135	i.	∞	s. eth.
2331	col. rhomb pl	...	218 (212)	subl at 84	0 0033	0 02^{18}	0 09 eth.; s. ac. a., conc. H_2SO_4, alk.; sl. s. chl., acet.
2332	liq , 1 42977^{15}	0 828$\frac{15}{4}$		208–9	i.	s	s. eth.
2333	leaf f. dil. me al	.	69	. . .	.	s.	s. eth.
2334	cr	0 999$\frac{20}{4}$	108 (98)	....	i.	s.	s. eth.
2335	col. need., 1 42855^{40}	0 8858$\frac{40}{4}$	31 5	268–70	sl s.	s.	s. eth.
2336	col. liq., 1 42575^{20}	0 8650$\frac{20}{4}$	−19 96	224 5 (110–2^{10})	∞	∞	∞ eth., chl.
2337	col liq	. ..	−18	224	i	v. s.	v. s. eth.
2338	need. or leaf. f al.	. .	38 5	270–5^{100}	i	s.	. ...
2339							
2340							
2341	cr	. . ...	23 9	...	i.	s.	s. eth.
2342							
2343							
2344	col. liq ...	0 8295$\frac{15}{4}$	−17 9	243 7 (236–7)	i.	v. sl s.	s. eth.
2345	col. liq ...	0 8335$\frac{20}{4}$	. .	131	i	v s	v s. eth.
2346	cr		51	.. . .		s	s eth.
2347	col. liq., 1 416	0 823$\frac{20}{4}$	<−100	163.4	0 04^{18}		.
2348							
2349	cr	0 999$\frac{20}{4}$	101.0	255	v. sl. s.	v. s.	s. eth., bz.
2350	col. oily liq , 1.41635	0 945$\frac{0}{0}$; 0 929$\frac{20}{4}$	−1 5 to −2 0 (−9 5)	205 (202)	0.4	s.	s. eth.
2351	col. liq	..		222 2	..		.. . .

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
2352	**Caproic acid**, butyl ester	butyl caproate; butyl hexanoate*	$CH_3(CH_2)_4$-$COOC_4H_9$	172 26
2353	——, ethyl ester......	ethyl caproate; ethyl hexanoate*	$CH_3(CH_2)_4$-$COOC_2H_5$	144 21
2354	——, isoamyl ester.....	γ-methylbutyl hexanoate* ..	$CH_3(CH_2)_4$-$COOC_5H_{11}$	186 29
2355	——, methyl ester.....	methyl hexanoate*; methyl caproate	$CH_3(CH_2)_4$-$COOCH_3$	130 18
2356	——, *p*-phenylphenacyl ester	....	$CH_3(CH_2)_4COO$-$CH_2COC_6H_4C_6H_5$	310 38
2357	——, piperazinium salt	....	$C_4H_{10}N_2 \cdot 2C_5H_{11}$-$COOH$	318 45
2358	——, **α-amino-.**	See *Norleucine.*		
2359	——, **α-bromo-** .	2-bromohexanoic acid* .	$CH_3(CH_2)_3CHBr$-$COOH$	195 07
2360	——, **α,ε-diamino-.**	See *Lysine.*		
2361	——, **α-ethyl-.........**	butylethylacetic acid; 3-heptanecarboxylic acid, 2-ethylhexanoic acid*	$CH_3(CH_2)_3CH$-$(C_2H_5)COOH$	144 21
2362	——, **α-hydroxy-.....**	2-hydroxyhexanoic acid*	$CH_3(CH_2)_3$-$CHOHCOOH$	132 16
2363	——, **γ-hydroxy-, lactone**	4-hydroxyhexanoic acid lactone*	CH_3CH_2-$CH(CH_2)_2COO$	114 14
2364	——, **α-methyl-** . ..	2-methylhexanoic acid*	$CH_3(CH_2)_3CH$-$(CH_3)COOH$	130 18
2365	——, **δ-methyl-..**	5-methylhexanoic acid*, isoamylacetic acid; isoheptylic acid	$(CH_3)_2CH(CH_2)_3$-$COOH$	130 18
2366	**Caproic aldehyde.**	See *Caproaldehyde*		
2367	**Caproic anhydride** ..	hexanoic anhydride*	$[CH_3(CH_2)_4CO]_2O$	214 30
2368	**Caproic nitrile.**	See *Capronitrile.*		
2369	**Caprokol.**	See *Resorcinol, 4-hexyl-*		
2370	**Capronaldoxime.**	See *Caproaldehyde, oxime.*		
2371	**Caprone.**	See *6-Hendecanone*.*		
2372	**Capronitrile**	hexanenitrile*; caproic nitrile, *n*-amyl cyanide	$CH_3(CH_2)_4CN$	97 16
2373	**Caprophenone, 2,4-dihydroxy-**	4-caproylresorcinol	$CH_3(CH_2)_4COC_6$-$H_3(OH)_2$	208 25
2374	**Caproyl chloride**	hexanoyl chloride*	$CH_3(CH_2)_4COCl$	134 61
2375	**Caprylaldehyde** .	octanal*, caprylic aldehyde, *n*-octylaldehyde	$CH_3(CH_2)_6CHO$	128 21
2376	——, oxime. ..	octanal oxime*; caprylaldoxime	$CH_3(CH_2)_6CH$ NOH	143 23
2377	**Caprylamide** . .	octanamide*...	$CH_3(CH_2)_6CONH_2$	143 23
2378	**sec-*n*-Caprylamine.**	See *Heptylamine, α-methyl-*.*		
2379	**Capryl chloride** .	decanoyl chloride*	$CH_3(CH_2)_8COCl$	190 71
2380	**Caprylene.**	See *Octylene.*		
2381	**Caprylic acid.....**	octanoic acid*; *n*-octoic acid; *n*-octylic acid	$CH_3(CH_2)_6COOH$	144 21
2382	——, ethyl ester.....	ethyl caprylate; ethyl octanoate*	$CH_3(CH_2)_6$-$COOC_2H_5$	172 26
2383	——, isoamyl ester . .	γ-methylbutyl octanoate*..	$CH_3(CH_2)_6$-$COOC_5H_{11}$	214 34
2384	——, methyl ester	methyl octanoate*; methyl caprylate	$CH_3(CH_2)_6$-$COOCH_3$	158 24
2385	——, *p*-phenylphenacyl ester		$CH_3(CH_2)_6COO$-$CH_2COC_6H_4C_6H_5$	338 43

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2352	col. liq. .	0.8843^{0}_{4}	.	204.3	v sl. s	∞	∞ eth.
2353	col. to yelsh. liq, 1.40727^{20}	0.8710^{20}_{4}	-67.5	168	0.0015^{20}	s.	s. eth.
2354	col. liq	.		$94–6^{10}$	i.	s	. .
2355	col liq	0.9038^{0}_{4}		149.5	i.	v. s.	v. s. eth.
2356	.		65	. ...	.		.
2357	wh cr		111-1.5	.... .	s	s	i eth; s. h acet
2358							
2359	liq			240 ($128–31^{10}$)	.	s	s eth.
2360							
2361	col liq.	0.903^{26}_{4}	<0	223–5	0.2		. .
2362	col need		62	subl. 100	s.	s	s eth.
2363	col. liq		<-18	220	s.	s	. .
2364	liq			209.6	∞	∞	∞ eth.
2365	col. liq.	0.926^{15}_{4}, 0.9138^{21}_{4}	<-25	211.5 (216.5)	sl. s.	s.	s eth.
2366							
2367	col oil	0.9279^{17}_{4}	-40.6	241–3 sl d	d	s.	∞ eth
2368							
2369							
2370							
2371							
2372	col liq., $1.40851^{14.3}$	0.809^{20}_{4}	-79.4	163	v sl. s.	s.	s. eth.
2373	....		56	$196–8^{7}$	i	s.	s. eth., chl., acet, pet eth; v. s bz.
2374	col liq., 1.4867	0.9704^{25}_{4}	-87.3	153	d	d	s. eth
2375	col liq, 1.4217	0.821^{20}_{4}		163.4 (81^{32})	v sl s	∞	∞ eth.
2376	cr		58–9	$120\text{-}5^{10}$	.....		. ...
2377	col leaf		110 (104)	>200 d.	0.45^{100}	s	s. eth.
2378							
2379	col liq .	0.973^{8}_{4}	-34.5	232.3 (195–6)	d	d.	s. eth.
2380							
2381	col. leaf. or oily liq., 1.4285	0.910^{20}_{4}	16	237.5	0.25^{100}	∞	∞ eth.; s. bz. chl., CS_2, glac ac. a.
2382	col. liq., 1.41775^{20}	0.8667^{20}_{4}	-44.8 (-43.1)	208	0.063^{20}	s.	s eth.
2383	col. liq			136^{16}	i.	s.	.. .
2384	col liq .	0.887^{20}_{4}	-41	192.9	i.	v. s.	v s eth.
2385	. .	. . .	67	. .	......	.. .	. . ....

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
2386	**Caprylic acid, α-amino-,*dl*-**	*dl*-2-aminooctanoic acid* ..	$CH_3(CH_2)_5CH(NH_2)COOH$	159 23
2387	——, **α-hydroxy-**	2-hydroxyoctanoic acid* .	$CH_3(CH_2)_5CHOHCOOH$	160 21
2388	**Caprylic anhydride**	octanoic anhydride*, *n*-octoic anhydride	$[CH_3(CH_2)_6CO]_2O$	270 40
2389	**Caprylidene.**	See 1-*Octyne**.		
2390	**Caprylone.**	See 8-*Pentadecanone**.		
2391	**Caprylonitrile** . ..	octanenitrile*, *n*-heptyl cyanide	$CH_3(CH_2)_6CN$	125 21
2392	**Caprylyl chloride**	octanoyl chloride* .	$CH_3(CH_2)_6COCl$	162 66
2393	**Carbamamidine.**	See *Guanidine*		
2394	**Carbamic acid,** benzyl ester	benzyl carbamate, benzyl aminomethanoate*	$NH_2COOCH_2C_6H_5$	151 16
2395	——, ethyl ester	ethyl carbamate, urethan	$NH_2COOC_2H_5$	89 09
2396	——, isoamyl ester	isoamyl carbamate, isoamyl urethan	$NH_2COOC_5H_{11}$	131 17
2397	——, isobutyl ester	β-methylpropyl aminomethanoate*	$NH_2COOCH_2CH(CH_3)_2$	117 15
2398	——, methyl ester	methyl urethan	NH_2COOCH_3	75 07
2400	——, propyl ester	*n*-propyl carbamate	$NH_2COOC_3H_7$	103 12
2401	——, **cyclohexylethylthiolthiono-,** cyclohexylethylammonium salt		$C_6H_{11}(C_2H_5)NCSSNH_2(C_2H_5)C_6H_{11}$	330 58
2402	——, **cyclopentamethylenedithio-,** salts See under 1-*Piperidinecarbodithioic*			
2403	——, **dibenzyldithio,** dibenzylammonium salt		$(C_6H_5CH_2)_2NCSSNH_2(CH_2C_6H_5)_2$	470 67
2404	——, ——, zinc salt		$[(C_6H_5CH_2)_2NCSS]_2Zn$	610 16
2405	——, **dibutylthiolthiono-,** zinc salt	.	$[(C_4H_9)_2NCSS]_2Zn$	474 11
2405M	——, **diethyl-** . .		$(C_2H_5)_2NCOOH$	117 15
2406	——, **diethylthiolthiono-,** benzal diester		$[(C_2H_5)_2NCSS]_2CHC_6H_5$	386 64
2407	——, ——, diethylammonium salt		$(C_2H_5)_2NCSSNH_2(C_2H_5)_2$	222 40
2408	——, **diethylthiolthiono-,** 6-nitrobenzothiazyl ester		See 2-*Benzothiazolethiol*, 6-*ni*	
2409	——, ——, zinc salt .	.	$[(C_2H_5)_2NCSS]_2Zn$	361 90
2410	——, **dimethylthiolthiono-,** dimethylammonium salt		$(CH_3)_2NCSSNH_2(CH_3)_2$	166 30
2411	——, ——, 2,4-dinitrophenyl ester		$(CH_3)_2NCSSC_6H_3(NO_2)_2$	287 31
2412	——, ——, selenium tetrasalt		$[(CH_3)_2NCSS]_4Se$	559.79
2413	——, ——, zinc salt ..	.	$[(CH_3)_2NCSS]_2Zn.$	305 79

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2386	waxy pl	.	263–4	d., subl	0 6[100]	v sl. s.	v. sl s eth.
2387	pl		69 5	. .	v sl s	v s	v s eth.
2388	liq... . .	0 9021$\frac{25}{4}$	-1	285	d	s	∞ eth.
2389							
2390							
2391	col. liq.....	0 820$\frac{13}{4}$, 0 8058$\frac{30}{4}$	-45 6	205 2 (194–5)	i	v. sl. s.	s. eth.
2392	liq . .	0 9671$\frac{0}{4}$	-6	195 55	d.	d.	s eth.
2393							
2394	leaf.	..	86	220 d	sl s.	s.	s. eth.
2395	col need f. lgr	0 9862$\frac{21}{1}$, 1 11$\frac{20}{20}$	50 (48)	180	100+[25]	166[25]	v. s. eth, bz.; s chl., glyc; sl s. lgr.
2396	need f. w...	0 944$\frac{70\ 6}{4}$	63 5	220	s. h.	s.	s. eth.
2397	col leaf .	0 943$\frac{20}{4}$	55	206–7	i.	s.	s eth.
2398	col. pl	1 136$\frac{56}{4}$	52	177	217[11]	73[15]	s. eth
2400	col pr	. .	60–1 (53)	200	v s.	v s	s eth
2401	pa yel cr		95–6		v s.	v s	s eth
2402	acid						
2403	yel cr		82 5		s.	v s	sl s eth.
2404	cream colored powd.		176–7		i.	i	i eth.; sl. s. chl.
2405	cream colored powd.	1 26$\frac{20}{4}$	108–9	.	i.	i.	sl s. eth., chl.
2405M	need. f. eth .	.	74 unst >-15		v. s	v s	2 6[22] eth.
2406	yel. cr.......	. ..	178–9	.. ...	i.	s h.	. .....
2407	pa. yel. pl...	..	81–2	.	v. s.	v. s.	v. sl s. eth.
2408	*tro-, diethylthiolthionocarbamic ester.*						
2409	wh powd ..	1 24$\frac{20}{4}$	173–4	. . .	i.	i.	i. eth.; sl. s. chl.
2410	pa yel. pl. .	......	129–30	.... .	v. s.	v. s.	v sl s eth.
2411	yel. cr.......	1 54$\frac{20}{4}$	139	..... .	i.	s h.	....
2412	dense or. cr...	....	179–80	. . . .	i.	i.	i. eth.; sl. s. chl.
2413	wh. powd	2 00$\frac{20}{4}$	248–50	.	i.	i	i eth.; sl s. chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2414	**Carbamic acid, di-phenyl-**, ethyl ester	diphenylurethan	$(C_6H_5)_2NCOOC_2H_5$	241 28
2415	——, **dithio-**.........	aminodithioformic acid; aminomethanethionothiolic acid*	NH_2CS_2H	93 16
2416	——, **ethyl-**, ethyl ester.	ethylurethan	$C_2H_5NHCOOC_2H_5$	117 15
2417	——, **ethylidenedi-**, diethyl ester	ethylidenediurethan	$CH_3CH(NHCOOC_2H_5)_2$	204 23
2418	——, **isobutyl-**, ethyl ester	ethyl isobutylcarbamate, isobutylurethan	$(CH_3)_2CHCH_2NHCOOC_2H_5$	145 20
2419	——, **methyl-**, ethyl ester	methylurethan	$CH_3NHCOOC_2H_5$	103 12
2420	——, **nitro-**, ethyl ester	nitrourethan	$NO_2NHCOOC_2H_5$	134 09
2421	——, **phenyl-**, esters. See under *Carbanilic acid*			
2422	——, **propyl-**, ethyl ester	*n*-propylurethan	$C_3H_7NHCOOC_2H_5$	131 17
2423	——, **thiol-**, ethyl ester	aminomethanethiolic acid ethyl ester, thiourethan	$NH_2COSC_2H_5$	105 15
2424	——, **thiono-**, ethyl ester	thiourethan, xanthogenamide	$NH_2CSOC_2H_5$	105 15
2425	**Carbamide.**	See *Urea*		
2426	**Carbamide oxide.**	See *Urea, hydroxy-.*		
2427	**Carbamonitrile.**	See *Cyanamide.*		
2428	**Carbamyl chloride** ..	chloroformamide, urea chloride, carbamide chloride	H_2NCOCl	79 49
2428M	——, **diphenyl-**	*N*-chloroformyldiphenylamine	$(C_6H_5)_2NCOCl$	231 68
2429	**Carbanil.**	See *Isocyanic acid, phenyl ester*		
2430	**Carbanilic acid,** ethyl ester	*N*-phenylurethan; ethyl phenylcarbamate	$C_6H_5NHCOOC_2H_5$	165 19
2431	——, isobutyl ester	isobutyl phenylcarbamate	$C_6H_5NHCOOCH_2CH(CH_3)_2$	193 24
2431M	——, propyl ester	*n*-propylphenylurethan; *n*-propyl carbanilate	$C_6H_5NHCO_2C_3H_7$	179 21
2432	——, **o-hydroxy-**, lactone. See 2(3)-*Benzoxazolone.*			
2433	**Carbanilide**.	*N,N'*-diphenylurea, *sym*-diphenylurea	$C_6H_5NHCONHC_6H_5$	212 24
2434	——, ***N,N'*-diethyl-**...	*N,N'*-diethyl-*N,N'*-diphenylurea*	$CO[N(C_2H_5)(C_6H_5)]_2$	268 35
2435	——, **2,2'-dimethylthio-**	di-*o*-tolylthiourea	$CS(NHC_6H_4CH_3)_2$	256 36
2436	——, **4,4'-dimethylthio-**	di-*p*-tolylthiourea .	$CS(NHC_6H_4CH_3)_2$	256 36
2437	——, ***N,N'*-diphenyl-.**	See *Urea, tetraphenyl-.*		
2438	——, ***N*-methyl-** .	. .	$C_6H_5(CH_3)NCONHC_6H_5$	226 27
2439	——, **2,2',4,4'-tetranitro-**	. .	$[(NO_2)_2C_6H_3NH]_2CO$	392 24
2440	——, **thio-**...........	*N,N'*-diphenylthiourea; *sym*-diphenylthiourea	$(C_6H_5NH)_2CS$	228 30
2441	——, **thio-o,o'-dimethyl-**	*sym*-di-*o*-tolylthiourea .	$(CH_3C_6H_4NH)_2CS$	256 36
2442	**Carbanilonitrile.**	See *Cyananilide.*		
2443	**Carbazide.**	See *Carbohydrazide.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2414	col pr f lgr		71-2	360	s.	v s.	v. s eth.
2415	col need	.			v s d	s.	s. eth.
2416	col liq .	0.981^{20}_{4}		176	$63.2^{15.5}$	...	.
2417	need .		125-6	$170\text{-}80^{20}$ d	sl s c	s.	s eth
2418	col liq., 1.4288	0.943^{20}_{4}	<-65	96^{17}	i.	.	. ..
2419	col liq, $1.4200^{18.9}$	1.009^{19}		170	$94.7^{15.5}$	s.	
2420	col leaf f lgr	. .	64	.	v s	v s.	v s eth, sl. s. lgr
2421							
2422	liq	0.992^{15}		191.5-2.5^{768} (186)	$9.80^{15.5}$	.	....
2423	pl or leaf		108 (102-9)	subl d.	v sl s c, s. h	v s h	v s h eth.
2424	monocl leaf f eth		41-2	d	i. (v sl s)	s	s eth.
2425							
2426							
2427							
2428	col liq	.	50	61-2	d.	d	.
2428M	pl f al	.	85				. .
2429							
2430	lgn need f w	1.106^{30}_{4}; 1.079^{60}_{4}	52	238	v sl s	v s	v s eth.; s. bz.
2431	cr		85.5-86	216 d	v. sl s	v s	v s eth
2431M	wh need		50-51	.			. .
2432							
2433	col rhomb f al, 1.583	1.239^{20}_{4}	238-9 (235)	260 subl	0.015^{25}	s	v s eth
2434	col cr. f w		72-3 (54)		s	v. s	.
2435	v sm. col need f al	.	156-8	218	v sl. s	sl. s	v sl. s. eth., s. ac a., bz.
2436	v sm rhomb need		178-9 (176-7)		v. sl s	sl. s.	v sl s eth.
2437							
2438	col need		104	203-5	i.	sl s.	v s. eth, bz.
2439	yel need.		189	.	i.	v s.	v sl s eth.
2440	col rhomb leaf f. al	1.321^{4}_{4}	154	d.	i (v. sl s.)	s.	s. eth.
2441	need f al		158	216-18	i.	s h	i eth, s ac a, bz.
2442							
2443							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
2444	**Carbazole**	dibenzopyrrole, diphenylenimine	$C_6H_4NHC_6H_4$	167 20
2445	**——, *N*-acetyl-**		$CH_3CONC_{12}H_8$	209 24
2446	**——, *N*-ethyl-** .		$C_{12}H_8NC_2H_5$	195 25
2447	**Carbinol.**	See *Methanol**		
2448	**——, acetyl-.**	See *Acetol*		
2449	**——, acetylenyl-.**	See *2-Propyn-1-ol**		
2450	**——, acetylmethyl-.**	See *Acetoin.*		
2451	**——, allyl-.**	See *3-Buten-1-ol**.		
2452	**——, allyldiethyl-.**	See *5-Hexen-3-ol, 3-ethyl-**		
2453	**——, allyldimethyl-.**	See *4-Penten-2-ol, 2-methyl-**.		
2454	**——, allylmethyl-.**	See *4-Penten-2-ol**		
2454M	**——, allylmethylpropyl-.**	See *1-Hepten-4-ol, 4-methyl-**.		
2455	**——, *p*-aminodiphenyl-.**	See *Benzohydrol, p-amino-*		
2456	**——, amyl-.**	See *1-Hexanol**.		
2457	**——, amyldiethyl-.**	See *3-Octanol, 3-ethyl-**		
2458	**——, amyldimethyl-.**	See *2-Heptanol, 2-methyl-**		
2459	**——, amylhexyl-.**	See *6-Dodecanol**		
2460	**——, amylmethyl-.**	See *2-Heptanol**		
2461	**——, amylpropyl-.**	See *4-Nonanol**		
2462	**——, benzoyl-.**	See *Acetophenone, α-hydroxy-*		
2463	**——, benzoylphenyl-.**	See *Benzoin*		
2464	**——, benzyl-.**	See *Phenethyl alcohol*		
2465	**——, benzylphenyl-.**	See *Ethanol, 1,2-diphenyl-.*		
2466	**——, bis-*p*-aminophenyl-4-amino-*m*-tolyl-.**	See *Rosaniline.*		
2467	**——, butyl-.**	See *1-Pentanol.**		
2468	**——, sec-butyl-.**	See *1-Butanol, 2-methyl-**.		
2469	**——, *tert*-butyl-.**	See *1-Propanol, 2,2-dimethyl-**		
2470	**——, butyldimethyl-.**	See *2-Hexanol, 2-methyl-**.		
2471	**——, *tert*-butyldimethyl-.**	See *2-Butanol, 2,3,3-trimethyl-**.		
2472	**——, butylethylmethyl-.**	See *3-Heptanol, 3-methyl-**		
2473	**——, butylmethyl-.**	See *2-Hexanol**.		
2473M	**——, 1-butynyldimethyl-.**	See *3-Hexyn-2-ol, 2-methyl-**.		
2474	**——, dibutyl-.**	See *5-Nonanol**.		
2475	**——, diethyl-.**	See *3-Pentanol**		
2476	**——, diethylisobutyl-.**	See *3-Hexanol, 3-ethyl-5-methyl-**		
2477	**——, diethylisopropyl-.**	See *3-Pentanol, 3-ethyl-2-methyl-**.		
2478	**——, diethylmethyl-.**	See *3-Pentanol, 3-methyl-**.		
2479	**——, diethylpropyl-.**	See *3-Hexanol, 3-ethyl-**.		
2480	**——, *p,p'*-dihydroxytriphenyl-.**	See *Benzaurin*		
2481	**——, diisoamyl-.**	See *5-Nonanol, 2,8-dimethyl-**		
2482	**——, diisobutyl-.**	See *4-Heptanol, 2,6-dimethyl-**		
2483	**——, diisopropyl-.**	See *3-Pentanol, 2,4-dimethyl-**.		
2484	**——, dimethyl-.**	See *Isopropyl alcohol.*		
2485	**——, dimethylethyl-.**	See *2-Butanol, 2-methyl-**.		
2486	**——, dimethylphenyl-.**	See *2-Propanol, 2-phenyl-.*		
2487	**——, dimethylpropenyl-.**	See *3-Penten-2-ol**		
2488	**——, dimethylpropyl-.**	See *2-Pentanol, 2-methyl-**.		
2489	**——, diphenyl-.**	See *Benzohydrol.*		
2490	**——, diphenylene-.**	See *9-Fluorenol**.		
2491	**——, dipropyl-.**	See *4-Heptanol**.		
2492	**——, ethyl-.**	See *Propyl alcohol.*		
2493	**——, ethyldipropyl-.**	See *4-Heptanol, 4-ethyl-**		
2493M	**——, ethylethynylmethyl-.**	See *1-Pentyn-3-ol, 3-methyl-**		
2494	**——, ethylhexyl-.**	See *3-Nonanol**		
2495	**——, ethylisobutyl-.**	See *3-Hexanol, 5-methyl-**.		
2496	**——, ethylisopropyl-.**	See *3-Pentanol, 2-methyl-**.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2444	col. leaf .		246 (243 5)	354 8	i	0 $92^{1.4}$	3 1^{30} eth ; 5 3^{50} bz., 3 1^{80} tol.; 11 1^{30} acet.; sl. s. ac. a, chl, CS_2, CCl_4
2445	need f w		69	>360 d	i c, sl s h	v s	v. s eth., bz.
2446	leaf f. eth ..	. .	67–8			s h	s eth
2447							
2448							
2449							
2450							
2451							
2452							
2453							
2454							
2454M							
2455							
2456							
2457							
2458							
2459							
2460							
2461							
2462							
2463							
2464							
2465							
2466							
2467							
2468							
2469							
2470							
2471							
2472							
2473							
2473M							
2474							
2475							
2476							
2477							
2478							
2479							
2480							
2481							
2482							
2483							
2484							
2485							
2486							
2487							
2488							
2489							
2490							
2491							
2492							
2493							
2493M							
2494							
2495							
2496							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2497	**Carbinol, ethylisoprop**	**ylmethyl-.** See *3-Pentanol, 2*	*,3-dimethyl-*.*	
2498	——, **ethylmethyl-.**	See *sec-Butyl alcohol*		
2499	——, **ethylmethylprop**	**yl-.** See *3-Hexanol, 3-methyl-**		
2500	——, **ethylphenyl-.**	See *1-Propanol, 1-phenyl-*		
2501	——, **ethylpropyl-.**	See *3-Hexanol*.*		
2502	——, **ethylvinyl-.**	See *1-Penten-3-ol*.*		
2503	——, **ethynyl-.**	See *2-Propyn-1-ol*.*		
2503H	——, **ethynylisopropyl**	**methyl-.** See *1-Pentyn-3-ol, 3*	*,4-dimethyl-*.*	
2503R	——, **ethynylmethylpr**	**opyl-.** See *1-Hexyn-3-ol, 3-me*	*thyl-**	
2504	——, **α-furyl-.**	See *Furfuryl alcohol*		
2505	——, **heptyl-.**	See *1-Octanol**		
2506	——, **heptylmethyl-.**	See *2-Nonanol**		
2507	——, **hexyldimethyl-.**	See *2-Octanol, 2-methyl-**		
2508	——, **hexylpropyl-.**	See *4-Decanol**		
2509	——, **isoamyl-.**	See *1-Pentanol, 4-methyl-*.*		
2510	——, **isoamylmethyl-.**	See *2-Hexanol, 5-methyl-*.*		
2511	——, **isobutyl-.**	See *Isoamyl alcohol*		
2512	——, **isobutyldimethyl**	**-.** See *2-Pentanol, 2,4-dimethy*	*l-**	
2513	——, **isobutylmethyl-.**	See *2-Pentanol, 4-methyl-**		
2514	——, **isohexyl-.**	See *1-Hexanol, 5-methyl-*.*		
2515	——, **isopropyl-.**	See *Isobutyl alcohol*		
2516	——, **isopropyldimethy**	**l-.** See *2-Butanol, 2,3,-dimethyl*	*-*.*	
2517	——, **methyl-.**	See *Ethyl alcohol*		
2518	——, **methyl-*tert*-but**	**yl-.** See *Pinacolyl alcohol*		
2519	——, **methyldipropyl-.**	See *4-Heptanol, 4-methyl-**		
2520	——, **methylhexyl-.**	See *2-Octanol*.*		
2521	——, **methylisopropyl-**	**.** See *2-Butanol, 3-methyl-**		
2522	——, **methylnonyl-.**	See *2-Hendecanol*.*		
2523	——, **methylphenyl-.**	See *Benzyl alcohol, α-methyl-*		
2524	——, **methylpropyl-.**	See *2-Pentanol**		
2525	——, **methylvinyl-.**	See *3-Buten-2-ol**		
2526	——, **1-naphthyldi-phenyl-**	diphenyl-α-naphthylcarbinol	$(C_6H_5)_2(C_{10}H_7)$-COH	310 38
2527	——, **nonyl-.**	See *1-Decanol*.*		
2528	——, **phenyl-.**	See *Benzyl alcohol*		
2529	——, **propenyl-.**	See *2-Buten-1-ol**		
2530	——, **propyl-.**	See *Butyl alcohol (n).*		
2531	——, **styryl-.**	See *Cinnamic alcohol*		
2532	——, **α-thienyl-.**	See *2-Thiophenecarbinol*		
2533	——, **o-tolyl-**	*o*-methylbenzyl alcohol, *o*-tolubenzyl alcohol	$CH_3C_6H_4CH_2OH$	122 16
2534	——, ***m*-tolyl-**	*m*-methylbenzyl alcohol, *m*-tolubenzyl alcohol	$CH_3C_6H_4CH_2OH$	122 16
2535	——, ***p*-tolyl-..**	*p*-methylbenzyl alcohol, *p*-tolubenzyl alcohol	$CH_3C_6H_4CH_2OH$	122 16
2536	——, ***p,p′,p″*-triaminot**	**riphenyl-.** See *Pararosaniline*		
2537	——, **triethyl-.**	See *3-Pentanol, 3-ethyl-**		
2538	——, **trimethyl-.**	See *tert-Butyl alcohol*		
2539	——, **p_3-trinitrotriphe**	**nyl-.** See *Carbinol, tris (p-nitr*	*ophenyl)-*	
2540	——, **triphenyl-** ..		$(C_6H_5)_3COH$	260 32
2541	——, **tripropyl-.**	See *4-Heptanol, 4-propyl-**		
2542	——, **tris(*p*-aminophe**	**nyl)-.** See *Pararosaniline.*		
2543	——, **tris(*p*-nitro-phenyl)-**	p_3-trinitrotriphenylcarbinol, 4,4′,4″-trinitrotritanol	$(NO_2C_6H_4)_3COH$	395 32
2544	**Carbinol o-carboxylic**	**anhydride, triphenyl-.**	See *Phthalide, 3,3-di*	*phenyl-.*
2545	**Carbinylamine, diethy**	**l-.** See *Propylamine, α-ethyl-.*		
2546	——, **dimethylethyl-.**	See *tert-Amylamine.*		
2547	——, **methylisopropyl-**	**.** See *Propylamine, α, β-dimeth*	*yl-*	
2548	——, **methylpropyl-.**	See *Butylamine, α-methyl-*		
2549	——, **trimethyl-.**	See *tert-Butylamine*		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2497							
2498							
2499							
2500							
2501							
2502							
2503							
2503 H							
2503 R							
2504							
2505							
2506							
2507							
2508							
2509							
2510							
2511							
2512							
2513							
2514							
2515							
2516							
2517							
2518							
2519							
2520							
2521							
2522							
2523							
2524							
2525							
2526	cr f lgr		136	d	i	s. h	v s. eth.; s. bz, sl. s. h. lgr
2527							
2528							
2529							
2530							
2531							
2532							
2533	col need	1.023^{40}_{4}	34	219 (223.3)	1^{20}, 1.5^{100}	v s	v. s eth.
2534	col liq	$1.036\frac{0}{4}$	<-20	217	5 c	s	s. eth.
2535	col need		59.5	217	sl s c	v s	v s eth.
2536							
2537							
2538							
2539							
2540	hex pr. f bz	$1.188\frac{20}{4}$	162.5	>360	i	v s.	v s eth., bz.
2541							
2542							
2543	monocl or rhomb. cr. f. bz		193 (171-2)	.	.	sl s h.	sl. s eth.; s. bz., ac. a.
2544							
2545							
2546							
2547							
2548							
2549							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2550	**"Carbitol".**	See *Diethylene glycol, monoethyl ether.*		
2551	**——, butyl.**	See *Diethylene glycol, monobutyl ether.*		
2552	**——, diethyl.**	See *Ether, bis(β-ethoxyethyl).*		
2553	**——, methyl.**	See *Diethylene glycol, monomethyl ether.*		
2554	**Carbocinchomeronic acid**	2,3,4-pyridinetricarboxylic acid	$C_5H_2N(COOH)_3 \cdot 1\frac{1}{2}H_2O$	238 15
2555	**β-Carbocinchomeronic acid.**	See *3,4,5-Pyridinetricarboxylic acid.*		
2556	**Carbodiimide, diphenyl-**	carbodiphenylimide ..	$C_6H_5N{:}C{:}NC_6H_5$	194 23
2556M	**Carbodinicotinic acid.**	See *2,3,5-Pyridinetricarboxylic acid.*		
2557	**Carbodiphenylimide.**	See *Carbodiimide, diphenyl-.*		
2558	**Carbohydrazide** . .	carbonic acid dihydrazide, carbazide	$CO(NHNH_2)_2$	90 09
2559	**——, 1,5-diphenyl-**	*sym*-diphenylcarbazide....	$(C_6H_5NHNH)_2CO$	242 28
2560	**Carbolic acid.**	See *Phenol.*		
2561	**Carbomethene.**	See *Ketene.*		
2562	**Carbon bisulfide.**	See *Carbon disulfide.*		
2563	**Carbon dioxide**... . .	carbonic anhydride, carbonic acid gas	CO_2	44 01
2564	**Carbon disulfethyl.**	See *Carbonic acid, dithiol-, diethyl ester.*		
2565	**Carbon disulfide**. ...	carbon bisulfide	CS_2	76 13
2566	**Carbon hexachloride.**	See *Ethane, hexachloro-*.*		
2566M	**Carbon hexafluoride.**	See *Ethane, hexafluoro-*.*		
2567	**Carbonic acid,** dibutyl ester		$CO(OCH_2CH_2CH_2CH_3)_2$	174 24
2568	——, diethyl ester	ethyl carbonate	$(C_2H_5)_2CO_3$.	118 13
2569	——, dihydrazide.	See *Carbohydrazide.*		
2570	——, diisoamyl ester	isoamyl carbonate . ..	$CO(OC_5H_{11})_2$.	202 29
2571	——, diisobutyl ester .	isobutyl carbonate.. .	$CO[OCH_2CH(CH_3)_2]_2$	174 24
2572	——, dimethyl ester .	methyl carbonate . .	$CO(OCH_3)_2$.	90 08
2573	—, diphenyl ester .	phenyl carbonate, diphenyl carbonate	$(C_6H_5)_2CO_3$	214 21
2574	——, dipropyl ester ...	......	$CO(OCH_2CH_2CH_3)_2$	146 18
2575	——, ethyl methyl ester	.. .	$CH_3C_2H_5CO_3$	104.10
2576	——, **chloro-,** esters.	See under *Formic acid, chloro-.*		
2577	——, **dithiol-,** diethyl ester	ethyldithiolcarbonate, carbon disulfethyl	$CO(SC_2H_5)_2$. . .	150 25
2578	——, **thiolthiono-,** *O*-ethyl ester. See *Xanthogenic acid*			
2579	——, **trithio-**	. ..	$CS(SH)_2$ ..	110.21
2580	**Carbonic acid gas.**	See *Carbon dioxide.*		
2581	**Carbonic anhydride.**	See *Carbon dioxide.*		
2582	**Carbonimide,** esters.	See under *Isocyanic acid.*		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2550							
2551							
2552							
2553							
2554	rhomb. f w.	. .	($-H_2O$, 115–20) anh. 250 d.	. .	1 2[15]	sl s.	i. eth., bz.
2555							
2556	α: syrup..	.		330–1	.	d. h.	v s bz.; d. HCl
	β: cr. ...		168–70		v sl s	v. sl s	v sl. s. eth.
2556M							
2557							
2558	need. f. dil. al		152 exp		v. v s.	v v s.	v v. s eth.; i. bz., chl.
2559	leaf	.	172–3	d	i	s	sl s. eth.; s. bz.
2560							
2561							
2562							
2563	col odorl gas	1 977 g/1, liq, 1 101^{-37}, solid 1 56^{-79}	-56 6[5 2atm]	-78 5 subl	179 7[0] cm³, 355[0]g, 90 1[20] cm³, 097[40]g, 058[60]g	31[15] cm³	.
2564							
2565	col inflam liq., 1.62950[18]	1 2628$\frac{20}{4}$	-108 6, frz -111	46 3	0 22[22]	∞	∞ eth, bz.
2566							
2566M							
2567	col. liq	0 9244$\frac{20}{4}$		207[720]	i	s	s eth
2568	col inflam. liq., 1.38456[20]	0 9751$\frac{20}{4}$	-43	125 8	i	∞	∞ eth
2569							
2570	liq........	0 912$\frac{15}{4}$	. .	228 7			. ...
2571	liq.	0 919$\frac{15}{4}$	.	190 3	i	∞	∞ eth.
2572	col. liq., 1.3687	1 0694$\frac{20}{4}$	0 5	90–1	i	s	s. eth.
2573	need f. al .	1 1215$\frac{87}{4}$	78, 81	306 (302)	i	s	s. eth., bz., CCl_4
2574	col liq.....	0 9411$\frac{20}{4}$		168 2	v. sl s.	∞	∞ eth.
2575	col. liq.....	1 002$\frac{27}{4}$	-14 5	109 2	i.	∞	∞ eth.
2576							
2577	yel. liq......	1.085[19]	.	196.7	i.	s.	s. eth.
2578							
2579	red brn. oil.	>1	d 20–30	57 d	i. d.	s.	s eth., Na_2CO_3.
2580							
2581							
2582							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2583	**Carbon monoxide**		CO	28 01
2584	**Carbon oxysulfide.**	See *Carbonyl sulfide.*		
2585	**Carbon suboxide**	malonic anhydride (so-called), dioxopropadiene*	$OC{:}C{:}CO$	68 03
2586	**Carbon tetrabromide**	tetrabromomethane*	CBr_4	331 67
2587	**Carbon tetrachloride**	tetrachloromethane*	CCl_4	153 84
2587M	**Carbon tetrafluoride**	tetrafluoromethane*	CF_4	88 01
2588	**Carbon tetraiodide**	tetraiodomethane*	CI_4	519.69
2589	**Carbonyl chloride.**	See *Phosgene*		
2589M	**Carbonyl fluoride**	fluoroformyl fluoride	COF_2	66 01
2590	**Carbonyl sulfide**	carbon oxysulfide	COS	60 07
2591	**Carbostyril**	2-quinolinol or 2(1)-quinolone, *o*-aminocinnamic acid lactam	C_9H_7NO	145 15
2592	——, **3-ethyl-**		$C_6H_4NHCOC(C_2H_5)CH$	173 21
2593	——, **4-methyl-**	2(1)-lepidone	$C_{10}H_9NO$	159 18
2594	**Carbothialdine**		$C_5H_{10}N_2S_2$	162 27
2595	**Carbylamine chloride,**	**phenyl-.** See *Aniline, N-(dic*	*hloromethylene)-.*	
	Carbylamine derivativ	**es.** See *Amyl isocyanide, Butyl*	*isocyanide, etc.*	
2596	**Carminic acid**		$C_{22}H_{20}O_{13}$	492 38
2597	**Carnaubyl alcohol**		$C_{24}H_{50}O$	354 65
2599	***α*-Carotene**	*α*-carotin	$C_{40}H_{56}$	536 85
2600	***β*-Carotene**	*β*-carotin; provitamin A	$C_{40}H_{56}$	536 85
2601	**Carotin.**	See *Carotene.*		
2602	***d*-Carpaine**		$C_{14}H_{25}NO_2$	239 35
2603	——, hydrochloride		$C_{14}H_{25}NO_2 \cdot HCl$	275 82
2604	**Carubinose.**	See *d-Mannose.*		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2583	col odorl. pois. gas	liq $0.814\frac{-195}{4.4}$; $1.250\frac{0}{4}$ g/l	-207 (-213)	-190 (-192)	0.0044^{0} g, 0.0028^{20} g, 0.0010^{80} g, 3.5^{0} cm^3	20^{20} cm^3	s bz, ac. a., Cu_2Cl_2
2584							
2585	col liq or gas, 1.454	1.114^{0}	-111.3 (-107)	7	d	.	s eth.
2586	col monocl tab, $1.59998^{99.5}$ (He)	3.42	α48.4 β90.1	189.5 sl d	0.024^{30}	s.	s. eth., chl.
2587	col. liq., 1.46305^{15}	$1.595\frac{20}{4}$, $1.63195\frac{0}{4}$	-22.8; frz to tri-morph., -28.6, -23.8; -21.2	76-7	0.08^{20}	∞	∞ eth., chl., bz.
2587M	col. gas	1.96^{-184}	-184	-128	sl. s		. . . .
2588	dk red cub	4.32	171 d.	subl. 90-100 vac.	i, d h	s., d h	s eth
2589							
2589M	col gas	1.139^{-114}	-114	-83	d	d	. . . . .
2590	gas	liq 1.24^{-87}, (A) 2.105; 2.721 g/l	-138	-50.2 (-47.5)	100 cm^3	800^{22} cm^3	4.4^{18} cm^3 pyr.; 12^{13} cm^3 nitro bz; 1500^{22} cm^3 tol
2591	pr f al		200	subl	v sl s	v s.	v s. eth; s. dil HCl
2592	col cr .	.	168				. . .
2593	col need f w	.	217.4	270^{17}	v. sl. s. c	v. s h	v sl s eth.; sl s bz.
2594	cr	.			i	sl s	i eth, s a.
2595							
2596	red monocl pr	.	136 d		v s	s	v sl s eth.; s. conc H_2SO_4, alk.; i bz., chl.
2597	leaf	.	69		sl s.	s.	.
2599	[α] $+364\frac{20}{Cd}$ in bz		175				. .
2600	red-br glist cr.	.	181-2	. . . .	i	sl s.	sl s eth, me. al, chl.; s. CS_2, bz., pet. eth.
2601							
2602	monocl. pr f. al. [α] +21°55′D in al	. . . . . .	121	. . . . . .	i.	11	3 eth.; s. chl., bz, amyl al., CS_2
2603	lng. wh rhomb or monocl. need	. . .	225 d.	. .	11.6	s.	s eth.
2604							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
2605	**Carvacrol**	2-*p*-cymenol; cymophenol	$CH_3(C_3H_7)C_6H_3$-OH	150 21
2606	**——, hexahydro-.**	See *Carvomenthol*		
2607	**Carvacrylamine**	2-*p*-cymylamine; 2-amino-*p*-cymene, 5-isopropyl-2-methylaniline, cymidine	$(CH_3)_2CH(CH_3)$-$C_6H_3NH_2$	149 23
2608	**Carvene.**	See *d-Limonene.*		
2609	**Carvenone**	3-*p*-menthen-2-one	$C_{10}H_{16}O$	152.23
2610	**Carveol, dihydro-**	*p*-menth-8(9)-en-2-ol	$C_{10}H_{17}OH$	154 25
2611	**Carvol.**	See *d-Carvone.*		
2612	**Carvomenthene**	1-*p*-menthene	$C_{10}H_{18}$	138.25
2613	**Carvomenthol**	2-*p*-menthanol, hexahydrocarvacrol	$C_{10}H_{19}OH$	156 26
2614	**Carvone, dihydro-**	*p*-menth-8(9)-en-2-one	$C_{10}H_{16}O$	152 23
2615	***dl*-Carvone,** oxime	*dl*-carvoxime . .	$C_{10}H_{14}$:NOH	165 23
2616	***d*-Carvone** . . .	*d*-6,8(9)-*p*-menthadien-2-one; carvol	$C_{10}H_{14}O$	150 21
2617	***dl*-Carvoxime.**	See *dl-Carvone, oxime*		
2618	**Caryophyllin**		$(C_{10}H_{16}O)_3$	456 69
2619	***d*-Catechin.**	See *d-Catechol.*		
2620	**Catechol.**	See also *Pyrocatechol.*		
2621	***d*-Catechol**	*d*-catechin; 3,5,7,3′,4′-flavanpentol (one form); 2-(3,4-dihydroxyphenyl)-3,5,7-chromantriol (one form)	$C_{15}H_{14}O_6$	290 26
2622	**Cedrarine.**	See *Quinazoline, 3,4-dihydro-3-phenyl-.*		
2623	**Cedrene** (artificial)		$C_{15}H_{24}$	204 34
2624	**Cedriret.**	See *Cerulignone*		
2625	**Cellobiose**	cellose glucose β-glucoside	$C_{12}H_{22}O_{11}$	342 30
2627	——, octaacetate (α)	octaacetylcellobiose	$C_{12}H_{14}O_3$-$(OOCCH_3)_8$	678 59
2628	**Cellose.**	See *Cellobiose.*		
2629	**"Cellosolve."**	See *Ethanol, 2-ethoxy-*.*		
2630	**——, benzyl.**	See *Ethanol, 2-benzyloxy-.*		
2631	**——, butyl.**	See *Ethanol, 2-butoxy-*		
2632	**——, methyl.**	See *Ethanol, 2-methoxy-*.*		
2633	**Cellulose**		$(C_6H_{10}O_5)_x$	(162-14)x

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
2605	col. oily liq., 1.52295	0 976	0 5 (1-2)	237 9	v. sl. s.	s	s. eth., alk.
2606							
2607	oil, 1.543^{19}	$0\ 9942\frac{20}{4}$	-16	241: 118^{12}	v. sl s.	s.	s. eth.
2608							
2609	liq., 1.483771^{19}	$0.9263\frac{20}{4}$		233	i.		.. . ...
2610	liq., 1 48168 .	0 927		225			... .
2611							
2612	col. oily liq	$0\ 829^{20}$		175		s	.. . .
2613	oil, 1 46296.	$0\ 904^{20}$		222 (220)		s	s. eth.
2614	oily liq., $1\ 47174^{19}$, [α]-19° (-16°)D.	$0\ 9253\frac{20}{4}$		220-1			.
2615	monocl cr		93-4 (70-71)		s	s	. . ..
2616	col liq., $1\ 49994^{18.2}$, $[\alpha]+62\ 07_D$ (l [α] $-39\ 34°^{18}_D$ in al)	$0\ 9608\frac{20}{4}$		230 (227-8; 225)	v sl. s	∞	∞ eth ; s. chl.
2617							
2618	silky need. $[\alpha]+54\ 5°_D$ in al.		310	subl. 285	i	sl s	v. s eth.; i. alk.
2619							
2620							
2621	wh cr powd. or need f w	$1\ 344\frac{4}{4}$	175 (217)	240-5 d	s	s	0 59 eth.; s. et. ac, alk.
2622							
2623	col liq, $1\ 5001^{19}$, $[\alpha]-52\ 6°_D$	0 929		262-3			..
2624							
2625	col. need., $[\alpha]+24\ 4°_D$ in w.		225		s.	v. v. sl s.	v v sl. s. eth.; i acet.
2627	col silky need., $[\alpha]+41\ 5°_D$ in chl.		228-9		i.	s h.	i eth
2628							
2629							
2630							
2631							
2632							
2633	wh. amorph	1 27-1 61	.	. .	i.	i.	i. eth., all ord. org. solv ; s. $Cu(NH_3)_4(OH)_2$

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
2636	**Cellulose**, acetate, tri-		$C_6H_7O_2(OOCCH_3)_3$	288 25
2636M	——, ethyl ether	ethylcellulose, triethylcellulose	2,3, and 6 "OH" groups ethylated	indefinite
2637	——, hexanitrate	chief constituent of guncotton	$C_{12}H_{14}(ONO_2)_6O_4$.	594 28
2638	——, pentanitrate		$C_{12}H_{15}(ONO_2)_5O_5$	549 28
2639	——, tetranitrate	constituent of collodion	$C_{12}H_{16}(ONO_2)_4O_6$.	504 28
2640	——, trinitrate	constituent of collodion	$C_{12}H_{17}(ONO_2)_3O_7$	459.28
2640M	——, **ethyl-.**	See *Cellulose, ethyl ether*		
2641	**Cerane**	isohexacosane	$C_{26}H_{54}$	366 70
2642	**Cerotic acid**	hexacosanoic acid*	$CH_3(CH_2)_{24}COOH$	396 68
2643	**Cerotin.**	See *Ceryl alcohol*		
2644	**Cerulignone**	3,3′,5,5′-tetramethoxydiphenoquinone, coerulignone, cedriret	$C_{16}H_{16}O_6$	304 29
2645	**Ceryl alcohol**	1-hexacosanol*, cerotin, *n*-hexacosyl alcohol	$CH_3(CH_2)_{24}CH_2OH$	382 70
2646	**Cetane.**	See *Hexadecane**		
2647	**Cetyl alcohol**	1-hexadecanol*, *n*-hexadecyl alcohol, ethal	$CH_3(CH_2)_{15}OH$	242 44
2648	——, acetate.	See *Acetic acid, cetyl ester.*		
2648M	**Cetylamine**	hexadecylamine* (*n*), 1-aminohexadecane	$CH_3(CH_2)_{15}NH_2$.	241 45
2649	**Cetyl cyanide.**	See *Margaronitrile*		
2650	**Cetylene.**	See 2-*Hexadecyne**		
2651	**Cetyl ether**	1-hexadecyloxyhexadecane*; hexadecyl ether, dicetyl ether	$(C_{16}H_{33})_2O$...	466 85
2652	**Cetyl iodide.**	1-iodohexadecane*, *n*-hexadecyl iodide	$CH_3(CH_2)_{14}CH_2I$	352 35
2653	**Cetyl sulfate**	hexadecyl sulfate, di-*n*-hexadecyl sulfate	$[CH_3(CH_2)_{15}]_2SO_4$	546 91
2654	**Cevadine.**	See *Veratrine* (crystalline)		
2654M	**Cevitamic acid.**	See *l-Ascorbic acid.*		
2655	**Chalcone**	benzalacetophenone, benzylideneacetophenone; phenyl styryl ketone, 1,3-diphenyl-2-propen-1-one	$C_6H_5CH{\cdot}CH{-}COC_6H_5$	208 25
2656	*d*-**Chaulmoogric acid**	*d*-13-(2-cyclopentenyl) tridecanoic acid	$CH{=}CHCH_2CH_2C{-}H(CH_2)_{12}COOH$	280 44
2657	**Chavibetol**	5-allylguaiacol; betel phenol	$CH_2\ CHCH_2C_6H_3{-}(OH)(OCH_3)$	164 20

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2636	ylsh. amor .	. ...	.		i	i.	i. eth., acet.; s. chl., glac. ac. a., nitro-bz.
2636M	fine wh. need. f 0 2% soln. in bz.	...	240–255	. ..	i.	i.	s. warm eth.
2637	wh. amor. ..	1 66	ign. 160–70		i.	i.	i. eth., bz.; v. v sl. s. eth. + al., s nitro-bz. ‡
2638	wh. amor	ca. 1 66	.		i	i	i. eth, bz ; s. eth + al.
2639	wh amor	1 66			i	i.	i eth., bz.; s. eth. + al., me. al.
2640	wh. amor	1 66	.		i	s.	s. me. al., h. glac. ac a.; i. bz.
2640M							
2641	cr. f eth	.	61	$207^{9.7}$	i	s.	s eth
2642	col. need. f al	$0\ 836^{79}$	87 7 (80–2)	d	i.	v sl s.	20^{35} eth.; s. acet, bz.
2643							
2644	bluish gr need	.	d.	.	i.	i	s. H_2SO_4, phenol, i ord. org solv.
2645	col. rhomb. pl	. .	79 5–79 8	305^{20} d.	i.	s	s eth
2646							
2647	leaf f al, $1\ 4283^{78.9}$	$0\ 8176\frac{50}{4}$	49 3	190^{15}; 344	i.	102	s eth, 97^{24} me. al., s. bz.
2648							
2648M	col. cr . .	.. .	... .	322 5; $143\ 9^{2}$	i.	s.	s. eth.
2649							
2650							
2651	leaf	....	55	270 d.	sl s.	s.	s. eth.
2652	leaf f. al., 1 4806	1 123	22	211^{15}	i	s.	s. eth.
2653	....	.	66 2–6 3			.	. . ..
2654							
2654M							
2655	pa yel. rhomb pl.	$1\ 071\frac{62}{4}$	62 (55–7)	348	i.	sl. s.	s. eth, chl., bz., CS_2, conc. H_2SO_4, v. sl. s. lgr.
2656	col. leaf. f. al. $[\alpha]+62°_D$ in chl.	. ....	68 5	$247\text{–}8^{20}$	i.	v sl s	s. eth, chl.
2657	liq, 1.5413^{20}.	$1\ 0690\frac{15}{15}$	8 5	254–5	i	s	s. eth.

For explanations and abbreviations see beginning of table.
‡All nitro celluloses are soluble in acet., et. ac., amyl acetate.

No.	Name	Synonyms	Formula	Mol. Wt.
2658	**Chavicol** .	*p*-allylphenol	$CH_2{\cdot}CHCH_2C_6H_4$-OH	134.17
2659	——, methyl ether	See *Estragole.*		
2660	**Chelerythrine,** alcoholate	. .	$C_{21}H_{19}NO_5{\cdot}C_2H_6O$	411 44
2661	**Chelidonine,** hydrochloride	. . .	$C_{20}H_{19}NO_5{\cdot}HCl$	389 83
2662	***d*-Chelidonine**.	. . . . .	$C_{20}H_{19}NO_5{\cdot}H_2O$	371 38
2663	**Chick antidermatitis factor.** See *Pantothenic acid.*			
2664	**Chinalgen.**	See *Analgen.*		
2664M	**Chitosamine.**	See D-*Glucosamine.*		
2665	**Chloral**	trichloroethanal*; trichloroacetaldehyde	CCl_3CHO	147 40
2666	——, alcoholate	2,2,2-trichloro-1-ethoxyethanol*; chloral hydrate monoethyl acetal	$CCl_3CH(OH)OC_2H_5$	193 47
2667	——, diethyl acetal	See *Ethane,* 1,1,1-*trichloro*-2,2-*diethoxy*-*.		
2668	——, hydrate	2,2,2-trichloro-1,1-ethanediol*; trichloroethylidene glycol	$CCl_3CH(OH)_2$	165 42
2669	**Chloral-antipyrine.**	See *Hypnal*		
2670	**Chloranil**	tetrachloroquinone, tetrachloro-*p*-benzoquinone	$C_6Cl_4O_2$	245 89
2671	**Chloranilic acid**	2,5-dichloro-3,6-dihydroxyquinone	$C_6Cl_2(OH)_2O_2$	208 99
2672	**Chlorbutanol.**	See *Chloretone*		
2673	**Chlorbutol.**	See *Chloretone*		
2674	**Chloretone**.	1,1,1-trichloro-2-methyl-2-propanol*, trichloro-*tert*-butyl alcohol; acetone-chloroform, chlorbutol; chlorbutanol	$(CH_3)_2C(OH)CCl_3$	177 47
2675	**Chlorhydrin.**	See 1,2-*Propanediol,* 3-*chloro*-*		
2676	**Chlorine cyanide.**	See *Cyanogen chloride*		
	Chloro-.	See the parent compounds (e.g., for chloroacetic acid see		
2677	**Chloroacetal** .	2-chloro-1,1-diethoxyethane*; chloroacetaldehyde diethyl acetal	$CH_2ClCH(OC_2H_5)_2$	152 62
2678	**Chloroacetol.**	See *Propane,* 2,2-*dichloro*-*.		
2679	**Chloroform**	trichloromethane*. .	$CHCl_3$. . .	119 39
2680	——, **methyl-.**	See *Ethane,* 1,1,1-*trichloro*-*.		
2681	——, **nitro-.**	See *Chloropicrin.*		
2682	——, **phenyl-.**	See *Toluene, α-trichloro-.*		
2683	**Chlorogenine.**	See *Alstonine.*		
2684	**α-Chlorohydrin.**	See 1,2-*Propanediol,* 3-*chloro*-*.		
2685	**Chlorophyll a.**	.	$C_{55}H_{72}MgN_4O_5 \cdot \frac{1}{2}H_2O$	902 49
2686	**Chlorophyll b.**		$C_{55}H_{70}MgN_4O_6$	907 47
2687	**Chloropicrin** .	trichloronitromethane*, nitrochloroform	CCl_3NO_2. .	164 39

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2658	liq., 1.5441^{18}.	$1.033\frac{18}{4}$	<-25	237	s	∞	∞ eth , chl.
2659							
2660	rhbdr leaf ; sol bl fluores.	. . . .	207	. . . . . .	sl. s	sl. s	v s. eth ; s. chl., amyl al., bz.
2661	wh fine cr.	. .			0.31^{18}	sl s	. . .
2662	monocl. tab.	. . .	135–6	.	i.	v. s	v s eth ; s. chl , amyl al.
2663							
2664							
2664M							
2665	col. liq , 1.45572	$1.512\frac{20}{4}$	-57.5	98	s.	∞	∞ eth ; s. chl.
2666	col. need	$1.143\frac{40}{4}$	44–7 (55)	115	v. s	s	s. eth.
2667							
2668	col monocl tab , 1.538, 1.600, 1.602	$1.9081\frac{20}{4}$	51.7 (61–3)	96.3^{764} (98 d)	470^{17}	77^{25}	66.7^{25} eth , s. chl.
2669							
2670	yel monocl. pr. f bz.	. . .	290 (in sealed tube)	subl.	i.	s. h.	s eth , bz.; sl. s chl , CS_2
2671	red leaf	.	283–4		v. sl s		.
2672							
2673							
2674	wh cr (+1H_2O) f. w.	.	+1H_2O 80–1 (anh. 97)	167	i c.	v. s	v s eth ; 125 glyc ; s. chl , acet., bz., glac. ac. a.
2675							
2676							
	Acetic acid, chlor	*o-).*					
2677	liq .	$1.026\frac{16}{4}$		156.8 ($62–4^{20}$)	sl. s.	∞	∞ eth.
2678							
2679	col liq., 1.44643^{18}	$1.49845\frac{15}{4}$	-63.5	61.26 (58–61.5)	1.0^{15}	∞; const boil. mixt. 7% et. al.	∞ eth ; s. bz., acet , CS_2
2680							
2681							
2682							
2683							
2684							
2685	hex lancet shaped pl.	.	150–3	d	i	v s	v. s. eth.; s. pet. eth.
2686	pl	. . . .	183–5	.	i.	v s.	v. s. eth., s. me al
2687	col. liq., 1.46075^{23}	$1.651\frac{20}{4}$, $1.69225\frac{0}{4}$	-64, frz. -69	112	i	∞	∞ eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2688	**Chloroprene**	2-chloro-1,3-butadiene*	CH_2:CHCCl:CH_2	88.54
2689	**Cholalic acid.**	See *Cholic acid.*		
2690	**Cholanic acid, trihydroxy-.**	See *Cholic acid.*		
2691	**Cholesterol**	cholesterin	$C_{27}H_{45}OH$	386.64
2692	——, benzoate		$C_6H_5COOC_{27}H_{45}$	490.75
2693	**Cholestrophan**	dimethylparabanic acid	N(CH_3)CON-(CH_3)COCO (ring)	142.11
2694	**Cholic acid**	cholalic acid; trihydroxy-cholanic acid, colalin	$C_{24}H_{40}O_5 \cdot H_2O$	426.58
2695	**Choline**	(β-hydroxyethyl)trimethyl-ammonium hydroxide, bilineurine; sincaline; amanitine	$HOCH_2CH_2N$-$(CH_3)_3OH$	121.18
2696	——, ***O*-acetyl-**, bromide	(β-acetoxyethyl) trimethyl-ammonium bromide	$CH_3COOCH_2CH_2$-$N(CH_3)_3Br$	226.12
2697	——, ***O*-acetyl-β-methyl-**, chloride	β-acetoxypropyltrimethyl-ammonium chloride	$CH_3CH(OOCCH_3)$-$CH_2N(CH_3)_3Cl$	195.69
2698	——, **β-methyl-**, chloride	β-hydroxypropyltrimethyl-ammonium chloride	$CH_3CHOHCH_2N$-$(CH_3)_3Cl$	153.65
2699	**3,5,7-Chromantriol.**	See *d-Catechol.*		
2700	**Chromone**	1,4-benzopyrone; γ-benzo-pyrone	$C_6H_4OCH \cdot CHCO$ (ring)	146.14
2701	**Chromone, 2-phenyl-.**	See *Flavone.*		
2702	**Chromotropic acid**	4,5-dihydroxy-2,7-naphtha-lenedisulfonic acid	$(HO)_2C_{10}H_4$-$(SO_3H)_2$	320.28
2703	**Chrysammic acid**	2,4,5,7-tetranitrochrysazin, chrysamminic acid; 1,8-di-hydroxy-2,4,5,7-tetranitro-anthraquinone	$C_{14}H_2(NO_2)_4$-$(OH)_2O_2$	420.20
2704	**Chrysaniline**	2-amino-5-*p*-aminophenyl-acridine	$C_{19}H_{15}N_3 \cdot 2H_2O$	321.37
2705	**Chrysarobin**		$C_{30}H_{26}O_7$	508.59
2706	**Chrysazin**	1,8-dihydroxyanthraquinone.	$HOC_6H_3(CO)_2$-C_6H_3OH	240.20
2707	——, **2-hydroxy-.**	See *Anthraquinone, 1,2,8-trihydroxy-.*		
2708	——, **3-methyl-.**	See *Chrysophanic acid.*		
2709	——, **2,4,5,7-tetranitro-.**	See *Chrysammic acid.*		
2710	**Chrysazol**	1,8-anthracenediol*, 1,8-anthradiol	$HOC_6H_3(CH)_2$-C_6H_3OH	210.22
2711	**Chrysene**	benzo[a]phenanthrene	$C_{18}H_{12}$	228.28
2712	**Chrysenequinone.**	See *Chrysoquinone.*		
2713	**Chrysin**	5,7-dihydroxyflavone	$C_{15}H_{10}O_4$	254.23
2714	**Chrysoidine** (base)	2,4-diaminoazobenzene; 4-phenylazo-*m*-phenylene-diamine	C_6H_5N:NC_6H_3-$(NH_2)_2$	212.25
2715	——, hydrochloride		C_6H_5N:NC_6H_3-$(NH_2)_2HCl$	248.71

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
2688	col. liq., 1.4583	$0\ 9583\frac{20}{20}$		59 4	v sl s	∞	∞ eth., s. most org solv.
2689							
2690							
2691	monocl. pearly leaf, cr. $+1H_2O$ f. dil. al	$1\ 067\frac{20}{4}$	anh 148 5	360 d.	$0\ 26^{20}$	$1\ 08^{17}$, 11^{78}	18 eth.; s. bz., chl, CS_2, pyr, h ac a.
2692	pl		150–1			i	s eth.
2693	pearly leaf.		145	275–7	sl s	sl s	....
2694	rhomb. cr. $+1H_2O$ f. w.		195 (anh)	d 160	0 025	4 27 70%	1 40 c. eth., s. ac a, acet., alk.
2695	col. visc. liq				s	s	i. eth
2696	col. need		143	d	v s	v s	s eth.
2697	micro. need. f al, eth		172–3	d	v s	v s.	i. eth.
2698	wh pr cr f N butanol		165–7	d	v s.	v. s.	i. eth.
2699							
2700	wh need f. pet eth		59	subl	i.	s.	s. eth., chl., bz.
2701							
2702	need or leaf $(+2H_2O)$				v s.	i	i. eth.
2703	yel monocl. pr		exp.	.	i.	s.	s. eth., min. a.
2704	yel need		270		v sl s	sl s	....
2705	yel leaf		205–10 (170–8)		i	s	s eth, chl.; sl. s c bz, CS_2
2706	red or yel need or leaf f al		193 (191)		sl s	s	s eth., caust. alk, chl, ac. a, nitro-bz.
2707							
2708							
2709							
2710	yel need f dil al		225 d		i	s	s. eth., alk, et. ac, bz.
2711	col rhomb pl f bz or ac a with red-vlt fluores		254 (250)	448	v sl s.	0 08 c	v. sl. s eth., bz, s. h. tol; sl s CS_2
2712							
2713	pa yel. pl .		275	subl.	i.	0 43 c	sl. s eth., lgr., CS_2, bz., chl., alk
2714	pa. yel cr. f. w		117 5		sl s.	s.	s eth.; v. s. chl.
2715	redsh -br cr or powd				v. s.	s.	..

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2716	**Chrysophanic acid**	1,8-dihydroxy-3-methylanthraquinone, 3-methylchrysazin	$C_{14}H_5(OH)_2(CH_3)O_2$	254 23
2717	**Chrysoquinone**	chrysenequinone; 1,2-chrysenedione	$C_{18}H_{10}O_2$	258 26
2718	**Cinchamidine.**	See *Hydrocinchonidine.*		
2719	**Cinchomeronic acid**	3,4-pyridinedicarboxylic acid	$C_5H_3N(CO_2H)_2$	167 12
2720	**Cinchonamine**		$C_{19}H_{24}N_2O$	296 40
2721	**Cinchonicine**	cinchotoxine	$C_{19}H_{22}N_2O$	294 38
2722	**Cinchonidine.**		$C_{19}H_{22}N_2O$	294 38
2723	——, bisulfate		$C_{19}H_{22}N_2O \cdot H_2SO_4 \cdot 5H_2O$	482 54
2724	——, hydrochloride		$C_{19}H_{22}N_2O \cdot HCl \cdot H_2O$	348 87
2725	——, sulfate		$(C_{19}H_{22}N_2O)_2 \cdot H_2SO_4 \cdot 3H_2O$	740 89
2726	**Cinchonine**		$C_{19}H_{22}N_2O$	294 38
2727	——, bisulfate		$C_{19}H_{22}N_2O \cdot H_2SO_4 \cdot 4H_2O$	464 53
2728	——, hydrochloride		$C_{19}H_{22}N_2O \cdot HCl \cdot 2H_2O$	366 88
2729	——, nitrate		$C_{19}H_{22}N_2O \cdot HNO_3 \cdot \frac{1}{2}H_2O$	366 41
2730	——, sulfate		$(C_{19}H_{22}N_2O)_2 \cdot H_2SO_4 \cdot 2H_2O$	722 88
2731	**——, hydroxy-.**	See *Cupreine*		
2731M	**Cinchoninic acid**	4-quinolinecarboxylic acid	C_9H_6NCOOH	173 16 (anh.)
2732	**Cinchotine**	hydrocinchonine, pseudocinchonine	$C_{19}H_{24}N_2O$	296 40
2733	**Cinchotoxine.**	See *Cinchonicine*		
2734	**Cineole**	1,8-epoxy-*p*-menthane, eucalyptole, cajeputole	$C_{10}H_{18}O$	154 25
2735	**1,4-Cineole**	*p*-cineole, 1,4-epoxy-*p*-menthane	$C_{10}H_{18}O$	154 25
2736	***l*-Cineolic acid**	*l*-tetrahydro-2,6,6-trimethyl-1,4-pyran-2,5-dicarboxylic acid*	$C_{10}H_{16}O_5$	216 23
2737	**Cinnamaldehyde**	3-phenylpropenal*, β-phenylacrolein; cinnamic aldehyde	$C_6H_5CH{:}CHCHO$	132 15
2737M	**Cinnamamide**	cinnamic amide	$C_6H_5CH{:}CHCONH_2$	147 17
2738	**Cinnamein.**	See *Cinnamic acid, benzyl ester.*		
2739	**Cinnamene.**	See *Styrene*		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
2716	hex or monocl yel. cr f al	0 92	196	subl.	sl s	0 050[15], 0 44 h	s eth, chl, bz, sl s. CS_2
2717	redsh or need f ac a		239 5 (235)	subl	i	s h	sl s eth, c ac a, tol; s H_2SO_4, h bz
2718							
2719	pr f w or HCl		260 d (266)	d	v sl s	sl s	v sl s eth; i. chl
2720	rhomb need f al		194 (185)		i	s	s eth, bz, chl.
2721	need $[\alpha]$ 47 $2^{\circ 15}_{D}$ in in al or chl		58–60		sl s.	s.	s. eth., chl, bz
2722	trim pr f al, 1 610, 1 625, 1 675, $[\alpha]$ $-107\ 9^{17\ 8}_{D}$		210 5 (202)		0 019[11 5]	4 81 c	0 41 c eth; s chl
2723	lng monocl pr				v s	v s	
2724	wh cr. powd		anh 242		5[20]	25 6[18 5]	0 33[25] eth, v. s chl
2725	monocl glist need efflor		anh 205		1 54	1 37	0 024 eth, 0 16[25] chl
2726	col need, col monocl f. al, 1 570, 1 685, 1 690, $[\alpha]$ $229\ 6^{\circ 17}_{D}$ in al		255 (264)	subl 220	0 027[20]	0 795[20]	0 27[10] eth; s. chl
2727	wh rhomb octah				217[14]	111[14]	s eth.
2728	col monocl, $[\alpha]$ + 165 5		anh 217–8		4 5 c	100	0 18 eth, s. chl
2729	col monocl				3 79[12]	s	
2730	col rhomb, $[\alpha]$ + 170 3°_{D}		anh 198 5		1 55[13]	17[11]	0 043 eth, 2 1 chl
2731							
2731M	monocl pr or need with $1H_2O$ f w		253–4		v sl s	v sl s	i eth
2732	pr, $[\alpha]$ + 204 $5^{\circ 14}_{D}$ in c t al		286		i c, s h	sl s	v sl s eth.
2733							
2734	col liq, 1 4584[15]	0 0239$^{20}_{4}$	+1 5	176–7	0 2 c	∞	∞ eth, s chl, glac ac a, oils
2735	1 4479[18]	0 8997[20]	+1	173 4	0 2 c	∞	∞ eth.
2736	cr, α 1 480, γ 1 522		196–7 d		1 4 d.	0 79 h	0 71 eth., sl s. chl
2737	col liq, 1 61949	1 1119$^{15}_{4}$	-7 5	251	v sl s	∞	∞ eth
2737M	need		147		sl s h	s.	s eth, CS_2
2738							
2739							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
2740	**Cinnamic acid** (ordinary or *trans*)	*trans*-β-phenylacrylic acid; *trans*-benzenepropenoic acid	$C_6H_5CH:CH\text{-}COOH$	148 15
2741	——, allyl ester. . . .	allyl cinnamate. . . .	$C_6H_5CH:CH\text{-}COOC_3H_5$	188 22
2742	——, benzyl ester. . .	cinnamein	$C_6H_5CH\ CHCO\text{-}OCH_2C_6H_5$	238 27
2743	——, dibromide.	See *Hydrocinnamic acid, α, β-dibromo-.*		
2744	——, ethyl ester	ethyl *trans*-3-phenylpropenoate	$C_6H_5CH.CH\text{-}COOC_2H_5$	176 21
2745	——, methyl ester . . .	methyl cinnamate . . .	$C_6H_5CH.CH\text{-}COOCH_3$	162 18
2746	——, γ-phenylallyl ester.	See *Styracin.*		
2747	——, *p*-phenylphenacyl ester	. . . . .	$C_6H_5CH\cdot CHCOO\text{-}CH_2COC_6H_4C_6H_5$	342 38
2748	——, **α-acetyl-**, ethyl ester	ethyl α-benzalacetoacetate	$C_6H_5CH\cdot C(CO\text{-}CH_3)COOC_2H_5$	218 24
2749	——, **o-amino-**	β-(*o*-aminophenyl) acrylic acid	$NH_2C_6H_4CH:CH\text{-}COOH$	163 17
2750	——, ——, lactam.	See *Carbostyril.*		
2751	——, ***m*-amino-**	. .	$NH_2C_6H_4CH\cdot CH\text{-}COOH$	163 17
2752	——, ***p*-amino-** . .	.	$NH_2C_6H_4CH\cdot CH\text{-}COOH$	163 17
2753	——, **α-bromo-**.	2-bromo-3-phenylpropenoic acid; α-bromo-β-phenylacrylic acid	$C_6H_5CH:CBr\text{-}COOH$	227 06
2754	——, **β-bromo-** . . .	3-bromo-3-phenylpropenoic acid, β-bromo-β-phenylacrylic acid	$C_6H_5CBr:CH\text{-}COOH$	227 06
2755	——, **o-carboxy-** .	*o*, β-styrenedicarboxylic acid	$(COOH)C_6H_4CH\ CHCOOH$	192 16
2756	——, ***p*-carboxy-** .	*p*, β-styrenedicarboxylic acid	$(COOH)C_6H_4CH.CHCOOH$	192 16
2757	——, **2,4-dihydroxy-.**	See *Umbellic acid*		
2758	——, **2,5-dihydroxy-**	3-(2,5-dihydroxyphenyl)-propenoic acid	$(HO)_2C_6H_3CH\text{-}CHCOOH$	180 15
2759	——, **3,4-dihydroxy-.**	See *Caffeic acid.*		
2760	——, **α-ethyl-**		$C_6H_5CH\cdot C\text{-}(C_2H_5)COOH$	176 21
2761	——, **o-hydroxy-.**	See *o-Coumaric acid.*		
2762	——, ***m*-hydroxy-.**	See *m-Coumaric acid.*		
2763	——, ***p*-hydroxy-.**	See *p-Coumaric acid.*		
2764	——, **3-hydroxy-4-methoxy-.**	See *Isoferulic acid.*		
2765	——, **4-hydroxy-3-methoxy-.**	See *Ferulic acid.*		
2766	——, **β-ketohydro-.**	See *Acetic acid, benzoyl-.*		
2767	——, **α-methyl-** .	α-benzalpropionic acid	$C_6H_5CH\text{:-}C(CH_3)COOH$	162 18
2768	——, **o-nitro-** .	.	$NO_2C_6H_4CH\text{:-}CHCOOH$	193 15
2769	——, ——, ethyl ester	. . . .	$NO_2C_6H_4CH\text{:}CHCOOC_2H_5$	221 21
2770	——, ***m*-nitro-**	. . . .	$NO_2C_6H_4CH\text{:}CHCOOH$	193 15
2771	——, ——, ethyl ester	. . . .	$NO_2C_6H_4CH\text{:-}CHCOOC_2H_5$	221 21
2772	——, ——, methyl ester .	.	$NO_2C_6H_4CH\text{:-}CHCOOCH_3$	207 18

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2740	col monocl.	$1\ 2475\frac{4}{4}$	133	300	$0\ 1^{20}$	23^{20}	v s eth, s. bz, glac ac. a, CS_2, $5\ 9^{15}$ chl
2741	wh-yel cr.	$1\ 052\frac{25}{25}$	..	286 d.	i.	v s.	∞ eth.
2742	col pr		39	244^{25}, $195\text{-}200^{5}$		s. h	s eth
2743							
2744	col liq, 1.55982	1 049	6 5 (12)	271, 141^{15}	i.	s.	v. s eth.
2745	col cr, $1\ 57661^{21\ 4}$	$1\ 0911\frac{20}{4}$; $1\ 042\frac{36}{0}$	36	261 9 (259 6)	i.	v. s.	s eth.
2746							
2747			182 5				
2748			59	181^{17}		s	s eth.
2749	yel need		159 d	. .	sl s c., s h	s.	s eth.
2750							
2751	pa yel need		181		sl s	s	s eth.
2752	pa yel need.		175-6 d		sl s	s	s eth
2753	(*cis*) rhomb f w		120-1	$111^{0.6}$	s h	s	s CS_2, bz.
	(*trans*) need f w		131-2	$121^{0.6}$	v sl s h	∞	∞ eth
2754	(*cis*) monocl f al		160	$111^{0.6}$	sl s h	sl s c	s eth, chl., h. bz
	(*trans*) need f w		134-5	$122^{0\ 6}$	sl s h	s	s h bz, sl s. CS_2
2755	need f w		175		sl s	v s	sl s eth; i. bz
2756	infus powd		358 d	subl >350	i		s h ac a.
2757							
2758	cr f. w		207 d.			s	
2759							
2760	need f. w.		104-5 (81)	.....	$0\ 01^{25}$	s	s eth, sl. s. pet. eth.
2761							
2762							
2763							
2764							
2765							
2766							
2767	need or pr f bz		74	288	0 12 h	s.	s eth, CS_2, bz
2768	sc. or need. f al		240	subl.	i. c.	$0\ 21^{25}$	. .
2769	yel rhomb need		44	. . .		v. s.	v. s. eth, bz.
2770	col (yel) need f al		193 (199-200)	.	v sl s	sl s	
2771			74-76		i.	sl s	sl s eth
2772	pa yel pr f al		123-4	d	i.	v sl s	v sl s eth, v. s chl, bz

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
2773	**Cinnamic acid, *p*-nitro-**	....	$NO_2C_6H_4CH$:-$CHCOOH$	193 15
2774	——, ——, ethyl ester	.	$NO_2C_6H_4CH$:-$CHCOOC_2H_5$	221 21
2775	**——, α-phenyl-.**	*trans-α,β*-diphenylacrylic acid	C_6H_5CH:-$C(C_6H_5)COOH$	224 25
2776	***allo*-Cinnamic acid** .	*cis*-cinnamic acid (68°).	C_6H_5CH.-$CHCOOH$	148 15
2777	**——, α, β-dibromo-** .	*cis*-2,3-dibromo-3-phenylpropenoic acid*; *β*-dibromo-cinnamic acid	C_6H_5CBr:-$CBrCOOH$	305 97
2778	**Cinnamic alcohol.**	3-phenyl-2-propen-1-ol*; styrylcarbinol, γ-phenyl-allyl alcohol, cinnamyl alcohol; styrone	C_6H_5CH:-$CHCH_2OH$	134 17
2779	**——, 4-hydroxy-3-methoxy-.** See *Coniferyl alcohol.*			
2779M	**Cinnamic amide.**	See *Cinnamamide.*		
2780	**Cinnamic anhydride**	*trans-β*-phenylacrylic anhydride	$(C_6H_5CH{:}CHCO)_2O$	278 29
2781	**Cinnamone.**	See *Styryl ketone.*		
2782	**Cinnamoyl chloride**	cinnamyl chloride; *trans-β*-phenylacrylyl chloride, *trans*-benzenepropenoyl chloride	C_6H_5CH -$CHCOCl$	166 60
2783	**Cinnamyl alcohol.**	See *Cinnamic alcohol*		
2784	**Cinnamyl chloride.**	See *Cinnamoyl chloride.*		
2785	**Cinnamyl chloride.**	See also *Propene, 3-chloro-1-phenyl-**.		
2786	**Citraconic acid** .	*cis*-methylbutenedioic acid*, methylmaleic acid	$CH_3C(COOH)$:-$CHCOOH$	130 10
2787	**Citraconic anhydride**	methylmaleic anhydride	$OCOC(CH_3){:}CHCO$	112 08
2788	**Citral a**	geranial	$C_{10}H_{16}O$	152 23
2789	**Citral b**	neral	$C_{10}H_{16}O$	152 23
2790	***dl*-Citramalic acid**	*dl*-2-hydroxy-2-methylbutanedioic acid*, *dl-α*-hydroxypyrotartaric acid, *dl-α*-methylmalic acid	$CH_3C(OH)$-$(COOH)CH_2$-$COOH$	148 11
2790M	**Citramide.**	citric triamide	$C_6H_{11}N_3O_4$	189 17
2791	**Citrene.**	See *d-Limonene.*		
2792	**Citric acid......**	2-hydroxy-1,2,3-propanetricarboxylic acid*, *β*-hydroxytricarballylic acid	$(COOH)CH_2C$-$(OH)(COOH)$-CH_2COOH	192 12
2793	——, *p*-phenylphenacyl ester		$C_{48}H_{38}O_{10}$	774 79
2794	——, trimethyl ester	methyl citrate	$C_3H_4(OH)$-$(COOCH_3)_3$	234 20
2795	**——, hydroxy-.**	See *Tricarballylic acid, α,β-dihydroxy-*		
2795M	**Citric triamide.**	See *Citramide*		
2796	***d*-Citronellal**	*d*-rhodinal . ..	$CH_2{:}C(CH_3)$-$(CH_2)_3CH$-$(CH_3)CH_2CHO$	154 25
2797	***l*-Citronellal**.... .	.	$C_{10}H_{18}O$	154 25

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc
2773	lt yel pr f al		286		0.0265^{25}	sl s. h	v sl s eth, i. CS_2, lgr
2774	yel tricl need		141 (136–7)		i	sl s.	sl. s eth
2775	(*trans*) wh need f dil. al	. .	172	subl	sl s h	s	s. eth.
	(*cis*) need .		137–8				
2776	monocl pr	1.284$\frac{4}{4}$	68	125^{19}, 265 d	0.937^{25}	v s	v s eth
2777	yel pl f chl		100	124$^{0.5}$	i	s	s eth, chl., ac a, lgr; sl. s pet eth
2778	need, 1.58190	1.0440$\frac{20}{4}$	33	257.5	sl s	v s	v s eth
2779							
2779M							
2780	need f al	.	135–6		i.	sl. s.	s. bz.
2781							
2782	cr, 1.61364$^{42.5}$		36	257.5	i	s	s eth, pet eth, chl
2783							
2784							
2785							
2786	monocl	1.617	91		238 c.		sl. s. eth, bz chl., i CS_2
2787		1.25$\frac{15}{4}$	7–8	213–4	d.	v s	v. s. eth
2788	col liq, 1.48752	0.8868$\frac{20}{4}$		229 (224–9) d	i	∞	∞ eth.
2789	1.4900	0.888$\frac{19}{4}$		103^{12}			
2790	monocl pr (d $[\alpha]+34.7^{\circ 14}_{D}$ in w)		119 (*d* 95, 109)	subl	v s	s	s. eth, acet et. ac; i bz
2790M	cr f w		210–215 d		2.7^{18}	i	i. eth.
2791							
2792	col rhomb, (cr +1H_2O f w), 1.493, 1.498, 1.509 (hyd)	1.542$\frac{18}{4}$	–H_2O 70–5, 153	d	133 c.	116^{25}	2.26 c eth
2793			146				
2794	col tricl		79	287 d	sl s	v s	v s eth
2795							
2795M							
2796	col liq, 1.4483$^{17.5}$ $[\alpha]+13.09^{\circ 15}_{D}$	0.855$\frac{17}{4}$		205–8	v sl. s.	∞	∞ eth
2797	1.4570	0.8567$\frac{15}{4}$		205–6	v sl s.	∞	∞ eth

For explanations and abbreviations see beginning of table

No.	Name	Synonyms	Formula	Mol Wt.
2798	***dl*-Citronellol**.......	dihydrogeraniol	$C_{10}H_{20}O$.	156 26
2799	***d*-Citronellol**...... ..	.. . .	$C_{10}H_{19}OH$. .	156 26
2800	**Civetone**....... ...	9-cycloheptadecen-1-one*	$CO(CH_2)_7CH:$ $CH(CH_2)_7$	250 41
2801	**Clupanodonic acid**	.	$C_{21}H_{33}COOH$ ...	330 50
2802	***l*-Cocaine**...... ..	benzoylmethylecgonine. .	$C_8H_{13}N(OOCC_6H_5)(COOCH_3)$	303 35
2803	——, chromate . ..	. ...	$C_{17}H_{21}NO_4 \cdot H_2CrO_4 H_2O$	439 39
2804	——, hydrochloride..	. ....	$C_{17}H_{21}NO_4 HCl$	339 81
2805	——, **cinnamoyl-**	so called; ecgonine cinnamate methyl ester	$C_{19}H_{23}NO_4$	329 38
2806	**Codamine**.	.	$C_{20}H_{25}NO_4$	343 41
2807	**Codeine** . .	morphine methyl ether .	$C_{18}H_{21}NO_3 H_2O$	317 37
2808	——, hydrochloride	.... .	$C_{18}H_{21}NO_3 \cdot HCl 2H_2O$	371 86
2809	——, phosphate..		$C_{18}H_{21}NO_3 \cdot H_3PO_4 2H_2O$	433 39
2810	——, sulfate.......	. . . .	$(C_{18}H_{21}NO_3)_2 \cdot H_2SO_4 5H_2O$	786 87
2811	**Coerulignone.**	See *Cerulignone.*		
2812	**Colalin.**	See *Cholic acid.*		
2813	***l*-Colchicine**... ..	.	$C_{22}H_{25}NO_6$ .. .	399 43
2814	——, compd. with chloroform	.	$C_{22}H_{25}NO_6 CHCl_3$	518 82
2815	***α*-Collidine**......	4-ethyl-2-methylpyridine*	$CH_3C_5H_3NC_2H_5$	121 18
2816	***β*-Collidine**... . .	3-ethyl-4-methylpyridine*	$CH_3 C_5H_3N \cdot C_2H_5$.	121 18
2817	***γ*-Collidine**	2,4,6-trimethylpyridine*	$(CH_3)_3C_5H_2N$	121 18

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2798		$0.8488\frac{19}{4}$	.	99^{10}	.	.	.. ..
2799	col. liq, 1.45659, $[\alpha]+4°^{17}_{D}$	$0.8565\frac{17}{4}$		222	v sl. s.	∞	∞ eth.
2800			32.5 (31)	342^{742}; $158\text{-}60^{2}$		....	....
2801	pa yel oil, 1.50571^{15}	$0.9410\frac{15}{4}$	<-78	236^{5}	i.		s. eth.
2802	col monocl pr f al, liq 1.50218, solid α 1.49, $[\alpha]$-15.83$°^{20}_{D}$ in chl		98	.	0.16^{25}, 0.38^{80}	20^{25}	26.3 eth.; s. bz, chl.
2803	or-yel leaf .		127		sl s		. .
2804	col monocl pr f al. $[\alpha]$ -71.95$°_{D}$ in w	.	197		250^{25}	38.4^{25}	i eth, 8 chl.; s glyc
2805	need f bz		121		i	s	s eth, chl., bz.
2806	pr		121		sl. s	v s	s eth
2807	col rhomb. octahdr (+1H_2O) f. w; (anh) 1.620, 1.630, 1.650, (hyd) 1.543, 1.636, 1.684, $[\alpha]$ -137.75$°_{D}$ in al	1.315^{14}	anh 155		0.83^{25}, 1.7^{80}	62.5^{25}	8^{25} eth.; s chl., bz, tol.
2808	col need, $[\alpha]$-108.2$°^{22}_{D}$ in w		anh. 264		3.84^{15}	s.	......
2809	col need or efflor powd. $[\alpha]$ -134$°_{D}$		235 d		44.5^{25}	0.38^{25}	0.07 eth.; s. chl.
2810	col rhomb $[\alpha]$-101.2$°^{15}_{D}$ in w.		278 d		3.3^{25}	0.1^{25}	i eth., chl.
2811							
2812							
2813	yel varnish; yel need f. et ac		anh 143-7		4.54	v s	0.638 eth, v.s. chl., 1 bz.
2814	need f chl ..				d h		.. ....
2815	col liq ...	$0.9268\frac{16}{4}$	.	179	s c, less s h.	v s.	v. s. eth.; s. bz.
2816	col. liq ...	$0.966\frac{0}{4}$, $0.9286\frac{16.8}{4}$		195-6	i	s	s. eth., chl.
2817	col liq	$0.917\frac{20}{4}$		172	20.8^{6}, 3.5^{20}	s.	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2819	**Conhydrine**	α-hydroxyconiine, 2-(α-hydroxypropyl)piperidine	$C_8H_{17}NO$. .. .	143 23
2820	**ψ-Conhydrine.**	See *Pseudoconhydrine.*		
2821	**α-Coniceine**.........	.. . .	$C_8H_{15}N$ .. .	125 21
2822	**β-Coniceine**	2-allylpiperidine..	$C_8H_{15}N$.... .	125 21
2823	**γ-Coniceine**....... ..	1,2,3,4-tetrahydro-6-propylpyridine	$C_8H_{15}N$.. .	125 21
2824	**δ-Coniceine.**	See *Piperolidine.*		
2825	**ϵ-Coniceine**..........	methylconidine...........	$C_8H_{15}N$....	125.21
2826	**Conidine, methyl-.**	See *ϵ-Coniceine*		
2827	**Coniferin**.....	. . ..	$C_{16}H_{22}O_8\ 2H_2O$	378 37
2828	**Coniferyl alcohol** .	3-(4-hydroxy-3-methoxyphenyl)-2-propen-1-ol; 4-hydroxy-3-methoxycinnamic alcohol, γ-hydroxyisoeugenol	$(CH_3O)(OH)C_6H_3$-$CH{:}CHCH_2OH$	180 20
2829	**Coniine, α-hydroxy-.**	See *Conhydrine.*		
2830	***d*-Coniine**	*d*-2-propylpiperidine	$C_5H_{10}N{\cdot}C_3H_7$	127 23
2831	——, hydrochloride	....	$C_8H_{17}N\ HCl$	163 69
2832	——, picrate	. .	$C_8H_{17}N\ C_6H_3N_3O_7$	356 33
2833	**Conquinamine** .. .		$C_{19}H_{24}N_2O_2$ ..	312 40
2834	**Conquinine.**	See *Quinidine.*		
2835	**Conylene**	octadiene (one form)	C_8H_{14}	110 19
2836	**Conyrine**	2-propylpyridine .	$C_3H_7C_5H_4N$.	121 18
2837	**Coriandrol.**	See *d-Linalool.*		
2839	**Corybulbine** . ..		$C_{18}H_{15}N(OH)$-$(OCH_3)_3$	355 42
2840	**Corycavine**	.. ..	$C_{23}H_{23}NO_6$ . .	409 42
2841	***dl*-Corydaline**.	....	$C_{18}H_{15}N(OCH_3)_4$	369 45
2842	**Corynine.**	See *Yohimbine.*		
2843	**Cotarnine**	. .	$C_{12}H_{15}NO_4$ .. .	237 25
2844	——, hydrochloride	styptícin .	$C_{12}H_{15}NO_4{\cdot}HCl$	273 71
2845	——, phthalate	styptol .	$2C_{12}H_{15}NO_4{\cdot}C_6H_4$-$(COOH)_2$	640 63
2846	**Cotoin**	2,6-dihydroxy-4-methoxybenzophenone	$C_6H_2(OH)_2$-$(OCH_3)COC_6H_5$	244 24
2847	**Coumalic acid**	2-oxo-1,2-pyran-5-carboxylic acid*	$OCOCH{:}CHC$-$(COOH){:}CH$	140 09

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2819	col. cr. f. eth., $[\alpha]+10°_D$	....	121	226	v. s.	s.	s. eth, chl.
2820							
2821	col. liq. (mixt. ?)	$0.893\frac{15}{4}$	-16	158	sl. s.	..	....
2822	col. need. (*l*) $[\alpha]$ $-50\ 47°^{45}_D$	$0\ 8519\frac{50}{4}$	39-41	168-9	sl. s.	s.	s. eth.
2823	col liq., $1.46068^{18.4}$	$0\ 872\frac{20}{4}$, $0\ 8825\frac{23}{4}$	>-50	172	sl. s.	s.	....
2824							
2825	liq. (*d*) $[\alpha]$ $+67\ 4°^{15}_D$	$0\ 8856\frac{15}{4}$	....	151-4	.....	s.	s. eth.
	(*l*) $[\alpha]$ $-87\ 34°^{15}_D$	$0\ 8624\frac{15}{4}$	...	143-5	......	.....	....
	(*dl*) ..	$0\ 8836\frac{15}{4}$		150-1	....	.	..
2826							
2827	glit. need. $(+2H_2O)$, $[\alpha]-66\ 9°^{20}_D$ in w.	.....	anh. 185	....	0 51	sl. s.	i. eth.
2828	pr	......	73-4	.....	sl. s. h.	s.	s. eth., alk.
2829							
2830	col. oily liq., $1.45119^{21.9}$, $[\alpha]+13.79°$ $(+15.7°)_D$	0 845	-2 5	166.5	1 1 c.	∞	v. s eth; s. bz, chl, amyl al, acet.
2831	col. rhomb. f. w	.	220 (217)	....	50	s.	i. eth.; s. chl.
2832	yel. need. f h w	.	75	....	......	s.	s eth.
2833	yel tetr.. .	....	123	....	...	s.	v s. eth.
2834							
2835	liq ...	$0\ 770\frac{0}{4}$	....	126^{758}	.	s	....
2836	liq	<1	2	165	sl s.	∞	∞ eth.
2837							
2839	need	......	238	..	i.	sl s.	sl. s eth.; s. c. HCl
2840	rhomb. tab. f al.	......	218-9	.	i.	i c.	i alk.
2841	col pr. f. al. (*d*) $[\alpha]$ $+295°^{25}_D$ in al.	....	*dl* 135; *dl*-meso, 158-9	....	i.	s. h.	s eth., chl.
2842							
2843	col. need. f. bz.	......	132-3 d.	.....	sl. s.	s.	s eth, NH_4OH
2844	yel. cr. powd	.....	142-4	.	v s.	v. s.	..
2845	yel. cr. or powd.	...	103	.	v s.	....	...
2846	yelsh. cr. f. h. w.	....	130-1		sl s.	s.	s eth, bz., chl, CS_2, acet
2847	pr	...	205-10 part d	218^{130}; subl. part. d	sl s. c.	s.	sl s. eth., s. ac a, acet., i. chl, bz., lgr.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2848	**o-Coumaric acid**......	o-hydroxycinnamic acid; o-cumaric acid	$HOC_6H_4CH:CH-COOH$	164 15
2849	——, lactone.	See *Coumarin.*		
2850	**m-Coumaric acid**.....	m-hydroxycinnamic acid; m-cumaric acid	$HOC_6H_4CH:CH-COOH$	164.15
2851	**p-Coumaric acid**......	p-hydroxycinnamic acid; p-cumaric acid	$HOC_6H_4CH:CH-COOH$	164.15
2852	——, **α, β-dihydro-.**	See *Phloretic acid.*		
2854	**Coumarilic acid**.......	2-benzofurancarboxylic acid; coumarone-2-carboxylic acid	$C_8H_5O{\cdot}COOH$ ...	162 14
2855	**Coumarin**............	1,2-benzopyrone; o-coumaric acid lactone; coumarinic lactone	$C_6H_4OCOCH:CH$	146 14
2856	——, **6,7-dihydroxy-.**	See *Esculetin.*		
2857	——, **7,8-dihydroxy-.**	See *Daphnetin.*		
2858	——, **7-hydroxy-.**	See *Umbelliferone.*		
2859	——, **3-methyl-**.......	α-methylcoumarin....	$C_6H_4OCOC(CH_3):CH$	160 16
2860	——, **4-methyl-**	β-methylcoumarin.........	$C_6H_4OCOCH:C(CH_3)$	160 16
2861	**Coumarone.**	See *Benzofuran.*		
2862	**Creatine**..............	(α-methylguanido) acetic acid; methylglycocyamine	$NH_2C(:NH)N(CH_3)CH_2COOH$	131.14
2863	**Creatinine**............	1-methylglycocyamidine...	$CH_3NC(:NH)NHCOCH_2$	113.12
2864	**Creosol**..............	2-methoxy-4-methylphenol; 4-methylguaiacol (OH=1); 2-methoxy-p-cresol (OH=1)	$CH_3OC_6H_3(CH_3)OH$	138 16
	Cresol. (In numbering derivatives, (OH=1)			
2865	**Cresol, hexahydro-.**	See *Cyclohexanol, methyl-.*		
2866	**o-Cresol**..............	o-methylphenol; o-hydroxytoluene; o-cresyl alcohol (incorrect)	$CH_3C_6H_4OH$. .	108 13
2867	——, acetate.......... ..	o-tolyl acetate; o-cresyl acetate	$CH_3COOC_6H_4CH_3$	150 17
2868	——, **3-amino-**........	3-amino-2-methylphenol; 2-amino-6-hydroxytoluene	$CH_3(NH_2)C_6H_3OH$	123.15
2869	——, **4-amino-**.... ...	4-amino-2-methylphenol; 5-amino-2-hydroxytoluene	$CH_3(NH_2)C_6H_3OH$	123.15
2870	——, **5-amino-**.......	5-amino-2-methylphenol; 4-amino-2-hydroxytoluene	$CH_3(NH_2)C_6H_3OH$	123 15
2871	——, **4,6-dinitro-**.	2-methyl-4,6-dinitrophenol.	$(NO_2)_2C_6H_2(CH_3)OH$	198 13
2872	——, **3-nitro-**.........	....	$NO_2(CH_3)C_6H_3OH$	153 13
2873	——, **4-nitro-**..... ...	2-methyl-4-nitrophenol..	$NO_2(CH_3)C_6H_3OH$	153 13
2874	——, **5-nitro-**........	2-methyl-5-nitrophenol..	$NO_2(CH_3)C_6H_3OH$	153.13
2875	——, **6-nitro-**...	2-methyl-6-nitrophenol..	$NO_2(CH_3)C_6H_3OH$	153.13
2876	——, **3,4,5,6-tetra-bromo-**	....	$CH_3C_6Br_4OH$.....	423.77
2877	——, **thio-**....... ..	2-toluenethiol*; o-tolyl mercaptan	$CH_3C_6H_4SH$.....	124 19
2878	**m-Cresol**............	m-methylphenol; m-hydroxytoluene	$CH_3C_6H_4OH$. .	108 13
2879	——, **5-amino-**........	5-amino-3-methylphenol; 3-amino-5-hydroxytoluene	$CH_3(NH_2)C_6H_3OH$	123 15

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2848	need. f. w.....	....	207-8 d.	d.	sl. s.	v. s.	v. sl. s. eth.; i. CS_2, chl.
2849							
2850	col. pr. f. w...	.....	191	..	v s. h.	s.	v. s. eth.; s. bz.
2851	col need (+$1H_2O$) f. c. w., anh. f. h. w.	.	210-3 (206)		v sl. s.	v. s.	v. s. eth.; sl. s. bz.; i. lgr.
2852							
2854	need. f. w ..	....	192-3	310-15 sl. d	s h.	s.	sl. s. CS_2, chl.
2855	col. rhomb. f. eth.	$0.935\frac{20}{4}$	67-8 (70)	301 72 (290-1)	0 01[25]	13 7[16] 90%	v. s. eth.; s. chl., oils
2856							
2857							
2858							
2859	need ..	....	90	......		s.	....
2860	need. f. bz....	....	82	....	.....	s.	s. bz.
2861							
2862	col monocl pr (+$1H_2O$) f. w	. .	$-H_2O$, 100; anh. 295	....	1 35[18]	0 0063 c.	i. eth.
2863	col. rhomb. pr. f. w.	. .	260 d.	d.	8 7[16]	0 98[16]	....
2864	col. oil, 1.5353[25]	$1\ 0919\frac{25}{4}$	5.5	221 8, 113 5[22]	sl s.	∞	∞ eth., bz.
2865							
2866	col cr. or liq., 1.5453	$1\ 0465\frac{20}{4}$	30	191 5	3 1[40], 5 6[100]	∞ >30	∞ >30 eth.; s. chl., ord. org. solv.
2867			. ..	208 (83-5[10])	v. sl s.	v s	v s eth.
2868	need	..	129	. .	sl. s.		sl s eth.
2869	need. f. bz .	..	172-3	subl.	sl. s.	v. s.	v. s. eth.; sl. s. bz.
2870	col. pl or need.	. .	159-61	subl.	sl. s. c., s. h	v. s.	v. s. eth.
2871	yel. pr f. al	.	85 8	....	v. sl s.	10 82[15]	v. s. eth.; s. acet ;sl. s. lgr.
2872	lt. yel cr. f. w.		142-3	..	v. sl. s.	v. s.	v. s eth.
2873	need. f. w.. .	...	82-5; 79-80	.....	v. sl. s.	v. s	v s. eth.
2874	yel. need f. lgr.	.	118	.	v. sl. s.	v. s.	v. s. eth.
2875	yel. pr	...	69 5	......	i.	v. sl. s.	v. sl. s. eth.
2876	yel. need f. chl		206-7	d.	i.	s.	v. s. eth.
2877	leaf .		15	194.3	i.	s.	v. s. eth.
2878	col. liq , 1.5398	$1\ 034\frac{20}{4}$	11-2	202.8	2 35[30]; 5.8[100]	∞	∞ eth.; s. chl., ord. org. solv.
2879	..		79	345	...		

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2880	***m*-Cresol, 6-amino-**	2-amino-5-methylphenol; 4-amino-3-hydroxytoluene	$CH_3(NH_2)C_6H_3OH$	123.15
2881	**——, 4-nitro-**	3-methyl-4-nitrophenol	$NO_2(CH_3)C_6H_3OH$	153.13
2882	**——, 5-nitro-**	3-methyl-5-nitrophenol	$NO_2(CH_3)C_6H_3OH$	153 13
2883	**——, 6-nitro-**	3-methyl-6-nitrophenol	$NO_2(CH_3)C_6H_3OH$	153 13
2884	**——, thio-**	3-toluenethiol*; *m*-tolyl mercaptan	$CH_3C_6H_4SH$	124 19
2885	**——, 2,4,6-trinitro-**	...	$(NO_2)_3C_6H(CH_3)$-OH	243 13
2886	***p*-Cresol**	*p*-methylphenol; *p*-hydroxytoluene	$CH_3C_6H_4OH$.	108 13
2887	**——, 2-amino-**	2-amino-4-methylphenol; 3-amino-4-hydroxytoluene	$CH_3(NH_2)C_6H_3OH$	123 15
2888	**——, 3-amino-**	3-amino-4-methylphenol, 2-amino-4-hydroxytoluene	$CH_3(NH_2)C_6H_3OH$	123 15
2889	**——, 2,6-dinitro-**	4-methyl-2,6-dinitrophenol	$(NO_2)_2C_6H_2(CH_3)$-OH	198 13
2890	**——, 2-methoxy-.**	See *Creosol.*		
2891	**——, 2-nitro-**	4-methyl-2-nitrophenol	$NO_2(CH_3)C_6$-H_3OH	153 13
2892	**——, 3-nitro-**	4-methyl-3-nitrophenol	$NO_2(CH_3)C_6$-H_3OH	153 13
2893	**——, thio-**	4-toluenethiol*; *p*-tolyl mercaptan	$CH_3C_6H_4SH$	124 19
2894	**Cresorcinol**	4-methylresorcinol; cresorcin; 2,4-dihydroxytoluene	$CH_3C_6H_3(OH)_2$.	124 13
2895	**2,3-Cresotic acid**	2-hydroxy-3-methylbenzoic acid; 2-hydroxy-*m*-toluic acid, *o*-homosalicylic acid; *o*-cresotic acid; *β*-cresotic acid	$CH_3C_6H_3(OH)$-COOH	152 14
2896	**2,4-Cresotic acid**	2-hydroxy-4-methylbenzoic acid, 2-hydroxy-*p*-toluic acid, *α*-*m*-homosalicylic acid; *m*-cresotic acid, *γ*-cresotic acid	$CH_3C_6H_3(OH)$-COOH	152 14
2897	**2,5-Cresotic acid**	2-hydroxy-5-methylbenzoic acid; 6-hydroxy-*m*-toluic acid; *p*-homosalicylic acid, *p*-cresotic acid; *α*-cresotic acid	$CH_3C_6H_3(OH)$-COOH	152 14
2898	**2,6-Cresotic acid**	2-hydroxy-6-methylbenzoic acid; 6-hydroxy-*o*-toluic acid; *β*-*m*-homosalicylic acid	$CH_3C_6H_3(OH)$-COOH	152 14
2899	**3,2-Cresotic acid**	3-hydroxy-2-methylbenzoic acid, 3-hydroxy-*o*-toluic acid	$CH_3C_6H_3(OH)$-COOH	152 14
2900	**3,4-Cresotic acid**	3-hydroxy-4-methylbenzoic acid, 3-hydroxy-*p*-toluic acid	$CH_3C_6H_3(OH)$-COOH	152 14
2901	**3,5-Cresotic acid**	3-hydroxy-5-methylbenzoic acid; 5-hydroxy-*m*-toluic acid	$CH_3C_6H_3(OH)$-COOH	152.14
2902	**3,6-Cresotic acid**	3-hydroxy-6-methylbenzoic acid; 5-hydroxy-*o*-toluic acid	$CH_3C_6H_3(OH)$-COOH	152 14

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2880	col. need. f bz.	. ..	157–9	.	..	.....	....
2881	need f w .		129	.	v. sl s	v. s.	v. s. eth.
2882	lt. yel cr	. . ..	90–1	....	v. sl. s.	v. s.	v. s. eth.
2883	yel monocl. need f. eth	.	56	volat.	sl s.	s.	v s. eth.
2884	liq	1 0625 $\frac{0}{4}$, 1 052 $\frac{12}{4}$	<-20	195–200	i.	s.	∞ eth.
2885	yel need f w		106	exp. 150	0 22[20], 0 81[100]	v. s	v s eth., s. bz.
2886	col. pr., 1 5395	1 0347 $\frac{20}{4}$	36 (32–4)	202 5	2 4[40], 5 3[100]	∞ > 36	∞ > 36 eth.; s. ord. org solv.
2887	sc. f eth, rhomb f. bz.		135	subl.	v sl s	v s	v s. eth.; s. chl.; sl. s. bz.
2888	col cr f. w		144 5	subl.	sl s		....
2889	lng. yel pr ..		81		sl s	s.	v s. eth.
2890							
2891	yel need. f dil al.	1 2399 $\frac{38}{4}$	36 5 (32)	125[25]	v sl s	v s	v s eth.
2892	yel pr f eth		77		v sl s	v s	v s eth.
2893	leaf f. eth		42–3	195	i.	s.	v s. eth.
2894	col cr f. bz +pet eth		104–5	267–70	s.	s.	s eth; sl. s. bz, lgr
2895	lng. need. f w		163–4	..	0 14[25], 1 16[100]	s.	s eth, chl.
2896	sm need. f. w		178	subl.	4 36[100]	v. s.	v.s.eth.; i.chl.
2897	lng need f w		152 5	..	v. sl. s.	v. s.	s. eth.; i. CS_2
2898	need. f. w	.	168	.	0 14[35]	v. s.	v. s. eth.
2899	glit. need. f. w.	.	145–6	.	s	v. s.	v. s. eth.
2900	lng need ..	.	207	subl	v. sl s.	v. s	s. eth.
2901	tab. f w		208	subl.	5 25[100]	v s.	v s. eth.
2902	need. f. w	.	$-H_2O$ 100; 177–8 (183–4)	....	sl s.	v s.	v.s. eth.; i. chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2903	**4,2-Cresotic acid**....	4-hydroxy-2-methylbenzoic acid; 4-hydroxy-*o*-toluic acid	$CH_3C_6H_3(OH)$-COOH	152 14
2904	**4,3-Cresotic acid**....	4-hydroxy-3-methylbenzoic acid; 4-hydroxy-*m*-toluic acid	$CH_3C_6H_3(OH)$-COOH	152 14
2905	**Cresyl alcohol.**	See *Cresol.*		
	Cresyl esters of organic acids. See "tolyl ester" under the names of the acids.			
2906	**Cresyl phosphate.**	See *Tolyl phosphate.*		
2907	**Croceic acid**....	2-naphthol-8-sulfonic acid; β-naphthol-α-monosulfonic acid; Baeyer's acid	$HOC_{10}H_6SO_3H$	224 22
2908	**Croconic acid**. . .	crocic acid	$C_5O_3(OH)_2{\cdot}3H_2O$	196 11
2909	**Crotonaldehyde**	2-butenal*; crotonic aldehyde; β-methylacrolein; propylene aldehyde	$CH_3CH{:}CHCHO$.	70 09
2909M	**Crotonamide**.. . . .	α-crotonic amide; 2-butenamide*	$CH_3CH{\cdot}CH$-$CONH_2$	85 10
2910	**Crotonic acid** (α or solid)	*trans*(?)-2-butenoic acid*; *trans*(?)-β-methylacrylic acid	$CH_3CH{:}CHCOOH$	86.09
2911	——, methyl ester.	methyl α-crotonate	$C_3H_5COOCH_3$ ..	100 11
2912	——, **β-bromo-**	3-bromo-*trans*-2-butenoic acid*	$CH_3CBr{:}CH$-COOH	165 00
2913	——, **α-chloro-**. . . .	2-chloro-2-butenoic acid* (one form)	$CH_3CH{:}CClCOOH$	120 54
2914	——, **α-ethyl-**....	2-ethyl-*trans*(?)-2-butenoic acid*; 2-pentene-3-carboxylic acid*	$CH_3CH{:}C(C_2H_5)$-COOH	114 14
2915	——, **β-hydroxy-**..	3-hydroxy-2-butenoic acid*; desmotropic with acetoacetic acid	$CH_3COH.CH$-COOH	102 09
2916	**β-Crotonic acid** (liquid).	See *Isocrotonic acid.*		
2916M	**α-Crotonic amide.**	See *Crotonamide*		
2917	**Crotonic anhydride**..	2-butenoic anhydride*.. ..	$(CH_3CH{:}CH$-$CO)_2O$	154 16
2917H	**Crotonic nitrile.**	See *Crotononitrile.*		
2917R	**Crotononitrile**	crotonic nitrile; 2-butenenitrile*; propenyl cyanide	$CH_3CH{:}CHCN$	67 09
2917V	**Crotonyl alcohol**. .	See 2-*Buten*-1-*ol.*		
2918	**Crotonylene.**	See 2-*Butyne**.		
2919	**Crotyl alcohol** (and acetate). See 2-*Buten*-1-*ol**.			
2920	**Cryptopine**....	... .	$C_{21}H_{23}NO_5$. .	369 40
2921	**Crystal violet** (base)	hexamethylpararosaniline	$[(CH_3)_2NC_6H_4]_3$-COH	389 53
2922	**Cubebin**........... .	....	$C_{20}H_{20}O_6$...	356 36
2923	**Cumaldehyde**.........	*p*-isopropylbenzaldehyde; *p*-cuminic aldehyde	$C_3H_7C_6H_4CHO$.	148 20
2924	**Cumaric acid.**	See *Coumaric acid.*		
2925	**Cumene**.......... ...	isopropylbenzene; 2-phenylpropane; cumol	$C_6H_5CH(CH_3)_2$.	120 19
2926	——, **hexahydro-.**	See *Cyclohexane, isopropyl-.*		
2927	——, **α-nitro-**	2-nitro-2-phenylpropane; (α-nitroisopropyl) benzene	$C_6H_5C(NO_2)$-$(CH_3)_2$	165 19
2928	**o-Cumenol.**	See *Phenol, o-isopropyl-.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2903	monocl. f. al. or w.	......	177 8	236-7, subl.	94^{100}	s.	s. eth.
2904	monocl. need. f. w.	....	172	subl. sl. d.	s. h.	v. s.	v. s. eth.; s. chl.
2905							
2906							
2907							
2908	yel. leaf	......	$-3H_2O$, 100; anh 180	subl.	156 c.	14.99 c.	.....
2909	col inflam. liq., $1\ 43838^{17\ 3}$	$0\ 8575\frac{15}{4}$	-69; frz. -74	104-5 (102 4)	18	∞	∞ eth., bz., tol.
2909M	need....		158		sl. s.	s.	v. sl. s. eth.; sl. s. bz.
2910	col. monocl. need. f w or lgr., $1.4228^{79.7}$	$1\ 018\frac{20}{4}$, liq. $0\ 964^{80}$	72	189	$8\ 28^{15}$		sl. s. lgr.
2911	col liq	$0\ 981\frac{4}{4}$		120 7	i.	v. s.	v. s. eth.
2912	leaf		97 (94-5)	..	sl. s.	v. s	v. s. eth., s. CS_2, bz.
2913	long need		99	212 subl.	2 12 c.	s.	s. eth.
2914	col monocl pr		45	209	sl. s.	s.	v. s. eth.
2915	liq			d.	∞	...	.....
2916							
2916M							
2917	col. liq., 1.47446	$1.0397\frac{20}{4}$	...	246-8	d.	d.	∞ eth.
2917H							
2917R	col. liq	$0\ 826\frac{23}{4}$	..	118-119		..	....
2917V							
2918							
2919							
2920	pr. f al, opt. i	$1\ 315\frac{20}{4}$	220-1 (218)	.	i.	sl. s.	sl. s. eth., chl.; v. sl. s. bz.
2921	vlt. cr. f. bz	..	195	....	i.	s.	s. eth.
2922	wh. need. f. al. or bz	....	131-2 (125)	not volat.	v. sl. s.	1.03^{12}	2.68 eth., s. chl.
2923	col. liq., 1.5301	$0\ 978\frac{20}{4}$	.....	235	i.	s.	s. eth.
2924							
2925	col. liq., 1.4930^{20}	$0.864\frac{20}{4}$	-96 9	152-3	i.	s.	s. eth., bz.
2926							
2927	liq.....	$1\ 1025\frac{20}{0}$	-35	d. 224; $123-8^{12}$	i. c.	.	....
2928							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2929	**Cumic acid**	*p*-isopropylbenzoic acid; *p*-cuminic acid	$(CH_3)_2CHC_6H_4$-COOH	164.20
2930	**Cumic alcohol**	*p*-isopropylbenzyl alcohol; *p*-cuminic alcohol; cuminyl alcohol	$(CH_3)_2CHC_6H_4$-CH_2OH	150.21
2931	**α-Cumidic acid**	4,6-dimethylisophthalic acid; 4,6-dimethyl-1,3-benzenedicarboxylic acid*	$(CH_3)_2C_6H_2$-$(COOH)_2$	194 18
2932	**Cumidine**	*p*-isopropylaniline	$(CH_3)_2CHC_6H_4$-NH_2	135 20
2933	***p*-Cuminic acid.**	See *Cumic acid.*		
2934	***p*-Cuminic alcohol.**	See *Cumic alcohol.*		
2935	***p*-Cuminic aldehyde.**	See *Cumaldehyde.*		
2935M	**Cuminyl alcohol.**	See *Cumic alcohol.*		
2936	**Cumol.**	See *Cumene.*		
2937	**Cumylic acid.**	See *Durylic acid.*		
2938	**Cupreine**	hydroxycinchonine	$C_{19}H_{20}N_2(OH)_2$	310 38
2939	**Curarine**		$C_{19}H_{25}N_2O{\cdot}OH$	314 42
2940	**Curcumin**	1,7-bis (4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione*	$[(CH_3O)(OH)C_6$-$H_3CH{:}CHCO]_2$-CH_2	368 37
2941	**Curine**		$C_{18}H_{19}NO_3$	297 34
2942	**Cuscohygrine** (anh)		$C_{13}H_{24}N_2O$	224 34
2943	**Cuscohygrine** (hydrate)		$C_{13}H_{24}N_2O{\cdot}3\frac{1}{2}H_2O$	287.40
2944	**Cuskhygrine.**	See *Cuscohygrine.*		
2945	**Cusparine**	2-homopiperonyl-4-methoxyquinoline	$C_{19}H_{17}NO_3$	307 34
2946	**Cyamelide**	*s*-trioxanetrimine; insoluble cyanic acid	$(HNCO)_3$	129 08
2947	**Cyanamide**	carbamonitrile	$CN{\cdot}NH_2$	42.04
2948	——, **benzyl-**		$C_6H_5CH_2NHCN$	132 16
2949	——, **diethyl-**	*N*-cyanodiethylamine	$CNN(C_2H_5)_2$	98 15
2950	——, **phenyl-.**	See *Cyananilide.*		
2951	**Cyananilide**	carbanilonitrile, phenylcyanamide; *N*-cyanoaniline	C_6H_5NHCN	118 13
2952	**Cyanic acid**		$HOCN$	43 03
2953	——, ethyl ester		C_2H_5OCN	71 08
2954	——, insoluble.	See *Cyamelide.*		
2955	——, **thio-.**	See *Thiocyanic acid.*		
2956	**Cyanidine.**	See *s-Triazine.*		
2957	——, **trihydroxy-.**	See *Cyanuric acid.*		
	Cyano-. See the parent compounds (e.g., for cyanoacetic acid see *Acetic acid, cyano-*).			
2958	**Cyanogen** (gas)	ethanedinitrile*; oxalonitrile; prussite	$N{:}CC{:}N$	52 04
2959	**Cyanogen bromide**	bromine cyanide	$CNBr$	105 93

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
2929	col. tricl. f. al..	$1.163\frac{4}{4}$	116.5	subl.	0.015[25]	v. s.	v. s. eth.
2930	col.-yel. liq. (oil), 1.522[24]	$0.978\frac{20}{20}$	....	248 4	sl s.	∞	∞ eth.
2931	lng. pr. f. bz. + al. or need. f. w.	.... .	266 (>320), subl without melting		sl s.	s. h.	... . ..
2932	col. liq . . .	$0\ 957\frac{20}{4}$	-63	225	i.	s.	s. eth., bz., a.
2933							
2934							
2935							
2935M							
2936							
2937							
2938	concentric pr. f. eth., $[\alpha]^{16}_{D}$-175 5° in al.	.. . .	anh 198 (202)	. ..	i.	s.	sl. s. eth.; v. sl. s. bz., chl.
2939	red-br. leaf	. . ....	161	..	i.	s.	. ..
2940	or.-yel. need. or powd.	. .	183 (177)		i.	s	sl. s. eth., CS_2; 0 05 bz.; s. alk.; i. lgr.
2941	col. cr		212	......	..	..	... ...
2942	oil	$0\ 9782\frac{16}{4}$	.. .	215[20]	∞		. . ..
2943	need.......	..	40–1; d. 120–30	. . . .			s. eth., bz. with sep. of H_2O
2944							
2945	lng. col. need	.	91-2	....	..	s.	s. eth.
2946	wh amor	$1\ 127\frac{15}{4}$	...	d.	0 01[15]	i.	i. eth., ord. org. solv.; s. conc. H_2SO_4; sl. s. NH_4OH
2947	col. need, 1.4418[48]	1 083	44	140[19] d.	v. s	v. s.	s. eth., chl., bz.
2948	pl. f. al .	. ....	43 (33)	.	i.	s.	s. eth.
2949	liq., 1.4126[48].	0 854		190, 68[10]	i.	s.	s. eth.
2950							
2951	need. f. eth.	.	47	.	sl s.	s.	s. eth.
2952	col gas.. ..	liq.1 $140\frac{0}{4}$		d.	sl s.	..	s. eth., ac. a.
2953	liq	$1\ 127\frac{15}{4}$, $0\ 89\frac{20}{4}$	. .	162 d.	i.	∞	∞ eth.
2954							
2955							
2956							
2957							
2958	col. pois. gas	liq. $0.866\frac{17}{4}$; 2 335 g/1	-34 4	-20.5	450[20] cm³	2300[20] cm³	500[20] cm³ eth.
2959	col need ...	$2\ 015\frac{20}{4}$	52	61.6	s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
2960	**Cyanogen chloride**....	chlorine cyanide.	CNCl..	61 48
2961	——, trimer.	See *Cyanuric chloride.*		
2962	**Cyanogen iodide**......	iodine cyanide .	CNI	152 94
2963	**Cyanogen sulfide.**	See *Thiocyanic acid, cyanogen ester.*		
2964	**Cyanuramide.**	See *Ammelide.*		
2965	**Cyanuric acid** (*n*). . .	s-triazinetriol; trihydroxy-cyanidine, tricyanic acid	N C(OH)N:C-(OH)N:C(OH)	129 08
2966	——, tribenzyl ester..	benzyl cyanurate	$(C_6H_5CH_2OC{\cdot}N)_3$	399 43
2967	——, **trithio-.**	See *Thiocyanuric acid*		
2968	**Cyanuric chloride** .	trichloro-s-triazine; trichlorocyanidine, tricyanogen chloride	$C_3Cl_3N_3$	184 43
2969	**Cyanurodiamide.**	See *Ammeline.*		
2970	**Cyanurotriamide.**	See *Melamine.*		
2971	**Cyclobutane*.** .	tetramethylene	$CH_2CH_2CH_2CH_2$	56 10
2972	——, **benzoyl-.**	See *Ketone, cyclobutyl phenyl*		
2973	——, **methyl-.**	.	CH_3-$CHCH_2CH_2CH_2$	70 13
2974	**1,2-Cyclobutanedi-carboxylic acid***	ethylenesuccinic acid	$C_4H_6(COOH)_2$	144 12
2975	**1,3-Cyclobutanedi-carboxylic acid***		$C_4H_6(COOH)_2$	144 12
2976	**Cyclobutene*.** . . .	cyclobutylene	$CH{:}CHCH_2CH_2$	54 09
2977	**9-Cycloheptadecen-1-one*.**	See *Civetone*		
2978	**Cycloheptane***.......	heptamethylene, suberane	$CH_2(CH_2)_5CH_2$..	98 18
2979	**Cycloheptanol***..... .	suberyl alcohol; suberol, hydroxyheptamethylene	$CH_2(CH_2)_5CHOH$	114 18
2980	**Cycloheptanone*** . .	suberone; ketoheptamethylene	$CO(CH_2)_5CH_2$	112 17
2981	**Cycloheptene***..... ..	suberene; suberylene	$CH{:}CH(CH_2)_4CH_2$	96 17
2982	**1,3-Cyclohexadiene*** ..	1,2-dihydrobenzene; $\Delta^{1,3}$-cyclohexadiene	$CH{\cdot}CHCH{\cdot}CH$-CH_2CH_2	80 12
2983	——, **5-isopropyl-2-methyl-.**	See *α-Phellandrene.*		
2984	**1,4-Cyclohexadiene** ...	1,4-dihydrobenzene; $\Delta^{1,4}$-cyclohexadiene	$CH{:}CHCH_2$-$CH{:}CHCH_2$	80 12
2985	**Cyclohexadiene-1,2-dicarboxylic acid*.**	See *Phthalic acid, dihydro-.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2960	col. liq. or pois. gas	1 218$\frac{4}{4}$; liq. 1 186$\frac{20}{4}$	-6	13.8	2500 cm^3	10,000 cm^3	5,000 cm^3 eth.
2961							
2962	col need f eth. or al.	.	146 5, scal. tube	subl.	s.	s.	s. eth., volat. oils
2963							
2964							
2965	col monocl. $(+2H_2O)$ f w, efflor	1 768$\frac{0}{4}$	>360	d	0 25[17]	0 35[22]	v. sl. s. eth.; s. conc H_2SO_4
2966	need f al		157	>320	i c.	s	sl. s. eth.
2967							
2968	monocl f. eth.	1 32$\frac{20}{4}$	146	190	sl s	v s.	s. h. eth, ac. a.; v s chl.
2969							
2970							
2971	liq or gas, 1 3752[0]	0 703$\frac{0}{4}$	50	13	i	∞	∞ eth.; v. s. acet.
2972							
2973	col. liq, 1.3836[20]	0 6931[20]		35-36[758]	i	∞	∞ eth.
2974	(*cis*) pl f w		138		s	s.	s. eth., sl s bz
	(*trans*) (*dl*) need. f. bz.		151		s	.	.
	(*d*) [α] +123 $3^{\circ 30}_{D}$ in w.		105			.	. . .
	(*l*) [α] -124 $3^{\circ 0}_{D}$ in w.		105	. . . .		.	. . .
2975	(*cis*) pr f w		138-9 (135-6)	252	34 5	v s.	v. sl. s. eth.
	(*trans*) pr		171	subl.	3 8	v. s.	v. sl. s. eth.
2976	gas	0 733$\frac{0}{4}$		2 (-3 to 1)		. .	s. acet.
2977							
2978	oil, 1 4440	0 8099$\frac{20}{4}$	-12	118 1	i.	v. s.	v. s. eth.
2979	. . . . . .	0 9717$\frac{0}{0}$, 0 9565$\frac{20}{4}$	.	185 2 (184 5)	1 1	v. s.	v. s. eth.
2980	oil, 1 46027[21 9]	0 9508$\frac{20}{4}$		179 5	sl. s.	v. s.	s. eth.
2981	oil, 1.4552. . .	0 8228$\frac{20}{4}$	.	115	i.	s.	s. eth.
2982	col liq, 1 4758, (1.4744)	0 8404$\frac{20}{4}$	-98	80 5 (83-4)	i.	s.	v. s eth
2983							
2984	col. liq., 1 46806[19]	0 8471$\frac{20}{4}$		86-7 (81-2)	i.	∞	∞ eth
2985							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
2986	**1,3-Cyclohexadiene-1, 4-dicarboxylic acid***	2,3-dihydroterephthalic acid	$C_6H_6(COOH)_2$	168 14
2987	**1,4-Cyclohexadienedione*.** See *Quinone.*			
2988	**Cyclohexane***	hexahydrobenzene; hexamethylene	C_6H_{12}. .	84 16
2989	——, **amino-.**	See *Cyclohexylamine*.*		
2990	——, **bromo-***	cyclohexyl bromide .	$C_6H_{11}Br$ . .	163 07
2991	——, **chloro-***	cyclohexyl chloride .	$C_6H_{11}Cl$.	118 61
2992	——, **1,3-dimethyl-**	hexahydro-*m*-xylene	$C_6H_{10}(CH_3)_2$	112 21
2993	——, **1,4-dimethyl-** .	hexahydro-*p*-xylene.	$C_6H_{10}(CH_3)_2$	112 21
2994	——, **1,2,3,4,5,6-hexabromo-** (*α* or *trans*)	benzene *trans*-hexabromide	$C_6H_6Br_6$ . .	557 60
2995	——, ——, (*β* or *cis*)	benzene *β*-hexabromide	$C_6H_6Br_6$.	557 60
2996	——, **1,2,3,4,5,6-hexachloro-** (*α* or *trans*)	benzene *trans*-hexachloride	$C_6H_6Cl_6$.	290 85
2997	——, ——, (*β* or *cis*)	benzene *cis*-hexachloride	$C_6H_6Cl_6$	290 85
2998	——, ——, (*γ*)	benzene *γ*-hexachloride	$C_6H_6Cl_6$	290 85
2999	——, ——, (*δ*)	benzene *δ*-hexachloride	$C_6H_6Cl_6$	290 85
3000	——, **isopropyl-**	hexahydrocumene, normenthane	$C_3H_7\ C_6H_{11}$	126 24
3001	——, **4-isopropyl-1-methyl-.** See *p-Menthane*			
3002	——, **methyl-**	hexahydrotoluene, cyclohexylmethane	$CH_3C_6H_{11}$	98 18
3003	——, **phenyl-**	cyclohexylbenzene, 1,2,3,4,-5,6-hexahydrobiphenyl	$C_6H_5C_6H_{11}$	160 25
3004	——, **1,3,5-trimethyl-**	hexahydromesitylene	$C_6H_9(CH_3)_3$	126 24
3005	**Cyclohexanecarboxylic acid***	hexahydrobenzoic acid	$C_6H_{11}COOH$.	128 17
3006	——, **2-hydroxy-.**	hexahydrosalicylic acid .	$HOC_6H_{10}COOH$	144 17
3007	——, **1,2,4,5-tetrahydroxy-*.** See *Quinic acid.*			
3008	**1,2-Cyclohexanedicarboxylic acid***	hexahydrophthalic acid	$C_6H_{10}(COOH)_2$	172 18
3009	**1,4-Cyclohexanedicarboxylic acid***	hexahydroterephthalic acid	$C_6H_{10}(COOH)_2$.	172.18

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
2986	flocks.	. . . .	. .	. . . .	i. c., s. h	. . .	. . . .
2987							
2988	col liq, 1.42900[15]	0 7791$\frac{20}{4}$	6 5	81.4	i.	∞	∞ eth.
2989							
2990	col. liq., 1 49564[15]	1 3290$\frac{15}{15}$	. .	163–5	i.	∞	∞ eth.
2991	col liq., 1.46264	1.0161$\frac{0}{0}$, 1 000$\frac{20}{4}$	–42.9	142.5	i.	∞	∞ eth, bz.
2992	col. liq (*cis*) 1 4269	0 7735$\frac{20}{4}$	–85	121	i.	∞	∞ eth.
	(*trans*) 1.4254	0 772$\frac{20}{4}$	.	119[754]	. . . .	. .	. . . . . .
2993	col liq, 1 421	(*cis*) 0.7671$\frac{20}{4}$; (*trans*) 0 7638$\frac{20}{4}$	–86	120 5[755]; 119			
2994	col. monocl. pr		212		i.	sl. s.	sl s eth; s. $CHCl_3$
2995	cub cr. f. bz.	. . .	253 d	. . . .	. . . .	i	i. eth, sl s. bz.
2996	col monocl pr.	1 87$\frac{20}{4}$	157	288 d.	i	s h	4 35[15] chl, 6 5[18] bz; v. s. aniline
2997	col cr .	1 89$\frac{19}{4}$	297	subl	i	sl s	0 13 $CHCl_3$,1[22] bz, 0 289[16] ac a.
2998	need f. al	. .	112–3	. . . . .	i.	. .	.
2999	pl .		129–32	. . . .	. .		
3000	col. liq . .	0 7902$\frac{20}{4}$		154.7	i.	v s.	v s eth.
3001							
3002	col. liq., 1.4235	0 7864$\frac{0}{4}$, 0 769$\frac{20}{4}$	–126 4	100 3	i.	s.	s eth.
3003	oil . . .	0 9440$\frac{20}{4}$	7	237.5	i.	v. s.	v s. eth.
3004	(*cis*) col. liq., 1 43010$^{20}_{He}$	0 773[20]		140–140 5[752]	. . .	. . . .	. . .
	(*trans*) 1 42740$^{20}_{He}$	0 7720[20]		138 5–139[7.4]		.	. .
3005	col monocl pr, 1 4561[53.8]	1 048$\frac{15}{4}$	31	233	0 201[15]	v. s.	v. s. eth.
3006	cr f w . .	. .	111	. . . . . .	v s.	v s.	v s eth.; sl. s. bz.
3007							
3008	(*cis*) tricl. pr f. w.		192; d –H_2O >192	. . . .	0 2	s.	s acet.
	(*trans*) monocl leaf. f w.	. . . .	221	. . . .	. . . . . .	. . . . . .	. . . .
3009	(*cis*) leaflets f. w		168–9	. . . .	v. s. h.	s.	s eth, $CHCl_3$
	(*trans*) pr f. w		300 subl.	.	1 34 h.	v s	sl. s. eth., s. acet, a $CHCl_3$

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3010	**1,3-Cyclohexanedione***	3-hydroxy-2-cyclohexen-1-one* (tautomeric form); dihydroresorcinol; hydroresorcinol	$COCH_2COCH_2CH_2CH_2$	112.12
3011	**1,4-Cyclohexanedione***	tetrahydroquinone; *p*-quinone tetrahydride	$CO(CH_2)_2COCH_2CH_2$	112 12
3012	**1,2,3,4,5,6-Cyclohexanehexacarboxylic acid***	hexahydromellitic acid	$C_6H_6(COOH)_6$ ..	348 22
3013	**1,2,3,4,5,6-Cyclohexanehexol***. See *i-Inositol*.			
3014	**Cyclohexanehexone***, hydrate	triquinoyl hydrate	$C_6O_6\ 8H_2O$	312 19
3015	**Cyclohexanepentol***.	See *d-Quercitol*.		
3016	**1,3,5-Cyclohexanetrione***, trioxime	1,3,5-trihydroxaminobenzene, phloroglucinol trioxime	$C_6H_6(NOH)_3$	171 16
3017	**Cyclohexanol***.... .	hexahydrophenol, hexalin	$C_6H_{11}OH$	100 16
3018	——, acetate	cyclohexyl acetate	$CH_3COOC_6H_{11}$	142 19
3019	——, benzoate.....	cyclohexyl benzoate, cyclohexyl benzenecarboxylate	$C_6H_5COOC_6H_{11}$.	204 26
3020	——, **2-methyl-**.	hexahydro-*o*-cresol	$CH_3C_6H_{10}OH$	114 18
3021	——, **3-methyl-(*l*)**. .	*l*-hexahydro-*m*-cresol.	$CH_3C_6H_{10}OH$..	114 18
3022	——, **4-methyl-**..	hexahydro-*p*-cresol	$CH_3C_6H_{10}OH$	114 18
3023	**Cyclohexanone*** ...	ketohexamethylene, pimelic ketone	$CO(CH_2)_4CH_2$..	98 14
3024	——, **2,5-dimethyl- (*d*)**	...	$COCH(CH_3)CH_2CH_2CH(CH_3)CH_2$	126 19
3024M	——, **2-hydroxy-**.	See *Adipoin*.		
3025	——, **2-methyl-**. . ..	....	$COCH(CH_3)CH_2CH_2CH_2CH_2$	112 17
3026	——, **3-methyl-**.. .	. ...	$COCH_2CH(CH_3)CH_2CH_2CH_2$	112 17
3027	——, **4-methyl-** .	....	$COCH_2CH_2CH(CH_3)CH_2CH_2$	112 17
3028	**Cyclohexanone pinacol**. See 1,2-*Ethanediol*, 1,2-*dicyclohexyl-*.			

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3010	pr. f. bz. or ethyl acetate	.	105–6	. . . .	s.	s.	v. sl. s. eth., CS_2, lgr.; s. chl.
3011	monocl f w		78	subl 100	s.	s.	s. eth.
3012	cr		d		v s.	v. s.	v s. eth.
3013							
3014	micr need f dil HNO_3		65		s h	i	i eth, s alk.
3015							
3016	cr. powd		exp 155	.	v sl s	v. sl. s.	s. chl., ac. a.
3017	col. need., hyg, $1.46560^{22.6}$	0.9449^{25}_{4}, 0.9624^{20}_{4}	24 (22–25)	161.5	5.67^{15}	s.	s. eth.; ∞ bz., CS_2, turpentine
3018	. .			177 (171–6)	i.	∞	∞ eth.
3019	. . . . .			160^{18}	i.	s.	s. eth.
3020	(*cis*) col. liq., 1.4640^{20}	0.937^{20}	–9.5 to –9.2	165	v sl s.	∞	s eth.
	(*trans*) col. liq., 1.4611^{20}	0.9238^{20}	–21.2 to –20.5	166.5	v. sl s	∞	s. eth.
3021	(*cis*) syrup, $1.45497^{21.8}$	$0.9145^{21.8}_{4}$	–47	173–4	1.03	∞	∞ eth
	(*trans*) syrup, $1.45497^{21.8}$	$0.9145^{21.8}_{4}$	.	$174–5^{762}$			.
3022	(*cis*) aromatic liq, $1.45327^{21.5}$	0.9129		$173–4^{750}$	v sl s	∞	s eth.
	(*trans*) aromatic liq., $1.45307^{20.7}$	0.9118		$173–4.5^{745}$	v. sl. s.	∞	s eth.
3023	col. liq., 1.4507	0.9478^{20}_{4}	frz. –45	156.7 (155)	2.4^{31}	s.	s. eth.
3024	oil, 1.44807^{20}; $[\alpha]^{20}+11.6$	0.8985^{20}		$172–174^{750}$	i.	s	s eth.
3024M							
3025	liq, $1.45049^{14.6}$	0.9248^{15}		163	i.	s	s. eth.
3026	liq., (*d*) 1.4456^{21}; $[\alpha]^{15}+13.38$; (*dl*) 1.4430^{20}	0.915 0.9136_{24}	.	169 168	i. i.	s. s.	s. eth s. eth.
3027	liq, $1.44322^{24.4}$	0.912^{24}_{4}		169	i.	s	s eth.
3028							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3029	**Cyclohexene***........	1,2,3,4-tetrahydrobenzene..	$CH_2CH_2CH_2CH_2$- CH:CH	82.14
3030	**——, 4-isopropyl-1-me**	**thyl-3-.** See *Menthene.*		
3031	**——, 3-isopropyl-6-me**	**thylene-.** See *β-Phellandre*	*ne.*	
3032	**——, 4-methyl-**......	1,2,3,6-tetrahydrotoluene..	CH:$CHCH_2CH$- $(CH_3)CH_2CH_2$	96 17
3033	**1-Cyclohexene-1-carboxylic acid***	2,3,4,5-tetrahydrobenzoic acid	$CH_2(CH_2)_3CH$:C- COOH	126.15
3034	**1-Cyclohexene-1,2-dicarboxylic acid***	Δ^1-tetrahydrophthalic acid	$C_6H_8(COOH)_2$..	170.16
3035	**2-Cyclohexen-1-one, 3-**	**hydroxy-*.** See 1,3-*Cyclohex*	*anedione*.*	
3036	**Cyclohexyl acetate.**	See *Cyclohexanol, acetate*		
3037	**Cyclohexylamine***.....	hexahydroaniline; aminocyclohexane	$C_6H_{11}NH_2$.......	99 17
3038	**——, *N*-butyl-**.... .	... .	$C_6H_{11}NH(CH_2)_3$-CH_3	155 28
3039	**——, *N*-ethyl-** . .	... . .	$C_6H_{11}NHC_2H_5$	127 23
3040	——, ——, cyclohexylethylth	iolthionocarbamate. See under	*Carbamic acid, cycloh*	*exyl-*
3041	**——, *N*-methyl-** .		$C_6H_{11}NHCH_3$.	113 20
3042	**Cyclohexyl benzoate.**	See *Cyclohexanol, benzoate.*		
3043	**Cyclohexyl bromide.**	See *Cyclohexane, bromo-*.*		
3044	**Cyclohexyl chloride.**	See *Cyclohexane, chloro-**		
3045	**1,3-Cyclopentadiene***		CH·CHCH·$CHCH_2$	66 10
3046	**Cyclopentane***......	pentamethylene	$CH_2CH_2CH_2$- CH_2CH_2	70 13
3047	**——, bromo-*** . ..	cyclopentyl bromide	C_5H_9Br .	149 04
3048	**Cyclopentanecarboxyl**	**ic acid, 3-carbamyl-1,2,2**	**-trimethyl-.** See	*α-Cam-*
3049	**——, 3-carbamyl-2, 2,**	**3-trimethyl-.** See *β-Camph*	*oramic acid.*	
3050	**——, 1,2,2,3-tetrameth**	**yl-*.** See *Campholic acid.*		
3051	**1,2-Cyclopentanedicarboxylic acid***	. . .	$C_5H_8(COOH)_2$..	158 15
3052	**1,3-Cyclopentanedicarboxylic acid***	.. .	$C_5H_8(COOH)_2$.	158 15
3053	**——, 1,2,2-trimethyl-(**	***cis*).** See *Camphoric acid.*		
3054	**——, 1,2,2-trimethyl-(**	***trans*).** See *Isocamphoric acid*	.	
3055	**1,3-Cyclopentanedicar**	**boxylic anhydride*.** See	*Camphoric anhydride*	.
3056	**Cyclopentanol***.....	.. . .	$CH_2CH_2CH_2CH_2C$- HOH	86 13
3057	**Cyclopentanone***.....	ketopentamethylene, adipic ketone	$COCH_2CH_2CH_2CH_2$	84 11
3058	**Cyclopentene***.......	.	CH·$CHCH_2CH_2CH$	68 11
3059	**——, 2-acetyl-1,3,3,4,4-**	**pentamethyl-.** See *Desoxy*	*mesityl oxide.*	
3060	**1-Cyclopentene-1-eth**	**ylamine, 2,3,3-trimethy**	**l-.** See *β-Camphyla*	*mine.*
3061	**Cyclopentyl bromide.**	See *Cyclopentane, bromo-*.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
3029	col. liq., 1.44507[22]	$0.8102\frac{26}{4}$	-103.7	83	i	s.	v. s. eth.
3030							
3031							
3032	liq	$0.841\frac{15}{4}$; $0.801\frac{20}{4}$		102–3	i	s.	s. eth.
3033	pl, 1.4903	$1.109\frac{20}{4}$, $1.072\frac{47}{4}$	38	243	0.7[20]		. .
3034	monocl. leaf. f. w.	. . .	120		v s		. . . . . .
3035							
3036							
3037	col liq, 1.43716	$0.8191\frac{20}{4}$ (0.8678)		134	sl s.	s.	s. eth.
3038	col. liq . .	. .		200–4	sl s	v s	v. s. eth.
3039	col liq .	$0.868\frac{0}{0}$		164	sl s.	∞	∞ eth.
3040	*ethylthiolthiono*-.						
3041	col liq . . .	. . . .		145–7	sl s.	v s.	∞ eth.
3042							
3043							
3044							
3045	col liq, 1.4446[19]	$0.80475\frac{19}{4}$		42.5	i	∞	∞ eth., bz.
3046	col. liq., 1.403[?]	$0.7510\frac{20}{4}$	-93.3	49.5	i.	∞	∞ eth.
3047	1.4875[19]	$1.3692\frac{15}{15}$		137–9			.
3048	*phoramic acid.*						
3049							
3050							
3051	(*cis*): need. f.w. (*trans*): warts f. w.		139 161	anh 150–60	v s v. s. h.	s. v. s	. v. sl. s. eth.; s. ct. ac., sl. s. bz., chl
3052	(*cis*) pr f w		121	300 d.	v s h	v. s.	v. s eth.; s. chl., acet., h. bz
	(*trans*) pr. f CCl_4		88		v s c		. . .
3053							
3054							
3055							
3056	oil, 1.41530.	$0.9488\frac{20}{4}$	.	139–40	sl s.	s.	. . .
3057	oil, 1.4366. .	$0.9480\frac{20}{4}$	-58.2	130.6	sl. s	∞	∞ eth.
3058	liq., 1.4218[18].	$0.7743\frac{18}{4}$	-93.3	45–6 (44)	i.	s.	s. eth.
3059							
3060							
3061							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
3062	**Cyclopropane***	trimethylene .	$CH_2CH_2CH_2$. .. .	42.08
3063	**——, 1,1-dimethyl-**	1,1-dimethyltrimethylene. .	$(CH_3)_2CCH_2CH_2$	70 13
3064	**——, methyl-...**	.. . .	$CH_3CHCH_2CH_2$.	56 10
3065	**Cyclopropanecarboxylic acid***	ethyleneacetic acid	$CH_2CH_2CHCOOH$	86.09
3066	**1,1-Cyclopropanedicarboxylic acid.***	See *Vinaconic acid.*		
3067	**1,2,3-Cyclopropanetricarboxylic acid***	. ..	$C_3H_3(COOH)_3$	174 11
3068	***o*-Cymene........**	*o*-isopropyltoluene; 2-isopropyl-1-methylbenzene	$CH_3C_6H_4CH(CH_3)_2$	134 21
3069	***m*-Cymene........ ..**	*m*-isopropyltoluene; 3-isopropyl-1-methylbenzene; isocymene	$CH_3C_6H_4CH(CH_3)_2$	134 21
3070	***p*-Cymene...**	cymene; *p*-isopropyltoluene, 4-isopropyl-1-methylbenzene	$CH_3C_6H_4CH(CH_3)_2$	134 21
3071	**——, 2-acetyl-.**	See *Acetophenone, 5-isopropyl-2-methyl-.*		
3072	**——, 2-amino-.**	See *Carvacrylamine.*		
3073	**——, 2-bromo- . .**	2-bromo-4-isopropyl-1-methylbenzene	$CH_3C_6H_3BrC_3H_7$	213 12
3074	**——, hexahydro-.**	See *p-Menthane*		
3075	**——, 2-nitro- ....**	4-isopropyl-1-methyl-2-nitrobenzene	$C_{10}H_{13}NO_2$	179 21
3076	**2-*p*-Cymenecarboxylic acid, 3-hydroxy-.**	See *o-Thymotic acid*		
3077	**2,5-*p*-Cymenediol.**	See *Thymohydroquinone.*		
3078	**2-*p*-Cymenol.**	See *Carvacrol.*		
3079	**3-*p*-Cymenol.**	See *Thymol.*		
3080	**Cymidine.**	See *Carvacrylamine.*		
3081	**Cymophenol.**	See *Carvacrol.*		
3082	**2-*p*-Cymylamine.**	See *Carvacrylamine.*		
3083	**3-*p*-Cymylamine.**	See *Thymylamine.*		
3084	***l*-Cysteine........ ..**	*l*-2-amino-3-mercaptopropanoic acid*; *l*-*β*-mercaptoalanine	$HSCH_2CH(NH_2)COOH$	121 15
3085	***dl*-Cystine..... . .**	. . . .	$[SCH_2CH(NH_2)COOH]_2$	240.29
3086	***d*-Cystine .. .**		$[SCH_2CH(NH_2)COOH]_2$	240 29
3087	***l*-Cystine .. .**	*l*-3,3′-dithiobis (2-aminopropanoic acid*), *l*-*β*, *β*′-dithiodialanine; dicysteine	$[SCH_2CH(NH_2)COOH]_2$	240 29
3088	***meso*-Cystine. . . .**		$[SCH_2CH(NH_2)COOH]_2$	240 29
3089	**Cytisine....... .**	ulexine; sophorine; baptitoxine	$C_{11}H_{14}N_2O$.	190 24
3090	***β*-Cytisolidine.**	See *Quinoline, 6,8-dimethyl-**.		
3091	**Dambose.**	See *i-Inositol.*		
3092	**Daphnetin. ... ...**	7,8-dihydroxycoumarin . .	$OCOCH{:}CHC_6H_2(OH)_2$	178 14
3093	**Daturine.**	See *Hyoscyamine.*		
3094	***dl*-Daturine.**	See *Atropine.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3062	col. gas.......	0 720^{-79}	-126 6	-34 4	i.	v. s.	v. s. eth.
3063	1 366	0 6604	. .	21	i.	s.	s. eth., H_2SO_4
3064	col. gas...	0 691^{-20}	....	5	sl. s.	v. s.	v. s. eth.
3065	1.43901^{20}. ..	1 0885$\frac{20}{4}$	18–19	182–4 (181)	sl s.	s.	s. eth.
3066							
3067	col. cr......	.. ...	220	.....	s	s.	. . ..
3068	col. liq., 1.50206$^{16.15}$	0 876$\frac{20}{4}$	-73.5	175 (175-8)	i	s	s. eth., chl.
3069	col. liq., 1.49385$^{17.05}$	0 8696$\frac{20}{4}$	<-25	175.7	i	s.	s. eth., chl.
3070	col. liq., 1.49474$^{15.0}$	0 8570$\frac{20}{4}$	-73 5 (-68 9)	176	i.	v. s.	s. eth., chl.
3071							
3072							
3073	liq	1 269$\frac{17}{4}$		233–5	i	v s	s. eth.
3074							
3075	aromatic oil, 1 53093^{20}	1 0774$\frac{20}{4}$		130–5^{15}	i.	v s	v s. eth.
3076							
3077							
3078							
3079							
3080							
3081							
3082							
3083							
3084	cr. powd				v. s		s. ac. a., NH_4OH
3085	need..... ..		260 (225–7)	. .	0 006^{25}	......	....
3086	wh. hex pl		247–9	....	0 011^{25}	i.	s. min. a., alk.
3087	hex. pl. f. dil. HCl, 1.700, 1.640, [α] -206°$^{20}_{D}$ in dil. HCl		258–61 d.	...	0 011^{25}, 0.052^{75}	i.	i. eth., chl., bz.; s. min. a., caustic alk., NH_4OH
3088	. ...	.	.	....	0 006^{25}	.. ..	. . . .
3089	col. lg. rhomb. cr. [α]-119.1°$^{17}_{D}$ in w.	. ...	152–3	.....	78^{16}	30.1^{6}	i. eth., CS_2, CCl_4; s. chl., bz.
3090							
3091							
3092	pa yel. need .	.	256	.. .	v. s h.	s h dil.	v. sl. s. eth.; i. chl., bz.
3093							
3094							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3094M	**1,3-Decadiene***	. . .	$(CH_3)(CH_2)_5$-CH·CHCH:CH_2	138.25
3095	**Decalin.**	See *Naphthalene, decahydro-**.		
3096	**Decamethylene glycol.**	See 1,10-*Decanediol**.		
3097	**Decanal*.**	See *Capraldehyde.*		
3098	**Decanamide*.**	See *Capramide.*		
3099	**Decane***	*n*-decane	$CH_3(CH_2)_8CH_3$	142.28
3100	**——, 1-amino-.**	See *Decylamine**.		
3101	**——, 1-iodo-***	*prim-n*-decyl iodide	$CH_3(CH_2)_9I$	268.19
3102	**Decanedioic acid*.**	See *Sebacic acid.*		
3103	**1,10-Decanediol***	decamethylene glycol	$CH_2OH(CH_2)_8$-CH_2OH	174.28
3104	**Decanenitrile*.**	See *Caprinitrile.*		
3105	**Decanoic acid*.**	See *Capric acid*		
3106	**Decanoic anhydride*.**	See *Capric anhydride.*		
3107	**1-Decanol***	*n*-decyl alcohol, nonylcarbinol	$CH_3(CH_2)_8CH_2OH$	158 28
3108	——, acetate	*n*-decyl acetate	$CH_3COO(CH_2)_9$-CH_3	200 31
3109	——, nitrate	*n*-decyl nitrate	$CH_3(CH_2)_9ONO_2$	203 28
3110	——, nitrite	*n*-decyl nitrite.	$CH_3(CH_2)_9ONO$	187 28
3111	——, sulfate	. .	$[CH_3(CH_2)_9]_2SO_4$	378 60
3112	**4-Decanol***	hexylpropylcarbinol, *sec*-decyl alcohol	$CH_3(CH_2)_2CH$-$OH(CH_2)_5CH_3$	158 28
3113	**2-Decanone***	methyl octyl ketone	$CH_3COC_8H_{17}$	156 26
3114	**3-Decanone***	ethyl heptyl ketone	$C_2H_5CO(CH_2)_6$-CH_3	156 26
3115	**4-Decanone***	hexyl propyl ketone	$CH_3(CH_2)_2CO$-$(CH_2)_5CH_3$	156 26
3116	**Decanoyl chloride*.**	See *Capryl chloride.*		
3117	**1-Decene***	*n*-decylene	CH_2:$CH(CH_2)_7$-CH_3	140 26
3118	**Decine.**	See *Decyne**.		
3119	***n*-Decoic acid.**	See *Capric acid.*		
3120	***n*-Decyl alcohol.**	See 1-*Decanol**.		
3121	***sec*-Decyl alcohol.**	See 4-*Decanol**.		
3122	***tert*-Decyl alcohol.**	See 4-*Heptanol, 4-propyl-**, 3-*Octanol, 3-ethyl-**		
3123	***n*-Decyl aldehyde.**	See *Capraldehyde*		
3124	***n*-Decylamide.**	See *Capramide.*		
3125	**Decylamine*(*n*)**	1-aminodecane	$CH_3(CH_2)_9NH_2$	157 29
3126	***n*-Decylene.**	See 1-*Decene**.		
	***n*-Decyl esters.**	See under 1-*Decanol.*		
3127	***n*-Decylic acid.**	See *Capric acid.*		
3128	***n*-Decylic amide.**	See *Capramide.*		
3129	***n*-Decylic anhydride.**	See *Capric anhydride.*		
3130	***prim-n*-Decyl iodide.**	See *Decane, 1-iodo-**.		
3131	**1-Decyne***	1-decine; *n*-octylacetylene	$CH\vdots C(CH_2)_7CH_3$	138 25
3131H	**5-Decyne***	5-decine, dibutylacetylene.	$C_4H_9C\vdots C$-C_4H_9	138 25
3132	**Dehydroacetic acid**	3-acetyl-6-methyl-2,4-pyrandione	OCOCH($COCH_3$)-COCH:C(CH_3)	168 14
3133	**Dehydromucic acid**	2,5-furandicarboxylic acid	$C_4H_2O(COOH)_2$	156 09
3134	——, dimethyl ester	. . .	$C_4H_2O(COOCH_3)_2$	184 14
3135	**——, tetrahydro-3, 4-dihydroxy-.** See *Isosaccharic acid*			

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3094M	liq .	0 750^{20}	. .	168–70	.	.....	....
3095							
3096							
3097							
3098							
3099	col. liq, 1.41203	0 73014$\frac{20}{4}$	-30 to -32	174	i.	∞	∞ eth.
3100							
3101	liq, 1 48269	1 2567$\frac{20}{4}$	.	132^{15}		.	. . ....
3102							
3103	.		71 5	179^{11}	v sl s	s	i. eth.
3104							
3105							
3106							
3107	col visc liq., 1.43682^{20}	0 8292$\frac{20}{4}$	-6	231	i	s.	∞ eth.
3108	col. liq..	....	-15 05	191 5; 125^{15}	i.	s.	s. eth., bz.
3109	liq	0 951$\frac{0}{4}$	.	127–8^{11}	.	.	. .. .
3110	liq	.... . .	.... .	105–8^{12}	..		. . ..
3111	.	....	37.6–37 8			.	. ...
3112	thk col oil	0 826$\frac{20}{4}$	. . .	210–1	i	s.	.... ..
3113	liq or need., 1 4263^{22}	0 825	14 (2 5)	211	i.	s.	s. eth.
3114	liq......	..... .		211		s.	s. eth.
3115	col. liq..	0 824$\frac{20}{4}$	-9	207	v sl s.	∞	∞ eth.
3116							
3117	col liq., 1 4385^{17}	0 763$\frac{0}{4}$	-87	172	i	∞	∞ eth.
3118							
3119							
3120							
3121							
3122							
3123							
3124							
3125	col liq or leaf	0 951$\frac{6}{4}$	17	220 5	sl s	s.	s. eth.
3126							
3127							
3128							
3129							
3130							
3131	col. liq .	0 791	-40	80–2^{32}	i	s.	s. eth.
3131H	col. liq., 1.4311	0 7673^{25}		78 8^{25}; 116^{115}	i.	s.	s. eth.
3132	rhomb. need. or pl.	.	109	270	1^{6}	s. h.	s. eth.
3133	pl. f. h. al.; need. f. w.	.	>320	....	i. c.	.....	....
3134	need. f. w....		109–10	154–6^{15}	i. c.	s.	s. eth.
3135							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
3136	**Dehydromucyl chloride**	2,5-furandicarbonyl chloride.	$C_4H_2O(COCl)_2$	192 99
3137	**Delphinine**.	. .	$C_{34}H_{47}NO_9$	613.73
3138	**Derritol**		$C_{21}H_{22}O_6$ . . .	370.39
3139	**Desoxalic acid**. . . .	1,2-dihydroxy-1,1,2-ethanetricarboxylic acid	$(COOH)CH(OH)-C(OH)(COOH)_2$	194.10
3140	**Desoxybenzoin**	α-phenylacetophenone; benzyl phenyl ketone	$C_6H_5CH_2COC_6H_5$.	196 24
3141	**——, α,α′-benzalbis-.**	See *Benzamarone*; *Isobenzamarone.*		
3142	**Desoxymesityl oxide** .	2-acetyl-1,3,3,4,4-pentamethylcyclopentene	$C_{12}H_{20}O$. . . .	180 28
3143	**Dextrin**.	starch gum; British gum, amylin; gommelin	$(C_6H_{10}O_5)_x$.	. $(162.14)_x$
3144	**Dextronic acid.**	See *D-Gluconic acid.*		
3145	**Dextrose.**	See *D-Glucose.*		
	Di-. For dibromo, diethyl, etc. derivatives see the parent compounds (e.g., *Acetic*			
3146	**Diacetamide**	. . . . .	$(CH_3CO)_2NH$	101 10
3147	**——, *N*-phenyl-.**	See *Diacetanilide.*		
3148	**Diacetanilide**.	*N*-phenyldiacetamide; *N,N*-diacetylaniline	$(CH_3CO)_2NC_6H_5$	177 20
3149	**——, *p*-ethoxy-**	*N,N*-diacetyl-*p*-phenetidine. .	$(CH_3CO)_2NC_6H_4-OC_2H_5$	221 25
3150	**Diacetin.**	See *Glycerol, diacetate.*		
3151	**Diacetoacetic acid,** ethyl ester	ethyl 2-acetyl-3-oxobutanoate*; ethyl α-acetylacetoacetate	$(CH_3CO)_2CH-COOC_2H_5$	172 18
3152	**Diacetone alcohol.**	See *2-Pentanone, 4-hydroxy-4-methyl-*.*		
3153	**Diacetonealkamine, benzoylvinyl-.**	See *β-Eucaine*		
3154	**Diacetosuccinic acid,** diethyl ester	diethyl 2,3-diacetylbutanedioate*; ethyl α,β-diacetylsuccinate	$(CH_3COCHCOO-C_2H_5)_2$	258 27
3155	**Diacetyl.**	See 2,3-*Butanedione**		
3156	**Diacetyl dioxime.**	See *Glyoxime, dimethyl-*		
3157	**Diacetyl peroxide.**	See *Acetyl peroxide*		
3158	**Dial.**	See *Barbituric acid, 5,5-diallyl-*		
3159	**Diallyl.**	See 1,5-*Hexadiene**		
3160	**Diallylamine**	di-2-propenylamine* .	$(CH_2{:}CHCH_2)_2NH$	97.16
3161	**Diallyl sulfide.**	See *Allyl sulfide.*		
3162	**Dialuramide.**	See *Uramil.*		
3163	**Dialuric acid**.	5-hydroxybarbituric acid, tartronylurea	NHCONHCO- CHOHCO	144 09
	Diamino-. See the parent compounds (e.g., for diaminophenol see *Phenol, diamino-*;			
3164	**Diamylamine**	di-*n*-amylamine .	$[CH_3(CH_2)_4]_2NH$	157.29
3165	**Diamyl ketone.**	See 6-*Hendecanone*.*		
3166	**Di-*n*-amyl sulfate.**	See *Amyl sulfate.*		
3167	**Diarsenic tetramethyl.**	See *Cacodyl.*		
3168	**1,2-Diazine.**	See *Pyridazine.*		
3169	**1,3-Diazine.**	See *Pyrimidine.*		
3170	**1,4-Diazine.**	See *Pyrazine.*		
3171	**Diazoacetic acid,** ethyl ester.	See under *Acetic acid, diazo-.*		
3172	**Diazoaminobenzene***	1,3-diphenyltriazene*; benzenediazoanilide	$C_6H_5N{:}NNHC_6H_5$	197 23
3173	**——,** (isomeric form).		$C_6H_5N{:}NNHC_6H_5$	197 23

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3136	yel. pl .		80	*ca.* 245	v. s.	......	v. s. eth.
3137	rhomb. pl .	..	191 d.		0 002^{20}	4 8^{20}	9^{20} eth.; v. s. chl.
3138	yel. need. f me. al.		161			....	....
3139	hyg cr		...	d. 50	v. s.	v. s.	sl. s. eth.
3140	wh pl f al		60 (55–6)	322	sl s h.	s.	s. eth.
3141							
3142	liq .			218–20	i		....
3143	col. amor., [α] gen >+200°D	1 $0384\frac{20}{4}$	d	.	s	i.	i. eth.
3144							
3145							
	acid, dibromo-;	*Benzene, diet*	*hyl-).*				
3146	col. need. f. eth.		78	223 5	s.	s.	s. eth., lgr.
3147							
3148	col. pl. f lgr.		37–8	142^{11}	s	s.	s. bz., lgr., tol.
3149	col need. f lgr.		53 5–54 (55–56)	182^{12}	0 25	v. s.	v. sl. s. eth.
3150							
3151	col. liq , $1.46950^{18.5}$	1 $104\frac{15}{4}$, 1 $089\frac{25}{25}$		211 sl d	sl. s.	v. s.	v. s. eth.
3152							
3153							
3154	α_1 oil				v. sl. s.	s.	s. eth.; 10 lgr.
	α_2 cr.		20–2			v. s.	v. s. eth
	α_3 pr		31–2		i	v. s.	v. s. eth.
	α_4 rhomb	1 $209\frac{20}{4}$	89–90			15	20 eth.
3155							
3156							
3157							
3158							
3159							
3160	liq			111–2		..	... .
3161							
3162							
3163	col tetr	.	214–5 d		sl s.		....
	for diaminonaph	thalene see	*Naphthalene*	*diamine).*			
3164	col liq .			$202\text{–}3^{745}$	v. sl. s.	v. s.	∞ eth.
3165							
3166							
3167							
3168							
3169							
3170							
3171							
3172	(1) golden-yel leaf. or pr. f. al.	.	98–9	d w sl. exp.	i.	s. h.	s. eth., bz.
	(2) yel. pr...	..	80–1			...	... .
3173	yel. pr ..		80–1	exp.	i.	s. h.	s. eth., bz., lgr.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3174	**Diazoaminobenzene, 4,4'-dinitro-***	1,3-*bis*(*p*-nitrophenyl)triazene*	$NO_2C_6H_4NNN$-$HC_6H_4NO_2$	287.23
3175	**——, 4-methyl-.**	See *Triazene-1-phenyl-3-p-tolyl-*.		
3176	**1,1'-Diazoaminonaphthalene***	1,3-di-1-naphthyltriazene*.	$C_{10}H_7N\cdot NNH$-$C_{10}H_7$	297 35
3177	**2,2'-Diazoaminonaphthalene***	1,3-di-2-naphthyltriazene* .	$C_{10}H_7N{:}NNH$-$C_{10}H_7$	297 35
3178	**Diazobenzene chloride**, etc	See *Benzenediazonium chloride**, *etc.*		
3179	**Diazobenzene imide.**	See *Benzene, triazo-*.		
3180	**Diazobenzene perbromide.**	See *Benzenediazonium tribromide**.		
3181	**Diazobenzolic acid.**	See *Aniline, N-nitro-*.		
3182	**1,2-Diazole.**	See *Pyrazole.*		
3183	**Diazomethane.**	See *Methane, diazo-*.		
3184	**Dibenzanthracene** ..		$C_{22}H_{14}$ ..	278 33
3185	**Dibenzo-*p*-dithiin.**	See *Thianthrene.*		
3186	**Dibenzofuran**......	diphenylene oxide; biphenylene oxide	$C_6H_4OC_6H_4$.	168 18
3187	**——, 3-amino-**....	...	$C_{12}H_7O\ NH_2$...	183 20
3188	**——, 2-bromo-**....	...	$C_{12}H_7BrO$	247.09
3189	**——, 3-nitro-**....	...	$O_2NC_{12}H_7O$	213 18
3190	**2-Dibenzofurancarboxylic acid**	..	$C_{12}H_7O\ COOH$	212 19
3191	**Dibenzo(*a*,*i*)phenanthrene.**	See *Picene.*		
3192	**Dibenzo-1,4-pyran.**	See *Xanthene.*		
3193	**Dibenzopyrrole.**	See *Carbazole.*		
3194	**Dibenzothiophene-2,7-diamine**, 9-dioxide.	See *Benzidine sulfone*		
3195	**Dibenzoyl.**	See *Benzil*		
3196	**Dibenzyl.**	See *Bibenzyl.*		
3197	**Dibenzylamine***	.	$(C_6H_5CH_2)_2NH$	197 27
3198	——, dibenzylthiolthionocarbamate	See under *Carbamic acid, dibenzylthiolthiono-*		
3199	**——, *N*-phenyl-**	*N*,*N*-dibenzylaniline	$(C_6H_5CH_2)_2N$-C_6H_5	273 36
3200	**Dibenzyl disulfide.**	See *Benzyl disulfide*		
	Dibromo-. See the parent compounds (e.g., for dibromobenzene see *Benzene, dibromo-*).			
3201	**β-Dibromohydrin.**	See 1-*Propanol*, 2,3-*dibromo-**		
3202	**Dibutylamine*** ..	di-*n*-butylamine .	$(C_4H_9)_2NH$	129.24
3203	**——, *N*-phenyl-.**	See *Aniline, N,N-dibutyl-*		
3204	**Di-*n*-butyl sulfate.**	See *Butyl sulfate*		
3205	**Dichloramine(T)**....	*N*,*N*-dichloro-*p*-toluenesulfonamide	$CH_3C_6H_4SO_2NCl_2$	240 11
	Dichloro-. See the parent compounds (e g , for dichlorobenzene see *Benzene, dichloro-*)			
3206	**α-Dichlorohydrin.**	See 2-*Propanol*, 1,3-*dichloro-**		
3207	**β-Dichlorohydrin.**	See 1-*Propanol*, 2,3-*dichloro-**		
3208	**Dichloronitrohydrin.**	See 2-*Propanol*, 1,3-*dichloro-*, *nitrate**.		
3209	**Dicyan(o)diamide.**	See *Guanidine*, 1-*cyano-*.		
3210	**Dicyan(o)diamidine.**	See *Urea, guanyl-*.		
3211	**Dicyclohexylamine***	. .	$(C_6H_{11})_2NH$	181 31
3211M	**Dicyclopentadiene**..	.	$C_{10}H_{12}$	132 20
3212	**Dicysteine.**	See *l-Cystine.*		
3213	**Di-*n*-decyl sulfate.**	See 1-*Decanol, sulfate*		
3214	**Di-*n*-dodecyl sulfate.**	See *Dodecyl sulfate.*		
3215	**Diethanolamine**	diethylolamine, 2,2'-iminodiethanol; β,β'-dihydroxydiethylamine, iminoethyl alcohol (incorrect)	$HN(CH_2CH_2OH)_2$	105 14
	Diethyl. For diethyl derivatives see the parent compounds (e.g., for diethylbenzene see			

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3174	yel. cr		233 d. (224–6)		i	v. sl. s. h.	s eth
3175							
3176	yel leaf. f. al.	.	exp.	. .		.....	. ..
3177	red need f xylene		156	. .	. .	....	. ...
3178							
3179							
3180							
3181							
3182							
3183							
3184	or. tab. f. bz. or brnsh. need. f. ac. a	.	267 5	...	i.	i.	i. eth, ac. a., c. bz.
3185							
3186	col leaf f. al, bl. fluor.		87	288	i.	sl. s.	v. s. eth ; s. bz.
3187	need .	.	99–99 5		i	v. s h.	v. s eth
3188	leaf		110	220^{40}	i	s. h.	s eth
3189	yel need		181–3	.	i	sl. s.	sl s. eth ; s. h. glac ac a.
3190	amor	.	246–7		v sl s.	s. h.	s eth.
3191							
3192							
3193							
3194							
3195							
3196							
3197	col liq., $1\ 57432^{22}$	$1\ 026^{22}$	-26	300 (268 -71^{250})	i	v s.	v. s. eth.
3198							
3199	need or pr. f al., 1.60647^{80}	$1\ 04436\frac{80}{4}$	71–2 (69 5)	>300 d	i.	sl. s.	s. eth, bz.
3200							
3201							
3202	col liq .	$0\ 767\frac{20}{4}$	.	159–61	s.	v. s.	v. s. eth.
3203							
3204							
3205	pa yelsh cr or powd.		83		sl s.	s.	s. eth., bz., chl., CCl_4, ac. a.
3206							
3207							
3208							
3209							
3210							
3211	col. liq ..			$254–6^{745}$	sl. s.	v. s.	∞ eth.
3211M	col. cr	$0\ 976^{35}$	32 9	170 sl. d.	..	v. s.	v. s. eth.
3212							
3213							
3214							
3215	liq or col pr, $1\ 4776^{30}$	$1\ 0966\frac{20}{4}$	28	208	∞	∞	v. sl. s. eth., sl. s. bz.
	Benzene, diethyl	-). For die	thyl esters o	f organic ac	ids see th	e acids.	

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3216	**Diethylamine***	... .	$(C_2H_5)_2NH$ ..	73 14
3217	—, diethylthiolthionocarbamate.	See under *Carbamic acid, diethylthiolthiono-*.		
3218	—, hydrochloride .	diethylammonium chloride*.	$(C_2H_5)NH\ HCl$....	109.60
3219	**—, *N*-cyano-.**	See *Cyanamide, diethyl-*.		
3219M	**—, 2,2′-diamino-.**	See *Diethylenetriamine*.		
3220	**—, β,β′-dihydroxy-.**	See *Diethanolamine*.		
3221	**—, β,β′-dihydroxy-*N*-methyl-.**	See *Ethanol, 2,2′-methyliminodi-*.		
3222	**—, *N*-formyl-.**	See *Formamide, N,N-diethyl-*.		
3223	**—, β-hydroxy-.**	See *Ethanol, 2-ethylamino-**.		
3224	**—, *N*-methyl-**..	. . . .	$(C_2H_5)_2NCH_3$.	87 16
3225	**—, *N*-nitro-**..	diethylnitramine, nitric diethylamide	$(C_2H_5)_2NNO_2$	118.14
3226	**—, *N*-nitroso-**.......	diethylnitrosamine; nitrous diethylamide	$(C_2H_5)_2NNO$.	102.14
3227	**—, *N*-phenyl-.**	See *Aniline, N,N-diethyl-*.		
3228	**Diethylenediamine.**	See *Piperazine*.		
3229	**Diethylene dioxide.**	See *p-Dioxane*.		
3230	**Diethylene disulfide.**	See *p-Dithiane*.		
3231	**Diethylene glycol** . ..	2,2′-oxydiethanol; 2,2′-dihydroxyethyl ether	$O(CH_2CH_2OH)_2$...	106 12
3232	—, diethyl ether.	See *Ether, bis (β-ethoxyethyl)*.		
3233	—, dioleate......	... .	$(C_{17}H_{33}COOC_2H_4)_2O$	635 00
3234	—, distearate......	glycosterin .	$(C_{17}H_{35}COOC_2H_4)_2O$	639 03
3235	—, monobutyl ether	2-(β-butoxyethoxy)ethanol*; butyl "Carbitol"	$C_4H_9OCH_2CH_2OCH_2CH_2OH$	162 23
3236	—, monobutyl ether acetate	... .	$C_4H_9O(CH_2)_2O(CH_2)_2OOCCH_3$	204.26
3237	—, monoethyl ether.	2-(β-ethoxyethoxy)ethanol*, "Carbitol"	$C_2H_5OCH_2CH_2OCH_2CH_2OH$	134 17
3238	—, monoethyl ether acetate	.	$C_2H_5O(CH_2)_2O(CH_2)_2OOCCH_3$	176 21
3238M	—, monolaurate . .	"Glaurin"......	$C_{11}H_{23}COOC_2H_4OC_2H_4OH$	288 42
3239	—, monomethyl ether	2-(β-methoxyethoxy)ethanol*, methyl "Carbitol"	$CH_3OCH_2CH_2OCH_2CH_2OH$	120 15
3240	**Diethylene oxide 2-iminoethyl alcohol.**	See *4-Morpholinethanol*.		
3240M	**Diethylenetriamine**	2,2′-diaminodiethylamine .	$(NH_2C_2H_4)_2NH$ ..	103 17
3241	**Diethylenimide oxide.**	See *Morpholine*.		
3242	**Diethyl ether.**	See *Ethyl ether*.		
3242H	**Diethyl formal.**	See *Methane, diethoxy-*.		
3242R	**Diethylolamine.**	See *Diethanolamine*.		
3243	**Diethylphosphoric acid**	diethyl hydrogen phosphate	$PO(OC_2H_5)_2OH$	154 11
3244	**Diethyl sulfate.**	See *Ethyl sulfate*.		
3245	**Diethyl sulfite.**	See *Ethyl sulfite*.		
3246	**Difurfurylamine**.. .	α,α′-di-2-furyldimethylamine	$(C_4H_3OCH_2)_2NH$	177 20
3247	***m*-Digallic acid** ..	gallic acid 3-monogallate .	$C_{14}H_{10}O_9$	322 22
3249	**Diglycolamidic acid.**	See *Acetic acid, iminodi-*.		
3250	**Diglycolic acid**	oxydiethanoic acid*; oxydiacetic acid	$O(CH_2COOH)_2$	134 09
3251	**Diglycolide.**	See *Glycolide*.		
3252	**Diglycolyl diamide.**	See *Glycine anhydride*.		
3253	**Diguanide.**	See *Biguanide*.		
3254	**Di-*n*-heptyl sulfate.**	See *Heptyl sulfate*.		
3255	**Di-*n*-hexadecyl sulfate.**	See *Cetyl sulfate*.		
3256	**Dihexyl.**	See *Dodecane**.		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3216	col. inflam. liq., 1.38730^{18}	$.7108\frac{18}{4}$	-50 (-39)	55.5	81.5^{144}	s.	s. eth.
3217							
3218	leaf. f. et. al .	$1.048\frac{21}{4}$	219–20	330	232^{25}	sl. s. c.	i. eth.
3219							
3219M							
3220							
3221							
3222							
3223							
3224	col. liq......			63–5	v. s.	s.	s. eth.
3225	liq	.	. .	206^{757}	sl. s.	∞	∞ eth.
3226	yel. liq., $1.43864^{19.9}$	$0.9422\frac{20}{4}$		177 (175.4)	s.	∞	∞ eth
3227							
3228							
3229							
3230							
3231	col. liq.......	1.132^{0}; 1.1177^{20}	-10.45 (-6.5)	244.5 (245–50)	s.	s.	s. eth.
3232							
3233	pa. yel liq...	$0.9310\frac{20}{4}$	..	..	disper-sible	∞	∞ eth.
3234	wh. wax-like solid	$0.9333\frac{20}{4}$	54-5	...	disper-sible	i.	i. eth.
3235	col. liq.. .. .	$0.9553\frac{20}{4}$	. ..	231.2	∞	v. s.	v. s. eth.
3236	col liq.......	$0.985\frac{20}{4}$		245		....	... .
3237	col. liq......	$0.9902\frac{20}{4}$	..	201.9	∞	v. s	s eth.
3238	col. liq.......	$1.009\frac{20}{4}$	....	218	∞	.	.
3238M	straw-colored oily liq.	$0.960\frac{25}{25}$	17–18	>270	i.	s.	s eth.
3239	col liq., 1.4264^{27}	$1.0354\frac{20}{4}$	... .	193.2	∞		.
3240							
3240M	col.-yel. liq	$0.9586\frac{20}{20}$	....	207.1	∞	s.	i. eth
3241							
3242							
3242H							
3242R							
3243	liq	1.175	. ...	203.3	i		. . ..
3244							
3245							
3246	col. liq.....	.. .	. .	$102\text{-}3^{1}$	i.	.	s. eth.
3247	need. (+1H_2O) f. al. +w.	.	268–70 d	.			.
3249							
3250	rhomb. or monocl. pr. (+1H_2O) f. w.	. .	148	d.	s.	s.	s. eth.
3251							
3252							
3253							
3254							
3255							
3256							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3257	**Di-*n*-hexyl sulfate.**	See *Hexyl sulfate.*		
	Dihydro-. See the parent compounds (e.g., for dihydronaphthalene see *Naphthalene,*			
	Dihydroxy-. See the parent compounds (e.g., for dihydroxyanthraquinone, see			
3258	**Diimide, dinaphthyl-.**	See *Azonaphthalene.*		
3259	**——, diphenyl-.**	See *Azobenzene.*		
3260	**——, dixenyl-.**	See *Azobiphenyl.*		
3261	**——, ethylphenyl-.**	See *Benzeneazoethane.*		
3262	**——, methylphenyl-.**	See *Benzeneazomethane.*		
3263	**——, α-naphthyl-β-naphthyl-.** See 1,2′-*Azonaphthalene.*			
3264	**Diisoamylamine**.....	bis(γ-methylbutyl)amine* .	$[(CH_3)_2CHCH_2CH_2]_2NH$	157 29
3265	**Diisoamyl sulfate.**	See *Isoamyl sulfate.*		
3266	**Diisoamyl sulfide.**	See *Isoamyl sulfide.*		
3267	**Diisobutylamine**...	bis(β-methylpropyl)amine* .	$[(CH_3)_2CHCH_2]_2NH$	129 24
3268	**Diisobutylene**..... .	....	$(CH_3)_2C{:}CHC(CH_3)_3$	112 21
3269	**Diisobutyl sulfate.**	See *Isobutyl sulfate.*		
3270	**Diisocrotyl.**	See 2,4-*Hexadiene, 2,5-dimethyl-**.		
3271	**Diisopropylamine***.	. . . .	$[(CH_3)_2CH]_2NH$	101 19
3272	——, ***N*-nitroso-**.....	diisopropylnitrosamine; nitrous diisopropylamide	$[(CH_3)_2CH]_2NNO$	130 19
3273	**Diketone, dimethyl.**	See 2,3-*Butanedione**.		
3274	**——, diphenyl.**	See *Benzil*		
3275	**α,γ-Dilaurin.**	See *Glycerol,* 1,3-*dilaurate.*		
	Dimethyl. For dimethyl derivatives see the parent compounds (e g., for dimethyl-			
3276	**Dimethylamine***	....	$(CH_3)_2NH$ ..	45.08
3277	——, dimethylthiolthionocarbamate. See under *Carbamic acid, dimethylthiolthiono-.*			
3278	——, hydrochloride	dimethylammonium chloride*	$(CH_3)_2NH\ HCl$	81 55
3279	**——, α,α'-dicyano-.**	See *Acetonitrile, iminodi-.*		
3280	**——, α,α'-di-2-furyl-.**	See *Difurfurylamine.*		
3281	**——, *N*-nitro-**...	dimethylnitramine; nitric dimethylamide	$(CH_3)_2NNO_2$	90 08
3282	**——, *N*-nitroso-** ..	dimethylnitrosamine; nitrous dimethylamide	$(CH_3)_2NNO$.	74 08
3283	**Dimethylarsenic monochloride.** See *Cacodyl chloride.*			
3284	**Dimethylenimine.**	See *Ethylenimine.*		
3284M	**α,α-Dimethylpropyl.**	See *tert-Butyl.*		
3285	**Dimethyl sulfate.**	See *Methyl sulfate.*		
3286	**Dimethyl sulfite.**	See *Methyl sulfite*		
3287	**1,2,7,8-Dinaphthanthracene.** See *Dibenzanthracene.*			
3288	**α-Dinaphthol.**	See 4,4′-*Bi*-1-*naphthol.*		
3289	**Dinaphthyl.**	See *Binaphthyl.*		
3290	**Di-2-naphthylamine***	....	$C_{10}H_7NHC_{10}H_7$ ..	269 33
3291	**Dinicotinic acid** .	3,5-pyridinedicarboxylic acid*	$C_5H_3N(COOH)_2$	167 12
	Dinitro-. See the parent compounds (e.g., for dinitrobenzene see *Benzene, dinitro-*)			
3292	**Di-*n*-nonyl sulfate.**	See *Nonyl sulfate.*		
3292M	**Dioctadecylamine***(*n*)		$[CH_3(CH_2)_{17}]_2NH$.	521 98
3293	**Di-*n*-octadecyl sulfate.**	See *Octadecyl sulfate.*		
3294	**Di-*n*-octyl sulfate.**	See *Octyl sulfate*		
3295	**Dionin.**	See *Morphine, ethyl-, hydrochloride*		
3296	***m*-Dioxane.**	1,3-dioxane; trimethylene glycol methylene ether; trimethylene methylene dioxide	$OCH_2OCH_2CH_2CH_2$	88 10

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3257	*dihydro-.)*						
	Anthraquinone,	*dihydroxy-*; f	or dihydroxy	naphthalene	see *Naph*	*thalenedi*	*ol.)*
3258							
3259							
3260							
3261							
3262							
3263							
3264	col liq., 1.42289^{21}	0.7672^{21}_{4}	−44	190 (185–8)	sl s (i.)	s.	∞ eth.
3265							
3266							
3267	col. liq., 1.40934	0.7450^{20}_{4}	−70; frz. −77	139–40	v. sl s.	s.	s. eth.
3268	col. liq	0.715^{15}_{4}	......	102.6		.....	....
3269							
3270							
3271	col liq .	0.722^{22}_{0}	. . .	83–4	sl. s.	.	. . .
3272	cr. f eth.	....	46	194.5	v. sl. s.	v. s.	s. eth., bz.
3273							
3274							
3275	benzoic acid see	*Benzoic acid,*	*dimethyl-*).F	or dimethyl	esters of o	rganic ac	ids see the acids
3276	col liq. or gas, liq. 1.350^{17}	0.6804^{0}_{4}	−96.0	7.4	v. s.	s.	s. eth.
3277							
3278	need. f al	....	171	....	369^{25}	v. s.	i. eth; 25 16^{25} chl.
3279							
3280							
3281	. . . .. .	....	57–8	187	s	s.	s. eth
3282	yel. oily liq., 1.43743^{18}	1.0049^{18}_{4}	.... .	152–3	s	s.	s. eth.
3283							
3284							
3284M							
3285							
3286							
3287							
3288							
3289							
3290	leaf. f. bz.....	....	171	471	i.	sl. s.	s. eth., h. ac. a., bz., blue fluores.
3291	cr	....	323	d.	v. sl. s.	..	
3292							
3292M	col. cr. . ..	....	73.5–74.5	....	i.	sl. s.	sl s eth.
3293							
3294							
3295							
3296	col liq., 1.41652	1.03422^{20}_{4}	.. .	105^{755}	∞	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3297	**p-Dioxane**............	1,4-dioxane; diethylene dioxide; glycol ethylene ether	$OCH_2CH_2OCH_2CH_2$	88.10
3298	**2,5-p-Dioxanedione.**	See *Glycolide.*		
3299	**2,5-p-Dioxanedione, 3,6-dimethyl-.** See *Lactide.*			
3300	**Dioxindole.**	See *Oxindole, 3-hydroxy-.*		
3301	**1,3-Dioxolane, 2-methyl-**	ethylene ethylidene ether; glycol ethylidene diether.	$OCH(CH_3)OCH_2CH_2$	88.10
3302	**α,γ-Dipalmitin.**	See *Glycerol, 1,3-dipalmitate.*		
3303	**Dipentene.**	See *dl-Limonene.*		
3304	**Diphenic acid**.........	2,2'-biphenyldicarboxylic acid; o,o'-bibenzoic acid; 1,10-diphenic acid	$(COOH)C_6H_4$-C_6H_4COOH	242 22
3305	——, dimethyl ester.. .	methyl diphenate ..	$(C_6H_4COOCH_3)_2$	270 27
3306	——, diphenyl ester	ethyl diphenate .	$(C_6H_4COOC_2H_5)_2$.	298 33
3307	——, **4,4',5,5',6,6'-hexahydroxy-**, dilactone. See *Ellagic acid*			
3308	——, **3-nitro-** (COOH=1)	o-nitrodiphenic acid	$COOHC_6H_3NO_2C_6$-H_4COOH	287 22
3309	——, **4-nitro-**.........	m-nitrodiphenic acid	$COOHC_6H_3NO_2$-C_6H_4COOH	287 22
3310	——, **5-nitro-**.........	p-nitrodiphenic acid..... .	$COOHC_6H_3NO_2$-C_6H_4COOH	287 22
3311	**Diphenic anhydride** ..	....	$(C_6H_4CO)_2O$	224 20
3312	**Diphenimide**.........		$(C_6H_4CO)_2NH$	223 22
3313	**Diphenine.**	See *Hydrazobenzene, 4,4'-diamino-.*		
3314	**Diphenoquinone, 3,3',5,5'-tetramethoxy-.** See *Cerulignone.*			
3315	**Diphenoyl chloride**....	2,2'-biphenyldicarbonyl chloride	$(C_6H_4COCl)_2$.	279.12
3316	**Diphenyl.**	See *Biphenyl.*		
	Diphenyl-. For diphenyl derivatives see the parent compounds (e.g., for diphenylmeth			
3317	**Diphenylamine***......	N-phenylaniline; anilinobenzene	$(C_6H_5)_2NH$....	169 22
3318	——, **N-acetyl-.**	See *Acetamide, N, N-diphenyl-.*		
3319	——, **o-amino-.**	See *o-Phenylenediamine, N-phenyl-.*		
3320	——, **p-amino-.**	See *p-Phenylenediamine, N-phenyl-.*		
3321	——, **N-benzyl-**.......	N,N-diphenylbenzylamine.	$C_6H_5CH_2N(C_6H_5)_2$	259 34
3322	——, **p,p'-bisdimethylamino-**	leuco base of Bindschedler green; tetramethyl-4,4'-diaminodiphenylamine	$NH[C_6H_4N(CH_3)_2]_2$	255 35
3322M	——, **N-chloroformyl-.**	See *Carbamyl chloride, diphenyl-.*		
3323	——, **4,4'-diamino-**...	p,p'-iminodianiline	$NH_2C_6H_4NHC_6$-H_4NH_2	199 25
3324	——, **2,4'-dinitro-***....	. ...	$NO_2C_6H_4NHC_6$-H_4NO_2	259 22
3325	——, **4,4'-dinitro-***....	....	$NO_2C_6H_4NHC_6$-H_4NO_2	259 22
3326	——, **N-ethyl-**........	.... .	$(C_6H_5)_2NC_2H_5$..	197.27
3327	——, **N-formyl-.**	See *Formamide, N, N-diphenyl-.*		
3328	——, **hydroxy-.** See *Phenol, anilino-.*			
3329	——, **N-methyl-** . ..	.. .	$(C_6H_5)_2NCH_3$.	183.24
3330	——, **p-nitro-**	....	$NO_2C_6H_4NHC_6H_5$	214.22
3331	——, **N-nitroso-**.......	diphenylnitrosamine; nitrous diphenylamide	$(C_6H_5)_2NNO$....	198 22
3332	——, **p-nitroso-**.......		$NOC_6H_4NHC_6H_5$.	198 22

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3297	col. liq., 1.4222	1.0353^{20}_{4} (1.03034^{20}_{4})	11.7 (9–13)	101.5	∞	∞	∞ eth., most org. liq.
3298							
3299							
3300							
3301	....	1.002^{0}_{4}	......	82.5	66.7	......	....
3302							
3303							
3304	monocl. leaf. f w.	......	228-9	subl.	sl. s.	s.	s. eth., most org. solv.
3305	pr. f. me. al..	....	74	....	......	......	....
3306	....	....	42				
3307							
3308	....	....	248–50 d.	....	......	......	....
3309	....	....	268	....	......	......	....
3310	....	....	214–6	....	......	......	....
3311	....	....	219	subl.	i.	......	sl. s. eth.
3312	need........	....	217.5(219)	....	i.	sl. s.	i. eth.; s. chl.
3313							
3314							
3315	....	....	94 (97)	....	......	......	sl. s. eth.; s. bz.
3316							
	ane see *Methane*	, *diphenyl*-.)					
3317	col. monocl. leaf.	1.159^{20}_{4}	53	302	0.03^{25}	44 c.	v. s. eth.; 57.5 me. al.; s. bz, lgr.
3318							
3319							
3320							
3321	need.	....	95 (88.5)	....	v. sl. s.	sl. s. c., s. h.	v. s. eth.
3322	tetr. pl. f. CS_2	....	119	....	v. sl. s.	s.	s. eth.
3322M							
3323	leaf. f. w. ...	....	158	d.	sl. s.	s.	s. eth.
3324	yelsh.-red need. f. bz.	....	222 (156–7)	....	i.	sl. s.	s. acet., chl., pyr.
3325	yel. need. f. al	....	216 (214.5)	....	i.	sl. s.	5.66^{22} acet.; s. glac. ac. a.; sl. s. bz.
3326	liq	....	....	297	i.	s.	s. eth.
3327							
3328							
3329	col. liq	1.048^{20}_{4}	-7.6	293.4	i.	s.	s. eth.
3330	yel. need .	. ....	132	211.0^{20}	i.	v. s.	v. s. ac. a.
3331	yel. monocl. pl. f. lgr.	. . . ..	66.5	....	......	sl. s. c., v. s. h.	s. h. bz.
3332	grn. pl. f. al. or bz	.....	143	....	sl. s.	s. c., v. s. h.	s. eth., bz.; v. s. chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3332M	**Diphenylamine, 2,2′,4,4′-tetrabromo-**	....	$(C_6H_3Br_2)_2NH$....	484.85
3333	**——, thio-.**	See *Phenothiazine.*		
3334	**Diphenyl carbonate.**	See *Carbonic acid, diphenyl ester.*		
3335	**Diphenylene ketone oxide.**	See *Xanthone.*		
3336	**Diphenylene oxide.**	See *Dibenzofuran.*		
3337	**Diphenylenimine.**	See *Carbazole.*		
3338	**Diphenyline.**	See *2,4′-Biphenyldiamine.*		
3339	**Diphosgene..........**	trichloromethyl chloroformate; superpalite; perchloromethyl formate	$ClCOOCCl_3$	197 85
3340	**Dipicolinic acid.......**	2,6-pyridinedicarboxylic acid*; α,α′-dipicolinic acid	$C_5H_3N(COOH)_2$ $1\frac{1}{2}H_2O$	194.14
3341	**Diplumbane, hexaethyl-.**	See *Lead, hexaethyldi-.*		
3342	**Diplumbic hexaethyl.**	See *Lead, hexaethyldi-.*		
3343	**Dipropargyl.**	See *1,5-Hexadiyne*.*		
3344	**Di-2-propenylamine*.**	See *Diallylamine.*		
3345	**Dipropylamine*.... .**	di-*n*-propylamine... . .	$(CH_3CH_2CH_2)_2NH$	101 19
3346	**——, *N*-nitroso-....**	dipropylnitrosamine; nitrous dipropylamide	$(CH_3CH_2CH_2)_2$-NNO	130.19
3347	**Dipropylene.**	See *2,4-Hexadiene*.*		
3348	**Di-*n*-propyl sulfate.**	See *Propyl sulfate.*		
3349	**Dipyridine.**	See *Nicotyrine.*		
3350	**Dipyridyl.**	See *Bipyridyl.*		
3351	**5,10-Dipyrrolo[1,2-*a*,1,2-*d*] pyrazinedione.**	See *Pyrocoll.*		
3353	**Diquinolyl.**	See *Biquinoline.*		
3354	**α,γ-Distearin.**	See *Glycerol, 1,3-distearate*		
3355	**Disulfide, bis(dibutylthiocarbamyl)**	tetrabutylthiuram disulfide	$[(C_4H_9)_2NCS]_2S_2$	408 73
3356	**——, bis(diethylthiocarbamyl)**	tetraethylthiuram disulfide	$[(C_2H_5)_2NCS]_2S_2$	296 52
3357	**——, bis(dimethylthiocarbamyl)**	tetramethylthiuram disulfide	$[(CH_3)_2NCS]_2S_2$	240 41
3358	**——, bis(ethylmethylthiocarbamyl)**	diethyldimethylthiuram disulfide	$[(CH_3)C_2H_5NCS]_2$-S_2	268 47
3359	**——, bis(1-piperidylthiocarbonyl)**	dicyclopentamethylenethiuram disulfide	$(C_5H_{10}NCS)_2S_2$	320 54
3360	**——, bis(tetrabenzylthiocarbamyl)**	tetrabenzylthiuram disulfide	$[(C_6H_5CH_2)_2NCS]_2$-S_2	544.78
3361	**——, diacetyl.**	See *Acetyl disulfide.*		
3362	**——, 2,2′-dibenzothiazyl.**	See *Benzothiazole, 2,2′-dithiobis-(S=1).*		
3363	**——, dibenzoyl.**	See *Benzoyl disulfide.*		
3364	**——, diethyl.**	See *Ethyl disulfide.*		
3365	**——, diisoamyl.**	See *Isoamyl disulfide.*		
3366	**——, dimethyl.**	See *Methyl disulfide.*		
3367	**——, diphenyl.**	See *Phenyl disulfide.*		
3368	**——, diphenylene.**	See *Thianthrene.*		
3369	**Ditaine.**	See *Echitamine.*		
3370	**Ditan.**	See *Methane, diphenyl-.*		
3371	**——, α-methyl-.**	See *Ethane, 1,1-diphenyl-.*		
3372	**Di-*n*-tetradecyl sulfate.**	See *Tetradecyl sulfate.*		
3373	***p*-Dithiane . ...**	1,4-dithiane; diethylene disulfide; tetrahydro-*p*-dithiin	$SCH_2CH_2SCH_2$-CH_2	120.22
3374	**1,3,5-Dithiazine, 5,6-dihydro-2,4,6-trimethyl-.**		See *Thialdine.*	
3375	**α,α-Dithienyl.**	See *2,2′-Bithiophene.*		
3376	***p*-Dithiin, tetrahydro-.**	See *Di-p-thiane.*		
3377	**Ditolan azotide.**	See *Amaron.*		
3378	**Di-*o*-tolylamine......**	. .....	$(CH_3C_6H_4)_2NH$..	197.27
3379	**Di-*m*-tolylamine . .**		$(CH_3C_6H_4)_2NH$..	197 27

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3332M	need, silky luster or pr	...	184	.	i.	sl. s. h.	..
3333							
3334							
3335							
3336							
3337							
3338							
3339	col liq	$1.653\frac{14}{4}$	-57	127.5	i.	v. s.	v. s. eth.
3340	col need ($+1\frac{1}{2}H_2O$) f. w		anh 226 d		v. sl. s.	v. sl. s.	.
3341							
3342							
3343							
3344							
3345	col liq, $1.40455^{19.5}$	$0.7384\frac{20}{4}$	-39.6	110.7	s	s	∞ eth.
3346	yel liq	$0.910\frac{25}{4}$		205	v. sl. s.	∞	∞ eth.
3347							
3348							
3349							
3350							
3351							
3353							
3354							
3355	yel. or liq				i.	sl. s.	s. eth.
3356	yel cr .		70		i.	sl. s.	sl. s. eth.; s. chl.
3357	yel cr ..	$1.29\frac{20}{4}$	155–6 (141–5)		i.	sl. s.	sl. s. eth.; s. chl
3358	yel. cr ..		72		i	sl. s.	sl. s. eth.; s. chl
3359	yel. cr		129–30		i	sl. s	sl. s. eth.; s. chl
3360	yel cr		132–3		i	sl. s	sl. s. eth.; s. chl.
3361							
3362							
3363							
3364							
3365							
3366							
3367							
3368							
3369							
3370							
3371							
3372							
3373	wh. monocl. pr. f. eth.	.. .	112, subl.	200	v. sl. s.	s. h.	s. eth., CS_2
3374							
3375							
3376							
3377							
3378	bl. cr .	.	52–3	313.4	v. sl. s.	.	
3379	liq		<-12	320	v. sl. s.	v. s.	v. s. eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3380	**Di-*p*-tolylamine**..... .	....	$(CH_3C_6H_4)_2NH$.	197 27
3381	**Diurea.**	See *p-Urazine*		
3382	**Divinyl.**	See 1,3-*Butadiene**		
3383	**Docosane*** (*n*)	...	$CH_3(CH_2)_{20}CH_3$	310 59
3384	**Docosanoic acid*.**	See *Behenic acid*		
3385	***cis*-13-Docosenoic acid**	*. See *Erucic acid*		
3386	***trans*-13-Docosenoic a**	**cid*.** See *Brassidic acid.*		
3387	***n*-Docosoic acid.**	See *Behenic acid*		
3388	**13-Docosynoic acid*.**	See *Behenolic acid.*		
3389	**Dodecanal*.**	See *Lauraldehyde*		
3390	**Dodecane*** ..	*n*-dodecane, bihexyl, dihexyl	$CH_3(CH_2)_{10}CH_3$	170 33
3391	——, **1-amino-.**	See *Dodecylamine**.		
3392	——, **1-bromo-***	dodecyl bromide, lauryl bromide	$CH_3(CH_2)_{10}CH_2Br$	249 24
3393	**Dodecanenitrile*.**	See *Lauronitrile*		
3394	**Dodecanoic acid*.**	See *Lauric acid*		
3395	**1-Dodecanol***.........	*n*-dodecyl alcohol, lauryl alcohol	$CH_3(CH_2)_{11}OH$	186 33
3396	**6-Dodecanol***	amylhexylcarbinol .	$CH_3(CH_2)_4CHOH-(CH_2)_5CH_3$	186 33
3397	**Dodecanoyl chloride*.**	See *Lauroyl chloride.*		
3398	**1-Dodecene***..	*α*-dodecylene	$C_{12}H_{24}$ .. .	168 31
3398M	**Dodecine.**	See *Dodecyne**.		
3399	***n*-Dodecyl alcohol.**	See 1-*Dodecanol**.		
3400	**Dodecylamine*** (*n*) ...	*pri-n*-dodecylamine, 1-aminododecane	$CH_3(CH_2)_{11}NH_2$.	185 35
3401	***α*-Dodecylene*.**	See 1-*Dodecene**		
3402	**Dodecyl sulfate**	di-*n*-dodecyl sulfate ..	$[CH_3(CH_2)_{11}]_2SO_4$.	434 71
3402M	**2-Dodecyne***.... . ..	decylmethylacetylene	$CH_3C⋮C(CH_2)_8-CH_3$	166 30
3402T	**6-Dodecyne***	6-dodecine, di-*n*-amylacetylene	$C_5H_{11}C\ C\ C_5H_{11}$	166 30
3403	**Dotriacontane*** . .	*n*-dotriacontane	$CH_3(CH_2)_{30}CH_3$.	450 85
3403M	**1-Dotriacontanol*** ..		*n*-$C_{32}H_{65}OH$	466 85
3404	**Duboisine.**	See *Hyoscyamine.*		
3405	**Dulcin.**	See *Urea, p-phenetyl-.*		
3406	**Dulcitol**	1,2,3,4,5,6-hexanehexol* (one form), dulcite, melampyrin	$C_6H_8(OH)_6$	182 17
3407	**Durene**..........	1,2,4,5-tetramethylbenzene	$(CH_3)_4C_6H_2$	134 21
3408	**Durylic acid** . . .	2,4,5-trimethylbenzoic acid, cumylic acid	$(CH_3)_3C_6H_2COOH$	164 20
3409	**Ecgonidine.**	See *dl-Anhydroecgonine*		
3410	**Ecgonine, benzoyl-** .		$C_{16}H_{19}NO_4\ 4H_2O$	361 39
3411	——, **benzoylmethyl-.**	See *Cocaine*		
3412	***l*-Ecgonine**	tropinecarboxylic acid	$C_9H_{15}NO_3 \cdot H_2O$.	203 24
3412M	——, cinnamate methyl ester	See *l-Cocaine, cinnamoyl-.*		

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3380	col need. f pet. eth.		79	330 5	v. sl. s		.
3381							
3382							
3383	cr. f al.	$0\ 778\frac{44}{4}$	44 4	317 4 (224^{15})	i	4^{78}	v s. eth.
3384							
3385							
3386							
3387							
3388							
3389							
3390	col liq .	$0\ 766\frac{0}{4}$, $0\ 7511\frac{20}{4}$	-12	214 5; 145^{100}	i	v s	v s. eth.
3391							
3392	liq			$175\text{–}80^{45}$	i.	s.	s. eth.
3393							
3394							
3395	leaf. f. dil. al	$0\ 8309\frac{24}{4}$	22 6 (24)	255	i	s.	s eth.
3396	cr		30	119^{9}		s.	s eth.
3397							
3398	col. liq . .	$0\ 7732\frac{0}{4}$, $0\ 762\frac{15}{4}$	-31 5	213-5	i.	v. s.	v s eth.
3398M							
3399							
3400	col. cr.......		27-8	259.1; 93.5^{2}	sl s	s.	s. eth.
3401							
3402	. ...		48 4-8 5	.			.
3402M	liq	$0.792\frac{15}{4}$	-9	105^{15}			
3402 T	col liq , $1\ 43,4^{25}$	$0\ 7816^{25}$	.	100^{14}, 115^{30}	i.	s	s eth.
3403	cr. pl f eth	$0\ 775^{79.4}$	74-5 (70)	310^{15}	.	v sl. s c.	s h. eth., h ac. a.
3403M			89 3-89 5	.			. ...
3404							
3405							
3406	col. monocl. pr.	$1\ 466\frac{15}{4}$	188	$295^{3.5}$	$3\ 2^{15}$	$0\ 0734^{15}$	v. sl. s. eth.
3407	col monocl leaf., β 1 615	liq. $0\ 838\frac{81}{4}$	80 (78-9)	193-5 subl.	i.	s.	s eth, bz., v. s. ac. a.
3408	col. need. f b.	.... .	149 5	.	v sl s h	v s.	v s. eth.; s bz.
3409							
3410	lust. need f w	.	90 2, anh 193-5	.	sl s c, s h	s	i eth, s dil. a, alk.
3411							
3412	col. monocl. pr. f. al.	$1\ 370\frac{12}{4}$; $0\ 777\frac{37}{4}$	198, anh 205	..	$21\ 7^{17}$	1 5	v. sl. s. eth.
3412M							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3413	***l*-Ecgonine**, hydrochloride	.....	$C_9H_{15}NO_3\ HCl$..	221.68
3414	**Echitamine**..........	ditaine.	$C_{22}H_{28}N_2O_4 \cdot 4H_2O$.	456.53
3415	**Echitin**..............		$C_{32}H_{52}O_2$.	468.74
3416	**Eglantine.**	See *α-Toluic acid, isobutyl ester.*		
3417	**Eicosane***............	*n*-eicosane	$CH_3(CH_2)_{18}CH_3$	282 54
3418	**Eicosanoic acid***. . .	See *Arachidic acid.*		
3419	**1-Eicosanol***.. ...	*pri-n*-eicosyl alcohol, arachic alcohol	$CH_3(CH_2)_{18}CH_2$-OH	298.54
3420	***n*-Eicosoic acid.**	See *Arachidic acid.*		
3421	***pri-n*-Eicosyl alcohol.**	See 1-*Eicosanol**.		
3422	**Eikonogen.**	See 2-*Naphthol-6-sulfonic acid, 1-amino-, sodium salt*		
3423	**Elaidic acid**... ...	*trans*-9-octadecenoic acid*	$C_8H_{17}CH$: $CH(CH_2)_7COOH$	282 46
3424	——, dibromide	*θ, ι*-dibromostearic acid (one form)	$C_{17}H_{33}Br_2COOH$	442 29
3425	——, ethyl ester . .	. .	$C_{17}H_{33}COOC_2H_5$	310 51
3426	——, methyl ester.		$C_{17}H_{33}COOCH_3$	296 48
3427	**β-Elaterin**..... . .		$C_{20}H_{28}O_5$.	348 43
3428	**Eleomargaric acid** ..	9,13-octadecadienoic acid* (?)	$C_{17}H_{31}COOH$.	280 44
3429	**α-Eleostearic acid** .	*cis*-9,11,13-octadecatrienoic acid(?)	$C_{17}H_{29}COOH$	278 42
3430	**β-Eleostearic acid.**	*trans*-9,11,13-octadecatrienoic acid(?)	$C_{17}H_{29}COOH$	278 42
3431	**Ellagic acid**..... .	4,4′,5,5′,6,6′-hexahydroxydiphenic acid dilactone	$C_{14}H_6O_8\ 2H_2O$.	338 22
3432	**Emetine** (*l*)....		$C_{29}H_{40}N_2O_4$	480 63
3433	——, hydrochloride (*d*)		$C_{29}H_{40}N_2O_4 \cdot 2HCl$ $7H_2O$	679 67
3434	**Emodin**........... .	1,3,8-trihydroxy-6-methylanthraquinone, rheum emodin, frangula emodin	$CH_3C_{14}H_4O_2(OH)_3$	270 23
3435	**Enanthaldehyde**.	heptanal*, enanthal, heptyl aldehyde; enanthole, *n*-heptaldehyde	$CH_3(CH_2)_5CHO$	114 18
3436	——, oxime..	heptanal oxime*; enanthaldoxime; *n*-heptaldoxime	$CH_3(CH_2)_5$-$CH\ NOH$	129.20
3437	**Enanthic acid**	heptanoic acid*, enanthylic acid; oenanthic acid, *n*-heptoic acid, *n*-heptylic acid	$CH_3(CH_2)_5COOH$	130 18
3438	——, ethyl ester...	ethyl heptanoate*	$CH_3(CH_2)_5$-$COOC_2H_5$	158 24
3439	——, heptyl ester .	*n*-heptyl *n*-heptylate. ..	$CH_3(CH_2)_5$-$COOC_7H_{15}$	228 37
3440	——, methyl ester	methyl heptanoate*.	$CH_3(CH_2)_5$-$COOCH_3$	144 21
3441	——, *p*-phenylphenacyl ester	. . ..	$CH_3(CH_2)_5COO$-$CH_2COC_6H_4C_6H_5$	324 40
3442	——, piperazinium salt .	.	$C_4H_{10}N_2\ 2C_6H_{13}$-$COOH$	346 50

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3413	rhomb. or tricl. tab., $[\alpha]$-57 °D	..	246	.	s.	sl. s.	..
3414	col cr., $[\alpha]$-28 $8^{\circ 15}_{D}$		206 d		s	v. s.	sl. s. eth., bz.; s. chl.
3415	leaf .		170		..	0 06^{15} 80%	sl. s. eth.; v. s. chl.
3416							
3417	cr, 1 $434^{42\ 9}$	0 $778\frac{37}{4}$	38	205^{15}	i		∞ eth.
3418							
3419	wh. waxy mass	.	71	220^{3}	i	v sl s	s h bz
3420							
3421							
3422							
3423	col. leaf f al	0 $851\frac{79}{4}$	51 5 (44-5)	288^{100}	i.	s.	s. eth., bz., chl.
3424		......	27		i.	i	s. eth.
3425	oil .	0 $868\frac{18}{4}$		217-8 5^{15}	i.	s.	s. eth.
3426	liq	0 $872\frac{15}{4}$		213 5^{15}	i	s.	s. eth.
3427	hex pl		195 (216)		i.	s	sl. s. eth., bz.; s. chl.
3428	rhomb. pl		48			s.	s. eth.
3429	leaf or need f al		48-9	235^{12} sl d	i	s.	v. s. eth., CS_2; s h ac. a.
3430	pl or need f. al		72		i	sl s.	s. warm glac ac. a.
3431	yel. cr .. .	1 $667\frac{18}{4}$	d		v sl s h.	sl s	i eth.
3432	amor .	....	68 (74)		v. sl s.	v s	v. s. eth.; s. chl, sl. s. bz.
3433	need f h w.	.	235-55		13 1^{18}	s.	i eth.
3434	or-red monocl need. f ac a		253 (250)	subl	i	s.	s. glac. ac. a.; i. amyl al., alk. sols.
3435	col. liq, 1 4131	0 $850\frac{20}{4}$	-45	155	sl. s	s.	∞ eth.
3436	large pl f al., $1.421^{83.9}$	0 $8583\frac{20}{4}$, 0 $834\frac{83}{4}$	55 5	195	v sl s.	s	s. eth.
3437	col. oily liq., $1.42162^{19.8}$	0 $9127\frac{25}{4}$	-10	223 5 ($108-110^{9}$)	0 241^{15}	s.	s. eth.
3438	col. liq., 1.41296^{20}	0 $8685\frac{20}{4}$		188	i.	s.	∞ eth.
3439	col. liq	0 $865\frac{19}{4}$		$273-4^{754}$ ($137-40^{10}$)	i.	s	s. eth.
3440	liq, 1.4114.	0 $881\frac{15}{5}$		172.1 (174-6)			.
3441	. ....		62	....			.
3442	wh. cr		95-6		s.	s.	i eth.; s h. acet.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3443	**Enanthic anhydride**	heptanoic anhydride*	$[CH_3(CH_2)_5CO]_2O$	242 35
3444	**Enanthole.**	See *Enanthaldehyde.*		
3445	**Enanthone.**	See 7-*Tridecanone**.		
3446	**Enanthylic acid.**	See *Enanthic acid.*		
3447	**Enanthylidene.**	See 1-*Heptyne**		
3448	**Enneamethylene glycol.**	See 1,9-*Nonanediol**		
3449	**Eosin**	2,4,5,7 tetrabromofluorescein	$C_{20}H_8Br_4O_5$	647.93
3450	——, (dye).	alkali salt of eosin .	$C_{20}H_6Br_4Na_2O_5$.	691 91
3451	**Ephedrine**.... ...	2-methylamino-1-phenyl-1-propanol (one form)	$C_6H_5CHOHCH(NHCH_3)CH_3 H_2O$	183 25
3452	——, hydrochloride (*l*)		$C_{10}H_{15}NO\ HCl$	201 69
3453	——, sulfate ..		$(C_{10}H_{15}NO)_2\ H_2SO_4$	428 54
3454	**Epichlorohydrin**. .	α-epichlorohydrin, 1-chloro-2,3-epoxypropane, γ-chloropropylene oxide; (chloromethyl)oxirane	OCH_2CHCH_2Cl	92 53
3455	**Epicyanohydrin**	β, γ-epoxybutyronitrile; γ-cyanopropylene oxide; oxiraneacetonitrile	OCH_2CHCH_2CN	83 09
3456	**α-Epidibromohydrin.**	See *Propene*, 2,3-*dibromo*-*		
3457	**α-Epidichlorohydrin.**	See *Propene*, 2,3-*dichloro*-*		
3458	**Epihydric alcohol.**	See *Glycidol.*		
3459	**Epiiodohydrin** . .	α-epiiodohydrin; 1,2-epoxy-3-iodopropane, γ-iodopropylene oxide, (iodomethyl)oxirane	OCH_2CHCH_2I	183 99
3460	**Epinephrine.**	See *Adrenaline.*		
3461	**Ergosterol**	ergosterin	$C_{28}H_{44}O$.	396 64
3461M	——, irradiated.	See *Calciferol.*		
3462	**Ergotinine** (amorphous).	See *Ergotoxine.*		
3463	***d*-Ergotinine**..... .		$C_{35}H_{39}N_5O_5$	609 71
3464	**Ergotoxine**......	ergotinine (amorphous)	$C_{35}H_{41}N_5O_6$	627 72
3465	**Erucic acid** (*cis*) .	*cis*-13-docosenoic acid*	$CH_3(CH_2)_7CH{\cdot}CH(CH_2)_{11}COOH$	338 56
3466	***trans*-Erucic acid.**	See *Brassidic acid.*		
3467	**Erythrene.**	See 1,3-*Butadiene**.		
3468	***i*-Erythritol**	*anti*-1,2,3,4-butanetetrol*, ordinary erythrite, erythrol, erythroglucin, phycitol	$(CH_2OHCHOH)_2$	122 12
3469	——, anhydride..	1,2,3,4-diepoxybutane* (one form); bioxirane	$OCH_2CHCHCH_2O$	86 09
3470	——, tetranitrate .	erythrol tetranitrate; nitroerythrite	$(CHNO_3CH_2NO_3)_2$	302 12
3471	**Erythroglucin.**	See *i-Erythritol*		
3472	**Erythrohydroxyanthraquinone.**	See *Anthraquinone*, 1-*hydroxy*-.		
3472M	**Erythrol**.......... .	3-butene-1,2-diol	$CH_2\ CHCHOH-CH_2OH$	88 10
3473	**Erythrol.**	See *i-Erythritol.*		
3473M	**Erythrose**............	.	$C_4H_8O_4$. .	120.10

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3443	liq, 1.4312 ..	0.932^{20}_{4}	17	258 (170–3[15])	i.	s.	s. eth.
3444							
3445							
3446							
3447							
3448							
3449	red monocl. need	. ..	.	.	i.	s	s. ac a., alk.
3450	red-br powd	.			s.	s.	.
3451	col cr f eth	.	43 (40)	255 d	s	s	s eth, chl.
3452	wh need		216 d	. .	s.	s	i. eth
3453	wh cr		.	.	s.	s. h.	.
3454	col liq., 1 4419[5 11 55]	$1\ 203\frac{0}{4}$; $1\ 1801\frac{20}{4}$	-25 6	117	i.	∞	∞ eth
3455	pr ..	.	162	....	s. h.	s.	... . .
3456							
3457							
3458							
3459	liq	$2\ 03\frac{13}{4}$	....	160–80	i.	s	s. eth.
3460							
3461	cr	.. ....	160–3	.... .	i.	s	s. eth.
3461M							
3462							
3463	lng need f al, sol fluores vlt., [α] 33 .°D in al	.	229		i	0 5[20]	s. eth, chl, bz., acet
3464	wh amor powd		162–4		v sl. s	s. h.	sl. s eth; s. NaOH
3465	col need f. al	$0\ 860\frac{55}{4}$	33 5 (31–2)	281[40]	i.	173	v s. eth; 163[21] me al.
3466							
3467							
3468	wh tetr pr, 1.544, 1 521	$1\ 451\frac{20}{4}$	119–20 (126)	331	61 5	sl s.	i. eth.
3469	col liq . ..	$1\ 113\frac{18}{4}$		138	∞ d.	. .	.. . .
3470	leaf f. al	. .	61	exp by percussion	i.	s.	s. eth.
3471							
3472							
3472M	....	... .	.. .	94–95[12]	. ....	.... .	. ...
3473							
3473M	col syrup; D–, [α] D -14 5, L+–, [α] D +21.5	.. . ...	....	.. ...	v. s.	v. s.	.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3474	**Erythrosin**	2,4,5,7-tetraiodofluorescein	$C_{20}H_8I_4O_5$. . .	835 94
3475	**Erythrosin** (dye)	alkali salt of erythrosin, iodeosin B	$C_{20}H_6I_4Na_2O_5$.	879 92
3476	**Esculetin**.	6,7-dihydroxycoumarin, aesculetin	$(HO)_2$-$C_6H_2OCOCH{\cdot}CH$	178 14
3477	**Esculin**.	aesculin.	$C_{15}H_{16}O_9\ \frac{1}{2}H_2O$.	349 29
3478	**Eserine.**	See *Physostigmine.*		
3479	**Estragole**.	estragol; *p*-allylanisole, chavicol methyl ether	$CH_2\ CHCH_2C_6H_4$-OCH_3	148 20
3480	**Ethal.**	See *Cetyl alcohol.*		
3481	**Ethanal*.**	See *Acetaldehyde.*		
3482	**——, hydroxy-*.**	See *Glycolaldehyde*		
3483	**——, trichloro-*.**	See *Chloral*		
3484	**Ethanamide*.**	See *Acetamide.*		
3485	**——, 2-cyano-2-nitro-*.**	See *Fulminuric acid.*		
3486	**——, 2-hydroxy-*.**	See *Glycolamide.*		
3487	**Ethanamidine*.**	See *Acetamidine*		
3488	**Ethane***	bimethyl, methylmethane, dimethyl	CH_3CH_3 .	30 07
3489	**——, amino-.**	See *Ethylamine**		
3490	**——, 1-amino-1-phenyl-.**	See *Benzylamine, α-methyl-*		
3491	**——, 1-amino-2-phenyl-.**	See *Phenethylamine.*		
3492	**——, arsino-.**	See *Arsine, ethyl-*		
3493	**——, 1,2-bisphenyl-sulfonyl-***	ethylenebisphenylsulfone	$(CH_2SO_2C_6H_5)_2$	310 37
3494	**——, bromo-*.**	See *Ethyl bromide*		
3495	**——, 1-bromo-2-chloro-***	ethylene chlorobromide	CH_2ClCH_2Br	143 43
3496	**——, 1-bromo-2-ethoxy-*.**	See *Ether, β-bromoethyl ethyl.*		
3497	**——, 1-bromo-1-phenyl-.**	See *Benzene, (α-bromoethyl)-*		
3498	**——, chloro-*.**	See *Ethyl chloride.*		
3499	**——, 1-chloro-2-(β-chloroethoxy)-*.**	See *Ether, bis-β-chloroethyl.*		
3500	**——, 1-chloro-2-(β-chloroethylthio)-*.**	See *Sulfide, β, β′-dichloroethyl.*		
3501	**——, 1-chloro-1-ethoxy-*.**	See *Ether, α-chloroethyl ethyl.*		
3502	**——, 1-chloro-2-ethoxy-*.**	See *Ether, β-chloroethyl ethyl.*		
3502M	**——, 1-chloro-1,1,-2,2,2-penta-fluoro-***	. . . .	$CClF_2CF_3$.	154 48
3503	**——, *sym*-diacetyl-.**	See *2,5-Hexanedione*.*		
3504	**——, 4,4′-diamino-*sym*-diphenyl-.**	See *α, α-Bi-p-toluidine.*		
3505	**——, 1,1-dibromo-***	ethylidene bromide, ethylidene dibromide	CH_3CHBr_2. . . .	187 88
3506	**——, 1,2-dibromo-*.**	See *Ethylene bromide*		
3507	**——, 1,1-dichloro-*** .	ethylidene chloride, ethylidene dichloride	CH_3CHCl_2.	98 97
3508	**——, 1,1-dichloro-2,2-diethoxy-*.**	See *Acetal, dichloro-.*		
3509	**——, 1,2-dichloro-*.**	See *Ethylene chloride.*		
3510	**——, 1,2-dichloro-1-ethoxy-*.**	See *Ether, α, β-dichloroethyl.*		
3510R	**——, 1,1-dichloro-1,-2,2,2-tetra-fluoro-***	. . . .	CCl_2FCF_3.	170 93
3511	**——, 1,2-dichloro-1,1,2,2-tetrafluoro-***	. . . . . .	$CClF_2CClF_2$	170 93
3512	**——, 1,1-diethoxy-*.**	See *Acetal.*		
3512L	**——, 1,1-difluoro-*** . .	ethylidene fluoride . .	CH_3CHF_2	66 05
3512M	**——, 1,2-difluoro-*.**	See *Ethylene fluoride.*		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3474	or cr f eth	..			i	s.	v. sl. s. eth.; i. bz.
3475	red-br powd.				s.	s.	
3476	need		270 d		sl s. c	s	v sl. s. eth ; s. dil alk.
3477	wh need., $[\alpha]_D^{18}$ −14.6° in me al.		160 d ; anh. 205	d 230	0 16 c., 8 h.	4 58^{78}	v sl. s. eth ; s. h chl., ac. a., alk.
3478							
3479	oil, 1 5230$_D^{17.5}$	0 9645$_4^{21}$		215	i	s	s eth.
3480							
3481							
3482							
3483							
3484							
3485							
3486							
3487							
3488	col gas	1 357^0 g/1; 0 561^{-100}	−172	−88 3	4 7^{20} cm^3	16^4 cm^3	
3489							
3490							
3491							
3492							
3493	need or leaf. f al.	. .	180		sl s h	sl s h	s glac ac. a., bz
3494							
3495	col liq ...	1 689$_4^{19}$	−16 6	107–8	0 688^{30}	∞	∞ eth.
3496							
3497							
3498							
3499							
3500							
3501							
3502							
3502M	col. gas			−38	i	s	s eth.
3503							
3504							
3505	liq , 1 51277	2 089$_4^{20.5}$		110 (108–10)	i	v s	v s. eth.
3506							
3507	col. liq., 1 41655	1 174$_4^{20}$	−96 7	57 3	0 55^{20}	v. s	v. s. eth.
3508							
3509							
3510							
3510 R	col gas			−2	i	s.	s. eth.
3511	col gas, 1 3092^0	1 5312^0		3 8	i.	s	s. eth.
3512							
3512 L	col gas .			−24 7	....	..	.. ..
3512M							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3513	**Ethane, 1,1-diiodo-*** . .	*uns*-diiodoethane; ethylidene iodide, ethylidene diiodide	CH_3CHI_2	281 89
3514	**——, 1,2-diiodo-*.**	See *Ethylene iodide.*		
3515	**——, 1,1-dimethoxy-*.**	acetaldehyde dimethyl acetal, dimethyl acetal, ethylidene dimethyl ether	$CH_3CH(OCH_3)_2$.	90 12
3516	**——, 1,1-dinitro-***	*uns*-dinitroethane	$CH_3CH(NO_2)_2$. .	120 07
3517	**——, 1,2-diphenoxy-***	glycol diphenyl ether, ethylene diphenyl ether	$(CH_2OC_6H_5)_2$	214 25
3518	**——, 1,1-diphenyl-** . . .	*uns*-diphenylethane, α-methylditan	$(C_6H_5)_2CHCH_3$. .	182 25
3519	**——, 1,2(or *sym*)-diphenyl-.** See *Bibenzyl.*			
3520	**——, 1,2-epoxy-*.**	See *Ethylene oxide.*		
3521	**——, ethenyloxy-*.**	See *Ether, ethyl vinyl.*		
3522	**——, ethoxy-*.**	See *Ethyl ether*		
3523	**——, 1-ethoxy-2-(β-ethoxyethoxy)-*.** See *Ether, bis(β-ethoxyethyl).*			
3524	**——, ethyldithio-*.**	See *Ethyl disulfide.*		
3525	**——, ethylsulfinyl-*.**	See *Ethyl sulfoxide.*		
3526	**——, ethylsulfonyl-*.**	See *Ethyl sulfone.*		
3527	**——, ethylthio-*.**	See *Ethyl sulfide.*		
3528	**——, fluoro-*.**	See *Ethyl fluoride.*		
3529	**——, hexabromo-*** .	perbromoethane	CBr_3CBr_3	503 52
3530	**——, hexachloro-*** . . .	perchloroethane, carbon hexachloride	CCl_3CCl_3	236 76
3530M	**——, hexafluoro-***	perfluoroethane; carbon hexafluoride	CF_3CF_3	138 02
3531	**——, hexamethyl-.**	See *Butane, 2,2,3,3-tetramethyl-*.*		
3532	**——, hexaphenyl-** . . .		$(C_6H_5)_3C$-$C(C_6H_5)_3$	486 62
3533	**——, iodo-*.**	See *Ethyl iodide.*		
3534	**——, methoxy-*.**	See *Ether, ethyl methyl.*		
3535	**——, methylthio-*.**	See *Sulfide, ethyl methyl.*		
3536	**——, naphthyl-.**	See *Naphthalene, ethyl-.*		
3537	**——, nitro-**	. . .	$C_2H_5NO_2$	75 07
3538	**——, pentabromo-*** . .	. . . . .	$CHBr_2CBr_3$	424 61
3539	**——, pentachloro-*** . .	. . . .	$CHCl_2CCl_3$	202 31
3539M	**——, pentachloro-fluoro-***	. . . .	CCl_3CCl_2F	220 31
3540	**——, pentachloro(pentachloroethoxy)-*.** See *Ether, bis(pentachloroethyl).*			
3541	**——, pentaiodo-*** .		CHI_2CI_3 .	659 63
3542	**——, perbromo-.**	See *Ethane, hexabromo-*.*		
3543	**——, perchloro-.**	See *Ethane, hexachloro-*.*		
3543M	**——, perfluoro-.**	See *Ethane, hexafluoro-**		
3544	**——, phenyl-.**	See *Benzene, ethyl-.*		
3545	**——, phosphino-.**	See *Phosphine, ethyl-.*		
3546	**——, 1,1,1,2-tetra-bromo-***	*uns*-tetrabromoethane	CH_2BrCBr_3	345 70
3547	**——, 1,1,2,2-tetra-bromo-***	*sym*-tetrabromoethane; acetylene tetrabromide	$CHBr_2CHBr_2$	345 70
3548	**——, 1,1,1,2-tetra-chloro-***	*uns*-tetrachloroethane	CH_2ClCCl_3	167 86

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
3513	liq . .	$2.84\frac{0}{4}$	.. . .	179	i.	v. s.	v. s. eth.
3514							
3515	col inflam. liq.	$0.8476\frac{25}{4}$	. ....	64 5	s.	s.	s. eth., chl.
3516	liq.	$1.3503\frac{23.5}{23.5}$		185–6	sl. s.	s.	s. eth.
3517	col. leaf. f. al		98 5	. ....	v sl s (i)	s. h.	v. s. eth.; s. chl
3518	col oil, 1.5761	$1.006\frac{21}{4}$, $0.9877\frac{25}{4}$	.	272 (268–86)	i.	s.	s. eth.
3519							
3520							
3521							
3522							
3523							
3524							
3525							
3526							
3527							
3528							
3529	rhomb pr, 1 740, 1 847, 1 863	$3.823\frac{20}{4}$	148–9 d	d 210	i	sl s	s CS_2; v. sl. s. al eth
3530	col rhomb. tab f al or eth	$2.091\frac{20}{4}$	subl 187		i.	v s.	v. s. eth.
3530M	col gas	1.85^{-78}	-100 6	-78 2	i.		.
3531							
3532	col cr		145–7 d.	. ...	i.	v sl s	s. chl.
3533							
3534							
3535							
3536							
3537	w. wh liq, $1.39007^{24.3}$	$1.052\frac{20}{20}$	<-50, frz -90	114 8	4 5 cc	∞	∞ eth.; s. chl., dil. alk.
3538	monocl pr	$3.312\frac{20}{4}$	57	210^{800} d.	i.	s.	v. s. eth.
3539	liq, $1.50250^{24.0}$	$1.709\frac{0}{4}$, $1.6728\frac{25}{4}$	-29	162	i.	∞	∞ eth.
3539M	wh. sld		101 3	137 9	i.	s.	s. eth.
3540							
3541	col monocl pr f ac a.	$3.312\frac{20}{4}$	56–7	210 d.	i.	s.	v. s eth, s ac. a., bz.
3542							
3543							
3543M							
3544							
3545							
3546	col liq, 1 62772	$2.875\frac{20}{4}$	0	$103.5^{13.5}$	....	s.	....
3547	col.-yel. liq, 1.63795	$2.9638\frac{20}{4}$	0 1	151^{54}; d. 239–42	0.0651^{30}	∞	∞ eth., chl., aniline, ac. a.
3548	liq., $1.48162^{23.2}$	$1.588\frac{20}{4}$		130 5	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
3549	**Ethane, 1,1,2,2-tetrachloro-***	*sym*-tetrachloroethane; acetylene tetrachloride	$CHCl_2CHCl_2$.	167.86
3549K	**——, 1,1,1,2-tetrachloro-2,2-difluoro-***	. . .	CCl_3CClF_2 .	203.85
3549P	**——, 1,1,2,2-tetrachloro-1,2-difluoro-***	.. . .	CCl_2FCCl_2F. .	203.85
3550	**——, 1,1,1,2-tetraphenyl-**	*uns*-tetraphenylethane, triphenylbenzylmethane, α-benzyltritan	$(C_6H_5)_3CCH_2C_6H_5$	334.44
3551	**——, 1,1,2,2-tetraphenyl-**	*sym*-tetraphenylethane .	$(C_6H_5)_2CHCH(C_6H_5)_2$	334.44
3552	**——, 1,1,2-tribromo-*.**	vinyl tribromide	$CH_2BrCHBr_2$.	266.79
3553	**——, 1,1,1-trichloro-***	methylchloroform	CH_3CCl_3. .	133.42
3554	**——, 1,1,1-trichloro-2,2-diethoxy-***	chloral diethyl acetal; trichloroacetal	$CCl_3CH(OC_2H_5)_2$	221.52
3555	**——, 1,1,2-trichloro-***	vinyl trichloride.	$CH_2ClCHCl_2$ ...	133.42
3555R	**——, 1,1,1-trichloro-2,2,2-trifluoro-***	. ...	CCl_3CF_3....	187.39
3556	**——, 1,1,2-trichloro-1,2,2-trifluoro-**	. ...	$C_2Cl_3F_3$....	187.39
3557	**——, 1,1,1-triethoxy-*.**	See *Orthoacetic acid, triethyl ester.*		
3557M	**——, 1,1,1-trifluoro-***	methylfluoroform	CH_3CF_3..	84.04
3558	**——, 1,1,1-triiodo-***	methyliodoform .	CH_3CI_3	407.80
3559	**——, 1,1,1-triphenyl- .**	α-methyltritan .	$(C_6H_5)_3CCH_3$	258.35
3560	**——, 1,1,2-triphenyl-**	. . .	$(C_6H_5)_2CHCH_2C_6H_5$	258.35
3561	**Ethaneazobenzene.**	See *Benzeneazoethane.*		
3561M	**Ethaneboronic acid.**	See *Boric acid, ethyl-.*		
3562	**Ethanedial*.**	See *Glyoxal.*		
3563	**Ethanediamide*.**	See *Oxamide.*		
3564	**1,2-Ethanediamine*.**	See *Ethylenediamine*		
3565	**1,1-Ethanedicarboxylic acid, 1-hydroxy-2-phenyl-.**	See *Tartronic acid,*		
3566	**Ethanedinitrile*.**	See *Cyanogen*		
3567	**Ethanedioic acid*.**	See *Oxalic acid*		
3568	**1,1-Ethanediol, 2,2,2-tribromo-*.**	See *Bromal, hydrate.*		
3569	**——, 2,2,2-trichloro-*.**	See *Chloral, hydrate.*		
3570	**1,2-Ethanediol*.**	See *Glycol.*		
3571	**——, 1,2-dicyclohexyl-**	dodecahydrohydrobenzoin; cyclohexanone pinacol	$C_{12}H_{22}O_2$	198.30
3572	**——, 1,2-diphenyl-.**	See *Hydrobenzoin; Isohydrobenzoin.*		
3573	**——, 1,1,2,2-tetraphenyl-*.**	See *Benzopinacol.*		
3574	**Ethanedioyl chloride*.**	See *Oxalyl chloride*		
3575	**1,2-Ethanedisulfonic acid***	ethylenedisulfonic acid	$C_2H_4(SO_3H)_2$.....	190.19
3576	**1,2-Ethanedithiol*....**	dithioglycol; ethylene mercaptan; ethylene dimercaptan	$HSCH_2CH_2SH$	94.19
3577	**Ethanenitrile*.**	See *Acetonitrile.*		
3578	**——, 2-oxo-2-phenyl-.**	See *Benzoyl cyanide.*		
3579	**Ethanesulfinic acid* .**	ethylsulfinic acid ..	$C_2H_5SO_2H$	94.13
3580	**Ethanesulfonic acid*..**	ethylsulfonic acid ..	$C_2H_5SO_2OH$....	110.13
3581	**——, 2-amino-.**	See *Taurine.*		
3582	**——, 2-hydroxy-.**	See *Isethionic acid.*		

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3549	col. liq., 1.4942	1.600^{20}_{4}	-43.8 (-36)	146.3	i.	∞	∞ eth.
3549 K	col. sld......	....	40.6	91.5	i.	s.	s. eth.
3549 P	col. liq., 1.41297^{25}	1.64470^{25}	24.65	92.8	i.	s.	s. eth.
3550	col. monocl. f. eth.	....	144	$277\text{-}80^{21}$	i.	sl. s	sl. s eth.
3551	col. rhomb. need. f. chl.	1.182^{20}_{4}	211 (209)	383	......	0.76^{78}	14 bz., s ac. a.
3552	liq., 1.58902. .	2.579^{20}_{4}	-26	188.4	. .	s.	. .
3553	col. liq., $1.43765^{21.6}$	1.3249^{26}_{4}	....	74.1	i.	∞	∞ eth.
3554	liq	1.266^{15}_{4}	. .. .	197	0.5	∞	∞ eth., glyc.
3555	col. liq., 1.4711	1.443^{20}_{4}	-36.7	113.5	i	∞	∞ eth.
3555 R	col. gas .	1.5702	13.2	45.8	i.	s	s. eth.
3556	col. liq., 1.35572^{25}	1.56354^{25}	-36.4	47.7	i.	s	s eth., ∞ bz.
3557							
3557M	col. gas	3.784 g/l	-107	-46.8			. ...
3558	yel. octahdr	. . . .	95 d.	.	. .	sl. s.	v. s. eth., CS_2, bz.; sl. s. lgr.
3559	need. f. al or eth	...	95		i	sl. s. c., s. h	v. s. eth
3560	monocl. leaf. f. dil. al	. .	54-4.5	$348\text{-}9^{7.1}$	i	v. s.	v. s. eth.
3561							
3561M							
3562							
3563							
3564							
3565	*benzyl-.*						
3566							
3567							
3568							
3569							
3570							
3571	need	. ..	129-30	....	....		v. s. bz.; s. pet. eth.
3572							
3573							
3574							
3575	cr. f. ac. a	.	104	. .	v. s.	v. s.	. ....
3576	liq .	1.123	.	146	.	s.	v. s. alk.; s. NH_4OH
3577							
3578							
3579	syrup ..	. ...	. ..	. . ..	. .	.	s alk.
3580	hyg. cr	.	.	....	s., deliq.	s.	s. alk.
3581							
3582							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3583	**Ethanesulfonyl chloride***	ethylsulfonyl chloride	$C_2H_5SO_2Cl$...	128.58
3584	**1,1,2,2-Ethanetetracarboxylic acid***, tetraethyl ester	ethyl *sym*-ethanetetracarboxylate	$(COOC_2H_5)_2CH$-$CH(COOC_2H_5)_2$	318.32
3585	**Ethanethial***, trimer.	See *sym-Trithiane, 2,4,6-trimethyl-*		
3586	**Ethanethiol***.	ethyl mercaptan, ethyl hydrosulfide, ethyl thioalcohol	C_2H_5SH....	62.13
3587	——, sodium derivative	sodium mercaptide; sodium thioethylate	C_2H_5SNa .	84.12
3588	**Ethanethiolic acid***.	See *Acetic acid, thiol-*.		
3589	**Ethanethionamide***.	See *Acetamide, thio-*.		
3590	**1,1,1-Ethanetricarboxylic acid***	ethenyltricarboxylic acid	$CH_3C(COOH)_3$	162.10
3591	**1,1,2-Ethanetricarboxylic acid, 1,2-dihydroxy-**. See *Desoxalic acid*.			
3592	**Ethanoic acid***.	See *Acetic acid*		
3593	——, **oxo-***.	See *Glyoxylic acid*.		
3594	**Ethanoic anhydride***.	See *Acetic anhydride*.		
3595	**Ethanol***.	See *Ethyl alcohol*.		
3596	——, **2-allyl-**.	See 4-*Penten-1-ol**.		
3597	——, **1-amino-***.	See *Acetaldehyde-ammonia*		
3598	——, **2-amino-***......	β-aminoethyl alcohol; ethanolamine, ethylolamine, β-hydroxyethylamine	$NH_2CH_2CH_2OH$.	61.08
3599	——, **2-anilino-**...	β-hydroxyethylaniline; ethoxylaniline	$C_6H_5NHCH_2$-CH_2OH	137.18
3600	——, **2-benzyloxy-**. .	glycolmonobenzyl ether; benzyl cellosolve	$C_6H_5CH_2OCH_2$-CH_2OH	152.19
3601	——, **2-bromo-***	β-bromoethyl alcohol; ethylene bromohydrin	CH_2BrCH_2OH	124.98
3602	——, ——, acetate.	β-bromoethyl acetate	CH_3COOCH_2-CH_2Br	167.01
3603	——, **2-butoxy-***	glycol monobutyl ether; butyl cellosolve	$C_4H_9OCH_2CH_2$-OH	118.17
3604	——, **2-(β-butoxyethoxy)-***. See *Diethylene glycol, monobutyl ether*			
3604M	——, **2-butylamino-***	*n*-butylethanolamine .	$CH_3(CH_2)_3NH$-CH_2CH_2OH	117.19
3605	——, **2-chloro-*** .	β-chloroethyl alcohol; ethylene chlorohydrin	CH_2ClCH_2OH	80.52
3606	——, ——, acetate ..	β-chloroethyl acetate; 2-chloroethyl ethanoate*	CH_3COOCH_2-CH_2Cl	122.55
3607	——, **2,2-dichloro-*** .	β,β-dichloroethyl alcohol	$CHCl_2CH_2OH$	114.97
3608	——, **2-diethylamino-***	β-diethylaminoethyl alcohol, 2-hydroxytriethylamine	$(C_2H_5)_2NCH_2$-CH_2OH	117.19
3609	——, ——, *p*-aminobenzoate hydrochloride. See *Procaine, hydrochloride*.			
3610	——, **2-dimethylamino-***	β-dimethylaminoethyl alcohol	$(CH_3)_2NCH_2$-CH_2OH	89.14
3611	——, **1,2-diphenyl-** .	benzylphenylcarbinol..	$C_6H_5CH_2CHO$-HC_6H_5	198.25
3612	——, **2-ethoxy-***.. ...	glycol monoethyl ether; "Cellosolve"	$C_2H_5OCH_2CH_2$-OH	90.12
3613	——, ——, acetate	β-ethoxyethyl acetate; "Cellosolve" acetate	$CH_3COOCH_2CH_2$-OC_2H_5	132.16
3614	——, **2-(β-ethoxyethoxy)-**. See *Diethylene glycol, monoethyl ether*.			
3615	——, **2-ethylamino-***	β-hydroxydiethylamine	$C_2H_5HNCH_2CH_2$-OH	89.14
3616	——, **2,2'-ethylenedioxydi-**. See *Triethylene glycol*.			
3617	——, **2,2'-ethyliminodi-**	β,β'-dihydroxytriethylamine	$C_2H_5N(CH_2CH_2$-$OH)_2$	133.19

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3583	liq . . .	1.357^{20}_{4}	....	177.5	d	d.	v. s. eth.
3584	pr .	.	76 (72-4)	305 d.		s.	....
3585							
3586	liq , 1.43055	0 840	-121 (-147 3)	34 7 (34.5-5 5)	1 5	s.	s. eth., alk.
3587	wh. cr				s	s	
3588							
3589							
3590	pr		159 d		s	s.	s eth.
3591							
3592							
3593							
3594							
3595							
3596							
3597							
3598	col liq., 1.4539	$1\ 0180^{20}_{4}$	10 5	172 2	∞	∞	0 72 eth.; s. chl.; sl. s. bz , lgr.
3599	col. liq....	$1\ 110^{0}_{4}$		286	v sl s	s	s eth., chl.
3600	col. liq.....	1 068	<-75	256	0 4		. ... . .
3601	col. liq., 1.4915	$1\ 7720^{20}_{4}$		150 3	s.	∞	∞ eth.
3602	col. liq	$1\ 514^{20}_{4}$	-13 8	161 5-4 5	v s.	∞	∞ eth.
3603	col. liq	$0\ 9027^{20}_{4}$		170.6	∞	∞	∞ eth.
3604							
3604M	$1\ 4437^{20}$... .	$0\ 8907^{20}_{4}$		200	s	s.	s. eth.
3605	col. liq . ..	$1\ 213^{20}_{4}$	-69	128.8	∞	s	2 3^{15} eth.
3606	col liq., 1.4247	$1\ 1783^{0}_{4}$		145	i.	∞	∞ eth.
3607	liq	$1\ 145^{15}_{4}$		146	sl s	s	s. eth.
3608	col liq., 1.4400^{25}	$0\ 8601^{25}_{25}$, $0\ 884^{20}_{4}$		163; $42\text{-}4^{8}$	s	s	s. eth., bz.
3609							
3610	col liq., 1.43	$0\ 8866^{20}_{4}$		135 (131-4)	∞	∞	∞ eth.
3611	need........		66-8	$167\text{-}70^{10}$	v sl s	s	v. s. eth.
3612	col. liq ...	$0\ 9311^{20}_{4}$		135 1	∞	∞	∞ eth.
3613	col. liq.... .	$0\ 9749^{20}_{4}$		156 2 (150-60)	22	∞	∞ eth.
3614							
3615	liq., 1.444..	$0\ 914^{20}_{4}$		$167\text{-}9^{751}$	v. s.	v. s.	v. s. eth.
3616							
3617	yel. liq , 1 4663	$1\ 0135^{20}_{4}$		$251\text{-}2^{750}$	s.	s.	sl. s. eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3617M	**Ethanol, 2-fluoro-*** ..	β-fluoroethyl alcohol; ethylene fluorohydrin	CH_2FCH_2OH	64 06
3618	**——, 2-heptyl-2-methyl-.**	See 1-*Nonanol, 2-methyl-**.		
3619	**——, 2,2′-iminodi-.**	See *Diethanolamine.*		
3619M	**——, 2-isobutylamino-***	isobutylethanolamine. ...	$(CH_3)_2CHCH_2NHCH_2CH_2OH$	117 19
3620	**——, 2-methoxy-*** ..	glycol monomethyl ether; methyl cellosolve	$CH_3OCH_2CH_2OH$	76 09
3621	——, ——, acetate.......	glycol monomethyl ether acetate; methyl cellosolve acetate	$CH_3COOCH_2CH_2OCH_3$	118 13
3622	**——, 2-(β-methoxyethoxy)-.**	See *Diethylene glycol, monomethyl ether.*		
3623	**——, 2-methylamino-***	β-hydroxy-*N*-methylethylamine	$CH_3HNCH_2CH_2OH$	75.11
3624	**——, 2,2′-methyliminodi-**	β, β′-dihydroxy-*N*-methyldiethylamine	$CH_3N(CH_2CH_2OH)_2$	119 16
3625	**——, 2-methyl-2-propyl-.**	See 1-*Pentanol, 2-methyl-**.		
3626	**——, 2,2′,2″-nitrilotri-**	triethylolamine; 2,2′,2″-trihydroxytriethylamine See *Triethanolamine*		.
3627	**——, 2-nitro-**	....	$NO_2CH_2CH_2OH$.	91 07
3628	**——, 2,2′-oxydi-.**	See *Diethylene glycol.*		
3629	**——, pentamethyl-.**	See 2-*Butanol, 2,3,3-trimethyl-**.		
3629M	**——, 2-phenoxy-**......	β-hydroxyethyl phenyl ether, phenyl cellosolve	$C_6H_5OCH_2CH_2OH$	138 16
3630	**——, 1-phenyl-.**	See *Benzyl alcohol, α-methyl-.*		
3631	**——, 2-phenyl-.**	See *Phenethyl alcohol.*		
3632	**——, 2,2′-thiodi-**......	thiodiglycol, bis-β-hydroxyethyl sulfide	$S(CH_2CH_2OH)_2$	122.18
3633	**——, 2,2,2-trichloro-***		CCl_3CH_2OH	149 42
3634	**——, 2,2,2-trichloro-1-ethoxy-*.**	See *Chloral, alcoholate*		
3635	**Ethanolamine.**	See *Ethanol, 2-amino-**.		
3636	**1-Ethanone, 2-ethoxy-1, 2-diphenyl-.**	See *Benzoin, ethyl ether.*		
3637	**Ethanoyl bromide*.**	See *Acetyl bromide.*		
3638	**Ethanoyl chloride*.**	See *Acetyl chloride.*		
3639	**Ethanoyl fluoride*.**	See *Acetyl fluoride.*		
3640	**Ethanoyl iodide*.**	See *Acetyl iodide.*		
3641	**Ethanoyl peroxide*.**	See *Acetyl peroxide.*		
3642	**Ethene*.**	See *Ethylene.*		
3643	**——, ethenyloxy-*.**	See *Vinyl ether.*		
3644	**——, ethenylthio-*.**	See *Vinyl sulfide.*		
3645	**Ethenol.**	See *Vinyl alcohol.*		
3646	**Ethenone.**	See *Ketene.*		
3647	**Ethenylamine*.**	See *Vinylamine.*		
3648	**Ethenyltricarboxylic acid.**	See 1,1,1-*Ethanetricarboxylic acid**.		
3649	**Ether.**	See *Ethyl ether.*		
3650	**——, allyl cresyl.**	See *Ether, allyl tolyl.*		
3651	**——, allyl ethyl**.....	3-ethoxypropene* .	$C_2H_5OCH_2CH{\cdot}CH_2$	86 13
3652	**——, allyl isoamyl**	3-methyl-1-(2-propenoxy)-butane*	$CH_2\ CHCH_2OCH_2CH_2CH(CH_3)_2$	128 21
3653	**——, allyl methyl.** ..	3-methoxypropene*	$CH_2{:}CHCH_2OCH_3$	72 10
3654	**——, allyl 2-naphthyl**	2-(2-propenoxy)naphthalene*	$C_{10}H_7OCH_2CH{:}CH_2$	184 23
3655	**——, allyl phenyl**	2-propenoxybenzene*....	$CH_2{:}CHCH_2OC_6H_5$	134 17
3656	**——, allyl o-tolyl.** ...	2-(2-propenoxy)toluene*; allyl *o*-cresyl ether	$CH_2{:}CHCH_2OC_6H_4CH_3$	148 20
3657	**——, allyl *m*-tolyl**	3-(2-propenoxy)toluene* .	$CH_2{:}CHCH_2OC_6H_4CH_3$	148 20

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3617M	col liq., $1.36470^{18.4}$	$1.11124^{18.3}$	-26.45	103.35	∞	∞	∞ eth.
3618							
3619							
3619M	1.4402^{20}	0.8818^{20}_{4}		190	s	s.	s. eth.
3620	col liq	0.9660^{20}_{4}		124.3	∞	v. s.	s. eth.
3621	liq	1.0054^{20}_{20}		143	∞		.
3622							
3623	col liq., 1.4385	0.937^{20}_{4}		159^{747}	∞	∞	∞ eth.
3624	liq., 1.4678	1.0377^{20}_{4}		$246–8^{747}$	∞	∞	sl. s. eth.
3625							
3626							
3627	col. liq	1.270^{15}_{4}	<-80	193.8	v. s.	v. s.	v. s. eth.
3628							
3629							
3629M	col. liq	1.1094^{20}_{20}		245.2	2.6	s	s. eth.
3630							
3631							
3632	col. liq., 1.519	1.1824^{20}_{4}	-16	168^{14}	∞	∞	sl. s. eth.
3633	rhomb. tab	1.550^{23}_{4}	17.8	152.2	sl. s.	∞	∞ eth.
3634							
3635							
3636							
3637							
3638							
3639							
3640							
3641							
3642							
3643							
3644							
3645							
3646							
3647							
3648							
3649							
3650							
3651	col. liq., 1.38810	0.765^{20}_{4}		67.6	i	∞	∞ eth.
3652	liq .	.		120	v. sl. s.	∞	∞ eth.
3653	col. liq	0.77^{11}_{4}	.	46	v. sl. s.	∞	∞ eth.
3654	oil	..		d. 210	i.		....
3655	col. oil.. .	0.9856^{15}_{15}		192; 85^{19}	i.	s.	∞ eth.
3656	oil .	0.969^{15}_{4}	..	205–8; 85^{12}			....
3657	...	0.965^{15}_{4}		211–4; $92–4^{12}$			....

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
3658	**Ether, allyl *p*-tolyl**	4-(2-propenoxy)toluene*	$CH_2:CHCH_2OC_6H_4CH_3$	148 20
3658R	**——, 2-aminodiethyl.**	See *Ethylamine, β-ethoxy-**.		
3659	**——, β-aminoethyl ethyl.**	See *Ethylamine, β-ethoxy-**.		
3660	**——, amyl ethyl**	1-ethoxypentane*	$C_2H_5O(CH_2)_4CH_3$	116 20
3661	**——, amyl methyl.**	See *Pentane, 1-methoxy-**.		
3662	**——, amyl phenyl**	amoxybenzene	$CH_3(CH_2)_4OC_6H_5$	164 24
3663	**——, benzyl butyl**	1-benzyloxybutane	$C_6H_5CH_2O(CH_2)_3CH_3$	164 24
3664	**——, benzyl ethyl**	α-ethoxytoluene	$C_2H_5OCH_2C_6H_5$.	136 19
3665	**——, benzyl methyl**	α-methoxytoluene	$C_6H_5CH_2OCH_3$.	122 16
3666	**——, benzyl 2-naphthyl**	2-benzyloxynaphthalene*	$C_6H_5CH_2OC_{10}H_7$	234 28
3667	**——, bis-*p*-bromophenyl**	4,4'-dibromodiphenyl ether, 1-bromo-4-(4-bromophenoxy)benzene*	$BrC_6H_4OC_6H_4Br$	328 02
3668	**——, bis-β-chloroethyl**	1-chloro-2-(β-chloroethoxy)-ethane*, *sym*-dichloroethyl ether; β, β'-dichlorodiethyl ether	$(ClC_2H_4)_2O$	143 02
3669	**——, bis-β-chloroisopropyl**	1-chloro-2-(β-chloroisopropoxy)propane*, β, β'-dichloroisopropyl ether	$ClCH_2CH(CH_3)OCH(CH_3)CH_2Cl$	171 07
3670	**——, bischloromethyl**	chloro (chloromethoxy)methane*, *sym*-dichlorodimethyl ether	CH_2ClOCH_2Cl	114 97
3671	**——, bis(*p*-chlorophenyl)**	4,4'-dichlorodiphenyl ether.	$(ClC_6H_4)_2O$	239 10
3672	**——, bis-β-ethoxyethyl**	1-ethoxy-2-(β-ethoxyethoxy)ethane*, diethylene glycol diethyl ether, diethyl carbitol	$(C_2H_5OCH_2CH_2)_2O$	162 23
3673	**——, bis-*p*-nitrophenyl**	1-nitro-4-(4-nitrophenoxy)-benzene*, 4,4'-dinitrodiphenyl ether	$NO_2C_6H_4OC_6H_4NO_2$	260 20
3674	**——, bispentachloroethyl**	pentachloro (pentachloroethoxy)ethane*, perchloroether, decachlorodiethyl ether	$C_2Cl_5OC_2Cl_5$	418 61
3675	**——, β-bromoethyl ethyl**	1-bromo-2-ethoxyethane*; β-bromoethyl ether	$BrCH_2CH_2OC_2H_5$	153 03
3676	**——, bromophenyl methyl.**	See *Anisole, bromo-*.		
3677	**——, butyl cresyl.**	See *Ether, butyl tolyl*.		
3678	**——, butyl ethyl**	1-ethoxybutane*	$(C_2H_5)O(CH_2)_3CH_3$	102 17
3679	**——, *tert*-butyl ethyl**	2-ethoxy-2-methylpropane*	$C_2H_5OC(CH_3)_3$	102 17
3680	**——, butyl 2-furylmethyl**	butyl furfuryl ether	$C_4H_3OCH_2OC_4H_9$	154 20
3681	**——, butyl methyl**	1-methoxybutane*	$CH_3O(CH_2)_3CH_3$	88 15
3682	**——, butyl phenyl**	butoxybenzene*	$CH_3(CH_2)_3OC_6H_5$	150 21
3683	**——, *n*-butyl tetrahydrofurfuryl.**	See *Furan, 2-butoxymethyltetrahydro-*.		
3684	**——, butyl *o*-tolyl.**	2-butoxytoluene*; butyl *o*-cresyl ether	$CH_3C_6H_4O(CH_2)_3CH_3$	164 24

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3658	.	0 9728$\frac{15}{15}$		214 5; 91[12]			.
3658 R							
3659							
3660	liq ..	0 759$\frac{18}{4}$		119–20	sl s	∞	∞ eth.
3661							
3662	liq .			111[17]			.
3663		0 9310$\frac{10}{4}$		220–1[744]	i.	∞	∞ eth.
3664	col. liq	0 949$\frac{20}{4}$		185	i.	∞	∞ eth.
3665	liq .	0 987$\frac{20}{4}$		174	i.	s.	s eth.
3666	leaf f al		99		i.	v s	v. s eth, s. chl, bz.
3667	leaf f. al		53–4 (54–6)	338–40	i.	v. s	∞ eth, v s. bz.
3668	liq., 1 457	1 222$\frac{20}{4}$	-50	178	1 02	s.	s. eth.
3669	col liq	1 1127		187 1 (93–5[18])	0 19		.
3670	col liq, 1 4346[20]	1 315$\frac{20}{4}$		105	d	∞	∞ eth.
3671	1.611	1 3164$\frac{11}{4}$		312–4	i.		.
3672	col. liq	0 907$\frac{20}{4}$		188	∞		.
3673	yel need f al		142–3	. .	i.	sl. s	sl. s. eth.; s. ac. a., bz.
3674	tetr scales	1 900$\frac{14}{4}$	69	d.	. .		. . . . . .
3675	.	1 370$\frac{0}{4}$		126–9	sl s.	∞	∞ eth.
3676							
3677							
3678	col liq	0 752$\frac{20}{4}$	-124	91 4 (90–3)	i.	∞	∞ eth.
3679	liq	0 7519$\frac{20}{4}$	. .	68–9	i.	s.	s eth.
3680	col liq	0 955$\frac{20}{4}$		189–90[765]	i.	s	v. s eth.
3681	col. liq	0 704$\frac{0}{4}$, 0 744$\frac{20}{4}$	-115 5	70 3	v. sl. s.	∞	∞ eth.
3682	col. liq, 1.5040[20]	0 9515$\frac{20}{4}$		210 3 (98–9[10])			. ..
3683							
3684		0 9437$\frac{0}{0}$		223 0			.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3685	**Ether, butyl *m*-tolyl** .	3-butoxytoluene* .	$CH_3C_6H_4OC_4H_9$	164.24
3686	**——, butyl *p*-tolyl**. . . .	4-butoxytoluene*. . .	$CH_3C_6H_4OC_4H_9$	164.24
3687	**——, cetyl phenyl**.	1-phenoxyhexadecane*	$C_6H_5OCH_2(CH_2)_{14}$-CH_3	318 53
3688	**——, chlorodiethyl.**	See *Ether, chloroethyl ethyl.*		
3689	**——, α-chloroethyl ethyl**	1-chloro-1-ethoxyethane*, α-chlorodiethyl ether	$CH_3CHClOC_2H_5$.	108 57
3690	**——, β-chloroethyl ethyl**	1-chloro-2-ethoxyethane*, β-chlorodiethyl ether	$CH_2ClCH_2OC_2H_5$	108 57
3691	**——, chloromethyl methyl**	chloromethoxymethane*	$ClCH_2OCH_3$	80 52
3692	**——, chlorophenyl eth**	**yl.** See *Phenetole, chloro-.*		
3693	**——, cresyl ethyl.**	See *Ether, ethyl tolyl.*		
3694	**——, cresyl methyl.**	See *Ether, methyl tolyl.*		
3695	**——, cresyl propyl.**	See *Ether, propyl tolyl.*		
3696	**——, decachlorodiethy**	**l.** See *Ether, bis(pentachloroeth*	*yl).*	
3697	**——, diallyl.**	See *Allyl ether.*		
3698	**——, di-*n*-amyl.**	See *Amyl ether.*		
3699	**——, dibenzyl.**	See *Benzyl ether.*		
3700	**——, 4,4′-dibromodiph**	**enyl.** See *Ether, bis-p-bromoph*	*enyl.*	
3701	**——, dibutyl.**	See *Butyl ether.*		
3702	**——, dicetyl.**	See *Cetyl ether.*		
3703	**——, dichloro-.**	See *Ether, α, β-dichloroethyl et*	*hyl.*	
3704	**——, β,β′-dichlorodiet**	**hyl.** See *Ether, bis-β-chloroethy*	*l.*	
3704M	**——, *sym*-dichlorodim**	**ethyl.** See *Ether, bischlorometh*	*yl.*	
3705	**——, 4,4′-dichlorodiph**	**enyl.** See *Ether, bis-p-chloroph*	*enyl.*	
3706	**——, *sym*-dichloroeth**	**yl.** See *Ether, bis-β-chloroethyl*		
3707	**——, α,β-dichloro-ethyl ethyl**	1,2-dichloro-1-ethoxyethane*; dichloroether; α, β-dichloroethyl ether	$CH_2ClCHClOC_2H_5$	143 02
3708	**——, β,β′-dichloroisop**	**ropyl.** See *Ether, bis-β-chloroi*	*sopropyl.*	
3709	**——, diethyl.**	See *Ethyl ether.*		
3710	**——, di-*n*-heptyl.**	See *Heptyl ether.*		
3711	**——, 2,2′-dihydroxydie**	**thyl.** See *Diethylene glycol.*		
3711M	**——, β,β′-dihydroxydi**	**-*n*-propyl.** See *2-Propanol,*	*1,1′-oxydi-.*	
3712	**——, 2,2′-dihydroxyet**	**hyl.** See *Diethylene glycol.*		
3713	**——, diisoamyl.**	See *Isoamyl ether.*		
3714	**——, diisobutyl.**	See *Isobutyl ether.*		
3715	**——, diisopropyl.**	See *Isopropyl ether.*		
3716	**——, dimethyl.**	See *Methyl ether.*		
3717	**——, dinaphthyl.**	See *Naphthyl ether.*		
3718	**——, di-*n*-octyl.**	See *Octyl ether.*		
3719	**——, diphenyl.**	See *Phenyl ether.*		
3720	**——, di-*n*-propyl.**	See *Propyl ether.*		
3721	**——, divinyl.**	See *Vinyl ether.*		
3722	**——, ethylene dipheny**	**l.** See *Ethane, 1,2-diphenoxy-**		
3723	**——, ethyl 2-furyl-methyl**	ethyl furfuryl ether	$C_4H_3OCH_2OC_2H_5$	126 15
3724	**——, ethyl heptyl**	1-ethoxyheptane*. .	$C_2H_5O(CH_2)_6CH_3$	144 25
3725	**——, ethyl hexyl** . .	1-ethoxyhexane* .	$C_2H_5O(CH_2)_5CH_3$	130 23
3725M	**——, ethylidene dieth**	**yl.** See *Acetal.*		
3725T	**——, ethylidene dimet**	**hyl.** See *Ethane, 1,1-dimethoxy*	*-*.*	
3726	**——, ethyl isoamyl** . .	1-ethoxy-3-methylbutane*	$C_2H_5OCH_2CH_2$-$CH(CH_3)_2$	116 20
3727	**——, ethyl isobutyl** .	1-ethoxy-2-methylpropane*	$C_2H_5OCH_2CH$-$(CH_3)_2$	102 17

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3685	...	0.9407^{0}_{0}		229.2			
3686	.. ...	0.9419^{0}_{0}		229.5			
3687	leaf., $1.4556^{82.4}_{\alpha}$	$0.8434^{82.4}_{4}$	41.8	200^{1}			.
3688							
3689	... .. .	.. .		98 part d.			
3690	liq..	1.0572^{0}_{4}, 0.989^{20}_{4}		107-8			.
3691	liq., 1.3974	1.0625^{10}_{4}	-103.5	59.5	d	s	s eth
3692							
3693							
3694							
3695							
3696							
3697							
3698							
3699							
3700							
3701							
3702							
3703							
3704							
3704M							
3705							
3706							
3707	col. inflam. liq	1.174^{23}_{4}		140-5		v s	v s. eth.
3708							
3709							
3710							
3711							
3711M							
3712							
3713							
3714							
3715							
3716							
3717							
3718							
3719							
3720							
3721							
3722							
3723	col. liq	0.9844^{20}_{4}		149.5-50.5[770]	i.	s.	s. eth.
3724	....	0.790^{16}_{4}		166.6	i.	s.	s. eth.
3725	liq.	0.8327^{0}_{4}	...	137	i.	v s	s. eth.
3725M							
3725 T							
3726	col. liq .	0.764^{18}_{4}	.	112	i.	∞	∞ eth.
3727	col. liq.. ..	0.751^{20}_{4}		80 (78-80)	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3728	**Ether, ethyl isopropyl**	2-ethoxypropane* . .	$C_2H_5OCH(CH_3)_2$	88 15
3729	**——, ethyl methyl. . . .**	methoxyethane*	$CH_3OC_2H_5$	60 09
3730	**——, ethyl β-methyla**	**minoethyl.** See *Ethylamine,*	*β-ethoxy-N-methyl-*	
3731	**——, ethyl β-4-morph**	**olylethyl.** See *Morpholine,* 4	-(*β-ethoxyethyl*)-.	
3732	**——, ethyl-1-naphthyl**	1-ethoxynaphthalene*	$C_{10}H_7OC_2H_5$	172 22
3733	**——, ethyl 2-naphthyl**	2-ethoxynaphthalene*; bromelia, nerolin (new)	$C_{10}H_7OC_2H_5$	172 22
3734	**——, ethyl octyl. . .**	1-ethoxyoctane*	$C_2H_5O(CH_2)_7CH_3$	158 28
3735	**——, ethyl phenyl.**	See *Phenetole*		
3736	**——, ethyl propargyl.**	See *Propyne, 3-ethoxy-**.		
3737	**——, ethyl propyl**	1-ethoxypropane*	$C_2H_5OC_3H_7$	88 15
3738	**——, ethyl tetrahydrof**	**urfuryl.** See *Furan, 2-ethoxy*	*methyltetrahydro-*.	
3739	**——, ethyl o-tolyl. . .**	2-ethoxytoluene*, o-cresyl ethyl ether	$CH_3C_6H_4OC_2H_5$	136 19
3740	**——, ethyl m-tolyl .**	3-ethoxytoluene* .	$CH_3C_6H_4OC_2H_5$	136 19
3741	**——, ethyl p-tolyl .**	4-ethoxytoluene . .	$CH_3C_6H_4OC_2H_5$	136 19
3742	**——, ethyl vinyl. . . .**	ethenoxyethane* . .	$CH:CH_2OC_2H_5$	72 10
3745	**——, 2-furylmethyl methyl**	furfuryl methyl ether	$C_4H_3OCH_2OCH_3$	112 12
3746	**——, heptyl methyl. .**	1-methoxyheptane*.	$CH_3OC_7H_{15}$.	130 23
3747	**——, heptyl phenyl. . .**	1-phenoxyheptane*. .	$C_6H_5O(CH_2)_6CH_3$	192 29
3748	**——, hexyl phenyl. . . .**	hexyloxybenzene; 1-phenoxyhexane*	$CH_3(CH_2)_5OC_6H_5$	178 27
3748M	**——, β-hydroxyethyl p**	**henyl.** See *Ethanol, 2-phenox*	*y-*.	
3749	**——, isoamyl 1-naphthyl**	1-(γ-methylbutoxy)naphthalene*	$C_{10}H_7OCH_2CH_2CH(CH_3)_2$	214 30
3750	**——, isoamyl 2-naphthyl**	2-(γ-methylbutoxy)naphthalene*	$C_{10}H_7OCH_2CH_2CH(CH_3)_2$	214 30
3751	**——, isoamyl phenyl**	isoamoxybenzene, 3-methyl-1-phenoxybutane	$C_6H_5O(CH_2)_2CH(CH_3)_2$	164 24
3752	**——, isobutyl methyl**	1-methoxy-2-methylpropane*	$CH_3OCH_2CH(CH_3)_2$	88 15
3753	**——, isobutyl phenyl**	isobutoxybenzene; 2-methyl-1-phenoxypropane	$(CH_3)_2CHCH_2OC_6H_5$	150 21
3754	**——, isopropyl methyl**	2-methoxypropane*	$CH_3OCH(CH_3)_2$.	74 12
3755	**——, isopropyl phenyl**	isopropoxybenzene, 2-phenoxypropane	$(CH_3)_2CHOC_6H_5$	136 19
3756	**——, methylene dieth**	**yl.** See *Methane, diethoxy-**		
3757	**——, methylene dimet**	**hyl.** See *Methane, dimethoxy-*	*.	
3758	**——, o,o'-methylenedi**	**phenyl.** See *Xanthene*.		
3759	**——, methylenediprop**	**yl.** See *Methane, dipropoxy-**.		
3760	**——, methyl 1-naphthyl**	1-methoxynaphthalene*; methyl α-naphthyl ether	$C_{10}H_7OCH_3$.	158 19
3761	**——, methyl 2-naphthyl**	2-methoxynaphthalene*; methyl β-naphthyl ether; nerolin (old); yara-yara	$C_{10}H_7OCH_3$	158 19
3762	**——, methyl phenyl.**	See *Anisole*.		
3763	**——, methyl propargyl**	. See *Propyne, 3-methoxy-**.		
3764	**——, methyl propyl.**	1-methoxypropane*	$CH_3OCH_2CH_2CH_3$	74 12
3765	**——, methyl 6-quinoly**	**l.** See *Quinoline, 6-methoxy-*.		
3766	**——, methyl o-tolyl . .**	2-methoxytoluene*; o-cresyl methyl ether	$CH_3C_6H_4OCH_3$	122 16

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3728	col. liq.....	0 745$\frac{0}{4}$	. .	54	s.	∞	∞ eth
3729	col liq. or gas.	0 7260$\frac{0}{4}$	....	7 9 (11–2)	s.	∞	∞ eth
3730							
3731							
3732	liq., 1 59509$^{22.8}$	1 061$\frac{20}{4}$	5 5	276 4; 160^{19}	i.	v. s.	v. s. eth
3733	pl, 1 59752$^{35 6}$ 1 5932$^{47.2}$	1 0606$\frac{25}{4}$	37 5	282	i.	sl. s.	s eth, pet. eth
3734	liq .	0 794$\frac{17}{4}$	.	182–4	i.	s	s eth.
3735							
3736							
3737	col liq., 1.36948	0 747 (0 732$\frac{20}{4}$)	<-79	64 (61 4)	s.	∞	∞ eth.
3738							
3739	liq., 1.508$^{13.3}$	0 9592$\frac{13\ 3}{4}$		180 1; 69 6–70 2^{12}			.
3740	1 513...	0 9560$\frac{0}{0}$		192, 73–5^{10}			
3741	liq., 1.5058$^{17.6}$	0 9662$\frac{0}{0}$		189 9, 70–1^{15}			.
3742	liq.	0 763$\frac{15}{18}$		35 5	sl s.	s.	∞ eth.
3745	col. liq ..	1 0163$\frac{20}{4}$		134–5^{762}	i.	s.	v. s. eth.
3746	col. liq.	0 795$\frac{0}{0}$		149 8	i.	∞	∞ eth.
3747	.. ..	0 9319$\frac{0}{0}$		266 8	..		. . .
3748	. .	0 9426$\frac{0}{4}$		246			. ..
3748M							
3749	liq., 1 5705$^{14.2}$	1 0069$^{14 2}$		317–9^{742} d			. ..
3750	leaf., 1.5768^{12}.	1 0155$\frac{12}{4}$	26 5	323–6 d.	i.	s	s eth
3751	col liq, 1.4872^{20}	0 9198$\frac{22}{4}$	.	225			.
3752	liq. .	0 7507$\frac{0}{4}$	. .	59^{741}	i.	s.	s eth.
3753	col. liq....	0 939$\frac{16}{4}$	.	198		...	
3754	col. liq .. .	0 7347$\frac{20}{20}$	..	32 5^{777}	sl. s.	s.	s eth
3755	col. liq.....	0 9464$\frac{15}{15}$	.	177 2		.	
3756							
3757							
3758							
3759							
3760	col. liq., 1.6232$^{13.9}$	1 0964$\frac{13.9}{4}$	<-10	265–9 (258)	i.	v. s.	v s. eth, s bz.
3761	col leaf. f. eth.	....	72	274	sl. s.	sl. s.	v. s. eth.; s. CS_2, bz
3762							
3763							
3764	col. liq., 1.3579	0 738$\frac{20}{4}$	.. ..	38 9	3 05^{25}	∞	∞ eth
3765							
3766	liq., 1 5199$^{15.3}$	0 9851$\frac{15}{15}$		171 3	i.	v. s.	v. s. eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
3767	**Ether, methyl *m*-tolyl**	3-methoxytoluene*	$CH_3C_6H_4OCH_3$.	122 16
3768	**——, methyl *p*-tolyl**	4-methoxytoluene*	$CH_3C_6H_4OCH_3$.	122 16
3769	**——, 1-naphthyl propyl**	1-propoxynaphthalene*	$C_{10}H_7OCH_2CH_2$-CH_3	186.24
3770	**——, 2-naphthyl propyl**	2-propoxynaphthalene*	$C_{10}H_7OCH_2CH_2$-CH_3	186 24
3771	**——, octyl phenyl** . .	1-phenoxyoctane*	$C_6H_5O(CH_2)_7CH_3$	206 32
3772	**——, perchloro-.**	See *Ether, bis(pentachloroethyl)*.		
3773	**——, phenyl propyl**	propoxybenzene*	$C_3H_7OC_6H_5$	136 19
3774	**——, phenyl vinyl** .	ethenoxybenzene*	$C_6H_5OCH{:}CH_2$	120 14
3775	**——, propyl *o*-tolyl** . .	2-propoxytoluene*, *o*-cresyl propyl ether	$CH_3C_6H_4O(CH_2)_2$-CH_3	150 21
3776	**——, propyl *m*-tolyl**	3-propoxytoluene*	$CH_3C_6H_4OC_3H_7$	150 21
3777	**——, propyl *p*-tolyl** .	4-propoxytoluene*.	$CH_3C_6H_4OC_3H_7$.	150 21
3778	**Ethine.**	See *Acetylene.*		
3779	**Ethinyl tribromide.**	See *Ethylene, tribromo-.*		
3780	**Ethinyl trichloride.**	See *Ethylene, trichloro-.*		
3781	**Ethionic anhydride**	carbyl sulfate, 1,3,2,4-dioxadithiane 2,4-bisdioxide	$SO_2OCH_2CH_2SO_2O$	188.17
3782	**Ethocain.**	See *Procaine, hydrochloride*		
3783	**Ethoxyamine*** .	α-ethylhydroxylamine	$C_2H_5ONH_2$	61 08
	Ethyl. For ethyl derivative	s see the parent compounds (e	g., for ethylbenzene	see
3784	**Ethyl acetate.**	See *Acetic acid, ethyl ester.*		
3784M	**Ethylal.**	See *Methane, diethoxy-.*		
3785	**Ethyl alcohol**.	ethanol*; methylcarbinol, alcohol, spirit of wine	CH_3CH_2OH. .	46 07
	——. For other derivatives se	e *Ethanol.*		
3786	— —, esters with organic acid	s. See "ethyl ester," under the	names of the acids.	
3787	**Ethylamine***. . .	aminoethane	$C_2H_5NH_2$. .	45 08
3788	——, hydrobromide	ethylammonium bromide*	$C_2H_5NH_2\cdot HBr$	126 01
3789	——, hydrochloride .		$C_2H_5NH_2\cdot HCl$	81 55
3789M	—, hydroiodide. . .		$C_2H_5NH_2\cdot HI$. .	173 01
3790	**——, *N*-benzylidene**	*N*-ethylbenzalimine; *N*-benzalethylamine	$C_6H_5CH.NC_2H_5$.	133 19
3791	**——, β,β-diethoxy-**	aminoacetaldehyde; 2, 2-diethoxyethylamine, aminoacetal, acetalylamine	$(C_2H_5O)_2CH$-CH_2NH_2	133.19
3792	**——, β,β-diethoxy-*N,N*-dimethyl-**	dimethylaminoacetal. .	$(CH_3)_2NCH_2$-$CH(OC_2H_5)_2$	161.24
3793	**——, α,α-dimethyl-.**	See *tert-Butylamine.*		
3794	**——, β-ethoxy-*** .	2-aminodiethyl ether; β-aminoethyl ethyl ether	$C_2H_5OCH_2CH_2$-NH_2	89.14
3795	**——, β-ethoxy-*N*-methyl-**	ethyl β-methylaminoethyl ether	$CH_3NHCH_2CH_2$-OC_2H_5	103.16
3796	**——, β-hydroxy-.**	See *Ethanol, 2-amino-*.*		
3797	**——, β-hydroxy-*N,N*-d**	**imethyl-.** See *Ethanol, 2-di*	*methylamino-*.*	
3798	**—, β-hydroxy-*N*-me**	**thyl-.** See *Ethanol, 2-methyla*	*mino-*.*	
3799	**——, α-phenyl-.**	See *Benzylamine, α-methyl-.*		
3800	**——, β-phenyl-.**	See *Phenethylamine.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3767	liq., 1.506[20].	$0.9766\frac{15}{15}$		177.2, (172–3)			. ....
3768	liq., 1.51237[19.3]	$0.9709\frac{19.3}{4}$		176.5 (173–4)			....
3769	liq., 1.5928[18.4]	1.0447[18.4]		298–9			. . . .
3770	need..	.	39.5–40	....			. .. .
3771	col. liq.	$0.9139\frac{15}{15}$	8	285.2			.
3772							
3773	col. liq	$0.9530\frac{15}{15}$		190.5		s	s. eth.
3774				155–6			.
3775		$0.9517\frac{0}{0}$		204.1			
3776		$0.9484\frac{0}{0}$		210.6			
3777		$0.9497\frac{0}{0}$		210.4			.
3778							
3779							
3780							
3781	deliq. cr		80		d		.
3782							
3783	col. liq .	0.8837.5		68	∞	∞	∞ eth
	Benzene, ethyl)	For ethyl esters of organic acids see the acids					
3784							
3784M							
3785	col. liq., 1.36242[18.35]	$0.7893\frac{20}{4}$; $0.78505\frac{25}{4}$	-117.3; -114.6	78.5 (78.37)	∞	.	∞ eth., chl., s. me. al
3786							
3787	col. liq....	$0.7059\frac{0}{4}$, $0.689\frac{15}{15}$	-80.6	1[illegible]6	∞	∞	∞ eth
3788	need. or pl. f. al.	$1.741\frac{20}{4}$	159.5				
3789	monocl. deliq. pl. f. al.	$1.2045\frac{21}{4}$	108	d. 315	238[17]	s	i. eth.
3789M	need. f. w		188.5			sl. s	.
3790	1.541^{20}_{He}	$0.937\frac{20}{4}$		195	i.	∞	∞ eth.
3791	liq., 1.4120	$0.9161\frac{25}{4}$		103	s	s	s. eth., $CHCl_3$
3792	yel. liq	$0.885\frac{7}{4}$		170–1	s.	s.	s. eth.
3793							
3794	liq., 1.4101[20]	$0.8512\frac{20}{4}$		108	∞	∞	∞ eth
3795	liq., 1.4147	$0.8363\frac{20}{4}$		114–5[744]			..
3796							
3797							
3798							
3799							
3800							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
3801	**Ethyl arsenate**	triethyl arsenate; ethyl orthoarsenate	$(C_2H_5)_3AsO_4$	226 09
3802	**Ethyl arsenite**	triethyl arsenite, ethyl orthoarsenite	$(C_2H_5)_3AsO_3$	210 09
3803	**Ethyl borate**	triethyl borate, triethoxyboron	$B(OC_2H_5)_3$	146 00
3804	**Ethyl bromide**	bromoethane*	CH_3CH_2Br	108 98
3805	**——, vinyl-.**	See 1-*Butene, 4-bromo-**		
3805M	**Ethylcellulose.**	See *Cellulose, ethyl ether*		
3806	**Ethyl chloride**	chloroethane*	CH_3CH_2Cl	64 52
3807	**Ethyl cyanide.**	See *Propionitrile*		
3808	**Ethyl disulfide**	ethyldithioethane*, diethyl disulfide	$(C_2H_5)_2S_2$	122 24
3809	**Ethylene**	ethene*; elayl	$CH_2:CH_2$	28 05
3810	——, esters	See "diacetate", "dibenzoate", etc under *Glycol*		
3811	**——, bromo-.**	See *Vinyl bromide*		
3812	**——, 1-bromo-2-phenyl-.**	See *Styrene, β-bromo-*		
3813	**——, butyl-.**	See 1-*Hexene**		
3814	**——, sec-butyl-.**	See 1-*Pentene, 3-methyl-**.		
3815	**——, *tert*-butyl-.**	See 1-*Butene, 3,3-dimethyl-**		
3816	**——, 1-butyl-1-methyl-.**	See 1-*Hexene, 2-methyl-**.		
3817	**——, 1-butyl-2-methyl-.**	See 2-*Heptene**		
3818	**——, 1-sec-butyl-1-methyl-.**	See 1-*Pentene, 2,3-dimethyl-**		
3819	**——, 1-sec-butyl-2-methyl-.**	See 2-*Hexene, 4-methyl-**		
3820	**——, chloro-.**	See *Vinyl chloride*		
3821	**——, 1,2-dibromo-**	acetylene dibromide, *sym*-dibromoethylene	CHBr.CHBr	185 87
3822	**——, 1,1-dichloro-**	*uns*-dichloroethylene	$CH_2 CCl_2$	96 95
3823	**——, 1,2 (or *sym*)-dichloro-(*cis*)**	acetylene dichloride	$CHCl:CHCl$	96 95
3823A	**——, 1,2 (or *sym*)-dichloro-(*trans*)**	acetylene dichloride	$CHCl:CHCl$	96 95
3824	**Ethylene, 1,1 (or *uns*)-diethyl-.**	See 1-*Butene, 2-ethyl-**.		
3825	**——, 1,2(or *sym*)-diethyl-.**	See 3-*Hexene**.		
3826	**——, 1,1-diethyl-2-methyl-.**	See 2-*Pentene, 3-ethyl-**.		
3826M	**——, 1,1-difluoro-**	*uns*-difluoroethylene	$CH_2:CF_2$	64 01
3827	**——, 1,2(or *sym*)-diisopropyl-.**	See 3-*Hexene, 2,5-dimethyl-**.		
3828	**——, 1,1(or *uns*)-dimethyl-.**	See *Propene, 2-methyl-**		
3829	**——, 1,2(or *sym*)-dimethyl-.**	See 2-*Butene**		
3830	**——, 1,1-dimethyl-2-propyl-.**	See 2-*Hexene, 2-methyl-**		
3831	**——, 1,2-dimethyl-1-propyl-.**	See 2-*Hexene, 3-methyl-**		
3832	**——, 1,1-diphenyl-**	*uns*-diphenylethylene	$(C_6H_5)_2C:CH_2$	180 24
3833	**——, *trans*-1,2-diphenyl-.**	See *Stilbene*.		
3834	**——, ethyl-.**	See 1-*Butene**.		
3835	**——, 1-ethyl-1,2-dimethyl-.**	See 2-*Pentene, 3-methyl-**		
3836	**——, 2-ethyl-1,1-dimethyl-.**	See 2-*Pentene, 2-methyl-**		
3837	**——, 1-ethyl-1-isobutyl.**	See 1-*Butene, 2-ethyl-3-methyl-**		
3838	**——, 1-ethyl-2-isopropyl-.**	See 3-*Hexene, 2-methyl-**		
3839	**——, 1-ethyl-1-methyl-.**	See 1-*Butene, 2-methyl-**		
3840	**——, 1-ethyl-2-methyl-.**	See 2-*Pentene**.		
3841	**——, 1-ethyl-1-propyl-.**	See 1-*Pentene, 2-ethyl-**.		
3842	**——, 1-ethyl-2-propyl-.**	See 3-*Heptene**		
3843	**——, ethyltrimethyl-.**	See 2-*Pentene, 2,3-dimethyl-**.		
3843M	**——, fluoro-.**	See *Vinyl fluoride*.		
3844	**——, iodo-.**	See *Vinyl iodide*.		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc
3801		$1\ 3264\frac{0}{4}$		238	d c		
3802		$1\ 224\frac{0}{4}$		166	d. c.		
3803	col liq., 1 381	$0\ 864^{26.5}$		120	d.	∞	∞ eth.
3804	col liq , 1 42386	$1\ 430\frac{20}{4}$; $1\ 4505\frac{25}{4}$	-119	38 0	$1\ 08^{0}$, $0\ 96^{17.5}$, $0\ 91^{20}$	∞	∞ eth., chl.
3805							
3805M							
3806	col liq or gas	$0\ 9214\frac{0}{4}$	-138 7	12 2	$0\ 574^{20}$	$48\ 3^{21}$	∞ eth
3807							
3808	oil, $1\ 50633^{20}$	$0\ 99267\frac{20}{4}$		153-4	v sl s	∞	∞ eth
3809	col gas, $1\ 363^{-100}$	$1\ 245^{0}$ g/1; $0\ 566\frac{-102}{4}$	-169 4, frz -181	-103 9	$25\ 6^{0}$ cm^3	360 cm^3	s. eth.
3810							
3811							
3812							
3813							
3814							
3815							
3816							
3817							
3818							
3819							
3820							
3821	col liq , 1 5428	$2\ 271\frac{17.5}{4}$	(*cis*)-53, (*trans*)-6 5	110^{754}, 108	i	v. s	v s. eth.
3822	liq	$1\ 250\frac{15}{4}$		37	i.		
3823	liq , $1\ 4519^{15}$	$1\ 291\frac{15}{4}$	-80 5	60 1	i	∞	∞ eth
3823A	liq , $1\ 4490^{15}$	$1\ 265\frac{15}{4}$	-50	48 4	i.	∞	∞ eth
3824							
3825							
3826							
3826M	col gas	.	. .	<-70	i	s.	s. eth.
3827							
3828							
3829							
3830							
3831							
3832	col liq , $1\ 610^{14}$	$1\ 038\frac{14}{4}$; $1\ 0206\frac{22}{4}$	9	277		. . .	
3833							
3834							
3835							
3836							
3837							
3838							
3839							
3840							
3841							
3842							
3843							
3843M							
3844							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
3845	**Ethylene, isoamyl-.**	See 1-*Hexene, 5-methyl-**.		
3846	**——, isobutyl-.**	See 1-*Pentene, 4-methyl-**.		
3847	**——, 1-isobutyl-1-methyl-.**	See 1-*Pentene*, 2,4-*dimethyl-**.		
3848	**——, 1-isobutyl-2-methyl-.**	See 2-*Hexene*, 5-*methyl-**.		
3849	**——, isopropyl-.**	See 1-*Butene*, 3-*methyl-**.		
3850	**——, 1-isopropyl-1,2-dimethyl-.**	See 2-*Pentene*, 3,4-*dimethyl-**.		
3851	**——, 2-isopropyl-1,1-dimethyl-.**	See 2-*Pentene*, 2,4-*dimethyl-**.		
3852	**——, 1-isopropyl-1-methyl-.**	See 1-*Butene*, 2,3-*dimethyl-**		
3853	**——, 1-isopropyl-2-methyl-.**	See 2-*Pentene*, 4-*methyl-**.		
3854	**——, methyl-.**	See *Propene**.		
3855	**——, 1-methyl-1-phenyl-.**	See *Benzene, isopropenyl-*		
3856	**——, 1-methyl-1-propyl-.**	See 1-*Pentene*, 2-*methyl-**.		
3857	**——, 1-methyl-2-propyl-.**	See 2-*Hexene**.		
3858	**——, perchloro-.**	See *Ethylene, tetrachloro-*.		
3858M	**——, perfluoro-.**	See *Ethylene, tetrafluoro-*.		
3859	**——, phenyl-.**	See *Styrene*.		
3860	**——, propyl-.**	See 1-*Pentene**.		
3861	**——, pseudobutyl-.**	See 1-*Butene*, 3,3-*dimethyl-**		
3862	**——, tetrachloro-**	perchloroethylene	$CCl_2:CCl_2$...	165 85
3862M	**——, tetrafluoro-**	perfluoroethylene....	$CF_2:CF_2$....	100 02
3863	**——, tetraiodo-**... ..	. . ..	$CI_2:CI_2$.. .	531 70
3864	**——, tetramethyl-.**	See 2-*Butene*, 2,3-*dimethyl-**		
3865	**——, tetraphenyl-**...	..	$(C_6H_5)_2C.C(C_6H_5)_2$	332 42
3866	**——, tribromo-** . .	ethinyl tribromide	$CHBr\cdot CBr_2$	264 78
3867	**——, trichloro-**	ethinyl trichloride	$CHCl:CCl_2$	131 40
3868	**——, trimethyl-.**	See 2-*Butene*, 3-*methyl-**.		
3869	**——, triphenyl-**.......	*α*-phenylstilbene	$(C_6H_5)_2C\cdot CHC_6H_5$	256 33
3870	**——, vinyl-.**	See 1,3-*Butadiene**.		
3871	**Ethylene bromide**	1,2-dibromoethane*; ethylene dibromide, glycol dibromide	CH_2BrCH_2Br	187 88
3872	**Ethylene bromohydrin.**	See *Ethanol*, 2-*bromo-**.		
3873	**Ethylenecarboxylic acid.**	See *Acrylic acid*		
3874	**Ethylene chloride**.....	1,2-dichloroethane*, ethylene dichloride, glycol dichloride	CH_2ClCH_2Cl	98 97
3875	**Ethylene chlorobromide.**	See *Ethane*, 1-*bromo-2-chloro-**		
3876	**Ethylene chlorohydrin.**	See *Ethanol*, 2-*chloro-**.		
3877	**Ethylene cyanide.**	See *Succinonitrile*.		
3878	**Ethylene cyanohydrin.**	See *Hydracrylonitrile*.		
3879	**Ethylenediamine** (anh.).	1,2-ethanediamine*....	$NH_2CH_2CH_2NH_2$	60 10
3880	**Ethylenediamine** (hydrate)	. . .. ..	$NH_2CH_2CH_2NH_2\cdot H_2O$	78 12
3880M	——, hexavanadate . .	.	$2C_2H_4(NH_2)_2\ H_4V_6O_{17}\ 4H_2O$	774 00
3881	——, hydrochloride	ethylenediammonium chloride	$HCl\ NH_2CH_2CH_2NH_2\ HCl$	133 03
3882	**——, *N,N'*-diphenyl-.**	*sym*-diphenylethylenediamine, ethylenediphenyldiamine	$C_6H_5NHCH_2CH_2NHC_6H_5$	212.29
3883	**1,1-Ethylenedicarboxylic acid, 2-phenyl-.**	See *Malonic acid, benzylidene-*.		
3884	***cis*-1,2-Ethylenedicarboxylic acid.**	See *Maleic acid*.		
3885	***trans*-1,2-Ethylenedicarboxylic acid.**	See *Fumaric acid*.		
3885M	**Ethylene difluoride.**	See *Ethylene fluoride*.		
3886	**Ethylene diiodide.**	See *Ethylene iodide*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3845							
3846							
3847							
3848							
3849							
3850							
3851							
3852							
3853							
3854							
3855							
3856							
3857							
3858							
3858M							
3859							
3860							
3861							
3862	col liq., 1.50547	$1.6311\frac{15}{4}$	-22 35	121 20	i.	∞	∞ eth
3862M	col. gas ...		-142 5	-78 4	i		....
3863	yel monocl. pr	$2.983\frac{20}{4}$	187	subl.	i	sl s	sl s eth.; v. s CS_2; s. bz., chl., tol., ac. a.
3864							
3865	col monocl or rhomb. f. bz		227 (221)	425	i	v sl s	v sl. s. eth.; v. s. bz.
3866	liq .	$2.708^{20.5}$		163-4, 53-5[9]			. . .
3867	col liq, 1.4777	$1.45560\frac{25}{4}$	-73 (-86)	87	0 1	∞	∞ eth.
3868							
3869	narrow leaf. f. al or ac. a		72-3	220-1[14]	i	v. s.	v. s. eth.
3870							
3871	col liq., 1 53789	$2.1701\frac{25}{4}$	9 97 (10)	131 6	0 431[30]	s.	∞ eth.
3872							
3873							
3874	col liq, 1 44432	$1.257\frac{20}{4}$	-35 3	83 5-3 7	0 92[0], 0 869[20]	s	∞ eth ; s. ord. org solv.
3875							
3876							
3877							
3878							
3879	col. liq., $1.45400^{25.1}$	$0.8994\frac{20}{4}$	8 5	116 1 (117)	s.		0 236 eth., i. bz
3880	col liq, 1.4500	$0.963\frac{21}{4}$	10	118			
3880M	brownish-yel .				sl s.	i.	i. eth.
3881	1 633						.
3882	col. leaf. f. dil. al.		65	. .	i.	v. s.	v s eth.
3883							
3884							
3885							
3885M							
3886							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
3887	**Ethylene dimercaptan**. See 1,2-*Ethanedithiol**			
3888	**Ethylenediphenyldiamine.** See *Ethylenediamine, N, N'-diphenyl-*.			
3889	**Ethylene diphenyl ether.** See *Ethane, 1,2-diphenoxy-**.			
3890	**Ethylene disulfonic acid.** See *1,2-Ethanedisulfonic acid**.			
3891	**Ethylene ethylidene ether.** See *1,3-Dioxolane, 2-methyl-*			
3891H	**Ethylene fluoride**	1,2-difluoroethane*, ethylene difluoride, glycol difluoride	CH_2FCH_2F	66 05
3891R	**Ethylene fluorohydrin.**	See *Ethanol, 2-fluoro-**.		
3892	**Ethylene glycol.**	See *Glycol.*		
3893	**Ethylene imine.**	See *Ethylenimine*		
3894	**Ethylene iodide** .	1,2-diiodoethane*, ethylene diiodide, glycol diiodide	CH_2ICH_2I	281 89
3895	**Ethylene lactic acid.**	See *Hydracrylic acid*		
3896	**Ethylene mercaptan.**	See *1,2-Ethanedithiol**.		
3897	**Ethylene nitrate.**	See *Glycol, dinitrate.*		
3898	**Ethylene nitrite.**	See *Glycol, dinitrite*		
3899	**Ethylene oxide**	1,2-epoxyethane*; oxirane.	$(CH_2)_2O$	44 05
3900	——, **α,α-dimethyl-**	1,2-epoxy-2-methylpropane, isobutylene oxide	$CH_2C(CH_3)_2O$	72 10
3900M	**Ethylene sulfide**	thiirane	$(CH_2)_2S$.	60 11
3901	**Ethylenimine** . . .	dimethyleneimine, dihydroazirine	$NHCH_2CH_2$	43 07
3902	**Ethyl ether**.....	ethoxyethane*, diethyl ether, ether, ethyl oxide, sulfuric ether	$C_2H_5OC_2H_5$	74 12
3903	**Ethyl fluoride**	fluoroethane* ..	CH_3CH_2F.	48 06
3904	**Ethyl hydrogen sulfate.** See *Ethylsulfuric acid.*			
3905	**Ethyl hydrosulfide.**	See *Ethanethiol**		
3906	**Ethylidene bromide.**	See *Ethane, 1,1-dibromo-**.		
3907	**Ethylidene chloride.**	See *Ethane, 1,1-dichloro-**.		
3908	**Ethylidene cyanohydrin.** See *Lactonitrile*			
3908M	**Ethylidene fluoride.**	See *Ethane, 1,1-difluoro-**		
3909	**Ethylidene glycol, tribromo-.** See *Bromal, hydrate*			
3910	——, **trichloro-.**	See *Chloral hydrate*		
3911	**Ethylidene iodide.**	See *Ethane, 1,1-diiodo-**.		
3912	**Ethyl iodide**......	iodoethane*	CH_3CH_2I	155 98
3913	**Ethyl isocyanide** ..	ethylcarbylamine*	C_2H_5NC	55 08
3914	**Ethyl ketone.**	See *3-Pentanone**		
3915	**Ethyl mercaptan.**	See *Ethanethiol**		
3916	**Ethyl mustard oil.**	See *Isothiocyanic acid, ethyl ester*		
3917	**Ethyl nitrate** .. .	nitric ether	$C_2H_5ONO_2$	91 07
3918	**Ethyl nitrite** ...	nitrous ether	C_2H_5ONO	75 07
3919	**Ethyloglycolic acid.**	See *Acetic acid, ethoxy-*		
3920	**Ethylolamine.**	See *Ethanol, 2-amino-**		
3921	**Ethyl orthoarsenate.**	See *Ethyl arsenate*		
3922	**Ethyl orthoarsenite.**	See *Ethyl arsenite.*		
3923	**Ethyl orthosilicate** .		$(C_2H_5)_4SiO_4$	208 30
3924	**Ethyl oxide.**	See *Ethyl ether*		
3925	**Ethyl phosphate** .	triethyl phosphate	$(C_2H_5)_3PO_4$	182 16

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3887							
3888							
3889							
3890							
3891							
3891 H	col gas			10–11			
3891 R							
3892							
3893							
3894	yel monocl pr f eth	2 132_4^{10}	81–2	d	sl s	s.	s eth.
3895							
3896							
3897							
3898							
3899	col liq or gas, 1 $3598^{8.4}$	1 965^0 g/1, 0 $887\frac{7}{4}$	-111 3	10 7	∞	∞	∞ eth
3900	liq ...	0 831	..	51–2		s.	s. eth.
3900M	col liq., 1 4914^{18}	1 $0368\frac{0}{4}$	d.	55–56	.	v. sl. s.	v sl s. eth.
3901	oil	0 $832\frac{20}{4}$		55–6	∞	s.	
3902	col liq. or rhomb, 1 $3497^{24.8}$	0 $7135\frac{20}{4}$	α–116 3 β–123 3	34 6	7 5^{20}	∞	∞ eth., chl, bz., s. conc. H_2SO_4
3903	col gas, 1 3057^{-40}	0 $8158^{-37.7}$, 2 198^0 g/1	-113 2	-37 7	198^{14} cm^3	v s	v s eth.
3904							
3905							
3906							
3907							
3908							
3908M							
3909							
3910							
3911							
3912	col liq, 1 $5222^{7.0}$	1 $933\frac{20}{4}$, 1 $9245\frac{25}{4}$	-108 5 (-105 to -111)	72 2	0 4^{20}	s.	s eth, bz, chl
3913	col liq., 1.3659^{24}	0 7402_4^{20}	<-66	79	v s	∞	∞ eth.
3914							
3915							
3916							
3917	col inflam. liq, 1 $38484^{21.5}$	1 105_4^{20}	-102 (-112)	88 7	1 3^{55} (1)	∞	∞ eth
3918	col or yelsh liq.	0 $900^{15.5}$		17	v sl s.	∞	s eth.
3919							
3920							
3921							
3922							
3923	col liq	0 $933\frac{20}{4}$		165 5	d	v. s	∞ eth
3924							
3925	liq, 1 40616^{10}	1 $0686\frac{25}{4}$		216	100^{25} d	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
3926	**Ethyl phosphite**	triethyl phosphite	$(C_2H_5)_3PO_3$	166 16
3927	**Ethyl selenide**	diethyl selenide	$(C_2H_5)_2Se$	137 08
3928	**Ethyl silicate.**	See *Ethyl orthosilicate*		
3929	**Ethyl sulfate**	diethyl sulfate	$(C_2H_5)_2SO_4$	154 18
3930	**Ethyl sulfide**	ethylthioethane*; diethyl sulfide	$(C_2H_5)_2S$	90 18
3931	**Ethylsulfinic acid.**	See *Ethanesulfinic acid.**		
3932	**Ethyl sulfite**	diethyl sulfite	$(C_2H_5)_2SO_3$	138 18
3933	**Ethyl sulfone**	ethylsulfonylethane*, diethyl sulfone	$(C_2H_5)_2SO_2$	122 18
3934	**Ethylsulfonic acid.**	See *Ethanesulfonic acid**		
3935	**Ethyl sulfoxide**	ethylsulfinylethane*, diethyl sulfoxide	$(C_2H_5)_2SO$	106 18
3936	**Ethylsulfuric acid**	ethyl hydrogen sulfate; acid ethyl sulfate	$C_2H_5OSO_3H$	126 13
3937	**Ethyl telluride**	tellurium ethyl, diethyl telluride	$(C_2H_5)_2Te$	185 73
3938	**Ethyl thioalcohol.**	See *Ethanethiol**.		
3939	**Ethyne*.**	See *Acetylene*		
3940	**Ethynyl bromide.**	See *Acetylene, bromo-.*		
3941	**α-Eucaine**		$C_{19}H_{27}NO_4$	333 42
3942	——, hydrochloride		$C_{19}H_{27}NO_4\ HCl\ H_2O$	387 90
3943	**β-Eucaine**	benzamine, betacaine	$C_{15}H_{21}NO_2$	247 33
3944	——, hydrochloride		$C_{15}H_{21}NO_2\ HCl$	283 79
3945	——, lactate	4-benzoxy-2,2,6-trimethylpiperidine lactate, benzamine lactate, benzoylvinyldiacetonealkamine lactate	$C_{15}H_{21}NO_2{\cdot}C_3H_6O_3$	337 41
3946	**Eucalyptole.**	See *Cineole.*		
3947	**Eugenic acid.**	See *Eugenol.*		
3948	**Eugenol**	4-allylguaiacol; eugenic acid	$CH_2{\cdot}CHCH_2C_6H_3(OCH_3)OH$	164 20
3949	——, methyl ether	See *Veratrole, 4-allyl-.*		
3950	**——, methyl-.**	See *Veratrole, 4-allyl-.*		
3951	**Eugetic acid**	5-allyl-3-methoxysalicylic acid; eugetinic acid	$C_3H_5C_6H_2(OCH_3)(OH)COOH$	208 21
3952	**Eupittone**	hexamethoxyaurin, eupittonic acid	$C_{19}H_8(OCH_3)_6O_3$	470 46
3953	**Euxanthic acid**		$C_{19}H_{16}O_{10}\ 3H_2O$	458 37
3954	**Euxanthone**	1,7-dihydroxyxanthone	$HOC_6H_3(CO)(O)C_6H_3OH$	228 19
3955	**——, 3-methoxy-.**	See *Gentisin.*		
3956	**Evernic acid**	orsellinic acid 4-everninate, lecanoric acid monomethyl ether	$C_{17}H_{16}O_7$	332 30
3957	**Everninic acid**	2-hydroxy-6-methylanisic acid; orsellinic acid 4-methyl ether	$CH_3OC_6H_2(OH)(CH_3)COOH$	182 17
3958	**d-Evodiamine**		$C_{19}H_{17}N_3O$	303 35
3959	**i-Evodiamine** (hydrate)		$C_{19}H_{17}N_3O\ H_2O$	321 37
3960	**Exalgin.**	See *Acetanilide, N-methyl-.*		

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3926	col. liq., 1.4079	$0.9687\frac{20}{4}$	....	156.5	i.	v. s.	v. s. eth.
3927	liq., 1.4768 ...	$1.2300\frac{20}{4}$	... ..	108	i.	.. ...	....
3928							
3929	col. oily liq., 1.4010^{13}	$1.1842\frac{15}{4}$; $1.172\frac{25}{4}$	-24.5	208 sl. d.; 96^{15}	i., sl. d.; d. h.	∞, d. h.	∞ eth.
3930	col. liq., 1.44233	$0.837\frac{20}{4}$	-102 1	92	0.313^{20}	s.	s. eth.
3931							
3932	col. liq., 1.4198^{11}	$1.1062\frac{0}{4}$; $1.077\frac{20}{4}$	. ...	158 (161.3)	s. d.	s.	s. eth.
3933	rhomb. pl.....	$1.357\frac{20}{4}$	73–4 (70)	248	15 6^{16}		s. h. eth.; v. s. bz.; i. pet. eth.
3934							
3935	syrupy liq.....	. ....	5	89^{15} d.	s.	s.	s. eth.
3936	col. oily liq	$1.316\frac{17}{4}$	. . . ...	280, d.	v. s.	s.	s. eth.
3937	red-yel. liq .	$1.599\frac{15}{4}$	.	138	i.	s.	....
3938							
3939							
3940							
3941	shining pr. cr..	.	103–5	...		. .	v. s. eth.
3942	rosettes f. sm. cr.	.	*ca.* 200 d.	.	10	117	sl. s. eth.
3943	wh. cr.. . .	.	78 (91)	..			v. s. eth
3944	wh. pl. or pr. .	.	268 d.	. . . .	3 33	3.53	s eth., chl.
3945	col. cr... .	.			s	s.	. . ... .
3946							
3947							
3948	col. liq., $1.5416^{19.4}$	$1.0664\frac{20}{4}$; $1.0620\frac{25}{4}$	10.3	252–3	v sl. s	∞	∞ eth.; s. chl., oils
3949							
3950							
3951	pr. f. w..... .	....	124; anh. 127	d.	sl. s. c.; s. h	s.	s. eth., $(NH_4)_2CO_3$
3952	cr. need. f. al..	.... ..	200 d.	....	. . .	sl. s. h.	s. glac. ac. a., alk., bl. color
3953	pa yel. need .	.. ....	155–8 d. (162)	d.	sl. s.	s. h.	v. sl. s. eth.; s. alk.
3954	yel. need......	..... .	240	subl. d.	i.	s. h.	sl. s. eth.; s. alk.
3955							
3956	need. or pr. f. al.	. ...	168–9 d. (164)	....	i. c., v. sl. s. h.	s.	s. eth.
3957	cr. f. w.......	....	170–1 d. (157)	....	s. h.	s.	s. eth., h. bz.
3958	yel. leaf. ...	....	278	....	.	.....	i. dil. a.
3959	rhomb. leaf...	....	146–7	.. . ..	.	.. ..	....
3960							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3962	**6-Fenchanol.**	See *Isofenchyl alcohol.*		
3963	**2-Fenchanone.**	See *Fenchone.*		
3964	***l*-α-Fenchene**.........	*l*-7,7-dimethyl-2-methylenenorcamphane	$C_{10}H_{16}$...	136.23
3965	***d*-Fenchone**...........	*d*-2-fenchanone; *d*-1,3,3-trimethyl-2-norcamphanone; fenchone	$C_{10}H_{16}O$...... ...	152.23
3966	**Ferulic acid**...........	4-hydroxy-3-methoxycinnamic acid	$HO(OCH_3)C_6H_3$-CH:CHCOOH	194 18
3967	**Filixic acid**...........	....	$C_{35}H_{40}O_{12}$..... ..	652.67
3968	**Fisetin**...............	3,7,3′,4′-tetrahydroxyflavone	HOC_6H_3OC-$[C_6H_3(OH)_2]C$-$(OH)CO$	286.23
3969	**Flavaniline**...........	2-(*p*-aminophenyl)lepidine..	$NH_2C_6H_4C_9H_5N\cdot CH_3$	234.29
3970	**3,5,7,3′,4′-Flavenpentol.**	See *d-Catechol.*		
3971	**Flavianic acid,** histidine salt.	See *Histidine, diflavianate.*		
3972	**Flavol**................	2,6-anthracenediol*; 2,6-anthradiol	$HOC_6H_3(CH)_2$-C_6H_3OH	210 22
3973	**Flavone**.	2-phenylchromone; 2-phenyl-1,4-benzopyrone	$C_6H_4OC(C_6H_5)$:CHCO	222 23
3974	**——, 5,7-dihydroxy-.**	See *Chrysin.*		
3975	**——, 3,5,7,2′,4′-pentahydroxy-.**	See *Morin.*		
3976	**——, 3,5,7,3′,4′-pentahydroxy-.**	See *Quercetin.*		
3977	**——, 3,7,3′,4′-tetrahydroxy-.**	See *Fisetin.*		
3978	**Flavopurpurin**........	1,2,6-trihydroxyanthraquinone	$HOC_6H_3(CO)_2$-$C_6H_2(OH)_2$	256.20
3979	**Fluoran**..............	9-hydroxy-9-xanthene-*o*-benzoic acid lactone	$C_{20}H_{12}O_3$. .	300 30
3980	**——,2,7-dihydroxy-.**	See *Hydroquinonephthalein.*		
3981	**Fluoranthene**.........	idryl	$C_{16}H_{10}$.... ..	202 24
3982	**Fluorene**.............	diphenylenemethane....	$C_6H_4CH_2C_6H_4$. .	166 21
3983	**——, keto-.**	See 9-*Fluorenone**.		
3984	**——, 9-oxo-.**	See 9-*Fluorenone**.		
3985	**Fluorene alcohol.**	See 9-*Fluorenol**.		
3986	**9-Fluorenol***..........	fluorene alcohol; diphenylenecarbinol	$C_6H_4CHOHC_6H_4$.	182 21
3987	**9-Fluorenone***........	9-oxofluorene; ketofluorene; diphenylene ketone	$C_6H_4COC_6H_4$	180 19
3988	**Fluorescein**...........	resorcinolphthalein.. ..	$C_{20}H_{12}O_5$	332 30
3989	**——, dibromohydroxymercuri-,** disodium salt.	See *Mercurochrome*		220
3990	**——, 4,5-dihydroxy-.**	See *Gallein.*		
3991	**——, 2,4,5,7-tetrabromo-.**	See *Eosin.*		
3992	**——, 2,4,5,7-tetraiodo-.**	See *Erythrosin.*		
	Fluoro-. See the parent compounds (e.g., for fluorobenzene see *Benzene, fluoro-*).			
3993	**Fluoroform**...........	trifluoromethane*...	CHF_3.......	70 02
3993M	**——, methyl-.**	See *Ethane,* 1,1,1-*trifluoro-**.		
3994	**Formal.**	See *Methane, dimethoxy-**.		
3995	**Formaldehyde**........	methanal*; oxomethane ...	HCHO....	30 03
3996	——, diethyl acetal.	See *Methane, diethoxy-**.		

***Name approved by the International Union of Chemistry.**

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3962							
3963							
3964	liq., 1.4724^{19}...	$0\ 864\frac{20}{4}$	....	158 (155–6)	i.	∞	∞ eth.
3965	oil, $1.4647^{14.5}$..	$0.9460\frac{20}{4}$	6	193–5	i.	v. s.	v. s. eth.
3966	rhomb. need. f. w.	......	168 (169–70)	d.	s. h.	v. s.	sl. s. eth., bz.
3967	cr......... .	....	184 (160)	....	i.	i.	sl. s. eth.; s CS_2
3968	yel. need.....	....	360	....	i.	s.	sl. s. eth., bz.
3969	col. pr. f. bz..	....	97	....	v. sl. s.	s.	s. bz.
3970							
3971							
3972	yel. cr. powd. f. al.	....	295–300 d. (270 d.)	....	i.	v. s.	v. s. eth.; s. ac. a.
3973	col. f. lgr.....	....	97	....	i.	s.	s. eth.
3974							
3975							
3976							
3977							
3978	yel. need. f. al	....	>360	459	v. sl. s. h.	s. h.	sl. s. eth.
3979	flat need.. ..	....	173–5	... .	.... .	s.	s. H_2SO_4, HNO_3
3980							
3981	col. monocl need f al	.... . .	110	251^{60}	i.	sl. s. c.	v. s. eth.; s. CS_2, ac a.
3982	col. leaf. f. al	....	116 (100–7)	295 (298)	i.	sl. s.	v. s. eth.; s. bz., CS_2
3983							
3984							
3985							
3986	hex. need. f. w.	..... .	153 (156)	....	. . .	s.	s. eth., bz.
3987	yel. rhomb. pr.	... ...	84	341.5	i.	v. s.	v. s. eth.
3988	or.-red cr. powd.	....	312–8 d. (d. 290)	....	i.	s.	sl. s. eth.; s. alk. sol., dil. a., h. glac. ac. a.; i. bz., chl.
3989	*soluble.*						
3990							
3991							
3992							
3993	col. gas.......	....	-163	-82 2; $20^{40\ atm.}$	75 cm^3	394.5 cm^3	sl. s. $CHCl_3$
3993M							
3994							
3995	col. gas......	$0\ 815\frac{-20}{4}$	-92	-21	s.	s.	s. eth.
3996							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3997	**Formaldehyde**, dimethyl acetal. See *Methane, dimethoxy-**.			
3997M	——, 2,4-dinitrophenylhydrazone	. . . . . .	$HCH:NNHC_6H_3(NO_2)_2$	210 15
3998	——, dipropyl acetal.	See *Methane, dipropoxy-**.		
3999	——, oxime	formoxime; formaldoxime	$HCH:NOH$ ...	45 04
4000	——, **2-thienyl-**.	See *2-Thiophenecarbonal*.		
4001	——, **thio-** (trimer) .	s-trithiane; trimethylene trisulfide; trithioformaldehyde, methanethial* (trimer)	$SCH_2SCH_2SCH_2$	138 26
4002	**Formaldoxime.**	See *Formaldehyde, oxime*		
4003	**Formamide.**	methanamide* . .	$HCONH_2$ ..	45 04
4004	——, oxime	methenyl amidoxime; isuretin	$HC(:NOH)NH_2$	60 06
4005	——, **chloro-**.	See *Carbamyl chloride*.		
4006	——, ***N,N*-diethyl-**	*N*-formyldiethylamine	$HCON(C_2H_5)_2$	101 15
4007	——, ***N,N*-diphenyl-** .	*N*-formyldiphenylamine, *N*-phenylformanilide	$HCON(C_6H_5)_2$	197 23
4008	——, ***N*-ethyl-**	*N*-ethylmethanamide	$HCONHC_2H_5$ ..	73 09
4009	——, ***N*-phenyl-**.	See *Formanilide*.		
4010	——, **ureido-**.	See *Biuret*		
4011	**Formamidine, amino-**.	See *Guanidine*.		
4012	——, ***N,N*-diphenyl-**		$C_6H_5N.CHNHC_6H_5$	196 24
4013	**Formamine.**	See *Hexamethylenetetramine*.		
4014	**Formanilide** .	*N*-phenylformamide	$HCONHC_6H_5$...	121 13
4015	——, ***N*-phenyl-**.	See *Formamide, N,N-diphenyl-*		
4016	**Formic acid**	methanoic acid*	$HCOOH$	46 03
4017	——, allyl ester	allyl formate; 2-propenyl methanoate*	$HCOOCH_2CH{:}CH_2$	86 09
4018	——, amyl ester	amyl formate; pentyl methanoate*	$HCOO(CH_2)_4CH_3$	116 16
4019	——, benzyl ester .	benzyl formate; benzyl methanoate*	$HCOOCH_2C_6H_5$	136 14
4020	——, butyl ester.	butyl formate; butyl methanoate*	$HCOOC_4H_9$.	102 13
4021	——, *sec*-butyl ester		$HCOOCH(CH_3)C_2H_5$	102 13
4022	——, ethyl ester	ethyl formate; ethyl methanoate*	$HCOOC_2H_5$ ..	74 08
4023	——, ethylene ester.	See *Glycol, diformate*		
4024	——, geranyl ester.	See *Geraniol, formate*.		
4025	——, heptyl ester .. .	*n*-heptyl formate.	$HCOOC_7H_{15}$ . .	144 21
4026	——, hexyl ester.	*n*-hexyl formate	$HCOO(CH_2)_5CH_3$.	130 18
4027	——, isoamyl ester	γ-methylbutyl methanoate*	$HCOO(CH_2)_2CH(CH_3)_2$	116 16

*Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
3997							
3997M	yel. cr		167	.	..	s. h.	v. sl. s. eth.
3998							
3999	col liq		.	84	ca 10, d. h.	.	. ....
4000							
4001	tetr. pr	. .	215–6	subl	i. c., sl. s h.	sl s.	sl s eth.
4002							
4003	col. liq., 1.44530$^{22.7}$	1.134$\frac{20}{4}$, 1.1292$\frac{25}{4}$	2.55	210.7 d (92—5^{10})	∞	∞	sl s. eth., bz.
4004	rhomb f acet. or al.		114	d.	s.	sl s.	sl. s. eth.; i. bz.
4005							
4006	col liq	0.908^{10}		177–8	∞	v. s.	v s. eth.
4007	rhomb. f al	1.230$\frac{20}{4}$	74 (70–1)	220	s h	s.	s. eth., bz.
4008	liq	0.952$\frac{21}{4}$		197–9	∞	∞	∞ eth.
4009							
4010							
4011							
4012	need f. al		135	>250	sl s	s	v. s. eth.; s. bz., acet, chl, CS_2; sl. s. pet. eth.
4013							
4014	col monocl. pr.	1.1437$\frac{17}{4}$, 1.112$\frac{60}{4}$	47.5	271	s	v s	s eth.
4015							
4016	col liq., 1.37137	1.22647$\frac{15}{4}$, 1.220$\frac{20}{4}$	8.40	100.7	∞	∞	∞ eth, glyc.
4017	liq	0.948$\frac{18}{4}$	.	83	sl. s.	s.	∞ eth.
4018	col liq, 1.3951$^{11.5}$	0.8926$\frac{15}{4}$	-73.5	130.4	sl s	∞	∞ eth.
4019	arom. liq	1.081$\frac{20}{4}$		203.4	i.	s.	∞ eth.
4020	col. liq, 1.3891	0.9108$\frac{0}{4}$, 0.8848$\frac{25}{4}$	-90.0	106.8	sl s.	∞	∞ eth.
4021	....	0.882$\frac{20}{4}$		97	sl s	∞	∞ eth.
4022	col liq, 1.35975	0.9236$\frac{25}{4}$	-80.5	54.3	11.8^{25}	s.	s. eth.
4023							
4024							
4025	col. liq . .	0.894$\frac{0}{4}$	.	176.7	i.	s.	s. eth.
4026	col. liq . .	0.898$\frac{0}{4}$		153.6	v s.	∞	∞ eth.
4027	col liq., 1.391	0.871$\frac{20}{4}$		123.5	0.307^{22}	s.	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
4028	**Formic acid**, isobutyl ester	isobutyl formate, β-methylpropyl methanoate*	$HCOOCH_2CH(CH_3)_2$	102 13
4029	——, isopropyl ester	isopropyl methanoate*	$HCOOCH(CH_3)_2$	88 10
4030	——, *l*-linalyl ester.	See *l-Linalool, formate.*		
4031	——, methyl ester	methyl methanoate*, methyl formate	$HCOOCH_3$	60 05
4032	——, octyl ester	*n*-octyl formate	$HCOO(CH_2)_7CH_3$	158 24
4033	——, *p*-phenylphenacyl ester		$HCOOCH_2COC_6H_4C_6H_5$	240 25
4034	——, propyl ester	*n*-propyl formate	$HCOOC_3H_7$	88 10
4035	——, **acetyl-.**	See *Pyruvic acid*		
4036	——, **o-aminobenzoyl-.**	See *Isatic acid.*		
4037	——, **benzoyl-.**	See *Glyoxylic acid, phenyl-*		
4038	——, **chloro-**, butyl ester	*n*-butyl chlorocarbonate	$ClCOO(CH_2)_3CH_3$	136 58
4039	——, ——, ethyl ester	ethyl chloromethanoate*, ethyl chlorocarbonate	$ClCOOC_2H_5$	108 53
4040	——, ——, isoamyl ester	γ-methylbutyl chloromethanoate*, isoamyl chlorocarbonate	$ClCOOC_5H_{11}$	150 61
4041	——, ——, isobutyl ester	β-methylpropyl chloromethanoate*; isobutyl chlorocarbonate	$ClCOOCH_2CH(CH_3)_2$	136 58
4042	——, ——, methyl ester	methyl chloromethanoate*, methyl chlorocarbonate	$ClCOOCH_3$	94 50
4043	——, ——, propyl ester	*n*-propyl chlorocarbonate	$ClCOOCH_2CH_2CH_3$	122 55
4044	——, ——, trichloromethyl ester.	See *Diphosgene.*		
4045	——, **cyano-**, ethyl ester	ethyl cyanomethanoate*; cyanoethyl carbonate	$CNCOOC_2H_5$	99 09
4046	——, **phenyl-.**	See *Benzoic acid.*		
4047	——, **2-thenoyl-.**	See *2-Thiopheneacetic acid, α-oxo-.*		
4048	**Formohydrazide**	formylhydrazine	$HCONHNH_2$	60 06
4049	**Formonitrolic acid**	methylnitrolic acid	$HC(:NOH)NO_2$	90 04
4050	**Formosa camphor.**	See *d-Camphor.*		
4051	**Formoxime.**	See *Formaldehyde, oxime.*		
4052	**Formyl chloride, chloro-.**	See *Phosgene.*		
4052M	**Formyl fluoride, fluoro-.**	See *Carbonyl fluoride.*		
4053	**Frangula emodin.**	See *Emodin.*		
4054	**Frangulin**	...	$C_{20}H_{20}O_9$	404 36
4055	**Fraxin**		$C_{16}H_{18}O_{10}$	370 31
4056	**D-Fructosamine**	isoglucosamine; isodextrosamine	$CH_2OH(CHOH)_3COCH_2NH_2$	179 17
4057	**D-Fructose**	levulose; fruit sugar	$C_6H_{12}O_6$	180 16
4058	**Fructosin.**	See *Levulin (synthetic).*		
4059	**Fruit sugar.**	See *D-Fructose.*		
4061	**Fucose**	2,3,4,5-tetrahydroxyhexanal* (one form)	$C_6H_{12}O_5$	164 16
4062	**Fulminic acid**, silver salt	silver fulminate; fulminating silver	$AgCNO$	149 90
4063	**Fulminuric acid**	2-cyano-2-nitroethanamide*; cyanonitroacetamide; isocyanuric acid	$CNCH(NO_2)CONH_2$	129 08

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4028	col. liq., $1.38584^{19.9}$	$0.875\frac{20}{4}$	-95 3	98 2	$1\ 01^{22}$	∞	∞ eth.
4029	liq	$0\ 883\frac{0}{4}$; $0\ 873\frac{20}{4}$	..	71 3 (66 5–8 5)	$2\ 1^{22}$	∞	∞ eth.
4030							
4031	col. liq., 1.344	$0\ 98149\frac{15}{4}$, $0\ 975\frac{20}{4}$	-99 0	31 50	$30\ 4^{20}$	∞	s. eth., me. al.
4032	col. liq., 1.414	$0\ 872\frac{12\ 5}{4}$		198	i.		. .
4033	. .	.	74				.
4034	col. liq , 1 3771	$0\ 9006\frac{20}{4}$	-92 9	81 3	$2\ 79^{20}$	∞	∞ eth.
4035							
4036							
4037							
4038	. . . . .	$1\ 074\frac{25}{4}$		140–5	d	d.	∞ eth.
4039	col. liq	$1\ 138\frac{20}{4}$	-80 6	94	d	d	s. eth., bz., chl.
4040	col liq	$1\ 024\frac{25}{25}$		156	d	∞	∞ eth.
4041	col. liq.	$1\ 037\frac{25}{4}$		130	d.	s., d.	∞ eth.; s bz., chl.
4042	col. liq	$1\ 236\frac{15}{4}$		71 4	d.	∞	∞ eth.; s bz., chl.
4043	col liq	$1\ 090\frac{20}{4}$		116	d	∞	∞ eth.
4044							
4045	liq	$1\ 013\frac{20}{4}$		116	i.	s.	s. eth.
4046							
4047							
4048	yel. pl. or need		54		i	s. h.	s. h. eth.; v. s. chl., bz.
4049	need f eth.		64		v s	s.	v s. eth.
4050							
4051							
4052							
4052M							
4053							
4054	yel need		226		v sl. s.	s. h.	s. h. eth., h. bz.
4055	need f al		190		s h	s.	i. eth.
4056	syrup	.				i	i. eth.; s. dil. a.
4057	need. f. w	$1\ 598\frac{20}{4}$, $1\ 669\frac{18}{4}$	105 (95)		v. s.	$6\ 71^{18}$	s. eth.
4058							
4059							
4061	need f al		145	d	v. s.	$1\ 66^{22}$	i. eth.
4062	sm. wh. need. f. w.		exp		$0\ 075^{13}$	s.	s. NH_4OH; i. HNO_3
4063	col pr f al		145 exp.	..	s.	s.	v. sl. s eth.; i chl., bz., lgr.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4064	**Fumaric acid**	*trans*-butenedioic acid*, *trans*-1,2-ethylenedicarboxylic acid	HOOCCH.CH-COOH	116 07
4065	——, diethyl ester	ethyl fumarate; diethyl fumarate	$(:CHCOOC_2H_5)_2$	172 18
4066	——, dimethyl ester	methyl fumarate	$(:CHCOOCH_3)_2$	144.12
4067	——, monoethyl ester	monoethyl fumarate	$HOOCCH:CH\text{-}COOC_2H_5$	144 12
4068	——, **bromo-**		BrC(COOH):CH-COOH	194.98
4069	——, **chloro-**		ClC(COOH):CH-COOH	150 52
4070	——, **methyl-.**	See *Mesaconic acid.*		
4071	**Furacrolein.**	See *Acrolein, β-2-furyl-.*		
4072	**Furacrylic acid.**	See 2-*Furanacrylic acid.*		
4073	**Fural.**	See *Furfural.*		
4074	**2-Furaldehyde.**	See *Furfural.*		
4075	**Furan**	furfuran	OCH:CHCH:CH	68 07
4076	——, **2-acetyl-.**	See *Ketone, 2-furyl methyl.*		
4077	——, **2-benzoyl-.**	See *Ketone, 2-furyl phenyl.*		
4078	——, **3-bromo-**	β-furyl bromide	C_4H_3OBr	146 98
4079	——, **2-butoxymethyl-tetrahydro-**	tetrahydrofurfuryl *n*-butyl ether	$C_4H_7O{\cdot}CH_2OC_4H_9$	158 24
4080	——, **2-chloro-**	α-furyl chloride; α-chlorofurfuran	C_4H_3OCl	102 52
4081	——, **2-chloromercuri-**		C_4H_3OHgCl	303 13
4082	——, **2-(chloromethyl)-**	furfuryl chloride	$C_4H_3OCH_2Cl$	116 55
4083	——, **2-(chloromethyl)tetrahydro-**	tetrahydrofurfuryl chloride	$C_4H_7O\ CH_2Cl$	120 58
4084	——, **2-(diethoxymethyl)-**	furfural diethyl acetal	$C_4H_3O\ CH\text{-}(OC_2H_5)_2$	170 20
4085	——, **2,5-dimethyl-**		$C_4H_2O(CH_3)_2$	96 12
4086	——, **2,5-dinitro-**		$C_4H_2O(NO_2)_2$	158 07
4087	——, **2,5-diphenyl-**		$C_4H_2O(C_6H_5)_2$	220 26
4088	——, **2-ethoxymethyl-tetrahydro-**	tetrahydrofurfuryl ethyl ether	$C_4H_7O{\cdot}CH_2OC_2H_5$	130 18
4089	——, **2-iodo-**	α-furyl iodide	C_4H_3IO	193 98
4090	——, **3-iodo-**	β-furyl iodide	C_4H_3IO	193 98
4091	——, **2,2′-mercuridi-.**	See *Mercury, di-2-furyl-.*		
4092	——, **2-methyl-.**	silvan; sylvan	$C_4H_3OCH_3$	82 10
4093	——, **3-methyl-**		$C_4H_3O{\cdot}CH_3$	82 10
4094	——, **2-nitro-**		$C_4H_3O\ NO_2$	113 07
4095	——, **tetrahydro-**	tetramethylene oxide	$OCH_2CH_2CH_2CH_2$	72.10
4096	——, **thio-.**	See *Thiophene.*		
4097	——, **2,3,4-trichloro-**		C_4HCl_3O	171.42

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4064	col. monocl. pr.	1 $635\frac{20}{4}$	287 (293-5)	290; subl. 200	0 70^{25}, 9 8^{100}	$5.75^{29.7}$, 4.76^{78}	0 72^{25} eth.; v. sl. s. CCl_4, chl.
4065	col. liq.. .	1 $054\frac{20}{20}$	0 6	218	sl. s.	s.	s. eth.
4066	col tricl. pr	.	102	192	i.	sl s	sl. s. eth.; s. c. chl.
4067	pl ..		66	147^{16}	sl s	v. s	v. s. eth.
4068	pl . .		185-6	d. 200	s	s	....
4069	pl. f. ac. a ..		191-2	subl.	v s	v s.	v s eth.; sl. s. bz
4070							
4071							
4072							
4073							
4074							
4075	col liq., 1 42157	0 9444^{15}, 0 $9366\frac{20}{4}$		32^{758}	i	v s	v s eth.
4076							
4077							
4078	liq, 1.4981 ..	1 $650\frac{20}{4}$		$101.9\text{-}2.2^{744}$	i	s.	.
4079	col liq	$0.9150\frac{20}{4}$		$194.5\text{-}6.0^{721}$	i.	s.	s eth.
4080	col. liq., 1.4571	1 $1923\frac{20}{4}$		$77.2\text{-}7.5^{744}$	i	s.	
4081	col. cr. powd. f. al.	..	148	......	i	s. h.	sl s. eth.
4082	col liq, 1.4941	1 $1783\frac{20}{4}$		$49.1\text{-}9$ 4^{26}	i	s.	s. eth.
4083	col. liq	1 $1102\frac{20}{4}$		149 0-9.5^{721}			.
4084	col. liq	...		$184\text{-}5^{740}$	i	v s.	
4085	col. liq., 1.4363	0 $9026\frac{17.7}{4}$		94	i	s.	s. eth., chl., ac. a., bz.
4086	need. f. w., pr. f. al.	. .	101	... ...		i. c.	s. eth.
4087	need. or leaf. f. dil. al.	. ..	91	343-5	i.	v. s.	v. s. eth.; s. most org. solv.
4088	col. liq	0 9386		$152\text{-}4^{726}$			....
4089	col. oil, 1.5661^{20}	2 $024\frac{20}{4}$		$43\text{-}5^{15}$			s. eth.
4090	col. liq . .	2 $045\frac{20}{4}$		132 2^{782}	i		s eth.
4091							
4092	col. liq	0 916	.	62 $5\text{-}3.0^{737}$	i	s.	s. eth
4093	col. liq..	0 $923\frac{18}{4}$	.	65 5		s.	s. eth.
4094	lt. yel. monocl. f. pet. eth.		28 8-9 2	. . ..	i	.	s. eth., alk.
4095	liq., 1.4040^{25}.	.... ..	..	64-66	v. s.	s.	....
4096							
4097	... .	1 $5471\frac{20}{4}$	.	$151.7\text{-}2.7^{734}$		.	....

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4098	**2-Furanacetonitrile**...	2-furylacetonitrile, furfuryl cyanide	$C_4H_3O\ CH_2CN$....	107 11
4099	**2-Furanacrylic acidc**..	β-2-furylacrylic acid; 2-furalacetic acid; furacrylic acid	$C_4H_3OCH:CH-COOH$	138.12
4100	——, amyl ester .	*n*-amyl β-2-furylacrylate	$C_4H_3OCH:CH-COOCH_5H_{11}$	208 25
4101	——, butyl ester	*n*-butyl β-2-furylacrylate ..	$C_4H_3OCH.CH-COOCH_4H_9$	194 22
4102	——, ethyl ester ...	ethyl β-2-furylacrylate; ethyl furacrylate	$C_4H_3OCH:CH-COOCH_2H_5$	166 17
4103	——, methyl ester . .	methyl β-2-furylacrylate .	$C_4H_3OCH:CH-COOCH_3$	152 14
4104	——, propyl ester ..	*n*-propyl β-2-furylacrylate .	$C_4H_3OCH.CH-COOC_3H_7$	180 20
4105	**2-Furancarbinol.**	See *Furfuryl alcohol*		
4106	**2-Furancarbonal*.**	See *Furfural.*		
4107	**2-Furancarbonyl chloride.** See 2-*Furoyl chloride.*			
4108	**2-Furancarboxylic acid.** See *Furoic acid*			
4109	**3-Furancarboxylic acid** 3-furoic acid		$C_4H_3O\ COOH$ ...	112 08
4110	——**, 4,5-dihydro-5-keto-.** See *Aconic acid*			
4111	——**, 2,5-dimethyl-.**	See *Pyrotritaric acid.*		
4112	——**, 2-methyl-** .	.	$CH_3C_4H_2O{\cdot}COOH$	126 11
4113	——, ——, ethyl ester .	.. . .	$CH_3C_4H_2O{\cdot}COOC_2H_5$	154 16
4114	——**, tetrahydro-5-oxo-.** See *Paraconic acid*			
4115	**2,5-Furandicarbonyl chloride.** See *Dehydromucyl chloride*			
4116	**2,3-Furandicarboxylic acid**	.	$C_4H_2O(COOH)_2$.	156 09
4117	——, dimethyl ester	. . . . .	$C_4H_2O(COOCH_3)_2$	184 14
4118	**2,5-Furandicarboxylic acid.** See *Dehydromucic acid.*			
4119	**2,5-Furandione.**	See *Maleic anhydride*		
4120	**2-Furanmethylamine.**	See *Furfurylamine.*		
4121	**Furfural**	2-furancarbonal*; 2-furaldehyde; fural; furfuraldehyde, furole; furfurole	C_4H_3OCHO .	96 08
4122	——, diacetate	furfurylidene diacetate .	$C_4H_3OCH-(OOCCH_3)_2$	198 17
4123	——, diethyl acetal.	See *Furan, 2-(diethoxymethyl)-.*		
4124	——, hydramide . . .	See *Hydrofuramide.*		
4125	——, phenylhydrazone	. . .	$C_4H_3OCH:NNH-C_6H_5$	186.21
4126	——**, 5-methyl-**	-methylfurfurole	$CH_3C_4H_2O\ CHO$..	110.11
4127	——**, 5-nitro-**..	. . . . .	$NO_2C_4H_2O{\cdot}CHO$..	141.08
4128	——**, tetrahydro-**.....	furfural tetrahydride	$C_4H_7O\ CHO$......	100 11
4128T	**Furfural acetone.**	See *Acetone, furfurylidene-.*		
4129	**Furfuralcohol.**	See *Furfuryl alcohol*		
4130	**Furfuramide.**	See *Hydrofuramide*		
4131	**Furfuran.**	See *Furan*		
4132	**Furfurine**		$C_{15}H_{12}N_2O_3$	268 26
4133	**Furfurole.**	See *Furfural.*		
4134	**Furfuryl alcohol** ...	2-furancarbinol; furfuralcohol; α-furylcarbinol.	$C_4H_3O{\cdot}CH_2OH$....	98.10
4135	——, acetate ...	. . . .	$C_4H_3OCH_2OOC-CH_3$	140.13
4136	——, butyrate	. . ..	$C_4H_3OCH_2-OOCC_3H_7$	168.19

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4098	col. liq.......	$1.0854\frac{25}{4}$	78–80[20]	....	sl. s.	v. s.	v. s. eth.
4099	wh. need. f. w., odorless, 1.5286[20]	.....	141	226; 117[8]	i.	s.	s. eth.
4100	col. liq.......	$1.0322\frac{20}{4}$	...	119.4	i.	...	....
4101	col. liq......	$1.0482\frac{20}{4}$	.	121.0[5]	i.	s.	....
4102	col. liq., 1.5286[20]	$1.0891\frac{25}{4}$	24.5	132–3[18]; 117[8]	i	s.	....
4103	col. liq., 1.4447[20]	.....	27	114–5[16]; 227–8[744]	i	s.	. . ..
4104	col. liq., 1.5229[20]	1.0744	.	119[7]	i	s.	....
4105							
4106							
4107							
4108							
4109	col. need. f. w		120.5-1.5	105–10[12]	i. c		v. s. eth.
4110							
4111							
4112	col. cr. f. w.		102–3			s	s. eth.
4113	col. liq ..			85–7[20]	i.		s. eth.
4114							
4115							
4116	col. cr. powd		225		s	s.	s. eth.
4117	col. gran. cr		37		i.	s.	v. s. eth.
4118							
4119							
4120							
4121	col.-yel. liq.; almond odor, 1.52608[20]	$1.1598\frac{20}{4}$	-36.5	161.7	8.3[20]	∞	∞ eth.
4122	col. cr. f. pet. eth.		52–3	220 (143–4[20])	i	s.	s. eth.
4123							
4124							
4125	....		97		i	s.	s. eth.
4126	col. liq.........	$1.1072\frac{18}{4}$; $1.109\frac{18}{18}$		187; 106–7[60]	3.3	v. s.	∞ eth.
4127	straw yel.....	.	36	.		.. ...	s. eth.
4128	col. liq.. .	$1.10947\frac{25}{4}$		144–5[740]	i.	s.	.
4128T							
4129							
4130							
4131							
4132	lt. br. need....	. .	117	.	i.	s.	s. eth.
4133							
4134	col.-yel. liq., almost odorless, 1.4850[25]	$1.1296\frac{20}{4}$	...	171[750]	∞	∞	∞ eth.
4135	col. liq., 1.4603[25]	$1.1175\frac{20}{4}$	.	175–7[764]	i.	s.	s. eth.
4136	col. liq	$1.0530\frac{20}{4}$	. .	212–3[764] (69–70[1])	v. sl. s.	s.	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4137	**Furfuryl alcohol**, propionate	....	$C_4H_3OCH_2$-$OOCC_2H_5$	154.16
4138	——, 2-furoate	furfuryl furoate; furfuryl pyromucate	$C_4H_3OCO_2CH_2$-C_4H_3O	192.16
4139	**——, 5-methyl-**	5-methyl-2-furancarbinol	$CH_3C_4H_2O{\cdot}CH_2OH$	112 12
4140	**——, tetrahydro-** . ..	tetrahydro-2-furancarbinol	$C_4H_7O{\cdot}CH_2OH$....	102.13
4141	**Furfurylamine**	2-furanmethylamine	$C_4H_3OCH_2NH_2$..	97 11
4142	**——, tetrahydro-** ..	tetrahydro-2-furanmethylamine	$C_4H_7OCH_2NH_2$..	101 15
4143	**Furfuryl chloride.**	See *Furan, 2-(chloromethyl)-.*		
	Furfuryl esters.	See under *Furfuryl alcohol*		
4144	**Furfurylidene diacetate.**	See *Furfural, diacetate.*		
4145	**Furfuryl mercaptan**	2-furylmethanethiol	$C_4H_3OCH_2SH$ ..	114 16
4146	**Furil**	bipyromucyl; di-2-furylglyoxal	$C_4H_3OCOCOC_4$-H_3O	190 15
4147	**2-Furoic acid, Furoic acid**	2-furancarboxylic acid; pyromucic acid	C_4H_3OCOOH	112 08
4147D	——, amyl ester	*n*-amyl furoate	$C_4H_3O{\cdot}COOC_5H_{11}$	182 21
4147E	——, butyl ester	*n*-butyl furoate	$C_4H_3O\ COOC_4H_9$.	168 19
4147F	——, *sec*-butyl ester ..	*sec*-butyl furoate	$C_4H_3O{\cdot}COOC_4H_9$	168 19
4147G	——, ethyl ester.	ethyl furoate	$C_4H_3O{\cdot}COOC_2H_5$.	140 13
4147H	——, furfuryl ester.	See *Furfuryl alcohol, 2-furoate*		
4147J	——, heptyl ester	*n*-heptyl furoate	$C_4H_3O\ COOC_7H_{15}$	210 27
4147K	——, hexyl ester.	*n*-hexyl furoate.	$C_4H_3O{\cdot}COOC_6H_{13}$	196 24
4147L	——, isoamyl ester	isoamyl furoate .	$C_4H_3O\ COOC_5H_{11}$	182 21
4147M	——, methyl ester	methyl furoate .	$C_4H_3O\ COOCH_3$	126 11
4147N	——, octyl ester	*n*-octyl furoate	$C_4H_3O\ COOC_8H_{17}$	224 29
4147P	——, propyl ester	*n*-propyl furoate	$C_4H_3O{\cdot}COOC_3H_7$	154 16
4147Q	**——, 3-bromo-**	β-bromopyromucic acid	$C_4H_2BrO\ COOH$	190 99
4147R	**——, 5-bromo-**	δ-bromopyromucic acid	$BrC_4H_2O{\cdot}COOH$	190 99
4147S	——, ——, ethyl ester		$BrC_4H_2O\ COOC_2$-H_5	219 04
4147T	**——, 3-chloro-** .	β-chloropyromucic acid	$ClC_4H_2O{\cdot}COOH$.	146 53
4147U	**——, 5-chloro-** .	δ-chloropyromucic acid	$ClC_4H_2O\ COOH$.	146 53
4147V	**——, 5-methyl-** ..	. .	$CH_3C_4H_2O\ COOH$	126 11
4147W	——, ——, methyl ester	......	$CH_3C_4H_2O{\cdot}COO$-CH_3	140.13
4147X	**——, 5-nitro-**.	.	$NO_2C_4H_2O{\cdot}COOH$	157 08
4147Y	**——, tetrahydro-**. . ..	tetrahydropyromucic acid ..	$C_4H_7O{\cdot}COOH$. .	116 11
4148	**3-Furoic acid.**	See *3-Furancarboxylic acid.*		
4149	**Furoin**...	....	C_4H_3OCHOH-COC_4H_3O	192 16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4137	col. liq.......	$1.1085\frac{20}{4}$	.. ..	$195\text{-}6^{762}$	v. sl. s. (i.)	s	∞ eth.
4138	dimorphous.	1 395; (1 330)	27 5 (19.5)	122^{3}	i.	s.	s. eth.
4139	col. liq ...	$1\ 0769\frac{20}{4}$	. .	$194\text{-}6^{744}$	s.	v. s.	v. s. eth.
4140	col., almost odorless liq., 1.4502^{19}	$1\ 0495\frac{20}{4}$	. .	$177\text{-}78^{743}$	∞	∞	∞ eth.
4141	col liq .	<1	. .	144-6	∞	s	s eth.
4142	col. liq .	.	..	$151\text{-}2^{735}$	∞	∞	∞ eth.
4143							
4144							
4145	col. oily liq., 1.5329	$1\ 13186\frac{20}{4}$	.	$155; 84^{65}$	i.		. .
4146	yel. need ...	.... .	165-6	.	i.	s.	s. eth.
4147	wh. monocl need., subl.	.. . .	133	230-2; subl. 100	$3\ 57^{15}$	s.	v. s. eth.
4147 D	col. liq .	1 0335	. ....	$95\text{-}7^{1}$	i.	∞	. . . . . .
4147 E	col. oil, d on standing	1 0555	.	$118\text{-}20^{25}; 83\text{-}4^{1}$	i	∞	∞ eth.
4147 F	col. liq	1 0465	.	$67\text{-}9^{1}$	i.	∞	∞ eth.
4147 G	wh. leaf. or pr., $1.4797^{20.8}$	$1\ 0974\frac{40}{4}$, $1\ 1774\frac{21}{4}$	34 (30-3)	195^{766}	i.	∞	∞ eth.
4147 H							
4147 J	col. liq.....	$1\ 0005\frac{20}{4}$	.	$116\text{-}7^{1}$	i.	s	.....
4147 K	col. liq	$1\ 0170\frac{20}{4}$	. ...	$105\text{-}7^{1}$	i.	s.	.. ..
4147L	col liq .. .		.. .	$135\text{-}7^{25}$	i.	∞	.
4147M	col liq ; turns yel. in light, 1.4860^{20}	$1\ 1739\frac{15}{15}$	.	181 3	i (sl s)	∞	∞ eth.
4147 N	col. liq . .	0 9885		$126\text{-}7^{1}$	i.	s.	....
4147P	col. liq. ...	1 075	.	211	i. (sl s)	s.	∞ eth.
4147Q	wh. need. f. w	.	127-9	.	$1\ 3^{20}$	s	s. eth.; v. sl. s. lgr., CS_2
4147R	wh. leaf. f. w		186		v sl s c.	s.	v. s. eth.
4147S	pr .	$1\ 528^{20}$	17	235^{767}	i.	s.	s. eth.
4147T	wh. cr		148 5-9 5	.. . ..	i.	s.	. .
4147U	wh. leaf		179-80		$0\ 3^{20}$	s.	.
4147V	pl. or need. f. w.		108-9	..	v. s. h.	v s	v. s. eth.
4147W	col. liq . ..	.	. .	98^{15}	..	. ...	s. eth.
4147 X	wh. cr. f. w ..	. .	185 0-5 5	subl.	s. h.	s.	s. eth.
4147Y	wh. cr	1 1933	21	$131\text{-}2^{14}$	. .	. ...	. . . .
4148							
4149	lt. br. need .	.	134-5	....	i.	sl. s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4150	**Furole.**	See *Furfural.*		
4151	**Furoyl chloride**	2-furoyl chloride; pyromucyl chloride	C_4H_3OCOCl	130.53
4152	**β-Furyl bromide.**	See *Furan,* 3-*bromo-*.		
4152H	**α-Furyl chloride.**	See *Furan,* 2-*chloro-*.		
4152M	**α-Furyl iodide.**	See *Furan,* 2-*iodo-*.		
4152S	**β-Furyl iodide.**	See *Furan,* 3-*iodo-*.		
4153	**G acid.**	See 2-*Naphthol*-6,8-*disulfonic acid.*		
4154	D-**Galactonic acid**	*d*-lactonic acid	$CH_2OH(CHOH)_4$-COOH	196.16
4155	D-**Galactose**	....	$C_6H_{12}O_6$	180.16
4156	D-**Galacturonic acid**	.	$C_5H_9O_5COOH$	194.14
4157	**Gallacetophenone**	2,3,4-trihydroxyacetophenone; 4-acetylpyrogallol	$CH_3COC_6H_2(OH)_3$	168.14
4158	**Gallanilide**	gallanol, 3,4,5-trihydroxybenzanilide	$C_6H_5NHCOC_6H_2$-$(OH)_3$	245.23
4159	**Gallein**	pyrogallolphthalein, 4,5-dihydroxyfluorescein	$C_{20}H_{12}O_7$	364.30
4160	**Gallic acid**	3,4,5-trihydroxybenzoic acid	$(HO)_3C_6H_2COOH$	170.12
4161	——, 3-monogallate	See *m-Digallic acid.*		
4162	——, trimethyl ether.	See *Benzoic acid,* 3,4,5-*trimethoxy-*.		
4163	**Gallin**	3,4,5,6-tetrahydroxy-9-xanthene-*o*-benzoic acid	$C_{20}H_{14}O_7$	366.31
4164	**Gelsemine,** compd. with acetone	..	$C_{20}H_{22}N_2O_2\cdot(CH_3)_2CO$	380.47
4165	***d*-Gelsemine**	. ....	$C_{20}H_{22}N_2O_2$	322.39
4166	——, hydrochloride	.	$C_{20}H_{22}N_2O_2\cdot HCl$	358.86
4167	**Gentianin.**	See *Gentisin.*		
4167M	**Gentiobiose**	amygdalose..	$C_{12}H_{22}O_{11}$	342.30
4168	**Gentisic acid**	2,5-dihydroxybenzoic acid, hydroquinonecarboxylic acid	$(HO)_2C_6H_3COOH\cdot 3H_2O$	208.17
4169	——, **4-hydroxy-.**	See *Benzoic acid,* 2,4,5-*trihydroxy-*.		
4170	**Gentisin**	1,7-dihydroxy-3-methoxyxanthone, 3-methoxyeuxanthone; gentianin	$C_{14}H_{10}O_5$	258.22
4171	**Geranial.**	See *Citral a.*		
4172	**Geranic acid**	3,7-dimethyl-2,6(and 2,7)-octadienoic acid*	$C_{10}H_{16}O_2$	168.23
4173	**Geraniol**	3,7-dimethyl-2,6-octadien-1-ol*, one form	$C_{10}H_{17}OH$	154.25
4174	——, acetate	geranyl acetate	$C_{12}H_{20}O_2$	196.28
4175	——, butyrate	geranyl butyrate	$CH_3(CH_2)_2$-$COOC_{10}H_{17}$	224.33
4176	——, formate	.	$HCOOC_{10}H_{17}$	182.26
4177	——, **dihydro-.**	See *dl-Citronellol.*		
4178	——, **tetrahydro-.**	See 1-*Octanol,* 3,7-*dimethyl-**.		
	Geranyl esters.	See under *Geraniol.*		
4179	**Germanium, tetraphenyl-***	..... .	$(C_6H_5)_4Ge$	381.00
4180	***d*-Glaucine**	....	$C_{21}H_{25}NO_4$	355.42
4180M	**Glaurin.**	See *Diethylene glycol, monolaurate.*		
4181	**Glonoin.**	See *Nitroglycerin.*		
4182	**Glucide.**	See *Saccharin*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4150							
4151	col. liq., lachrymatory		0	59 5-61 5^{7}; 176	d.		s. eth.
4152							
4152H							
4152M							
4152S							
4153							
4154	need. f. w		95-100	d. 140-1	s.	.	. . . .
4155	hex tab. f al	. .	+1H_2O 118-20; anh. 165-8	. .	10 3^{9}, 68 3^{25}	0 59^{38} 85%	v. sl. s. me. al.
4156	micro. need, $[\alpha]+53\ 59°_D$		159-60 d.	.	s.	s. h.	i. eth.
4157	leaf	.. . .	173	. . . .	sl. s.	s.	s. eth.; v sl s. bz.
4158	col. cr or powd.	...	205	. .	s. h.	s.	s. eth.
4159	red cr powd	.	d.		v sl s. h.	s.	sl. s. h. eth.; s. alk.
4160	col. monocl. need. f. w.	1 $694\frac{4}{4}$	220 d.	d.	1 16^{25}, 33^{100}	27.2^{25}	2 5^{15} eth ; s. glyc
4161							
4162							
4163	need.......		.		s.	s.	s. eth.
4164	pr. f. acet..		anh. at 120	. .			. . . . .
4165	....	. . .	178	. .	i.	s.	s eth., chl., bz.
4166	pr. f. w	.	300		s.	sl s	.
4167							
4167M	two cr. forms: α and β	. .	α189-95; β190-95	. . . . .	s.	.	s. h. me. al.
4168	col need. f. w.		200	d.	v. s.	v. s.	v. s. eth.; i. CS_2, chl., bz.
4169							
4170	yel. need		267	400 subl	v. sl s	sl. s. h.	sl. s. h. eth.; s. alk.
4171							
4172	thin oil, $1.48695^{28.2}$	0 $952\frac{20}{4}$	.	119^{20}	i.	s.	s. eth.
4173	col. liq., 1.4798	0 $8812\frac{16}{4}$	<-15	229; 120-2^{17}	i.	∞; 5.41 50%	∞ eth.
4174	col liq., 1.4660	0 $917\frac{15}{4}$		242-5^{764} d.	v. sl. s.	v. s.	∞ eth.
4175	....	0 $9008\frac{17}{4}$	. ...	151-3^{18}	i.	s.	s. eth.
4176	liq.	0 $927\frac{20}{4}$	..	113-4^{15}	i.	s.	s. eth.
4177							
4178							
4179	col tetr... ..	. .	235 7	>400	i.	.	sl.s. eth., acet., lgr.; s. chl., bz., tol.
4180	yel. rhomb. pr.	.. ..	119-20	. . . . .	s. h.	v. s.	s. eth.; v. s. chl.; sl. s. bz.
4180M							
4181							
4182							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4184	**D-Gluco-α-heptose** . . .	. . . .	$CH_2OH(CHOH)_5CHO$	210 18
4185	**D-Gluconic acid**	dextronic acid; *d*-glyconic acid; maltonic acid; glycogenic acid	$C_5H_6(OH)_5COOH$	196 16
4186	——, δ-lactone.	. . . .	$C_5H_6(OH)_4COO$	178 14
4186M	**D-Glucosamine**	chitosamine; 2-amino-D-glucose	$C_6H_{13}NO_5$.	179 17
4187	**D-Glucosazone.**	See D-*Glucose, phenylosazone.*		
4188	**Glucose,** β-glucoside.	See *Cellobiose.*		
4188M	**——, tetraethyl-.**	See D-*Glucose, tetraethyl ether.*		
4189	**D-Glucose** (anh.)	dextrose; grape sugar.	$C_6H_{12}O_6$.	180 16
4190	——, (α)	. . . .	$C_6H_{12}O_6 \cdot H_2O$.	198 17
4191	——, (β)	. . . .	$C_6H_{12}O_6.H_2O$.	198 17
4192	——, diacetate.	diacetyl-*d*-glucose.	$C_6H_8(OOCCH_3)_2(OH)_3CHO$	264.23
4193	——, α-pentaacetate.	pentaacetyl-α-*d*-glucose . .	$C_6H_7O(OOCCH_3)_5$	390 34
4194	——, β-pentaacetate . . .	β-pentaacetyl-*d*-glucose	$C_6H_7O_6(OCCH_3)_5$.	390 34
4195	——, μ-pentaacetate . .	. . . . . .	$C_6H_7O(OOCCH_3)_5$	390 34
4197	——, α-phenylhydrazone. .	. . . .	$C_6H_{12}O_5NNHC_6H_5$	270 28
4198	——, β-phenylhydrazone	. .	$C_6H_{12}O_5NNHC_6H_5$	270 28
4199	——, phenylosazone .	*d*-glucosone bisphenylhydrazone; detxrosazone; *d*-glucosazone	$C_6H_{10}O_4(:NNHC_6H_5)_2$	358 39
4199H	——, tetraethyl ether	tetraethylglucose. .	$C_{14}H_{28}O_6$	292 37
4199R	**——, 2-amino-.**	See D-*Glucosamine.*		
4200	**——, pentaacetyl-.**	See D-*Glucose, pentaacetate.*		
4202	**D-Glucoside, α-methyl-**	. . . . .	$C_7H_{14}O_6$.	194 18
4203	**——, β-methyl-.**	. . . .	$C_7H_{14}O_6$	194 18
4204	**D-Glucosone,** bisphenylhydrazone. See D-*Glucose, phenylosazone.*			
4205	**Glutamic acid, β-hydroxy-(*dl*)**	*dl*-α-amino-β-hydroxyglutaric acid	$COOHCH_2CH(OH)CH(NH_2)COOH$	163 13
4206	**β-hydroxy-(*d*)**.	*d*-2-amino-3-hydroxypentanedioic acid	$COOHCH_2CHOHCH(NH_2)COOH$	163 13
4207	***dl*-Glutamic acid**.	*dl*-glutaminic acid; *dl*-α-aminoglutaric acid	$COOH(CH_2)_2CH(NH_2)COOH$	147 13
4208	***d*-Glutamic acid**.	*d*-glutaminic acid; *d*-α-aminoglutaric acid	$COOH(CH_2)_2CH(NH_2)COOH$	147 13
4209	***l*-Glutamic acid**	*l*-glutaminic acid; *l*-α-aminoglutaric acid	$C_3H_5(NH_2)(COOH)_2$	147 13

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
4184	rhomb. pl. f. w.	....	215 d. (180–90)	......	9.5, v. s. h.	v. sl. s.	....
4185	cr	.....	125–6; (130–2)	....	s.	i.	i. eth.
4186	need .	..	146 (130–5)	......	....	......	......
4186M	need f et. al.		110	.	s.	sl. s.	i. eth., $CHCl_3$
4187							
4188							
4188M							
4189	rhomb. need. f al.	$1\ 544\frac{25}{4}$	(+$1H_2O$ 118–20) anh. 146	......	$83^{17.5}$	$1\ 94^{17.5}$	i. eth.
4190	....	$1\ 544\frac{25}{4}$	146	......	$32\ 3^{0}$, 82.0^{25}	2 (initial), 4 5 (final) 80%	...
4191	need. f. al.....	$1.5620\frac{18}{4}$	150	....	154^{15}	4.9 (initial), 9 1 (final) 80%	i. eth.
4192	col cr. or lt. yel. amor.	.. ..	<100	......	s.	s.	s. eth.; i bz.
4193	fine need. f. lgr or al.	...	113 (111–2)	subl.	$0\ 15^{18.5}$	$1\ 32^{15}$	2.7^{15} eth.
4194	need. f al ..		131	....	$0\ 09^{18.5}$	$0\ 82^{19}$	$2\ 1^{15}$ eth.
4195	monocl. tab..	.	116–8	.....	s. warm	s.	sl. s. eth.
4197	col. cr	. .	160	...	v. s.	v. s. h.	v. sl. s. eth.
4198	col. need	...	141	..	sl. s.	s.	v. sl. s. c. eth.
4199	yel. need	. .	208 d.	.....	v. sl. s.	s. h.	....
4199H	$[\alpha]_D^{20}$ 65 3°. .	.	61–4	$138\text{–}9^{6.5}$	......	.....	....
4199R							
4200							
4202	rhomb. f w	. .	165	...	63	1 6	i. eth.
4203	tetr f al .	....	104	.	58	4.2	i. eth.
4204							
4205	rhomb pr. and need.	......	198 d.	.	v. s. h	......	....
4206	pr. f. w... ...	....	soft. 100, hyd 105; (rac. 198 d.)	d. >100	v. s.	i.	i. eth.; v. s. ac. a.
4207	tetr. pl.... ..	$1.4601\frac{20}{4}$	225–7 d.	....	$2\ 64^{25}$, $8\ 16^{50}$	v. sl. s.	v. sl. s. eth.
4208	tetr. pl.. .	1 538	247–9 d.	....	0.89^{25}, $2\ 23^{50}$	0.037^{25} 75%, 0.003^{25} 100%	$0\ 007^{25}$ me. al.; 0.0004^{25} acet.
4209	col. rhomb. pl. f. w., 1.490, 1.605, 1.620	1 538 (1 460)	202 (198), l 213 d.	. .	$1\ 5^{20}$	0.07^{15}	i. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4210	**l-Glutamic acid**, hydrochloride........	....	$C_5H_9NO_4 \cdot HCl$....	183 60
4211	**d-Glutamine**.........	d-α-aminoglutaramic acid .	$C_3H_5(NH_2)$-$(CONH_2)COOH$	146 15
4212	**Glutaramic acid, α-amino-**. See *Glutamine.*			
4213	**Glutaric acid**..... .	pentanedioic acid*.	$COOH(CH_2)_3$-$COOH$	132 11
4214	——, diethyl ester...	diethyl pentanedioate*; ethyl glutarate	$C_2H_5OOC(CH_2)_3$-$COOC_2H_5$	188 22
4215	——, piperazinium salt .	. .	$C_4H_{10}N_2\ 2C_5H_8O_4$..	350 37
4216	——, **α-amino-.**	See *Glutamic acid.*		
4218	——, **α-hydroxy-** .	2-hydroxypentanedioic acid*	$COOHCHOH$-$(CH_2)_2COOH$	148 11
4219	——, **β-keto-.**	See *Acetonedicarboxylic acid.*		
4220	——, **α,β,γ-trihydroxy-(dl)**	. . .	$COOH(CHOH)_3$-$COOH$	180 11
4221	——, **α,β,γ-trihydroxy-(d or l)**	2,3,4-trihydroxypentanedioic acid*	$COOH(CHOH)_3$-$COOH$	180 11
4222	**Glutaronitrile**........	pentanedinitrile*, trimethylene dicyanide; trimethylene cyanide	$CN(CH_2)_3CN$.	94 11
4223	**Glyceraldehyde**	2,3-dihydroxypropanal*; α, β-dihydroxypropionaldehyde	$CH_2OHCHOH$-CHO	90 08
4224	**Glyceric acid**..........	2,3-dihydroxypropanoic acid*, α, β-dihydroxypropionic acid	$CH_2OHCHOH$-$COOH$	106 08
4225	——, ethyl ester.. . ..	ethyl 2,3-dihydroxypropanoate*	$CH_2OHCHOH$-$COOC_2H_5$	134 13
4226	——, methyl ester... .	methyl glycerate . .	$CH_2OHCHOH$-$COOCH_3$	120 10
4227	**Glycerin.**	See *Glycerol.*		
4228	**Glycerol**..............	glycerin; 1,2,3-propanetriol*	$CH_2OHCHOH$-CH_2OH	92 09
4229	——, borate	glyceryl borate. .	$(C_3H_5BO_3)_x$	$(99\text{-}89)_x$
4230	——, α-chlorohydrin.	See 1,2-*Propanediol, 3-chloro-** .		
4231	——, diacetate .	diacetin ...	$C_3H_5(OH)$-$(OOCCH_3)_2$	176 17
4232	——, *sym*-dichlorohydrin.	See 2-*Propanol*, 1,3-*dichloro-**		
4233	——, *uns*-dichlorohydrin.	See 1-*Propanol*, 2,3-*dichloro-**		
4234	——, 1,3-dilaurate	α, γ-dilaurin. .	$(C_{11}H_{23}COO)_2$-C_3H_5OH	456 69
4235	——, 1,3-dinitrate	... .	$C_3H_5(OH)(NO_3)_2$ $\frac{1}{2}H_2O$	191 10
4236	——, 1,3-dipalmitate ..	α, γ-dipalmitin..	$(C_{15}H_{31}COO)_2$-C_3H_5OH	568 90
4237	——, 1,3-distearate. .	α, γ-distearin.... . .	$(C_{17}H_{35}COO)_2$-C_3H_5OH	625 01
4238	——, ethylidene ether.	See *Acetoglyceral.*		
4239	——, monoacetate.	monoacetin	$CH_2OHCHOH$-CH_2OOCCH_3	134 13
4240	——, 1-monolaurate.. ..	α-monolaurin...... .. .	$C_{11}H_{23}COOCH_2$-$CHOHCH_2OH$	274 39
4241	——, α-mononitrate	. . . . .	$CH_2OHCHOH$-CH_2ONO_2	137 09

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4210	tricl. pl., [α] 1.546°D; [β]1.559°D	...	d. 201	....	v. s., d.	s.	v. sl. s. conc. HCl
4211	need.	..	185–6	.....	4.25^{25}	$.00046^{25}$	i. eth.
4212							
4213	col. monocl., $1.4188^{106.4}$	1.429^{15}_{4}; 1.192^{106}_{4}	97.5; 95–6	304 d.	64^{20}	v. s.	v. s. eth.; s. bz., chl.; sl. s. pet. eth.
4214	syrup 1.4241^{20}	1.025^{20}_{4}	-24.1	237	0.88^{20}	v. s.	s. eth.
4215	wh. cr	.	152	....	s.	s. h.	i. eth.
4216							
4218	sm. col. cr		72–3	.....	s.	s.	....
4219							
4220	col. tab. f. acet		152 d.	....	v. s.	v. s. h.	s. acet.
4221	col. leaf. f. acet.	...	128	......	v. s.	v. s.	s. acet.
4222	col. liq., $1.4365^{23.2}$	0.995^{15}_{4}	-29	287.4	s.	s.	i. eth.
4223	need. or pr. f. me. al.	1.453^{18}_{4}	138	....	sl. s.	v. sl. s.	v. sl. s. eth.
4224	syrup ..	.....	....	....	∞	∞	i. eth.; v. s. acet.
4225	liq	1.191^{15}_{15}	....	230–40; 121^{14}	s.	v. s.	v. s. eth.
4226	liq.	1.279^{15}_{4}	....	239–44, 120^{14}	∞	∞	v. sl. s. eth.
4227							
4228	rhomb. or col. liq., 1.4729	1.260^{20}_{4}	17.9, solidifies at a much lower temperature	290	∞	∞	i. eth., chl.
4229	glassy yel.	...	....	....	d.	....	....
4230							
4231	col. liq	1.184^{16}_{4}	40	176^{40}; 280 (250–3)	∞	v. s.	s. eth.; i. CS_2
4232							
4233							
4234	cr	....	56.6	.....		s.	s. eth.
4235	liq..........	1.47^{15}_{4}	<-30; anh. 26	148^{15}	7.7	v. s.	s. eth.
4236	cr. f. al. or chl.	.....	70	....	....	sl. s. c., v. s. h.	sl. s. c., v. s. h. eth.; s. chl.
4237	rhomb. pl. f. chl. or lgr.	......	79.1	. .	...	sl. s. c., s. h.	sl. s. c., s. h. eth.
4238							
4239	col. oil	1.2060^{20}_{4}	....	158^{165}	v. s.	v. s.	sl. s. eth.; i. bz.
4240	wh. need	..	63.0	....		sl. s. c., s. h.	sl. s. c., s. h. eth.
4241	col. pr	1.40^{15}_{4}	58	155–60	70	v. s.	v. sl. s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4242	**Glycerol**, β-mononitrate	....	$CH_2OHCH(ONO_2)CH_2OH$	187.09
4243	——, 1-monooleate	monoölein................	$C_{17}H_{33}COOCH_2CHOHCH_2OH$	356.53
4244	——, 1-monopalmitate	α-monopalmitin...........	$C_{15}H_{31}COOCH_2CHOHCH_2OH$	320.50
4245	——, monoricinoleate	....	$C_{17}H_{32}COOC_3H_5(OH)_2$	356.53
4247	——, 1-monostearate	α-monostearin.............	$C_{17}H_{35}COOCH_2CHOHCH_2OH$	358 55
4248	——, 1-octadecyl ether.	See 1,2-*Propanediol, 3-octadecyloxy-**.		
4249	——, 1-sodium derivative	sodium glycerolate, sodium glycerate (so called)	$CH_2OHCHOHCH_2ONa$	114 08
4250	——, triacetate.....	triacetin	$C_3H_5(OOCCH_3)_3$	218 20
4251	——, tribenzoate	tribenzoin......	$C_3H_5(OOCC_6H_5)_3$.	404.40
4252	——, tribromohydrin.	See *Propane, 1,2,3-tribromo-**.		
4253	——, tributyrate.....	butyrin; tributyrin...	$(CH_3CH_2CH_2CO)_3C_3H_5O_3$	302 36
4254	——, trichlorohydrin.	See *Propane, 1,2,3-trichloro-**.		
4255	——, trilaurate...	trilaurin; laurin....	$(C_{11}H_{23}COO)_3C_3H_5$	638 99
4256	——, trimyristate.....	myristin; trimyristin. ...	$(C_{13}H_{27}COO)_3C_3H_5$	723.15
4257	——, trinitrate.	See *Nitroglycerin.*		
4258	——, trinitrite...	....	$C_3H_5(ONO)_3$	179 09
4259	——, trioleate.........	triolein; olein; glyceryl oleate	$(C_{17}H_{33}COO)_3C_3H_5$	885.41
4260	——, tripalmitate......	tripalmitin; palmitin.	$(C_{15}H_{31}COO)_3C_3H_5$	807 30
4261	——, tristearate.	stearin; tristearin. ...	$(C_{17}H_{35}COO)_3C_3H_5$	891 46
4262	——, **1-thio-**....	3-mercapto-1,2-propanediol*	$(HO)_2C_3H_5SH$.	108 15
4263	**Glycerol ether** (of Berthelot and de Luca)	glyceryl ether	$C_6H_{10}O_3$.	130 14
4264	**Glycerophosphoric acid**	glycerolphosphoric acid	$C_3H_5(OH)_2OPO_3H_2$	172 08
4265	**Glyceryl α-chlorohydrin.**	See 1,2-*Propanediol, 3-chloro-**.		
	Glyceryl esters.	See under *Glycerol.*		
4266	**Glyceryl ether.**	See *Glycerol ether (of Berthelot and de Luca).*		
4267	**Glyceryl nitrate.**	See *Nitroglycerin.*		
4268	**Glycidol**..............	2,3-epoxy-1-propanol*; epihydric alcohol; glycide	OCH_2CHCH_2OH..	74 08
4269	**Glycine**...............	aminoacetic acid; aminoethanoic acid*; glycocoll	NH_2CH_2COOH...	75 07
4270	——, methyl ester	methyl aminoethanoate* ..	$NH_2CH_2COOCH_3$	89.09
4271	——, ***N*-(*p*-acetamidophenyl)-**	(*p*-acetamidoanilino)acetic acid	$CH_3CONHC_6H_4NHCH_2COOH$	208 21
4272	——, ***N*-acetyl-.**	See *Aceturic acid.*		
4273	——, ***N*-(*p*-aminophenyl)-**	(*p*-aminoanilino)acetic acid	$NH_2C_6H_4NHCH_2COOH$	166.18
4274	——, ***N*-benzoyl-.**	See *Hippuric acid.*		
4275	——, ***N*-carbamyl-.**	See *Hydantoic acid.*		
4276	——, ***N*-ethyl-.**	(ethylamino)ethanoic acid*; (ethylamino)acetic acid; *N*-ethylglycocoll	$C_2H_5NHCH_2COOH$	103.12
4277	——, ***N*-*dl*-leucyl-**...	....	$(CH_3)_2CHCH_2CH(NH_2)CONHCH_2COOH$	188 23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4242	leaf.........	1.40^{20}_{4}	54	160	s.	v. s.	sl. s. eth.
4243	....	0.947^{21}_{4}	35	...	i.	s.	v. s. eth.
4244	leaf	....	77.0	...	.....	$5.306^{22.5}$	sl. s. c., s. h. eth.
4245	amber liq....	1.0284^{20}_{4}	....	......	dispersible	∞	∞ eth.
4247	need. or wax-like solid	0.9841^{20}_{4}	81.1 (57–8)	...	dispersible	sl. s. c., v. s. h.	sl. s. c., v. s. h. eth.
4248							
4249	wh. powd. ...	......	d. 245	......	d.	s.	....
4250	col. liq.....	1.161^{20}_{4}	-78	259	7.17	∞	∞ eth.
4251	need. f. me. al	1.228^{12}_{4}	76.5	d	i.	s. h.	v. s. eth.
4252							
4253	col. oily liq., 1.4359	1.0350^{20}_{4}	<-75	315 (203–4^{25})	i.	v. s.	v. s. eth.
4254							
4255	col. need ...	0.8944^{60}_{4}	46.4	.	i.	s.	s. eth.; v. s. bz.
4256	glit. need. f. eth., 1.4429^{60}	0.885^{60}_{4}	56.5	....	i.	s.	s. eth., bz., v. s. chl.
4257							
4258	yel. liq......	1.291^{10}_{16}	....	150 sl. d.	i.	d.	s. eth., chl., bz.; i. CS_2
4259	col. oil.	0.915^{20}_{4}	-17; frz. -6	240^{18}	i.	sl. s.	v.s. eth.; s. chl.
4260	col. need. f. eth., 1.4381^{80}	0.866^{80}_{4}	65.1; 46	310–20	i.	.004^{21}	v.s. eth.; s. chl.
4261	col. cr. f. eth., 1.4399^{80}	0.862^{80}_{4}	54.5; 70.8	....	i.	v. sl. s.	s. eth.
4262	thick liq	1.295^{14}_{4}	....	d.	v. sl. s.	∞	i. eth.
4263	col. liq .	1.091^{20}_{4}	.....	173	∞	∞	∞ eth.
4264	col. oily liq..	1.59^{14}_{4}	-20	.	∞	∞	.
4265							
4266							
4267							
4268	col. liq ...	1.165^{0}_{4}	......	162 d.	∞	∞	∞ eth.
4269	wh. monocl., 1.495, 1.615, 1.650	1 [illegible]	233 d.; (225–30)	289–92 d.	25.3^{25}, 57.5^{75}	0.043^{25}, 90%	0.61^{29} pyr.
4270	col. liq.... .	....	. .	ca. 130 d		. .	.
4271	....	.....	241–2	....		.	. . .
4272							
4273	leaf	....	222–3 d.	..	sl. s.	....	....
4274							
4275							
4276	leaf. f. al .	. .	>160 d.	. .	s.	s.	....
4277	cr. f. w	......	243 d.	....	6.6 h.	v. sl. s.	v. sl. s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4278	**Glycine, *N*-methyl-.**	See *Sarcosine.*		
4279	**——, *N*-*o*-nitrophenyl-**	. ...	$NO_2C_6H_4NHCH_2$-COOH	196 16
4280	**——, *N*-phenyl-**	anilinoacetic acid...	$C_6H_5NHCH_2$-COOH	151 16
4281	——, ——, *o*-carboxylic acid.	See *Anthranilic acid, N-(carboxymethyl)-.*		
4282	**Glycine anhydride**....	2,5-piperazinedione; α, γ-diacipiperazine, diglycolyl diamide	NHCOCH₂NH-COCH₂ (ring)	114.10
4283	**Glycocholic acid**......	. . . .	$C_{24}H_{39}O_4NHCH_2$-COOH	465 62
4284	**Glycocoll.**	See *Glycine.*		
4285	**Glycocyamidine, 1-methyl-.**	See *Creatinine.*		
4286	**Glycocyamine**........	guanidoacetic acid	$NH_2C(:NH)$-$NHCH_2COOH$	117 11
4287	**——, methyl-.**	See *Creatine.*		
4288	**Glycogen**............	animal starch	$(C_6H_{10}O_5)_x$ ..	$(162.14)_x$
4289	**Glycogenic acid.**	See D-*Gluconic acid*		
4290	**Glycol**................	1,2-ethanediol*; ethylene glycol	CH_2OHCH_2OH	62 07
4291	——, For derivatives see also	1,2-*Ethanediol.*		
4292	——, cyanohydrin.	See *Hydracrylonitrile.*		
4293	——, diacetate . .	ethylene acetate. .	$(CH_2OOCCH_3)_2$	146 14
4294	——, dibenzoate....... .	ethylene benzoate; ethylene dibenzoate	$(C_6H_5COO)_2C_2H_4$.	270 27
4295	——, dibromide.	See *Ethylene bromide.*		
4296	——, dibutyrate	ethylene butyrate	$(CH_2OOCCH_2$-$CH_2CH_3)_2$	202 25
4297	——, dichloride.	See *Ethylene chloride.*		
4297M	——, difluoride.	See *Ethylene fluoride.*		
4298	——, diformate....... ..	ethylene formate.	$HCOOCH_2CH_2$-OOCH	118 09
4299	——, diiodide.	See *Ethylene iodide.*		
4300	——, dilaurate.	ethylene laurate	$(C_{11}H_{23}COOCH_2)_2$	426 67
4301	——, dimyristate...	ethylene myristate	$(C_{13}H_{27}COOCH_2)_2$	482 77
4302	——, dinitrate	ethylene nitrate	$C_2H_4(ONO_2)_2$	152.07
4303	——, dinitrite. .	ethylene nitrite . ..	$C_2H_4(ONO)_2$.	120 07
4304	——, dipalmitate..	ethylene palmitate ...	$(C_{15}H_{31}COOCH_2)_2$	538 87
4305	——, diphenyl ether.	See *Ethane, 1,2-diphenoxy-*.*		
4306	——, dipropionate . . .	ethylene propionate . .	$(CH_3CH_2$-$COOCH_2)_2$	174 19
4307	——, distearate . .	ethylene stearate	$[CH_3(CH_2)_{16}$-$COOCH_2$-$]_2$	594 98
4308	——, dithiocyanate	ethylene (di)thiocyanate..	$(CH_2SCN)_2$ . .	144 21
4309	——, ethylene ether.	See *p-Dioxane.*		
4310	——, ethylidene diether.	See 1,3-*Dioxolane, 2-methyl-.*		
4311	——, monoacetate...	.. . .	CH_3COOCH_2-CH_2OH	104.10
4312	——, monobenzyl ether.	See *Ethanol, 2-benzyloxy-.*		
4313	——, monobutyl ether.	See *Ethanol, 2-butoxy-*.*		
4314	——, monoethyl ether.	See *Ethanol, 2-ethoxy-*.*		
4315	——, monoformate	β-hydroxyethyl formate.. .	$HCOOCH_2CH_2OH$	90 08

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4278							
4279	dk. red cr. f. al.	....	192-3 d.	.. .. .	v. sl. s.	v. s. h.	sl. s. eth.
4280	col. cr...	....	127	....	s.	s.	sl. s. eth.
4281							
4282	tab	....	275 d.	subl.	s. h.	v. s.	....
4283	col. need.....	....	134	....	0.33 c.	v. s.	0 09[20] eth.
4284							
4285							
4286	leaf. or need. f. w.	. .	d.	... ...	0 45[15]	v. sl s.	v. sl. s. eth.
4287							
4288	wh. amor .	.. .	240	. . .	v. s.	i. c., s. h.	i. eth.
4289							
4290	col. liq., 1.4274	$1\ 1155\frac{20}{4}$	-17.4 (-12)	197 2 (198-200)	∞	∞	7 89 eth.
4291							
4292							
4293	col. liq., 1.415	$1\ 128\frac{0}{4}$; $1\ 104\frac{20}{4}$	-31	186 (190.5)	14 3	∞	∞ eth.
4294	rhomb pr. f eth.	. .	73-4	d. 360	i.	......	s. eth.
4295							
4296	liq..........	$1\ 024\frac{0}{4}$	....	240	i.	v. s.	v. s. eth.
4297							
4297M							
4298	1.35800......	$1\ 193\frac{0}{4}$	.... ..	174	sl s.	s.	s. eth.
4299							
4300	.... ..	. .....	50-2	188[28]	i.	v. s	v. s. eth.
4301	cr....... ..	..	62-3	.		.	.....
4302	yel. liq..	1 483[8]	-20	exp. 114-6	i.	s.	d. alk.
4303	liq..	$1\ 2156\frac{0}{4}$	<-15	98	i.	s.	s eth.; d. alk.
4304	leaf. or need...	0.8594[77.9]	68 7 (69-72)	226	i.	0.31[38]	s. h. eth.
4305							
4306	liq........	1 0544[15]	....	211; 90-2[8]	sl. s.	∞	∞ eth.
4307	leaf	0.8581[78]	76-7	241[28]	i.	0.122[40]	v. s. eth.
4308	col. rhomb. pl. or need.	....	90	d.	s.	s.	s. eth.
4309							
4310							
4311	col. liq.......	1.108[15]	....	182	∞	∞	∞ eth.
4312							
4313							
4314							
4315	liq	$1.199\frac{15}{4}$	.. . .	180; 88[25]	∞	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4316	**Glycol**, monomethyl ether.	See Ethanol, 2-methoxy-*.		
4317	——, monomethyl ether acetate.	See Ethanol, 2-methoxy-*, acetate.		
4318	——, monopalmitate		$C_{15}H_{31}COOCH_2$-CH_2OH	300.47
4319	——, monostearate		$C_{17}H_{35}COOCH_2$-CH_2OH	328.52
4320	**——, decamethylene.**	See 1,10-Decanediol*.		
4321	**——, diethylene.**	See Diethylene glycol.		
4322	**——, *sym*-dimethyl-.**	See 2,3-Butanediol*.		
4323	**——, *uns*-dimethyl-.**	See 1,2-Propanediol, 2-methyl-*.		
4323M	**——, dipropylene.**	See 2-Propanol, 1,1′-oxydi-.		
4324	**——, dithio-.**	See 1,2-Ethanedithiol*.		
4324M	**——, divinyl-.**	See 1,5-Hexadiene-3,4-diol*.		
4325	**——, ethyl-.**	See 1,2-Butanediol*.		
4326	**——, ethylene.**	See Glycol.		
4327	**——, ethyl methyl.**	See 2,3-Pentanediol*.		
4328	**——, heptamethylene.**	See 1,7-Heptanediol*.		
4329	**——, isopropyl-.**	See 1,2-Butanediol, 3-methyl-*.		
4330	**——, nonamethylene.**	See 1,9-Nonanediol*.		
4331	**——, octamethylene.**	See 1,8-Octanediol*.		
4332	**——, octylene.**	See 4,5-Octanediol*.		
4333	**——, pentamethylene.**	See 1,5-Pentanediol*.		
4334	**——, γ-pentylene.**	See 1,4-Pentanediol*.		
4335	**——, tetraethyl-.**	See 3,4 Hexanediol, 3,4-diethyl-*.		
4336	**——, tetramethyl-.**	See Pinacol.		
4337	**——, tetramethylene.**	See 1,4-Butanediol*.		
4338	**——, tetraphenyl-.**	See Benzopinacol.		
4339	**——, thiodi-.**	See Ethanol, 2,2′-thiodi-.		
4340	**——, triethylene.**	See Triethylene glycol.		
4341	**——, trimethyl-.**	See 2,3-Butanediol, 2-methyl-*.		
4342	**——, xylylene.**	See Xylylene glycol.		
4343	**Glycolaldehyde**	hydroxyethanal*; glycolic aldehyde	CH_2OHCHO	60.05
4344	**Glycolamide**	2-hydroxyethanamide*; hydroxyacetamide	$CH_2OHCONH_2$	75 07
4345	**Glycoleucine.**	See Norleucine.		
4346	**Glycolic acid**	hydroxyethanoic acid*; hydroxyacetic acid	$HOCH_2COOH$	76 05
4347	——, ethyl ester	ethyl hydroxyethanoate*	$CH_2OHCOOC_2H_5$	104 10
4348	——, ethyl ether.	See Acetic acid, ethoxy-.		
4349	——, methyl ester	methyl hydroxyethanoate*; methyl glycolate	$CH_2OHCOOCH_3$	90 08
4350	——, phenyl ether.	See Acetic acid, phenoxy-.		
4351	**——, benzoyl-**	α-hydroxy-β-ketohydrocinnamic acid; 2-hydroxy-3-oxo-3-phenylpropanoic acid	$C_6H_5COCH(OH)$-$COOH$	180 15
4352	**——, diphenyl-.**	See Benzilic acid.		
4353	**——, phenyl-.**	See Mandelic acid.		
4354	**——, styryl-.**	See 3-Butenoic acid, 2-hydroxy-4-phenyl-.		
4355	**——, thio-.**	See Acetic acid, mercapto-.		
4356	**Glycolic aldehyde.**	See Glycolaldehyde.		
4357	**Glycolic anhydride**		$(CH_2OHCO)_2O$	134.09
4358	**Glycolide**	2,5-*p*-dioxanedione, diglycolide	$OCOCH_2OCOCH_2$	116 07
4359	**Glycoluric acid**	See Hydantoic acid.		
4360	**Glycoluril**	acetylenediurein	$C_2H_2(CON_2H_2)_2$	142.12
4361	**Glyconic acid.**	See Gluconic acid.		
4362	**Glycosterin.**	See Diethylene glycol, distearate.		
4363	**Glyoxal**	ethanedial*; oxalaldehyde; biformyl	$CHOCHO$	58 04
4364	——, dioxime.	See Glyoxime.		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc
4316							
4317							
4318	cr.	$0.8786\frac{60.5}{4}$	51.5	. . . .	. . . .	24.08^{25}	s. h. eth.
4319	cr.	$0.8780\frac{60}{4}$	58.5	. . . .	. .	10.61^{29}	s. h. eth.
4320							
4321							
4322							
4323							
4323M							
4324							
4324M							
4325							
4326							
4327							
4328							
4329							
4330							
4331							
4332							
4333							
4334							
4335							
4336							
4337							
4338							
4339							
4340							
4341							
4342							
4343	col. pl		97	.	v. s.	v. s. h.	sl. s. eth
4344	col rhomb		120	. . .	v s.	sl. s.	sl. s. eth.
4345							
4346	rhomb. leaf. f. eth.		α63; β79	d.	s.	s.	s. eth
4347	col. liq. . . .	$1.0826\frac{23}{4}$	.	160		v. s.	v. s eth
4348							
4349	col. liq.	$1.168\frac{18}{4}$	. . .	151 2	s.	∞	∞ eth
4350							
4351	lng. pr	.	125	.	sl s. c	s.	s. eth.
4352							
4353							
4354							
4355							
4356							
4357	cr. powd	. . .	130	d.	i. c., s. h.	i.	i. eth.
4358	col. leaf. f. al.	. . .	86–7	. . . . .	s. h.	sl. s.	sl. s. eth.; s. ac. a, h. chl.
4359							
4360	wh. need. f. w.	. . .	. . . .	. . . . .	1.333^{15}	s.	s. eth.
4361							
4362							
4363	yel. cr., 1.3828.	$1.14\frac{20}{4}$	15	50.4	v. s.	s.	s. eth.
4364							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4365	**Glyoxal, di-2-furyl-.**	See *Furil.*		
4366	**——, dimethyl-.**	See 2,3-*Butanedione*.*		
4367	**——, diphenyl-.**	See *Benzil.*		
4368	**Glyoxalic acid.**	See *Glyoxylic acid.*		
4369	**Glyoxaline.**	See *Imidazole.*		
4370	**Glyoxime**	glyoxal dioxime	HON:CHCH:NOH	88 07
4371	**——, dimethyl-**	2,3-butanedione dioxime*; diacetyl dioxime	$CH_3C(:NOH)C(.NOH)CH_3$	116 12
4372	**Glyoxyldiureide.**	See *Allantoin.*		
4373	**Glyoxylic acid**	oxoethanoic acid*; glyoxalic acid, oxalaldehydic acid	HCOCOOH	74 04
4374	**——, o-aminophenyl-.**	See *Isatic acid.*		
4375	**——, o-carboxyphenyl-.**	See *Phthalonic acid.*		
4376	**——, o-nitrophenyl-**	*o*-nitrobenzoylformic acid.	$NO_2C_6H_4COCOOH$	195 13
4377	**——, phenyl-**	benzoylformic acid	$C_6H_5COCOOH$	150.13
4378	**——, 2-thienyl-.**	See 2-*Thiopheneacetic acid, α-oxo-.*		
4379	**Gnoscopine**	*dl*-narcotine	$C_{22}H_{23}NO_7$	413 41
4380	**Gommelin.**	See *Dextrin.*		
4381	**Granatonine, methyl-.**	See *Pseudopelletierine.*		
4382	**Grape sugar.**	See D-*Glucose.*		
4383	**Guaiacol**	*o*-methoxyphenol; pyrocatechol monomethyl ether, *o*-hydroxyanisole	$CH_3OC_6H_4OH$	124 13
4384	**——, 4-allyl-.**	See *Eugenol*		
4385	**——, 5-allyl-.**	See *Chavibetol*		
4386	**——, 4-methyl-.**	See *Creosol.*		
4387	**——, 4-propenyl-.**	See *Isoeugenol.*		
4388	**——, 5-vinyl-.**	See *Hesperetol.*		
4389	**Guaiene**	2,3-dimethylnaphthalene	$C_{10}H_6(CH_3)_2$	156 22
4390	**Guaiole.**	See *Tiglaldehyde.*		
4391	**Guanidine**	aminomethanamidine*; carbamamidine; aminoformamidine	$NH:C(NH_2)_2$	59 07
4391H	——, carbonate		$2CH_5N_3 \cdot H_2CO_3$	180 18
4391R	——, picrate		$CH_5N_3 \cdot C_6H_3O_7N_3$	288 18
4392	**——, 1-amino-**	guanylhydrazine	$NH_2NHC(.NH)NH_2$	74 09
4393	**——, 1-carbamyl-.**	See *Urea, guanyl-.*		
4394	**——, 1-cyano-**	dicyan(o)diamide; param	$NH_2C(\cdot NH)NHCN$	84 08
4395	**——, diphenyl-**	melaniline	$NH:C[NHC_6H_5]_2$	211 26
4396	——, ——, mercaptide with 2-benzothiazolethiol. See under 2-*Benzothiazolethiol*			
4397	**——, di-o-tolyl-**		$C_{15}H_{17}N_3$	239 31
4398	**——, guanyl-.**	See *Biguanide.*		
4399	**——, nitro-***		$NH_2C(:NH)NHNO_2(?)$	104 07
4400	**——, phenyl-o-tolyl-**		$C_{14}H_{15}N_3$	225 29
4401	**——, 1,1,3,3-tetraphenyl-***		$NH:C[N(C_6H_5)_2]_2$	363.44
4402	**——, 1,1,3-triphenyl-***	*β*-triphenylguanidine	$HN:C(NHC_6H_5)N(C_6H_5)_2$	287 35
4403	**——, 1,2,3-triphenyl-***	*α*-triphenylguanidine	$C_6H_5N:C(NHC_6H_5)_2$	287 35

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4365							
4366							
4367							
4368							
4369							
4370	rhomb. tab. f. w.		178		v s h	s	s. eth.
4371	col. cr. f. dil. al.	.	234 5 (246)		i.	v. s.	v. s. eth.
4372							
4373	col. rhomb ...		d.		v s.	s.	. . .
4374							
4375							
4376	need. f w		46–7		v s h		
4377	col. cr. f. CCl_4		66	$147\text{–}51^{12}$	s.	s.	s. eth.; i. CS_2
4378							
4379	lng. need .		229			06	s. chl., bz.; i. alk.
4380							
4381							
4382							
4383	col hex. pr, $1\ 53833^{21.4}_{\alpha}$	$1\ 1287\frac{21.4}{4}$	28 2 (32)	205; $106\ 5^{24}$	$1\ 6^{15}$	s.	s. eth., chl, glac. ac. a.
4384							
4385							
4386							
4387							
4388							
4389	leaf. f. al...	$1\ 008\frac{20}{4}$	104–104 5	260–265	i.	s.	s. eth.
4390							
4391	col cr				v s.	v. s	.
4391 H	octahr. or tetr. columns	1 24	197		v s c	i	.
4391R	or-yel. pl. or need.		333 d.	.	037^{0}; 574^{80}	sl. s.	sl. s eth.
4392	cr		d.		s.	s.	i. eth.
4393							
4394	rhomb. leaf	$1\ 40\frac{14}{4}$	205 (207)	d.	$2\ 26^{13}$	$1\ 26^{13}$	$0\ 01^{13}$ eth.; i. bz.
4395	monocl. need f. al.	$1\ 13\frac{20}{4}$	147–8	d. >170	sl s	$9\ 1^{20}$ 90%, 5^{16}	v. sl s. eth.; s. CCl_4, chl., h. bz., h tol, dil. min a.
4396							
4397	wh. cr. ..	$1\ 10\frac{20}{4}$	179	.	v sl. s.	sl. s. c., s. h.	sl. s. eth
4398							
4399	yelsh. need. f. w.		246–7 (231)		$0\ 26^{18.5}$	sl. s.	i eth, s sol. KOH
4400	wh. cr	. . .	129 5–30	.	v. sl s.	sl. s. c., s h.	sl. s eth.
4401	rhomb. f. lgr	.	130		i.	s.	s. eth, v. s. bz.
4402	regular tab . .		131		v. sl. s.	v. s	v. s. eth; sl. s. bz.
4403	wh need. or pr f al	$1\ 13\frac{20}{4}$	145	d.	v. sl. s.	3.55 c.	s. eth., chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4404	**Guanine**	2-aminohypoxanthine	$C_5H_5N_5O$	151 13
4404M	D-**Gulose**	*l*-gulose, formerly	$C_6H_{12}O_6$	180 16
4405	**Guncotton.**	See *Cellulose, hexanitrate.*		
4406	**Guvacine**		$C_6H_9NO_2$	127 14
4407	——, **1-methyl-.**	See *Arecaidine.*		
4408	**H acid.**	See 1-*Naphthol*-3,6-*disulfonic acid, 8-amino-.*		
	Haem-.	See *Hem-.*		
4409	**Harmaline**		$C_{13}H_{14}N_2O$	214 26
4410	**Harmine**		$C_{13}H_{12}N_2O$	212 24
4411	**Helenin**	alantolactone	$C_{15}H_{20}O_2$	232.31
4412	*l*-**Helicin**	salicylaldehyde glucoside	$C_6H_4(OC_6H_{11}O_5)$-CHO	284 26
4413	**Heliotropin.**	See *Piperonal.*		
4414	**Hematein**	haematin; hematin	$C_{16}H_{12}O_6$	300 26
4415	**Hematin**	haematin	$C_{32}H_{32}FeN_4O_4$	592 45
4416	**Hematoxylin**	haematoxylin	$C_{16}H_{14}O_6\,3H_2O$	356 32
4417	**Hemellitene.**	See *Hemimellitene.*		
4418	**Hemellitic acid**	2,3-dimethylbenzoic acid; 2,3-xylic acid, *vic-o*-xylic acid	$(CH_3)_2C_6H_3COOH$	150 17
4419	**Hemimellitene**	1,2,3-trimethylbenzene; *vic*-trimethylbenzene, hemellitene	$(CH_3)_3C_6H_3$	120 19
4420	——, **4,5,6-trinitro-**		$(NO_2)_3C_6(CH_3)_3$	255 19
4421	**Hemimellitic acid**	1,2,3-benzenetricarboxylic acid*	$C_6H_3(COOH)_3$	210 14
4422	**Hemipic acid**	3,4-dimethoxyphthalic acid; hemipinic acid; narcotine hemipic acid	$(CH_3O)_2C_6H_2$-$(COOH)_2$	226 18
4423	**Hemiterpene.**	See *Isoprene.*		
4424	**Hendecanal***	undecanal*, *n*-undecylaldehyde	$CH_3(CH_2)_9CHO$	170 29
4425	——, oxime		$CH_3(CH_2)_9$-$CH{\cdot}NOH$	185 30
4426	**Hendecane***	undecane*	$CH_3(CH_2)_9CH_3$	156 30
4427	——, **1-amino-.**	See *Hendecylamine**.		
4428	**Hendecanoic acid***	undecanoic acid*; *n*-undecylic acid	$CH_3(CH_2)_9COOH$	186 29
4429	**1-Hendecanol***	1-undecanol*; *pri-n*-undecyl alcohol	$CH_3(CH_2)_9CH_2OH$	172 30
4430	**2-Hendecanol***	2-undecanol*; methylnonylcarbinol	$CH_3(CH_2)_8CH$-$OHCH_3$	172 30
4431	**2-Hendecanone***	2-undecanone*; methyl nonyl ketone	$CH_3CO(CH_2)_8$-CH_3	170 29
4432	**3-Hendecanone***	3-undecanone*; ethyl octyl ketone	$C_2H_5CO(CH_2)_7$-CH_3	170 29

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4404	col. need......	....	360 d.	...	i.	v. sl. s.	v. sl. s eth., NH_4OH; s. KOH
4404M	col syrup, $[\alpha]^{20}_D$ -20.4°	....	....	..	s.	sl. s.	... .
4405							
4406	lust. sc......	......	271-2 d.	.	s.	s.	i. eth.
4407							
4408							
4409	rhomb pr. f al.+bz.	.	250 d. (238)	.	v sl. s.	sl. s.	sl. s. eth
4410	monocl or rhomb. pr. f. al.		257-9 d	.	2 5[20]	sl. s.	sl. s. eth
4411	wh need. f. al.+w.		76	275; 192[10]	v sl s	v. s.	v. s. eth, s. bz., chl.
4412	fine need	..	175	. ..	60 c, v s. h.	s.	i. eth.
4413							
4414	br. pl	. .	250 d.	. ....	0 6[20]	sl. s.	0.0093[20] eth.; s alk, i bz, chl.
4415	br powd .	.... ..	>200	.. ... .	i.	i. c., s. h.	i. eth., chl.; s. alk
4416	col.-yelsh. tetr. cr. f. dil. $(NH_4)_2SO_4$	.	anh. 140	$-H_2O$, 100-20	v. sl. s	s.	s.eth., NH_4OH, glyc, caustic alk.
4417							
4418	col. pr f al		144	..... .	v. sl. s. h.	s.	s. eth.
4419	col. liq, 1.51335[19.55]	0 $895\frac{20}{4}$	<-15	176 5	i	s.	s. eth
4420	pr f al .	.	209		i.	s.	.
4421	col need		190	d.	3 15[19]	.	s. eth.
4422	monocl. cr ..	.	186-8; 159-60 anh.	subl.	sl s.	sl. s.	0 7 eth
4423							
4424	liq., 1.4334	0 $830\frac{20}{1}$	-4	117[18]	i.	s.	s. eth.
4425	need. f. me al	.	72	. . . .	s.	s.	s. eth.
4426	col. liq., 1 4184	0 $741\frac{20}{4}$	-26 5	195 84 (197)	i.	∞	∞ eth.
4427							
4428	col sc. 1 4294[45.2]	0 8905; 0 $8889\frac{30}{4}$	29 3	228[160] .	i.	sl. s.	s. eth.
4429	cr or liq., 1.4404	0 $8334\frac{23}{4}$	11 (19)	131[15]	i.	s.	v. s. eth.
4430	liq	0 8363	12	225.4; 228-9	.02[20]	s.	s eth.
4431	col. arom. liq., 1.43002[17.3]	0 $826\frac{20}{4}$	15; (12 1); frz. 6	228 (226)	i.	s.	s eth.
4432	liq .	.	4 5	104-6 (227)	i.	s.	s. eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4433	**6-Hendecanone***	6-undecanone*; diamyl ketone, dipentyl ketone; (*n*)-caprone	$CH_3(CH_2)_4CO(CH_2)_4CH_3$	170.29
4434	**2-Hendecene***.........	2-undecene*; β-undecylene...	$CH_3CH{:}CH(CH_2)_7CH_3$	154.29
4435	**9-Hendecenoic acid***..	9-undecenoic acid*; θ-undecylenic acid	$CH_3CH{:}CH(CH_2)_7COOH$	184 27
4436	**Hendecylamine*** (*n*)...	pri-*n*-undecylamine; 1-aminohendecane	$CH_3(CH_2)_{10}NH_2$.	171.32
4436M	**1-Hendecyne***..	1-undecyne*; rutylidene. .	$CH{:}C(CH_2)_8CH_3$	152 27
4437	**Heneicosane***...... ..	....	$CH_3(CH_2)_{19}CH_3$..	296 57
4438	**Hentriacontane*** .	*n*-hentriacontane .	$CH_3(CH_2)_{29}CH_3$.	436 83
4439	**16-Hentriacontanone***	dipentadecyl ketone; palmitone	$(C_{15}H_{31})_2CO$.. .	450 81
4439M	**Hepatoflavin.**	See D-*Riboflavin.*		
4440	**Heptacosane***.........	*n*-heptacosane .	$CH_3(CH_2)_{25}CH_3$	380 72
4440M	**1-Heptacosanol***.. ...	*n*-heptacosyl alcohol	n-$C_{27}H_{55}OH$.	396 72
4440Q	***n*-Heptacosyl alcohol.**	See 1-*Heptacosanol.**		
4441	**Heptadecane***.........	*n*-heptadecane	$CH_3(CH_2)_{15}CH_3$	240 46
4441M	**——, 1-amino-.**	See *Heptadecylamine**(*n*).		
4442	**9-Heptadecanecarboxylic acid*.** See *Capric acid, α-octyl-.*			
4443	**Heptadecanenitrile*.**	See *Margaronitrile.*		
4444	**Heptadecanoic acid*.**	See *Margaric acid.*		
4445	**1-Heptadecanol***......	pri-*n*-heptadecyl alcohol	$CH_3(CH_2)_{16}OH$.	256 46
4446	**9-Heptadecanone***....	di-*n*-octyl ketone, pelargone; nonylone	$(C_8H_{17})_2CO$ ..	254 45
4447	***n*-Heptadecoic acid.**	See *Margaric acid.*		
4448	***pri-n*-Heptadecyl alcohol.** See 1-*Heptadecanol**.			
4448M	**Heptadecylamine***(*n*)	1-aminoheptadecane .	$CH_3(CH_2)_{16}NH_2$.	255 48
4449	***n*-Heptadecylic acid.**	See *Margaric acid.*		
4450	**2,4-Heptadiene*** ..	....	$CH_3CH{:}CHCH{:}CHCH_2CH_3$	96 17
4450M	**1,3-Heptadiene, 2,6-dimethyl-***	isogeraniolene..	$CH_2{:}C(CH_3)CH{\cdot}CHCH_2CH(CH_3)_2$	124.22
4451	**1,6-Heptadiene-3,5-dione, 1,7-bis(4-hydroxy-3-methoxyphenyl)-*.**			
4452	**2,5-Heptadien-4-one, 2,6-dimethyl-*.** See *Phorone*			
4453	***n*-Heptaldehyde.**	See *Enanthaldehyde.*		
4454	***n*-Heptaldoxime.**	See *Enanthaldehyde, oxime.*		
4455	**Heptamethylene.**	See *Cycloheptane**.		
4456	**Heptamethylene glycol.** See 1,7-*Heptanediol**.			
4457	**Heptanal*.**	See *Enanthaldehyde.*		
4458	**Heptane***	*n*-heptane .	$CH_3(CH_2)_5CH_3$.	100 20
4458M	***n*-Heptane, 2-amino-.**	See *Hexylamine, α-methyl-.*		
4459	**Heptane, 1-bromo-***...	*n*-heptyl bromide.......	$CH_3(CH_2)_6Br$	179 11
4460	**——, 1-chloro-***.......	*n*-heptyl chloride.....	$CH_3(CH_2)_6Cl$	134 65
4461	**——, 2,6-dimethyl-***...	diisobutylmethane; isobutylisoamyl	$(CH_3)_2CH(CH_2)_3CH(CH_3)_2$	128.25
4462	**Heptane, 1-ethoxy-*.**	See *Ether, ethyl heptyl.*		
4463	**——, 4-ethyl-***........	ethyldipropylmethane. . .	$CH_3(CH_2)_2CH(C_2H_5)(CH_2)_2CH_3$	128 25
4464	**——, 1-heptyloxy-*.**	See *Heptyl ether.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4433	leaf........	0 $8262\frac{20}{4}$	14–5	226	i.	v. s.	v. s. eth.
4434	col. liq., 1.4333	0 $7729\frac{20}{4}$	....	193	i.	∞	∞ eth.
4435	wh. cr. mass or col. to yelsh. liq.	0 $9075\frac{25}{4}$	24 5	295	i.	∞	∞ eth.; s. chl.
4436	col. liq....	...	16.5	241.6	sl. s.	s.	s eth.
4436M	liq	0 $867\frac{25}{4}$	–33	210–5	i.	s.	s. eth.
4437	cr., $1.4344^{45.8}$	0 $778\frac{40}{4}$	40	215^{15}	.. ...	. .	.. ....
4438	cr	0 $781\frac{68}{4}$	68.1	302^{15}	.	.. .	sl. s. eth.
4439	leaf. f. al., $1\ 4297^{93.5}$	liq. 0 $795\frac{91}{4}$	82.8	.. ...	i.	s.	s. eth.
4439M							
4440	cr	0 $780\frac{60}{4}$	59 5	270^{15}	i	v. s.	sl. s. eth.
4440M	.... .	. ..	81 2–81.6	....		.. ..	. . . ..
4440Q							
4441	hex. leaf., 1.437	0 $778\frac{20}{4}$	22.5	303	i	sl. s.	s eth.
4441M							
4442							
4443							
4444							
4445	cr	8475	53 31 (54)	308 5	$01+^{20}$	s	s eth.
4446	pl. f. me. al	.	53 (50 5^{0})			sl. s.	s. me. al.
4447							
4448							
4448M	col. cr........			335 9; 155 0^{2}	i	s	s. eth.
4449							
4450	liq........ .	0 $733\frac{21\ 5}{4}$		107 (104–6)			.... .
4450M	liq.......... .	0.$765\frac{10}{4}$	..	$143–5^{755}$	i.	.	. . . .
4451	See *Curcumin.*						
4452							
4453							
4454							
4455							
4456							
4457							
4458	col liq., 1.3867^{23}	0 $684\frac{20}{4}$	–90 5	98 52	$0.0052^{15.5}$	100	∞ eth., chl.
4458M							
4459	col. liq....	1 $133\frac{16}{4}$	–58 86	178.8	i.	v. s.	v. s. eth.
4460	liq., 1.42844 .	0 $8725\frac{20}{0}$	–69 5	159.5	i.	∞	∞ eth.
4461	col. liq......	0 $7247\frac{0}{4}$; 0.$712\frac{20}{0}$	......	132–3	i.	i.	s. eth.
4462							
4463	col. liq., 1.408.	0 $741\frac{20}{4}$	.. ..	139	i.	i.	s. eth.
4464							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4465	**Heptane, 1-iodo-***	*n*-heptyl iodide.....	$CH_3(CH_2)_5CH_2I$..	226.11
4466	**——, 1-methoxy-*.**	See *Ether, heptyl methyl.*		
4467	**——, 2-methyl-***......	amyldimethylmethane; isooctane	$(CH_3)_2CH(CH_2)_4$-CH_3	114 23
4468	**——, 3-methyl-***......	butylethylmethylmethane	$CH_3CH_2CH(CH_3)$-$(CH_2)_3CH_3$	114.23
4469	**——, 4-methyl-***.	methyldipropylmethane .	$CH_3(CH_2)_2CH$-$(CH_3)(CH_2)_2CH_3$	114 23
4470	**——, 1-phenoxy-*.**	See *Ether, heptyl phenyl.*		
4471	**3-Heptanecarboxylic acid.**	See *Caproic acid, α-ethyl-.*		
4472	**1,7-Heptanedicarboxylic acid.**	See *Azelaic acid.*		
4473	**Heptanedioic acid.***	See *Pimelic acid.*		
4474	**——, 4-oxo-*.**	See *Acetonediacetic acid.*		
4475	**1,7-Heptanediol*** ...	heptamethylene glycol .	$CH_2OH(CH_2)_5$-CH_2OH	132.20
4476	**1-Heptanethiol*** ..	*n*-heptyl mercaptan.	$CH_3(CH_2)_5CH_2SH$	132 26
4477	**Heptanoic acid*.**	See *Enanthic acid.*		
4478	**1-Heptanol***........	*n*-heptyl alcohol .	$CH_3(CH_2)_5CH_2OH$	116 20
4479	——, esters of organic acids.	See "heptyl ester" under the names of the acids.		
4480	——, nitrite.	See *Heptyl nitrite.*		
4481	**2-Heptanol***.	amylmethylcarbinol .	CH_3CHOH-$(CH_2)_4CH_3$	116 20
4482	**——, 2-methyl-*** .	amyldimethylcarbinol .	$(CH_3)_2COH$-$(CH_2)_4CH_3$	130 23
4483	**3-Heptanol, 3-methyl-***	butylethylmethylcarbinol	CH_3CH_2COH-$(CH_3)(CH_2)_3CH_3$	130 23
4484	**4-Heptanol*** . . .	dipropylcarbinol .	$CH_3(CH_2)_2CH$-$OH(CH_2)_2CH_3$	116 20
4485	**——, 2,6-dimethyl-*.** .	diisobutylcarbinol .. .	$[(CH_3)_2CHCH_2]_2$-$CHOH$	144 25
4486	**——, 4-ethyl-*** .. .	ethyldipropylcarbinol.	CH_3CH_2COH-$(CH_2CH_2CH_3)_2$	144 25
4487	**——, 4-methyl-*** .	methyldipropylcarbinol.	$CH_3(CH_2)_2COH$-$(CH_3)(CH_2)_2CH_3$	130 23
4488	**——, 4-propyl-*** .	tripropylcarbinol; *tert*-decyl alcohol	$(C_3H_7)_3COH$.	158 28
4489	**2-Heptanone*** ...	amyl methyl ketone	$CH_3CO(CH_2)_4CH_3$	114.18
4490	**3-Heptanone*** . .	ethyl butyl ketone	$C_2H_5CO(CH_2)_3CH_3$	114.18
4491	**——, 6-methyl-*** .	ethyl isoamyl ketone.	$C_2H_5COCH_2CH_2$-$CH(CH_3)_2$	128.21
4492	**4-Heptanone***	dipropyl ketone, butyrone	$C_3H_7COC_3H_7$ ..	114 18
4493	**——, 2,6-dimethyl-*.**	diisobutyl ketone; *s*-diisopropylacetone, isovalerone, valerone	$[(CH_3)_2CHCH_2]_2$-CO	142 24
4494	**——, 2-methyl-***......	isobutyl propyl ketone	$CH_3CH_2CH_2CO$-$CH_2CH(CH_3)_2$	128 21
4495	**1-Heptene***	α-heptylene . .	$CH_2:CH(CH_2)_4$-CH_3	98 18
4496	**2-Heptene***...........	1-butyl-2-methylethylene; β-heptylene	$CH_3CH:CH$-$(CH_2)_3CH_3$	98 18
4497	**3-Heptene***...	1-ethyl-2-propylethylene, γ-heptylene	$CH_3CH_2CH:CH$-$CH_2CH_2CH_3$	98 18

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
4465	liq .	$1\ 4034^{0}_{4}$, $1\ 366^{21}_{4}$	-48 2	203 95, $91\text{-}3^{20}$	i.	s	s. eth.
4466							
4467	col liq, 1.3935	$0\ 7029^{20}_{4}$		116 0	i	sl s	s. eth.
4468	liq	0 7161		122 2	i	sl s	s. eth
4469	col liq, $1\ 398^{15}$	$0\ 7211^{20}_{4}$		118 0	i	sl s	s eth
4470							
4471							
4472							
4473							
4474							
4475	cr .		12	259, $143\ 6^{8}$	s	s	i eth
4476	liq .	$0\ 8389^{25}_{4}$	-43 4	176 2 (174-5)	i	∞	∞ eth.
4477							
4478	col liq, $1\ 42410^{20}$	$0\ 8219^{20}_{4}$	-34 6	176	$0\ 09^{18}$, $0\ 28^{100}$	∞	∞ eth.
4479							
4480							
4481	liq, 1 4213, $1\ 4190^{25}$	8187	.. .	160 4	35^{20}	s	s. eth.
4482	col liq, 1 4303	$0\ 879^{20}_{4}$	. ...	162	i	s	s. eth.
4483	col liq., $1\ 4279^{20}$	$0\ 8282^{20}_{4}$	.	163 5, 65 2-$65\ 8^{15}$	v sl s	s	s eth.
4484	liq, 1 4205	$0\ 820^{20}_{4}$	-41 5	155 4	i	s	s eth.
4485	col liq, $1\ 423^{21}$	$0\ 8237^{0}_{4}$, $0\ 8155^{12}_{4}$		$172\text{-}4^{750}$	i	s	s eth.
4486	liq	$0\ 8349^{20}_{4}$		179 5	i	s	s eth.
4487	col liq, 1 427	$0\ 8248^{20}_{4}$		161 5	i	s	s. eth.
4488	col oil	$0\ 8338^{21}_{0}$		190 2	i	s	.
4489	col liq	$0\ 822^{15}_{4}$		150	v sl s	s	s eth
4490	col liq	$0\ 8183^{20}_{4}$	39 0	148 5	i	∞	∞ eth
4491	liq			163 5	i	s	s. eth
4492	col liq, $1\ 40732^{20}$	$0\ 8174^{20}_{4}$	32 6, (-34)	144	i	∞	∞ eth.
4493	col oil, $1\ 412^{21}$	$0\ 806^{20}_{4}$		168 (165-6)	i	∞	∞ eth
4494	liq . .	0 813		155	i	s	s eth
4495	col liq .	$0\ 6993^{20}_{4}$	-10	94 9 (95-100)	i	s.	s eth.
4496		$0\ 7034^{20}_{4}$		98 1-8 4			
4497		$0\ 7043^{20}_{4}$		95 8-6 1			.

For explanations and abbreviations see beginning of table

No.	Name	Synonyms	Formula	Mol. Wt.
4497M	**1-Hepten-4-ol, 4-methyl-***	allylmethylpropylcarbinol	$CH_2{:}CHCH_2C(CH_3)(C_3H_7)OH$	128 21
4498	**5-Hepten-2-one, 6-methyl-***		$(CH_3)_2C{:}CH(CH_2)_2COCH_3$	126 19
4499	**Heptine.**	See *Heptyne**.		
4500	***n*-Heptoic acid.**	See *Enanthic acid*		
4501	***pri-n*-Heptyl alcohol.**	See 1-*Heptanol**		
4502	***n*-Heptyl aldehyde.**	See *Enanthaldehyde.*		
4503	**Heptylamine*** (*n*) .		$CH_3(CH_2)_6NH_2$	115 22
4504	——, **α-methyl-**	2-aminooctane, *sec-n*-octylamine, *sec-n*-caprylamine	$CH_3(CH_2)_5CH(CH_3)NH_2$	129 24
4505	***n*-Heptyl bromide.**	See *Heptane,* 1-*bromo-**.		
4506	***n*-Heptyl chloride.**	See *Heptane,* 1-*chloro-**.		
4507	***n*-Heptyl cyanide.**	See *Caprylonitrile.*		
4508	**Heptylene.**	See *Heptene**.		
	Heptyl esters of organic a	cids. See "heptyl ester," under	the names of the acid	s
4509	**Heptyl ether**	1-heptyloxyheptane*, di-*n*-heptyl ether	$(C_7H_{15})_2O$	214 38
4510	***n*-Heptylic acid.**	See *Enanthic acid*		
4511	***n*-Heptyl iodide.**	See *Heptane,* 1-*iodo-**		
4512	***n*-Heptyl mercaptan.**	See 1-*Heptanethiol**.		
4513	**Heptyl nitrite** (*n*)		$CH_3(CH_2)_6ONO$	145 20
4514	**Heptyl sulfate**	di-*n*-heptyl sulfate	$[CH_3(CH_2)_6]_2SO_4$	294 44
4515	**1-Heptyne***	1-heptine, *n*-amylacetylene, enanthylidene	$CH{:}C(CH_2)_4CH_3$	96 17
4516	**2-Heptyne***	2-heptine, butylmethylacetylene	$CH_3C{:}C(CH_2)_3CH_3$	96 17
4516F	**3-Heptyne***	3-heptine, ethylpropyl acetylene	$C_2H_5C{:}C(CH_2)_2CH_3$	96 17
4517	**Herapathite.**	See *Quinine, iodosulfate*		
4518	**Heroin.**	See *Morphine, diacetyl-*		
4519	**Hesperetic acid.**	See *Isoferulic acid*		
4520	**Hesperetol**	5-vinylguaiacol, 3-hydroxy-4-methoxystyrene	$CH_2{:}CHC_6H_3(OCH_3)OH$	150 17
4521	**Hesperidene.**	See *d-Limonene*		
4522	**Hesperidin** .		$C_{22}H_{26}O_{12}$	482 43
4523	**Hexacosanoic acid*.**	See *Cerotic acid*		
4524	**1-Hexacosanol*.**	See *Ceryl alcohol*		
4525	***n*-Hexacosyl alcohol.**	See *Ceryl alcohol*		
4526	**Hexadecanal,** oxime*.	See *Palmitaldehyde, oxime*		
4527	**Hexadecanamide*.**	See *Palmitamide*		
4528	**Hexadecane***	*n*-hexadecane, cetane, bioctyl	$CH_3(CH_2)_{14}CH_3$	226 44
4528M	——, **1-amino-.**	See *Cetylamine.*		
4529	——, **1-hexadecyloxy-*.**	See *Cetyl ether*		
4530	——, **1-iodo-*.**	See *Cetyl iodide*		
4531	——, **1-phenoxy-*.**	See *Ether, cetyl phenyl*		
4532	**Hexadecanenitrile*.**	See *Palmitonitrile*		
4533	**Hexadecanoic acid*.**	See *Palmitic acid*		
4534	**1-Hexadecanol*.**	See *Cetyl alcohol.*		
4535	**Hexadecanoyl chloride**	*. See *Palmitoyl chloride*		
4536	**7-Hexadecenoic acid*.**	See *Hypogeic acid (artificial)*		
4537	**2-Hexadecine.**	See 2-*Hexadecyne**		
4537M	***n*-Hexadecyl.**	See *Cetyl.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
4497M				$159–160^{748}$	.		.. . . ..
4498	col. liq	0.860^{20}_{4}	-67.3	174	i	∞	∞ eth.
4499							
4500							
4501							
4502							
4503	col. liq., 1.424	0.777^{20}_{4}	-23	158.3	sl. s.	∞	∞ eth.
4504	liq., 1.4254	0.7721^{20}_{4}		164-6	i	v. s	v. s. eth.
4505							
4506							
4507							
4508							
4509	col. liq. . .	0.815^{0}_{4}		260	i	s	s. eth.
4510							
4511							
4512							
4513	liq	0.8939^{0}_{4}		155	i		s. eth.
4514	col. liq., 1.4362^{25}	0.9819^{25}_{25}	11.4	$146.6^{1.5}$			. . . . ..
4515	col. liq	$0.738^{19.6}_{4}$ 0.7288^{25}_{4}	-70	99.8; 26.5^{50}	i	∞	∞ eth.
4516	col. liq., 1.4220^{25}	0.745^{25}, 0.750^{19}_{4}		112, 39.5^{50}	i	∞	∞ eth.
4516F	col. liq., 1.415^{25}	0.7337^{25}		106-7	i	∞	∞ eth.
4517							
4518							
4519							
4520	cr		57		v. sl. s	v. s	v. s. eth.
4521							
4522	yel. hyg. need		171	251 d.	0.02 h	0.5	i eth., bz., s.h. ac. a.
4523							
4524							
4525							
4526							
4527							
4528	col. leaf.	0.7751^{20}_{4}	20 (16–7)	287.5	i.	∞	∞ eth.
4528M							
4529							
4530							
4531							
4532							
4533							
4534							
4535							
4536							
4537							
4537M							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
4538	***n*-Hexadecylic acid.**	See *Palmitic acid.*		
4538X	**1-Hexadecyne***		$CH_3(CH_2)_{13}C:CH$	222.40
4539	**2-Hexadecyne*.**	2-hexadecine, cetylene	$CH_3(CH_2)_{12}$-$C:CCH_3$	222.40
4540	**7-Hexadecynoic acid*.**	See *Palmitolic acid*		
4541	**1,5-Hexadiene***	biallyl; diallyl	$CH_2{:}CHCH_2CH_2$-$CH{:}CH_2$	82.14
4542	**2,4-Hexadiene***	bipropenyl, dipropylene	$CH_3CH{:}CH$-$CH{:}CHCH_3$	82.14
4543	**——, 2,5-dimethyl-***	diisocrotyl	$(CH_3)_2C{:}CH$-$CH{:}C(CH_3)_2$	110.19
4544	**2,4-Hexadienedioic acid*.**	See *Muconic acid*		
4544M	**1,5-Hexadiene-3, 4-diol***	divinyl glycol	$CH_2{:}CHCHOH$-$CHOH.CH{:}CH_2$	114.14
4545	**2,4-Hexadienoic acid*.**	See *Sorbic acid*		
4546	**1,5-Hexadien-3-yne***	divinylacetylene	$CH_2{:}CHC{:}C$-$CH{:}CH_2$	78.11
4547	**1,5-Hexadiyne***	bipropargyl, 1,5-hexadiine, dipropargyl	$CH{:}CCH_2CH_2$-$C{:}CH$	78.11
4548	**Hexalin.**	See *Cyclohexanol**		
4549	**Hexamethylene.**	See *Cyclohexane**		
4550	**Hexamethylenediamine.**	See 1,6-*Hexanediamine**		
4551	**Hexamethylene glycol.**	See 1,6-*Hexanediol**		
4552	**Hexamethylenetetramine**	methenamine, formamine, hexamine, urotropine	$(CH_2)_6N_4$	140.19
4553	**Hexamine.**	See *Hexamethylenetetramine*		
4554	**Hexanal*.**	See *Caproaldehyde*		
4555	**Hexanamide*.**	See *Caproamide*		
4556	**Hexane***	*n*-hexane	$CH_3(CH_2)_4CH_3$.	86.17
4557	**——, 1-amino-*.**	See *Hexylamine*		
4558	**——, 2-amino-.**	See *Amylamine, α-methyl-*		
4559	**——, 1-bromo-***	*n*-hexyl bromide	$CH_3(CH_2)_4CH_2Br$	165.08
4560	**——, 1-chloro-***	*n*-hexyl chloride	$CH_3(CH_2)_4CH_2Cl$	120.62
4561	**——, 2-chloro-***		$CH_3CHCl(CH_2)_3$-CH_3	120.62
4562	**——, dihydroxy-.**	See *Hexanediol**		
4563	**——, 1,6-diiodo-***	1,6-hexylene iodide	$ICH_2(CH_2)_4CH_2I$	338.00
4564	**——, 2,3-dimethyl-***	isopropylmethylpropylmethane	$CH_3CH(CH_3)CH$-$(CH_3)CH_2CH_2CH_3$	114.23
4565	**——, 2,4-dimethyl-***	ethylisobutylmethylmethane	$(CH_3)_2CHCH_2$-$CH(CH_3)CH_2CH_3$	114.23
4566	**——, 2,5-dimethyl-***	biisobutyl	$(CH_3)_2CH(CH_2)_2$-$CH(CH_3)_2$	114.23
4567	**——, 3,4-dimethyl-***	bi-*sec*-butyl, *sec*-butylethylmethylmethane	$CH_3CH_2CH(CH_3)$-$CH(CH_3)CH_2CH_3$	114.23
4568	**——, 1-ethoxy-*.**	See *Ether, ethyl hexyl*		
4569	**——, 3-ethyl-***	diethylpropylmethane	$(CH_3CH_2)_2CH$-$CH_2CH_2CH_3$	114.23
4570	**——, 1-iodo-*.**	*n*-hexyl iodide	$CH_3(CH_2)_4CH_2I$	212.09
4571	**——, 2-methyl-***	ethylisobutylmethane	$(CH_3)_2CH(CH_2)_2$-CH_2CH_3	100.20
4572	**——, 3-methyl-***	ethylmethylpropylmethane	$CH_3CH_2CH(CH_3)$-$CH_2CH_2CH_3$	100.20
4573	**——, 3-methylene-*.**	See 1-*Pentene, 2-ethyl-**		
4574	**——, 1-phenoxy-*.**	See *Ether, hexyl phenyl*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
4538							
4538X	cr	0.797^{20}	15	155^{15}	i		
4539	..		25	280–5			
4540							
4541	liq., 1.4044	0.6880^{20}_{4}	−141	59.6	i		s. eth
4542	col. liq., 1.4384	0.7108^{20}_{4}		82	i		
4543	col liq	0.7158^{21}_{4}	−91.3	102.5^{756}	i	s	s eth.
4544							
4544M	1.4745^{22}	1.006^{22}_{4}		100.2^{12}			.
4545							
4546	col liq., 1.504	0.7851^{20}_{4}		83.5			... ...
4547	col liq., $1.44132^{23.8}$	0.8049^{20}_{4}	frz. −6	86 (85.4)	i	s	v. s. eth.; s. ord org solv.
4548							
4549							
4550							
4551							
4552	rhomb f al		263	subl. 263 d	150^{20}	3	i eth ; s. H_2SO_4
4553							
4554							
4555							
4556	col liq., 1.37536	0.6603^{20}_{4}	94.3	69.0	$0.0138^{15.5}$	50^{33}	s eth., chl.
4557							
4558							
4559	liq., 1.4478	1.1705^{20}_{4}	85.0	156.0	i	∞	∞ eth.
4560	col liq., 1.4194	0.8719^{20}_{4}	−83	132.4	i		
4561	1.4142^{24} ..	$0.876^{1?}_{4}$		123 (125–6)			
4562							
4563	col need. or liq., 1.5899^{15}	2.05^{18}_{4}	9.5 (6–7)	163^{17} d	i	v s	v s eth.
4564	col liq., 1.4093	0.7240^{20}_{4}		113.9	i	sl s	s eth.
4565	col. liq., 1.4026	0.7077^{20}_{4}		110.0	i.	sl s	s. eth.
4566	col liq., 1.3929	0.6985^{20}_{4}	−91	108.25	i	sl s	s eth.
4567	liq., 1.4058	0.721^{20}_{4}		116.5	i	sl s	s eth.
4568							
4569	col. liq., 1.4016	0.7169^{20}_{4}	.	118.9	i	sl. s	s eth.
4570	col liq., 1.4929	1.441^{20}_{4}		180		.	... .
4571	col. liq.....	0.6789^{20}_{4}	−119.1	90.0	i	s.	s. eth.
4572	col. liq....	0.6957^{20}_{4} (0.6870^{20}_{4})	−119.4	89.4 (91.8)	i	s.	s. eth.
4573							
4574							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
4575	**3-Hexanecarboxylic acid.** See *Valeric acid, α-ethyl-*			
4576	**Hexanedial*.**	See *Adipaldehyde.*		
4577	**Hexanediamide*.**	See *Adipamide*		
4578	**1,6-Hexanediamine*.**	hexamethylenediamine	$NH_2(CH_2)_6NH_2$	116 21
4579	**Hexanedioic acid*.**	See *Adipic acid.*		
4580	——, **2,3,4,5-tetrahydroxy-.** See *Mucic acid, Saccharic acid.*			
4581	**1,6-Hexanediol*** ..	hexamethylene glycol	$CH_2OH(CH_2)_4$-CH_2OH	118 17
4582	**2,3-Hexanediol***	2,3-dihydroxyhexane	$CH_3(CH_2)_2$-$(CHOH)_2CH_3$	118 17
4583	**3,4-Hexanediol, 3,4-diethyl-***	tetraethylethylene glycol	$(C_2H_5)_2COHCO$-$HC(C_2H_5)_2$	186 29
4584	**2,3-Hexanedione,** 3-oxime*	α-isonitrosobutyl methyl ketone	$CH_3COC(NOH)$-$(CH_2)_2CH_3$	129 16
4585	**2,5-Hexanedione***...	acetonylacetone, *sym*-diacetylethane	$CH_3CO(CH_2)_2$-$COCH_3$	114 14
4586	**Hexanedioyl chloride*.**	See *Adipyl chloride*		
4587	**1,2,3,4,5,6-Hexanehexol*.** See *Dulcitol, Sorbitol.*			
4588	**Hexanenitrile*.**	See *Capronitrile.*		
4589	**1,2,3,4,5-Hexanepentol*.** See *Rhamnitol.*			
4590	**1-Hexanethiol***	*pri-n*-hexyl mercaptan	$CH_3(CH_2)_5SH$	118 23
4591	**Hexanoic acid*.**	See *Caproic acid*		
4592	**Hexanoic anhydride*.**	See *Caproic anhydride*		
4593	**1-Hexanol*** .	*n*-hexyl alcohol, amylcarbinol	$CH_3(CH_2)_4CH_2OH$	102 17
4594	——, esters of organic acids	See "hexyl ester" under the names of the acids.		
4595	——, nitrite . .	See *Hexyl nitrite.*		
4596	——, **2-ethyl-*** . .		$C_4H_9CH(C_2H_5)$-CH_2OH	130 23
4597	——, ——, acetate	β-ethylhexyl acetate	$C_4H_9CH(C_2H_5)$-CH_2OOCCH_3	172 26
4598	——, **3-isopropyl-5-methyl-***	isocapric alcohol, β-isoamylisoamyl alcohol, diamyl alcohol	$(CH_3)_2CHCH$-$(CH_2OH)(CH_2)_2$-$CH(CH_3)_2$	158 28
4599	——, **2-methyl-***		$CH_3(CH_2)_3CH$-$(CH_3)CH_2OH$	116 20
4600	——, **5-methyl-*.**	isoheptyl alcohol, isohexylcarbinol	$(CH_3)_2CH(CH_2)_3$-CH_2OH	116 20
4601	**2-Hexanol***	butylmethylcarbinol	CH_3CHOH-$(CH_2)_3CH_3$	102 17
4602	——, **2-methyl-***	butyldimethylcarbinol	$CH_3COH(CH_3)$-$(CH_2)_3CH_3$	116 20
4603	——, **5-methyl-*** ...	isoamylmethylcarbinol	$CH_3CHOH(CH_2)_2$-$CH(CH_3)_2$	116 20
4604	**3-Hexanol***	ethylpropylcarbinol	CH_3CH_2CHOH-$(CH_2)_2CH_3$	102 17
4605	——, **3-ethyl-***	diethylpropylcarbinol	CH_3CH_2COH-$(C_2H_5)(CH_2)_2CH_3$	130 23
4606	——, **3-ethyl-5-methyl-***	diethylisobutylcarbinol	$(C_2H_5)_2COHCH_2$-$CH(CH_3)_2$	144 25
4607	——, **3-methyl-*** . .	ethylmethylpropylcarbinol	$CH_3(CH_2)_2COH$-$(CH_3)CH_2CH_3$	116 20

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4575							
4576							
4577							
4578	silk leaf......	.. .	39–40	196; (204–5) subl.	v. s	sl. s.	sl. s. bz.
4579							
4580							
4581	need. f. w.....	....	42	250	s.	s.	sl. s. h. eth.
4582	.. ..	$0.9669\frac{0}{4}$	.....	207	∞	s.	s. eth.
4583	....	....	27–8	230; 116–9[17]	i.	v. s.	v. s. eth.
4584	leaf	... ..	49.5	.	..		.....
4585	col. liq., 1.449	$0.970\frac{20}{4}$	–9	192–4	∞	∞	∞ eth ;i. KOH, K_2CO_3
4586							
4587							
4588							
4589							
4590	col liq ..	$0.849\frac{20}{4}$	–81.03	149–50[768]	i.	∞	∞ eth.
4591							
4592							
4593	col liq., 1.41790[20]	$0.8186\frac{20}{4}$	–51.6	157.2	0.59[20]	s.	∞ eth.
4594							
4595							
4596	col liq	0.8340	<–76	183.5	10[20]	s.	s. eth.
4597	col. liq., 1.420	$0.872\frac{20}{4}$	–93	199.3	0.01[43]		....
4598	col oil..	$0.8569\frac{0}{4}$		211 (203.3[764])	i	s.	...
4599	liq . ..	$0.831\frac{13}{4}$		162-4[750]	i	∞	∞ eth.
4600	liq, 1.4254 . .	$0.8311\frac{0}{4}$, $0.825\frac{11.5}{4}$	.	167–9	v sl s	s	s. eth.
4601	col liq, 1.4126	$0.8287\frac{0}{4}$; $0.80977\frac{20}{4}$, $0.8044\frac{25}{4}$		140–0.4 (136–9)	v sl s	s	∞ eth.
4602	col. liq., 1.4175[20]	$0.8119\frac{20}{4}$		139.4–140.4[735]; 53–53.5[15]	v. sl s.	∞	∞ eth.
4603	liq	$0.8185\frac{17}{4}$	...	148–50	i.	s.	s. eth.
4604	col. liq....	$0.8188\frac{20}{4}$	....	135	v. sl. s.	s.	∞ eth.
4605	col. liq., 1.433	$0.8379\frac{20}{0}$	.....	160.5	i.	s.	s. eth.
4606	liq	$0.8396\frac{22}{4}$	....	172	i	s.	s. eth.
4607	col. liq., 1.423	$0.8234\frac{20}{4}$	.	141	i	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
4608	**3-Hexanol, 5-methyl-***	ethylisobutylcarbinol	CH_3CH_2CHOH-$CH_2CH(CH_3)_2$	116 20
4609	**——, 2,2,5,5-tetra-methyl-***	....	$(CH_3)_3CCH_2CH$-$OHC(CH_3)_3$	158 28
4610	**2-Hexanone*...**	butyl methyl ketone	$CH_3CO(CH_2)_3CH_3$	100 16
4611	**——, 5-methyl-***	isoamyl methyl ketone	$CH_3COCH_2CH_2$-$CH(CH_3)_2$	114 18
4612	——, ——, oxime	.. .	$CH_3C(:NOH)$-C_6H_{11}	129 20
4613	**——, 1,3,4,5,6-pentahydroxy-*.** See *Sorbose*			
4614	**3-Hexanone* .**	ethyl propyl ketone	$C_2H_5CO(CH_2)_2CH_3$	100 16
4614M	**——, 4-hydroxy-*.**	See *Propoin*		
4615	**——, 5-methyl-***	ethyl isobutyl ketone	$C_2H_5COCH_2CH$-$(CH_3)_2$	114 18
4616	**Hexanoyl chloride*.**	See *Caproyl chloride*		
4617	**2-Hexenal, 2-ethyl-***	α-ethyl-β-propylacrolein	$CH_3(CH_2)_2CH.C$-$(C_2H_5)CHO$	126 19
4618	**1-Hexene*.....**	butylethylene .	CH_2 $CH(CH_2)_3$-CH_3	84 16
4618H	**——, 5-amino-4-methyl-.** See 4-*Pentenylamine*, 1, 2-*dimethyl-*.			
4619	**——, 2-methyl-***	1-butyl-1-methylethylene	CH_2 $C(CH_3)CH_2$-$CH_2CH_2CH_3$	98 18
4620	**——, 3-methyl-***		$CH_2{\cdot}CHCH(CH_3)$-$CH_2CH_2CH_3$	98 18
4621	**——, 4-methyl-***		CH_2 $CHCH_2CH$-$(CH_3)CH_2CH_3$	98 18
4622	**——, 5-methyl-***	isoamylethylene	$CH_2{\cdot}CHCH_2CH_2$-$CH(CH_3)_2$	98 18
4623	**2-Hexene*....**	β-hexylene; 1-methyl-2-propylethylene	$CH_3CH:CH$-$(CH_2)_2CH_3$	84 16
4624	**——, 2-methyl-***	1,1-dimethyl-2-propyl-ethylene	$(CH_3)_2C.CHCH_2$-CH_2CH_3	98 18
4625	**——, 3-methyl-***	1,2-dimethyl-1-propyl-ethylene	$CH_3CH{\cdot}C(CH_3)$-$CH_2CH_2CH_3$	98 18
4626	**——, 4-methyl-***	1-*sec*-butyl-2-methyl-ethylene	$CH_3CH{\cdot}CHCH$-$(CH_3)CH_2CH_3$	98 18
4627	**——, 5-methyl-***	1-isobutyl-2-methylethylene	$CH_3CH.CHCH_2$-$CH(CH_3)_2$	98 18
4628	**3-Hexene***	*sym*-diethylethylene, γ-hexylene	CH_3CH_2CH CH-CH_2CH_3	84 16
4629	**——, 2,5-dimethyl-***	*sym*-diisopropylethylene	$(CH_3)_2CHCH$ CH-$CH(CH_3)_2$	112 21
4630	**——, 2-methyl-***	1-ethyl-2-isopropylethylene	$(CH_3)_2CHCH$ CH-CH_2CH_3	98 18
4631	**2-Hexenoic acid***	β-propylacrylic acid	$CH_3CH_2CH_2CH$ $CHCOOH$	114 14
4632	**——, 5-methyl-***	α, β-isoheptenic acid	$(CH_3)_2CHCH_2$-$CH:CHCOOH$	128.17
4633	**5-Hexen-3-ol, 3-ethyl-***	allyldiethylcarbinol	$CH_2:CHCH_2COH$-$(C_2H_5)CH_2CH_3$	128 21
4634	**5-Hexen-2-one***	allylacetone	$CH_2:CHCH_2CH_2$-$COCH_3$	98 14
4635	**Hexine.**	See *Hexyne**.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4608	liq			148 2	i	s	s. eth.
4609	cr	.	52-3	173-4	i	s	s. eth.
4610	col. liq., $1.39694^{17.4}$	$0\ 830\frac{0}{4}$	56 9	127 2	v sl s	∞	∞ eth.
4611	col. liq....	$0.818\frac{17}{4}$		144	v sl s.	∞	∞ eth.
4612	col.-yel. oil	$0\ 888\frac{20}{4}$		195-6 d			.
4613							
4614	col liq., $1\ 39899^{22}$	$0\ 813\frac{21\ 8}{4}$		124	v sl. s	∞	∞ eth.
4614M							
4615	col. liq .	$0\ 815\frac{17}{0}$		136	i	∞	∞ eth.
4616							
4617	col liq ..	$0\ 848\frac{20}{4}$		175	i	s.	s. eth.
4618	col. liq., 1.3821	$0\ 6732\frac{20}{4}$	98 5	64 1	i	∞	∞ eth
4618H							
4619		$0\ 7000\frac{20}{4}$		91 1-1 5			
4620		$0\ 6953\frac{20}{4}$		84 0			
4621		$0\ 6969\frac{20}{4}$		87 2-7 5			. .
4622		$0\ 6936\frac{20}{4}$		84 7			. .
4623	..	$0\ 6813\frac{20}{4}$		67 9-8 1			s dil. H_2SO_4
4624		$0\ 7089\frac{20}{4}$		94 4-4 6			. .
4625		$0\ 7120\frac{20}{4}$		93 1-3 3			.
4626		(1) $0\ 7007\frac{20}{4}$		87 1-7 6			.
		(2) $0\ 6981\frac{20}{4}$		85 1-5 6			. . .
4627		(1) $0\ 6990\frac{20}{4}$		91 1-1 6			. .
		(2) $0.7020\frac{20}{4}$		85 6-6 1			. .
4628		(1) $0\ 722\frac{15}{4}$		67 5			.
		(2) $0\ 693\frac{20}{20}$		70-1			. .
4629				116-20			. ..
4630	. .	$0\ 6942\frac{20}{4}$		86 4-6 9			. .. .
4631	need. f. w, $1\ 4467^{40}$	$0\ 965\frac{20}{4}$	32	217	sl s	s	v s eth.
4632	1.4524....	$0\ 942\frac{20}{4}$	16 5	227		s	. .
4633	. ...			156			. ..
4634	col. liq., $1.42126^{15.4}$	$0\ 846\frac{20}{4}$		129 5	i	∞	∞ eth.
4635							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
4636	**n-Hexoic acid.**	See *Caproic acid*		
4637	**n-Hexoic aldehyde.**	See *Caproaldehyde*		
4638	**Hexoylene.**	See 2-*Hexyne**.		
4639	**Hexyl alcohol, active.**	See 1-*Pentanol*, 3-*methyl*-*.		
4640	**n-Hexyl alcohol.**	See 1-*Hexanol**.		
4641	**Hexylamine*(n)**		$CH_3(CH_2)_5NH_2$	101 19
4641M	—, **α-methyl-**	2-amino-n-heptane	$CH_3(CH_2)_4CH(CH_3)NH_2$	115 22
4642	**n-Hexyl bromide.**	See *Hexane*, 1-*bromo*-*.		
4643	**n-Hexyl chloride.**	See *Hexane*, 1-*chloro*-*		
4644	**Hexylene.**	See *Hexene**.		
4645	**1,6-Hexylene iodide.**	See *Hexane*, 1,6-*diiodo*-*		
	Hexyl esters of organic acids	See "hexyl ester" under the	names of the acids	
4646	**n-Hexyl iodide.**	See *Hexane*, 1-*iodo*-*		
4647	**pri-n-Hexyl mercaptan.**	See 1-*Hexanethiol**		
4648	**Hexyl nitrite(n)**		$CH_3(CH_2)_5ONO$	131 17
4649	**Hexyl sulfate**	di-n-hexyl sulfate	$[CH_3(CH_2)_5]_2SO_4$	266 39
4650	**1-Hexyne***	butylacetylene, 1-hexine	$HC\colon C(CH_2)_3CH_3$	82 14
4651	**2-Hexyne***	2-hexine, methylpropylacetylene, hexoylene	$CH_3C\colon C(CH_2)_2CH_3$	82 14
4651F	**3-Hexyne***	3-hexine; diethylacetylene	$C_2H_5C\colon CC_2H_5$	82 14
4651H	**1-Hexyn-3-ol, 3-methyl-***	ethynylmethylpropylcarbinol	$HC\colon CC(OH)(CH_3)C_3H_7$	112 17
4651R	**3-Hexyn-2-ol, 2-methyl-***	1-butynyldimethylcarbinol	$(CH_3)_2C(OH)C\colon CC_2H_5$	112 17
4652	**Hippuric acid**	N-benzoylglycine; benzamidoacetic acid	$C_6H_5CONHCH_2COOH$	179 17
4653	—, p-phenylphenacyl ester		$C_6H_5CONHCH_2COOCH_2COC_6H_4C_6H_5$	373 39
4653M	**Histamine**	4-imidazoleethylamine; β-aminoethylglyoxaline	$C_3H_3N_2CH_2CH_2NH_2$	111 15
4654	**dl-Histidine**	dl-α-amino-5-imidazolepropionic acid	$C_3H_3N_2CH_2CH(NH_2)COOH$	155 16
4655	**d-Histidine**		$C_3H_3N_2CH_2CH(NH_2)COOH$	155 16
4656	**l-Histidine**		$C_3H_3N_2CH_2CH(NH_2)COOH$	155 16
4657	—, diflavianate		$C_6H_9N_3O_2(C_{10}H_6N_2O_8S)_2$	783 61
4658	—, dihydrochloride		$C_6H_9N_3O_2\cdot 2HCl$	228 09
4659	**Homatropine**	mandelyltropeine, homoatropine	$C_{16}H_{21}NO_3$	275 34
4660	—, hydrobromide		$C_{16}H_{21}NO_3\cdot HBr$	356 26
4661	—, hydrochloride		$C_{16}H_{21}NO_3\cdot HCl$	311 80
4662	**Homoanthranilonitrile.**	See p-*Tolunitrile*, 2-*amino*-		
4663	**Homoatropine.**	See *Homatropine*.		
4664	**Homocinchonidine**		$C_{19}H_{22}N_2O$	294 38
4665	**Homohydroquinone.**	See *Toluhydroquinone*.		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4636							
4637							
4638							
4639							
4640							
4641	col liq		-19	132.7	sl s.	∞	∞ eth.
4641M	1.41997^{19}. . . .	$0.7665\frac{10}{4}$		142	sl s	s	s. eth.
4642							
4643							
4644							
4645							
4646							
4647							
4648	yel liq . . .	$0.8851\frac{20}{4}$		129–30	i	s	s eth.
4649	1.4344^{25}	$1.0039\frac{25}{25}$		$125\ 3^{2}$			.
4650	col liq	$0.736\frac{0}{4}$, $0.7120\frac{25}{4}$	-150	71 5	i.	s.	s eth.
4651	liq	0.7494^{5}, $0.7377\frac{13}{4}$		84	i.	∞	∞ eth.
4651F	col liq., 1.4112^{25}	0.7263^{25}			i	∞	∞ eth.
4561H	col. liq, 1.4338^{20}	0.8620^{20}		58^{26}	s.	s	s. eth.
4651R	col liq, 1.4411^{0}	0.962^{0}		145–147	s.	s	s eth.
4652	col. rhomb, 1.535, 1.592, 1.760	$1.371\frac{20}{4}$	187 5 (189–90)	d	0.33^{20}	sl s.	sl s. eth; 0.11 chl., i bz, pet. eth.
4653	. .		163				.
4653M	wh. cr . .		83 4	$209\text{–}10^{18}$	s	sl s.	.
4654	tetr pr . .		285–6 d	d	s	i.	i eth., acet., chl
4655	lng pl		287–8			i.	i eth, acet., chl.
4656	leaf f. w		277 d	d 209^{15}	s	v sl. s	i eth.
4657	need		251 2 d		sl s	i.	i. eth.
4658	rhomb pl		245 d.	. .	v. s., d.	s.	i. eth.; v. sl. s. conc. HCl
4659	deliq pr. f eth; glist. pr. f al		95 5–8 5	. . .	v. sl s.	s.	s. eth, acet, dil. a., bz., chl.
4660	col. rhomb. pr	. . . . .	212 d.	.	$17\ 5^{25}$	3 3	i. eth.; s. chl.
4661	sm. wh. cr		216–7	. . .	s	s.	. . . .
4662							
4663							
4664	pr		207 6	. .	i	1 8	s. chl
4665							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
4666	**Homophthalic acid**	α-2-toluenedicarboxylic acid	$C_6H_4(CH_2COOH)$-COOH	180 15
4667	**4-Homopyrocatechol.**	4-methylpyrocatechol	$CH_3C_6H_3(OH)_2$..	124 13
4668	**o-Homosalicylic acid.**	See 2,3-*Cresotic acid.*		
4669	***m*-Homosalicylic acid** (α).	See 2,4-*Cresotic acid*		
4670	***m*-Homosalicylic acid** (β).	See 2,6-*Cresotic acid.*		
4671	***p*-Homosalicylic acid.** .	See 2,5-*Cresotic acid*		
4672	**Hordenine**	*p*-hydroxy-*N*,*N*-dimethyl-phenethylamine	$C_{10}H_{15}NO$......	165 23
4673	——, sulfate		$(C_{10}H_{15}NO)_2H_2$-SO_4 H_2O	446 55
4674	**Hydantoic acid** .	*N*-carbamylglycine, ureido-acetic acid, glycoluric acid, ureaacetic acid	$NH_2CONHCH_2$-COOH	118 09
4675	**Hydantoin** .	glycolylurea	NHCONHCOCH$_2$	100 08
4676	——, **1-methyl-**	β-methylhydantoin	$N(CH_3)CONH$-$COCH_2$	114 10
4677	——, **5-methyl-**	α-lactylurea	NHCONHCOCH-(CH_3)	114 10
4678	——, **2-thio-**	glycolylthiourea .	$C_3H_4N_2OS$	116 14
4679	——, **5-ureido-.**	See *Allantoin*		
4680	**Hydracetin.**	See *Hydrazine, 1-acetyl-2-phenyl-*		
4681	**Hydracrylic acid**	3-hydroxypropanoic acid*, β-hydroxypropionic acid, ethylene lactic acid	CH_2OHCH_2COOH	90 08
4682	——, **α-phenyl-.**	See *Tropic acid.*		
4683	**Hydracrylonitrile** .	3-hydroxypropanenitrile*, ethylene cyanohydrin, glycol cyanohydrin, β-hydroxypropionitrile	$HOCH_2CH_2CN$	71 08
4684	**Hydrastine**		$C_{21}H_{21}NO_6$.	383 39
4685	——, hydrochloride	. . .	$C_{21}H_{21}NO_6$ HCl	419 85
4686	**Hydrastinine** .	.	$C_{11}H_{13}NO_3$	207 22
4687	——, bisulfate	. . ..	$C_{11}H_{11}NO_2$ H_2SO_4	287 28
4688	——, hydrochloride (*i*)	.	$C_{11}H_{11}NO_2$ HCl	225 67
4689	**Hydratropic acid**	α-methyl-α-toluic acid; α-phenylpropionic acid	$C_6H_5CH(CH_3)$-COOH	150 17
4690	——, **α-hydroxy-.**	See *Atrolactic acid.*		
4691	**Hydrazine, 1-acetyl-2-phenyl-**	acetic acid β-phenylhydrazide, hydracetin, pyrodin	$CH_3CONHNH$-C_6H_5	150 18
4692	——, **benzal-.**	See *Benzaldehyde, hydrazone.*		
4693	——, **benzalphenyl-.**	See *Benzaldehyde, phenylhydrazone*		
4694	——, **benzoyl-.**	See *Benzoic acid, hydrazide.*		
4695	——, **1-benzoyl-2-phenyl-.**	See *Benzoic acid, phenylhydrazide*		
4696	——, **benzyl-**.. . . .		$C_6H_5CH_2NHNH_2$	122 17
4697	——, **benzylidene-.**	See *Benzaldehyde, hydrazone*		
4698	——, **benzylidenephenyl-.**	See *Benzaldehyde, phenylhydrazone.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4666	cr f. w		175		s. h.	v s	sl. s. eth.
4667	col., 1.5425^{74}	$1\ 129\frac{74}{4}$	65	252	v s.	v s	v s. eth.
4668							
4669							
4670							
4671							
4672	rhomb. pr		117 8 subl	140–50	s.	v s.	v. s. eth.; s. chl ; sl s bz.
4673	col. cr	.	208–10		s	sl. s.	i. eth.
4674	monocl. pr	.	171		3^{20}	$0\ 39^{20}$	v sl. s. eth.
4675	need	.	220		s h	s	. .
4676	pr		157-8	subl	s	s	. . . ..
4677	rhomb		anh. 145		v s	v s	v sl s. eth.
4678	need f h w		d 200		s h	i	i eth.
4679							
4680							
4681	syrup			d	v s.	s.	∞ eth.
4682							
4683	col. liq .	$1\ 059\frac{9}{4}$		$221^{728.0}$	∞	∞	$1\ 64^{15}$ eth.
4684	col rhomb. pr, $[\alpha]^{17}_{D}$ $-678°$ in chl.		132		$0\ 025^{80}$	$0\ 74^{25}$	$0\ 8^{25}$ eth.; s. chl.
4685	wh. hyg. pwd		210 (116)		s	s	v sl. s. eth ; sl s. chl.
4686	wh -yelsh. need f lgr.		116 7		sl s	s	s eth , chl., a.; d bz.
4687	grn. fluores. cr.		216 d		s.	s	. . . . .
4688	yel. need.; aq sol bl. fluores		212 d		v s.	v. s	0 077 eth.; s. chl.
4689	col liq	$1\ 1\frac{0}{4}$	< 20	265	sl. s.		. . . .
4690							
4691	col hex		128		v. sl. s c., v. s h.	s	sl. s. eth.; s. bz., chl.
4692							
4693							
4694							
4695							
4696	col. oil .		26	103^{41}	∞	∞	∞ eth.
4697							
4698							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
4699	**Hydrazine, *p*-bromophenyl-**		$BrC_6H_4NHNH_2$	187 05
4700	**——, 1-butylidene-2-phenyl-.** See *Butyraldehyde, phenylhydrazone*			
4701	**——, carbamyl-.**	See *Semicarbazide.*		
4702	**——, dibenzal-.**	See *Benzaldehyde, azine.*		
4703	**——, diisopropylidene-.**	See *Acetone, azine.*		
4704	**——,(dimethylphenyl)-.**	See *Hydrazine, xylyl-*		
4705	**——, 1,2-di-1-naphthyl-**	1,1′-hydrazonaphthalene	$C_{10}H_7NHNHC_{10}H_7$	284 35
4706	**——, 1,2-di-2-naphthyl-**	2,2′-hydrazonaphthalene	$C_{10}H_7NHNHC_{10}H_7$	284 35
4707	**——, 2,4-dinitrophenyl-***		$(NO_2)_2C_6H_3$-$NHNH_2$	198 14
4708	**——, 1,1-diphenyl-***	*uns*-diphenylhydrazine	$(C_6H_5)_2NNH_2$	184 23
4709	**——, 1,2-diphenyl-***	hydrazobenzene, *sym*-diphenylhydrazine	$C_6H_5NHNHC_6H_5$.	184 23
4710	**——, 1,2-di-*o*-tolyl-**	*o*-hydrazotoluene	$CH_3C_6H_4NHNH$-$C_6H_4CH_3$	212 29
4711	**——, 1,2-di-*m*-tolyl-**	*m*-hydrazotoluene	$CH_3C_6H_4NHNH$-$C_6H_4CH_3$	212 29
4712	**——, 1,2-di-*p*-tolyl-**	*p*-hydrazotoluene	$CH_3C_6H_4NHNH$-$C_6H_4CH_3$	212 29
4713	**——, ethyl-..**		$NH_2NHC_2H_5$	60 10
4714	**——, 1-ethylidene-2-phenyl-.** See *Acetaldehyde, phenylhydrazone*			
4715	**——, 1-ethyl-1-phenyl-**		$C_6H_5(C_2H_5)NNH_2$	136 19
4716	**——, 1-ethyl-2-phenyl-**		$C_6H_5NHNHC_2H_5$.	136 19
4717	**——, formyl-.**	See *Formohydrazide*		
4718	**——, guanyl-.**	See *Guanidine, 1-amino-.*		
4719	**——, 1-isoamyl-1-phenyl-**	.	$C_6H_5N(C_5H_{11})NH_2$	178 27
4720	**——, 1-isobutyl-1-phenyl-**	1-(*β*-methylpropyl)-1-phenylhydrazine*	$C_4H_9(C_6H_5)NNH_2$	164 25
4721	**——, methyl-***		CH_3NHNH_2	46 07
4722	**——, 1-methyl-1-phenyl-**		$C_6H_5N(CH_3)NH_2$	122 17
4723	**——, 1-methyl-2-*m*-tolyl-**	*m*-methylhydrazobenzene	$CH_3C_6H_4NHNH$-C_6H_5	198 26
4724	**——, 1-methyl-2-*p*-tolyl-**	*p*-methylhydrazobenzene	$CH_3C_6H_4NHNH$-C_6H_5	198 26
4725	**——, (1-naphthyl)-**		$C_{10}H_7NHNH_2$	158 20
4726	**——, (2-naphthyl)-**		$C_{10}H_7NHNH_2$	158 20
4727	**——, *o*-nitrophenyl-**		$NO_2C_6H_4NHNH_2$	153 14
4728	**——, *m*-nitrophenyl-**		$NO_2C_6H_4NHNH_2$	153 14
4729	**——, *p*-nitrophenyl-**		$NO_2C_6H_4NHNH_2$	153 14
4730	**——, phenyl-*** .		$C_6H_5NHNH_2$...	108 14
4731	——, ——, hydrochloride		$C_6H_5NHNH_2\ HCl$	144 60
4733	**——, 1-phenyl-2-*o*-tolyl-**	*o*-methylhydrazobenzene	$CH_3C_6H_4NHNH$-C_6H_5	198 26

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
4699	need or leaf. f. al. or lgr.		106	.....	i	s	s eth , bz
4700							
4701							
4702							
4703							
4704							
4705	col. leaf. f. bz		271, 274		i	v. s.	v. s eth.; s. bz.
4706	col. flocks....		164		i	sl. s.	v. s. eth.
4707	purp -red pr. f. al.; vlt. fluores.		194 (198 d)	exp	i	v. sl s	i. (sl s.) eth.; s aniline, h. ethyl acetate; sl. s. chl., CS_2, bz.
4708	ylsh -br. liq. or pl f. lgr.	1 $190\frac{16}{4}$	34 5, 44	220^{50}	v sl. s	v s.	v. s. eth.; s. conc. H_2SO_4
4709	col -yelsh. rhomb. tab. f. al.	1 $158\frac{16}{4}$	131 (126)	d.	v sl s.	3 95^{16}	s. eth.
4710	col leaf f. al		165	d.	v sl s	s	s. eth., bz.
4711	col oil				i.	s	....
4712	col monocl. pl f al -eth.	0 $957\frac{20}{4}$	133-4 (126)	d.	i.	v s	v. s. eth.; s. bz.
4713	col. liq......			101 5	v s	v s	v. s. eth.
4714							
4715	liq	1 $018\frac{15}{4}$		237			.
4716	liq , $1.57108\frac{20.8}{He}$	1 $004\frac{15}{15}$		240, 104^{10}	sl s	s	s. eth.
4717							
4718							
4719	liq...........			$173\text{-}5^{50}$			
4720	....	0 $9633\frac{20}{4}$		245			. ....
4721	col. hyg. liq.			87 5	v s	∞	∞ eth.
4722	yel. liq., 1.583	1 $040\frac{20}{4}$		227 5	sl s.	∞	∞ eth.
4723	col.-lt. yel. pr. f lgr.		59–61		i.	v s.	sl.s. eth.; s.bz.
4724	col sc. f. lgr.		86-7			v s.	v. s. eth., bz.
4725	col. leaf......	.	116	203^{20}	v sl s c	v. s. h.	sl. s. eth.; v. s. chl.
4726	col. leaf. f. w		124-5		sl. s. h	v. s. h.	sl s. eth.; s chl., bz.
4727	brick red need		90		i	sl. s.	sl. s. eth.
4728	yel. need. ...		93		sl s	sl. s.	....
4729	or.-red. leaf. or need.		157	d.	sl s.	s.	s. eth., chl., ethyl acetate; v. sl s. bz.
4730	yel. monocl. or oil	1 $0978\frac{20}{4}$	19 6	sl. d.	12 6^{20}, 23^{50}	∞	∞ eth.
4731	leaf f. al.		240-1		v s.	s.	i. eth.
4733	col. leaf. f. al		101-2		i.	sl. s. c.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4734	**Hydrazine, picryl-**	2,4,6-trinitrophenylhydrazine	$(NO_2)_3C_6H_2NH$-NH_2	243 14
4735	**——, tetraphenyl-***		$(C_6H_5)_2NN$-$(C_6H_5)_2$	336 42
4736	**——, *o*-tolyl-**		$CH_3C_6H_4NHNH_2$.	122 17
4737	**——, *m*-tolyl-**		$CH_3C_6H_4NHNH_2$.	122 17
4738	**——, *p*-tolyl-**		$CH_3C_6H_4NHNH_2$	122 17
4739	**——, 2,4,6-trinitrophenyl-.**	See *Hydrazine, picryl-*		
4740	**——, triphenyl-***		$(C_6H_5)_2NNHC_6H_5$	260 33
4741	**——, 2,3-xylyl-**	(2,3-dimethylphenyl)hydrazine	$(CH_3)_2C_6H_3NH$-NH_2	136 19
4742	**——, 2,5-xylyl-**	(2,5-dimethylphenyl)hydrazine	$(CH_3)_2C_6H_3NH$-NH_2	136 19
4743	**Hydrazobenzene.**	See *Hydrazine, 1,2-diphenyl-**		
4744	**——, 4,4′-diamino-**	*p,p′*-hydrazodianiline, diphenine	$NH_2C_6H_4NHNH$-$C_6H_4NH_2$	214 27
4745	**——, methyl-.**	See *Hydrazine, 1-phenyl-2-tolyl-*		
4746	***o*-Hydrazobenzoic acid**	*o,o′*-hydrazodibenzoic acid	$(COOHC_6H_4NH)_2$	272 25
4747	***m*-Hydrazobenzoic acid**	*m,m′*-hydrazodibenzoic acid	$(COOHC_6H_4NH)_2$	272 25
4748	***p*-Hydrazobenzoic acid**	*p p′*-hydrazodibenzoic acid	$(COOHC_6H_4NH)_2$	272 25
4749	**Hydrazonaphthalene.**	See *Hydrazine, dinaphthyl-*		
4750	**Hydrazophenylene.**	See *Phenazine, 5,10-dihydro-.*		
4751	**Hydrazotoluene.**	See *Hydrazine, ditolyl-*		
4752	**Hydrindene.**	See *Indan*		
4753	**α-Hydrindone.**	See *1-Indanone*		
4754	**β-Hydrindone.**	See *2-Indanone*		
4754M	**Hydroanisoin**	*p,p′*-dimethoxyhydrobenzoin, one form	$[p$-$CH_3OC_6H_4$-$CHOH]_2$	274 31
4755	**Hydroanthranol.**	See *Anthranol, 9,10-dihydro-*		
4756	**Hydrobenzamide**	tribenzaldiamine *N,N′*-dibenzylidene-*α,α*-toluenediamine	$(C_6H_5CH)_3N_2$	298 37
4757	**Hydrobenzoin**	1,2-diphenyl-1,2-ethanediol (one form), tolylene glycol	$C_6H_5CHOHCH$-OHC_6H_5	214 25
4757M	**——, *p,p′*-dimethoxy-.**	See *Hydroanisoin, Isohydroanisoin.*		
4758	**——, *α,α′*-dimethyl-.**	See *2,3-Butanediol, 2,3-diphenyl-*		
4759	**——, dodecahydro-.**	See *1,2-Ethanediol, 1,2-dicyclohexyl-.*		
4760	**Hydroberberine**	tetrahydroberberine	$C_{20}H_{21}NO_4$	339 38
4761	**Hydrocarbostyril**	3,4-dihydro-2(1)-quinolone, *o*-aminohydrocinnamic acid lactam	$C_6H_4NHCOCH_2CH_2$	147 17
4762	**Hydroceruli̇gnone**	4,4′-dihydroxy-3,3′,5,5′-tetramethoxybiphenyl	$C_{12}H_4(OH)_2(OCH_3)_4$	306 31
4763	**Hydrocinchonidine**	cinchamidine	$C_{19}H_{24}N_2O$	296 40
4764	**Hydrocinchonine.**	See *Cinchotine*		
4765	**Hydrocinnamaldehyde**	3-phenylpropanal	$C_6H_5CH_2CH_2CHO$	134 17
4766	**Hydrocinnamic acid.**	*β*-phenylpropionic acid, benzenepropionic acid	$C_6H_5CH_2CH_2$-$COOH$	150 17
4767	——, ethyl ester	ethyl benzenepropanoate, ethyl *β*-phenylpropionate	$C_6H_5CH_2CH_2$-$COOC_2H_5$	178.22
4768	——, piperazinium salt		$C_4H_{10}N_2\ 2C_9H_{10}O_2$	386 48
4769	**——, α-acetyl-**, ethyl ester	ethyl α-benzylacetoacetate	$C_6H_5CH_2CH$-$(CO$-$CH_3)COOC_2H_5$	220 26

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
4734	yel. need . .	. . . .	186–7	d.	i.	sl. s.	sl. s. eth
4735	rhomb. pr. f. al.+chl.	. . .	147	. . .	i.	v. sl. s. h.	s. bz, chl., acet, H_2SO_4, blue color
4736	col. tab. f. lgr	. . .	56	.		v s	v s eth, chl; sl s. lgr.
4737	liq		. . . .	224			
4738	col. rhomb. leaf	.	61	240–4 d.	sl s.	v s	v. s eth, bz
4739							
4740	need f bz .	0 $869\frac{70}{4}$	142 d.	.	i.	s.	sl. s. eth., v. s. bz.
4741	col need . .		149–50			s	s. eth.
4742	need f. eth.	. . .	85	d.	v. sl. s	v. s.	s. eth
4743		.					
4744	yel cr		145	.	s h	s	s. eth
4745							
4746	col. leaf f. al		205		i.	s.	s alk
4747	yel. cr f. al		.		i.	sl s h.	s alk.
4748	sm. need f. al				i.	sl s	s KOH
4749							
4750							
4751							
4752							
4753							
4754							
4754M	col rhomb. tab.	. .	168–170, 170–171		v sl. s.	v s h., s. c.	v sl s eth
4755							
4756	col. pr. f. al	.	101 (110)	130	i.	v. s.	v s. eth.
4757	monocl. leaf. f. al.	0 927^{134}	139	>300	0 25 c., 1 25 h.	v. s.	
4757M							
4758							
4759							
4760	wh. need. or pa. yel octahdr cr.		167		i.	s.	s. chl, CS_2
4761	col pr f al., 1.479, 1.710, 1 810		163	. .	v. sl. s	v. s.	v. s eth.
4762	monocl pr. f al	.	190	d.	sl. s.	s.	sl s. eth, i CS_2
4763	leaf		230	. . . . . .	i.	sl s.	sl s eth
4764							
4765	col. monocl. pr f. al		47	280	i.	17	∞ eth
4766	col. monocl. need f. al.	1 $071\frac{19}{4}$	48 6	279 8	0 59^{20}	372^{20}	s eth
4767	col. liq., 1.4954^{12}	1 $015\frac{20}{4}$		249	i	s	s eth
4768	wh cr		150 5–1 5		sl s	s h	i eth
4769	col. liq . .	1 $061\frac{25}{25}$	. . . . . .	290 d.	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
4770	**Hydrocinnamic acid, *o***	**-amino-,** lactam. See *Hydro*	*carbostyril*	
4771	**——, α-amino-.**	See *Alanine, β-phenyl-*		
4772	**——, β-amino-.**	.. ..	$C_6H_5CH(NH_2)$-CH_2COOH	165 19
4773	**——, α-amino-*p*-hydr**	**oxy-.** See *Tyrosine.*		
4774	**——, α,β-dibromo-(*i*).**	*i*-cinnamic acid dibromide	$C_6H_5CHBrCH$-$BrCOOH$	307 99
4776	**——, *o*-hydroxy-.**	See *Melilotic acid.*		
4777	**——, *p*-hydroxy-.**	See *Phloretic acid*		
4778	**——, α-hydroxy-β-ket**	**o-.** See *Glycolic acid, benzoyl-*		
4779	**Hydrocinnamonitrile,**	**β-keto-.** See *Acetonitrile, ben*	*zoyl-.*	
4780	**Hydrocinnamyl alcoho**	**l.** See 1-*Propanol,* 3-*phenyl-*		
4781	**Hydrocotarnine......**	. .	$C_{12}H_{15}NO_3\,\frac{1}{2}H_2O$	230 26
4782	***o*-Hydrocoumaric acid.**	See *Melilotic acid*		
4783	**Hydrocyanic acid**	hydrogen cyanide, prussic acid	HCN	27 03
4784	**Hydrofuramide.**	furfural hydramide, trifuraldiamine, furfuramide	$(C_5H_4O)_3N_2$	268 26
4785	**Hydrogen cyanide.**	See *Hydrocyanic acid.*		
4786	**Hydrogen methyl sulfa**	**te.** See *Methylsulfuric acid*		
4787	**Hydrohydrastinine**		$C_{11}H_{13}NO_2$	191 22
4788	**α-Hydronaphthoquino**	**ne.** See 1,4-*Naphthalenediol**		
4789	**Hydrophlorone.**	See *Hydroquinone,* 2,5-*dimethy*	*l-*	
4790	**Hydroquinine ....**	..	$C_{20}H_{26}N_2O_2$	326 43
4791	**Hydroquinone.......**	1,4-benzenediol*; quinol, hydroquinol, *p*-dihydroxybenzene	$C_6H_4(OH)_2$	110 11
4792	—, diacetate .	quinol diacetate, *p*-phenylene diacetate, diacetylhydroquinone	$C_6H_4(OOCCH_3)_2$	194 18
4793	——, diethyl ether	See *Benzene,* 1,4-*diethoxy-**		
4794	——, dimethyl ether	See *Benzene,* 1,4-*dimethoxy-**		
4795	——, monoamyl ether	See *Phenol, p-amoxy-*		
4796	——, monobutyl ether	See *Phenol, p-butoxy-.*		
4797	——, monoethyl ether	See *Phenol, p-ethoxy-*		
4798	—, monoheptyl ether	See *Phenol, p-heptyloxy-*		
4799	——, monohexyl ether	See *Phenol, p-hexyloxy-*		
4800	——, monomethyl ether	See *Phenol, p-methoxy-*		
4801	——, monooctyl ether.	See *Phenol, p-octyloxy-.*		
4802	——, monopropyl ether.	See *Phenol, p-propoxy-*		
4803	**——, 2-acetyl-.**	See *Acetophenone,* 2,5-*dihydrox*	*y-*	
4804	**——, bromo- .. ...**	2-bromo-1,4-benzenediol*	$BrC_6H_3(OH)_2$	189 02
4805	**——, chloro- ...**	2-chloro-1,4-benzenediol*, chloroquinol	$ClC_6H_3(OH)_2$	144 56
4806	**——, 2,3-dimethyl-**	2,3-dimethyl-1,4-benzenediol*, *o*-xylohydroquinone, 3,6-dihydroxy-*o*-xylene	$(CH_3)_2C_6H_2(OH)_2$	138 16
4807	**——, 2,5-dimethyl-**	2,5-dimethyl-1,4-benzenediol*, *p*-xylohydroquinone, hydrophlorone, hydro-*p*-xyloquinone, 2,5-dihydroxy-*p*-xylene	$(CH_3)_2C_6H_2(OH)_2$	138 16
4808	**——, 2,6-dimethyl-**	2,6-dimethyl-1,4-benzenediol*, 2,5-dihydroxy-*m*-xylene	$(CH_3)_2(OH)_2C_6H_2$	138 16
4809	**——, dithio-**	1,4-benzenedithiol*; *p*-phenylene dimercaptan	$C_6H_4(SH)_2$	142 23
4810	**——, hydroxy-.**	See 1,2,4-*Benzenetriol**		
4811	**——, 2-isopropyl-5-me**	**thyl-.** See *Thymoquinone.*		
4812	**——, 2-methyl-.**	See *Toluhydroquinone.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4770							
4771							
4772	monocl. f. w		231 d.		sl. s. c.	s.	sl. s. eth.
4773							
4774	monocl. pr		203-4		d h.	s.	s. eth., CS_2
4776							
4777							
4778							
4779							
4780							
4781	monocl. pr. f. al		55-6			v. s.	v. s. eth , chl., bz.; s alk.
4782							
4783	col pois. liq., 1 2675[10]	0 6876$^{20}_{4}$	-14	26	∞	∞	∞ eth.
4784	need. f al.		117	250 d	i	s	s eth
4785							
4786							
4787	wh cr		66			v. s.	v. s. eth.
4788							
4789							
4790	+2H_2O, need f chl or eth		168; 172 anh.		sl s.	s.	s. eth., chl., acet., NH_4OH
4791	col hex. pr f w, 1 633, 1 626	1 358$^{20}_{4}$	170 5 (173 1)	286 2	5 9^{15}	v s.	v. s. eth.
4792	pl or leaf f. al.		124		sl s h	sl. s	v. s. eth.; s. chl.
4793							
4794							
4795							
4796							
4797							
4798							
4799							
4800							
4801							
4802							
4803							
4804	leaf. f. pet. eth		110-1 (113-5)	subl.	s	s.	s eth , bz., ac. a., chl., lgr.
4805	monocl leaf. f chl.		106	263	v. s.	v. s	s. eth., h chl.
4806	cr. f. w		221 d		s.	s.	s eth.
4807	leaf f w		217 (212)	subl	sl s	s.	s. eth.; sl. s. CS_2, ac. a., chl.; v. sl. s. bz.
4808	need. f. xylene		149-51			s.	s. eth.
4809	hex leaf. f. dil. al.		98		sl s	s.	s. eth., bz., lgr ; v. s. ac. a.
4810							
4811							
4812							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4813	**Hydroquinone, tetrachloro-**	tetrachloro-1,4-benzenediol*	$C_6Cl_4(OH)_2$	247.90
4813M	**——, 2,3,5-trimethyl-**		$(CH_3)_3C_6H(OH)_2$	152.19
4814	**——, trichloro-**		$Cl_3C_6H(OH)_2$	213.46
4815	**Hydroquinonecarboxylic acid.** See *Gentisic acid.*			
4816	**Hydroquinone-2-carboxylic acid, 5-hydroxy-.** See *Benzoic acid, 2,4,5-trihy-*			
4817	**2,5-Hydroquinonedicarboxylic acid.** See *Terephthalic acid, 2,5-dihydroxy-*			
4818	**Hydroquinonephthalein**	2,7-dihydroxyfluoran ..	$C_{20}H_{12}O_5$.	332.30
4819	**Hydroresorcinol.**	See 1,3-*Cyclohexanedione**.		
4820	**Hydrotoluquinone.**	See *Toluhydroquinone*		
	Hydroxy-. See the parent compounds (e.g., for hydroxybenzoic acid see *Benzoic acid, hy-*			
4821	**Hydroxylamine, benzyl-***	*β* (or *N*)-benzylhydroxylamine	$C_6H_5CH_2NHOH$.	123.15
4822	**——, *α*(or *O*)-benzyl-.**	See *Benzyloxyamine**		
4823	**——, ethyl-***	*β*-ethylhydroxylamine	C_2H_5NHOH....	61.08
4824	**——, *α*-ethyl-.**	See *Ethoxyamine**.		
4825	**——, methyl-*** ..	*β*-methylhydroxylamine	CH_3NHOH. ...	47.06
4826	**——, *α*-methyl-.**	See *Methoxyamine**.		
4827	**——, phenyl-*.** .	*β*-phenylhydroxylamine	C_6H_5NHOH.	109.12
4828	**——, propyl-*** ..	.. ..	$CH_3CH_2CH_2NHOH$	75.11
4829	**——, *o*-tolyl-** .. .	*β* (or *N*)-*o*-tolylhydroxylamine	$CH_3C_6H_4NHOH$	123.15
4830	**——, *m*-tolyl-** .	......	$CH_3C_6H_4NHOH$	123.15
4831	**——, *p*-tolyl-**	. .	$CH_3C_6H_4NHOH$	123.15
4832	**Hyenic acid**..... .		$C_{24}H_{49}COOH$	382.66
4833	**Hyoscine**....... .	*l*-scopolamine	$C_{17}H_{21}NO_4$.	303.35
4834	——, hydrobromide . .		$C_{17}H_{21}NO_4 \cdot HBr \cdot 3H_2O$	438.32
4835	——, sulfate.........	*l*-scopolamine sulfate	$(C_{17}H_{21}NO_4)_2 \cdot H_2SO_4 \cdot 2H_2O$	740.80
4836	**Hyoscyamine**...	*l*-hyoscyamine, daturine, duboisine	$C_{17}H_{23}NO_3$	289.36
4837	——, hydrobromide	.	$C_{17}H_{23}NO_3 \cdot HBr$	370.29
4838	——, hydrochloride..	.	$C_{17}H_{23}NO_3 \cdot HCl$.	325.83
4839	——, sulfate. .		$(C_{17}H_{23}O_3N)_2 \cdot H_2SO_4 \cdot 2H_2O$	712.84
4840	***dl*-Hyoscyamine.**	See *Atropine.*		
4841	***d*-Hyoscyamine**.... .	.	$C_{17}H_{23}NO_3$	289.36
4842	***d*-Hypaphorine**		$C_{14}H_{18}N_2O_2 \cdot 2H_2O$.	282.33
4844	**Hypnal**...........	antipyrine chloral hydrate; chloral-antipyrine	$C_{11}H_{12}N_2O \cdot CCl_3 \cdot CH(OH)_2$	353.64
4845	**Hypogeic acid** (artificial)	7-hexadecenoic acid...	$CH_3(CH_2)_7CH \cdot CH(CH_2)_5COOH$	254.40
4846	**Hypoxanthine**...	6(1)-purinone; 6-oxypurine; sarcine	$C_5H_4N_4O$	136.11

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4813	col monocl. f bz.		232	subl d	i.	v s	v s. eth ; s bz.
4813M	wh. cr		170–171		v. sl s c.; s. h	s	s eth
4814	col. pr. f. w		134 (138)	subl	$0\ 6^{15}$	v s	v s eth.
4815							
4816	*droxy–*.						
4817							
4818	need. f. eth.		232-4	d.	v sl s h	s	s eth , alk.; i. lgr
4819							
4820	*droxy–*; for hydr	oxypropane	see *Propano*	*l*)			
4821	need. f lgr..		57		s.		. .
4822							
4823	col. leaf or need f lgr, $1\ 41519^{63\ 9}$	$0\ 908^{20}_{4}$	59 d		v s	v s	sl s eth.
4824							
4825	hyg pr, 1 41638	1.0003^{20}_{4}	42	$62\ 5^{15}$	v s	v s	sl s eth.
4826							
4827	col need .	.	82		2 c, 10 h	v. s	v. s. eth.; v. sl. s lgr.
4828	need. f. eth.		*ca* 46		v. s.	s	s. eth , i lgr.
4829	col need f. bz., eth.		44	.	i.	v s	v. s. eth.; sl. s. lgr
4830	leaf. f. bz., eth		68		sl. s h	s	s eth , sl. s. lgr.
4831	col. leaf. f. bz		94		1 c., 50 h, d	v s	v s eth.; sl. s. bz.
4832	cr f. eth		78		i.	sl s.	s. eth.
4833	col. syrup, $[\alpha]$-33 1°D		55		$10\ 5^{15}$	v s	v s eth.; s. chl.; sl. s. bz.
4834	col. rhomb. cr f w., $[\alpha]-32\ 9^{\circ 15}_{D}$		ca 194		$66\ 6^{25}$	$6\ 3^{25}$	i. eth.; 0 13 chl.
4835	wh micr. need. f. w.		.		v. s.	v s	....
4836	wh. need..		106-8		....	s	s eth., chl.
4837	wh. deliq pr		152		v s.	50	0 06 eth.
4838	wh cr		149–51		s.	s	.....
4839	need f al, $[\alpha]$-28 6°D		anh. 206	.	v s	15 6	0 04 eth.; s. chl.
4840							
4841	silky need. f w.+al, $[\alpha]-20\ 3^{\circ 15}_{D}$		106	...	5	v s	s. eth., chl., bz.
4842	lg. monocl. cr. f. w.		anh. 255		.		....
4844	rhomb. cr.		68	.. ...	12	sl s.	sl. s. eth.
4845	col. need .		33	236^{15}	i.	v s.	s. eth.
4846	need .		d 150		$0\ 07^{19}$, $1\ 4^{100}$	sl. s	s. eth., alk.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4847	**Hypoxanthine, 2-amino-.** See *Guanine.*			
4848	**Hystazarin**...........	2,3-dihydroxyanthraquinone, hystazin	$C_6H_4(CO)_2C_6H_2(OH)_2$	240.20
4848M	**Idose**......	....	$C_6H_{12}O_6$..	180.16
4849	**Idryl.**	See *Fluoranthene.*		
4850	**Imesatin**........... ..	3-iminooxindole .	$C_6H_4NHCOC{\cdot}NH$	146.14
4851	**Imidazole**.....	glyoxaline; iminazole	$NHCH.NCH{:}CH$	68.08
4852	——, **4,5-dihydro-2,4,5-triphenyl-.** See *Amarine.*			
4852M	——, **2-ketotetrahydro-.** See *Urea, ethylene-.*			
4853	——, **1-methyl-** .	*N*-methylglyoxaline	$N(CH_3)CH.NCH\,CH$	82.10
4854	——, **2,4,5-triphenyl-.**	See *Lophine.*		
4855	**4-Imidazolecarboxylic acid, tetrahydro-4-hydroxy-2,5-diketo-.** See			
4856	**2,4-Imidazoledione, 5-hydroxy-.** See *Allantoic acid.*			
4856M	**4-Imidazoleëthylamine.** See *Histamine.*			
4857	**5-Imidazolepropionic acid, α-amino-.** See *Histidine.*			
4858	**2(3)-Imidazolone, dihydro-.** See *Urea, ethylene-.*			
4859	**Imidazolo[4,5-*d*]pyrimidine.** See *Purine.*			
4860	**Imperatorin.**	See *Peucedanin.*		
4861	**Indaconitine**.... . .	acetylbenzoylpseudaconine	$C_{34}H_{47}NO_{10}$.	629.73
4862	**Indan**....	hydrindene; 2,3-dihydroindene	$C_6H_4CH_2CH_2CH_2$	118.17
4863	**1-Indanone**....	1-ketoindan; α-hydrindone	$C_6H_4COCH_2CH_2$	132.15
4864	**2-Indanone**.	2-ketoindan, β-hydrindone	$C_6H_4CH_2COCH_2$	132.15
4865	**Indanthrene**	*N,N'*-dihydroanthraquinonazine	$C_{28}H_{14}N_2O_4$	442.41
4866	**Indene**	.	$C_6H_4CH_2CH{\cdot}CH$	116.15
4867	——, **2,3-dihydro-.**	See *Indan.*		
4868	**Indican** (of plants) .	. ...	$C_{14}H_{17}NO_6\ 3H_2O$	349.33
4869	**Indigo, Indigo blue.**	See *Indigotin.*		
4870	——, **soluble.**	See 5,5'-*Indigotindisulfonic acid, disodium salt.*		
4871	**Indigo carmine.**	See 5,5'-*Indigotindisulfonic acid, disodium salt.*		
4872	**Indigopurpurin.**	See *Indirubin.*		
4873	**Indigo red.**	See *Indirubin.*		
4874	**Indigotin**	indigo; indigo blue	$C_{16}H_{10}N_2O_2$.	262.26
4876	**4,4'-Indigotindicarboxylic acid**		$C_{18}H_{10}N_2O_6$.	350.28
4877	**5,5'-Indigotindisulfonic acid**	.	$C_{16}H_{10}N_2O_8S_2$.	422.38
4878	——, disodium salt	indigo carmine; soluble indigo	$C_{16}H_8N_2Na_2O_8S_2$	466.35
4878M	**Indigotinsulfonic acid**		$C_{16}H_{10}N_2O_5S$	342.32
4879	**Indigo white**	leucoindigo	$C_{16}H_{12}N_2O_2$	264.27
4880	**Indirubin**	indigo red; indigopurpurin	$C_{16}H_{10}N_2O_2$.	262.26

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4847							
4848	yel need. f. ac. a.	...	260	......	..	sl. s.	sl. s. eth.; s. H_2SO_4
4848M	glassy brittle mass, L-idose, $[\alpha]^{22}_{D} + 63\ 2°$	......	osazone 168	.....	......	....	.. .
4849							
4850	yel pr........	.....	....	...	i.	s.	sl. s. eth.
4851	col pr		90	256	v s	v. s.	s. eth.
4852							
4852M							
4853	..	$1\ 036^{10}_{4}$	-6	197-9	∞		
4854							
4855	*Alloxanic acid.*						
4856							
4856M							
4857							
4858							
4859							
4860							
4861	cr . .		202-3 d.		i	s	s eth.
4862	col. liq., $1.53877^{16.4}$	$0\ 965^{20}_{4}$	. ....	176 5	i.	∞	∞ eth.
4863	rhomb. need. f w., $1\ 56084^{44.75}$	$1\ 101^{45}_{4}$	41	244	v sl. s.	v. s.	s. eth.
4864	need f al., 1.5377^{66}	$1\ 071^{67}_{4}$	61	225 d.	i.	v. s.	v. s. eth
4865	bl. powd	...	470-500 d.	. ..	i.	i.	i. eth ; s dil alk sol
4866	col. liq., $1.57107^{12.7}$	$1\ 006^{20}_{4}$	-2	182 4	i.	∞	∞ eth.; s. pyr, CCl_4, acet., CS_2, turpentine
4867							
4868	br. rhomb....	.....	51-7; anh. 100-2	d.	v. s.	v. s.	s. eth., sl s bz.
4869							
4870							
4871							
4872							
4873							
4874	rhomb., purp	$1\ 35^{20}_{4}$	392 d.	subl.	i.	i.	i. eth.; s. h. chl., h. anil
4876	blue powd..	...	....		i.	i.	i. eth., chl ; s. H_2SO_4
4877	blue amor		.	. .	s.	s.	.
4878	blue powd...	. .			s.	sl s.	.
4878M	purp . .	.	200 d.		s.	s.	
4879	wh. powd ...	.			i.	s	s. eth , alk
4880	br. need			subl.	i.	s.	s eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4881	**Indole**	benzo[b]pyrrole	$C_6H_4NHCH{:}CH$	117.14
4882	**——, 1-acetyl-**		CH_3CO-$NCH{:}CHC_6H_4$	159 18
4883	**——, 2-methyl-**	α-methylindole; methylketole	$CH_3NC_8H_6$	131 17
4884	**——, 3-methyl-.**	See *Skatole.*		
4885	**2-Indolecarboxylic acid, 3-hydroxy-.**	See *Indoxylic acid.*		
4886	**3-Indolepropionic acid, α-amino-.**	See *Tryptophan.*		
4887	**2,3-Indolinedione.**	See *Isatin.*		
4888	**3-Indolol.**	See *Indoxyl.*		
4889	**2(3)-Indolone.**	See *Oxindole.*		
4890	**Indophenin**		$(C_{12}H_7NOS)_x$	$(213\text{-}24)_x$
4891	**Indoxyl**	3-indolol	$C_6H_4NHCH{:}COH$	133.14
4892	**——, 1-nitroso-**	isatoxime	$C_6H_4N(NO)$-$CH{:}COH$	162 14
4893	**Indoxylic acid**	3-hydroxy-2-indolecarboxylic acid	C_6H_4NHC-$(COOH){:}COH$	177.15
4894	***i*-Inositol**	1,2,3,4,5,6-cyclohexanehexol*, *i*-inosite; phaseomannitol; dambose	$C_6H_6(OH)_6$	180.16
4895	**Inulin**		$(C_6H_{10}O_5)_6{\cdot}H_2O$	990 86
4896	**Iodeosin B.**	See *Erythrosin (dye).*		
4897	**Iodine cyanide.**	See *Cyanogen iodide.*		
	Iodo-. See the parent compounds (e.g., for iodobenzene see *Benzene, iodo-*).			
4898	**Iodoform**	triiodomethane	CHI_3	393 78
4899	**——, methyl-.**	See *Ethane, 1,1,1-triiodo-*.*		
4900	***dl*-Iodogorgoic acid**	3,5-*dl*-diiodotyrosine	$HOC_6H_2I_2CH_2$-$CH(NH_2)COOH$	433 01
4901	***d*-Iodogorgoic acid**	*d*-3,5-diiodotyrosine	$C_9H_9I_2NO_3$	433 01
4902	**Iodol.**	See *Pyrrole, 2,3,4,5-tetraiodo-.*		
4903	**Iodonium iodide, diphenyl-**		$(C_6H_5)_2II$	408 01
4904	**Iodophen.**	See *Phenolphthalein, 3′,3″,5′,5″-tetraiodo-.*		
4905	**α-Ionone**	4-(2,6,6-trimethyl-2-cyclohexenyl)-3-buten-2-one	$C_{13}H_{20}O$	192 29
4906	——, semicarbazone.		$C_{13}H_{20}{:}NNH$-$CONH_2$	249 35
4907	**β-Ionone**	4-(2,6,6-trimethyl-1-cyclohexenyl)-3-buten-2-one	$C_{13}H_{20}O$	192 29
4908	——, semicarbazone.		$C_{13}H_{20}{:}NNH$-$CONH_2$	249 35
4909	**β-Irone**	natural irone, 4-(2,2,6-trimethyl-3-cyclohexenyl)-3-buten-2-one	$C_{13}H_{20}O$	192 29
4910	**Isatic acid**	*o*-aminophenylglyoxylic acid; *o*-aminobenzoylformic acid; isatinic acid	$NH_2C_6H_4CO$-$COOH$	165 14
4911	——, lactam.	See *Isatin.*		
4912	**Isatin**	2,3-indolinedione; isatic acid lactam	$C_6H_4NHCOCO$	147.13
4913	**——, acetyl-.**	See *Pseudoisatin, 1-acetyl-.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4881	col. leaf. f. w	....	52.5	254	s. h.	v s.	v. s. eth ; s. bz., lgr.
4882	liq...........	....	....	$152\text{-}3^{14}$		.	... .
4883	need. or leaf...	$1.07\frac{20}{4}$	59	272 3	v sl s	v s	v. s. eth.; s H_2SO_4
4884							
4885							
4886							
4887							
4888							
4889							
4890	bl. need.....	....	... ...	....	i.	sl s	sl. s eth ; s H_2SO_4; i. bz.
4891	oil	....	85	110	. .		s. alk.
4892	yel need	.. ....	202	....	sl. s.	s.	s. KOH
4893	tricl........	. ...	. ....	subl. 123	sl s., d h.		...
4894	col. monocl. f. w.	$1\ 524\frac{15}{4}$	anh. 225	319^{15}, d.	$4\ 5^{15}$	i	i. eth.
4895	col hyg. cr	anh $1\ 35\frac{20}{4}$	178 d. (160)	. .	0.01^{0}	$0\ 02^{16}$	
4896							
4897							
4898	yel hex, 1 800, 1 750	$4\ 008\frac{20}{4}$	119	subl.; 210 exp.	$0\ 01^{25}$	$1\ 3^{18}$, $7\ 8^{78}$	$13\ 6^{25}$ eth.; s. chl, glyc, CS_2
4899							
4900	rect pr .	.	204 d.		$0\ 062^{25}$, $0\ 56^{75}$		.... .
4901	need . .		194 d.				....
4902							
4903	yel. need. f. al		182			s h	. .
4904							
4905	col liq., $1\ 49842^{22.3}$	0 930		$147\ 5^{28}$	v sl. s	∞	∞ eth., s. chl.
4906	col cr. f. bz, lgr.		110			s	..... .
4907	col liq, $1\ 51977^{18\ 9}$	0 944	....	140^{18}	v sl. s	∞	∞ eth.
4908	need. f. al	...	148	.	i.	s.	s. eth, bz.
4909	col. liq., 1.5011	0.939	....	144^{16}	v. sl. s.	v. s.	v. s. eth.
4910	wh. powd .	....	d.	...	sl. s.	..	.
4911							
4912	red monocl. need. f. al.	.. ...	201 (198-9)	subl.	v. sl. s. c, s. h.	s.	sl. s. eth.; s. alk.
4913							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
4914	**Isatin, 1-methyl-**	*N*-methylisatin	$C_6H_4N(CH_3)COCO$	161.15
4915	**——, 5-methyl-**	*p*-methylisatin	$CH_3C_6H_3NHCOCO$	161.15
4916	**——, nitro-...**		$C_6H_3(NO_2)NH$-COCO	192.13
4917	**——, thio-.**	See *Thionaphthenequinone*		
4918	**Isatin chloride**	2-chloro-3-pseudoindolone	C_6H_4N CClCO	165.58
4919	**Isatoic anhydride**	*N*-carboxyanthranilic acid anhydride	$C_6H_4COOCONH$	163.13
4920	**Isatoxime.**	See *Indoxyl, 1-nitroso-.*		
4921	**α-Isatropic acid**	1,2,3,4-tetrahydro-1-phenyl-1,4-naphthalenedicarboxylic acid (one form)	$C_{18}H_{16}O_4$	296.31
4922	**Isethionic acid**	2-hydroxyethanesulfonic acid	$CH_2OHCH_2SO_3H$	126.13
4922M	**Isoalloxazine.**	See D-*Riboflavin.*		
	Isoamyl. For isoamyl derivatives see the parent compounds (e g , for isoamylbenzene			
4923	**Isoamyl alcohol**	isobutylcarbinol, 3-methyl-1-butanol*	$(CH_3)_2CHCH_2$-CH_2OH	88.15
4924	**sec-Isoamyl alcohol.**	See *2-Butanol, 3-methyl-**.		
4925	**Isoamyl aldehyde.**	See *Isovaleraldehyde.*		
4926	**Isoamylamine.**	1-amino-3-methylbutane	$(CH_3)_2CHCH_2$-CH_2NH_2	87.16
4927	**Isoamyl borate**	triisoamyl borate	$B(OC_5H_{11})_3$	272.24
4928	**Isoamyl bromide**	1-bromo-3-methylbutane*	$(CH_3)_2CHCH_2$-CH_2Br	151.06
4929	**Isoamyl chloride**	1-chloro-3-methylbutane*	$(CH_3)_2CHCH_2$-CH_2Cl	106.60
4930	**Isoamyl cyanide.**	See *Isocapronitrile.*		
4931	**Isoamyl disulfide**	diisoamyl disulfide	$C_5H_{11}S_2C_5H_{11}$	206.40
4932	**α-Isoamylene.**	See *1-Butene, 3-methyl-**.		
4933	**β-Isoamylene.**	See *2-Butene, 3-methyl-**		
4934	**α-Isoamylene glycol.**	See *1,2-Butanediol, 3-methyl-**		
4935	**β-Isoamylene glycol.**	See *2,3-Butanediol, 2-methyl-**		
4936	**γ-Isoamylene glycol.**	See *1,3-Butanediol, 3-methyl-**		
4937	**Isoamyl ether**	3-methyl-1-(γ-methylbutoxy)butane*; diisoamyl ether	$(CH_3)_2CH(CH_2)_2$-$O(CH_2)_2CH$-$(CH_3)_2$	158.28
4938	**Isoamyl iodide**	1-iodo-3-methylbutane*.	$(CH_3)_2CHCH_2$-CH_2I	198.06
4939	**Isoamyl isocyanide**	γ-methylbutyl isocyanide, isoamylcarbylamine	$(CH_3)_2CH(CH_2)_2$-NC	97.16
4940	**Isoamyl mercaptan.**	See *1-Butanethiol, 3-methyl-**		
4941	**Isoamyl nitrate**	γ-methylbutyl nitrate*	$(CH_3)_2CHCH_2$-CH_2ONO_2	133.15
4942	**Isoamyl nitrite.**	γ-methylbutyl nitrite*	$(CH_3)_2CHCH_2$-CH_2ONO	117.15
4943	**Isoamyl sulfate**	diisoamyl sulfate	$[(CH_3)_2CHCH_2$-$CH_2]_2SO_4$	240.35
4944	**Isoamyl sulfide**	diisoamyl sulfide, 3-methyl-1-(γ-methylbutylthio)butane*	$[(CH_3)_2CH$-$(CH_2)_2]_2S$	174.34
4945	**Isoamyl urethan.**	See *Carbamic acid, isoamyl ester*		
4946	**Isoanthraflavic acid.**	2,7-dihydroxyanthraquinone	$HOC_6H_3(CO)_2$-C_6H_3OH	240.20

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4914	red need		134				. . . .
4915	red leaf. f. w		187		sl s c	sl. s.	sl. s. eth.; s. alk., h. HCl
4916	need f. al.		230		sl. s.	v. s.	s. alk.
4917							
4918	br. need...		180 d.		i	s.	v. s. eth.
4919	monocl. f. acet.		240 d.		0.7^{100}	3^{78}	sl. s eth., 1 3 h. acet.
4920							
4921	cr		237		v sl. s	sl. s.	i. eth., bz., CS_2
4922	. . .			100 d.	v s.	i.	. . . . . .
4922M	see *Benzene*, iso	*amyl*-). For	isoamyl est	ers of organ	ic acids	see the a	cids.
4923	col liq., $1.4084^{17.8}$	0 812	117 2	130 5 (130–2)	2.672^{22}	∞	∞ eth.
4924							
4925							
4926	col. liq....	$0.7505\frac{20}{4}$		95	s.	∞	∞ eth ; s. chl.
4927	col. liq., 1.421	$0.872\frac{0}{4}$		255	d.	∞	∞ eth.
4928	col. liq., 1.4412	1 215	-111 9	120 65	$0.02^{16.5}$	s.	s. eth.
4929	col. liq ..	0 893		98 9	i	∞	∞ eth.
4930							
4931	liq	0.918^{19}		$250, 122\text{–}5^{10}$	d		. . . .
4932							
4933							
4934							
4935							
4936							
4937	col. liq., 1.408	$0.78073\frac{15}{15}$		172 5-3 0	i	∞	∞ eth.
4938	col. liq	1 510		148	i	s.	∞ eth.
4939	liq.........		.	137	i.	s.	s. eth.
4940							
4941	col. liq., $1.41219^{21.7}$	0.996^{22}		148	v sl s.	s.	v. s. eth.
4942	ylsh. inflam liq., $1.38708^{20.7}$	0 872		99	v. sl. s.	∞	∞ eth.
4943	.. .. ..			$149\text{–}51^{12}$	.		.. . . . .
4944	col. liq., 1.45238	$0.84314\frac{20}{4}$		209–11 (216)	i.	v s.	v. s. eth.
4945							
4946	lng yel. need f. dil. al.		330 subl.	d.–H_2O, 100		s	v. sl. s. eth.; s. alk., H_2SO_4

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
4947	**Isobenzamarone**	α,α'-benzalbisdesoxybenzoin, 1,2,3,4,5-pentaphenyl-1,5-pentanedione (one form)	$C_6H_5CH[CH(C_6H_5)COC_6H_5]_2$	480 58
4948	**1(3)-Isobenzofuranone**	See *Phthalide*		
4949	**Isobornyl chloride**	2-chlorocamphane (one form), camphene hydrochloride, bornyl chloride (incorrect)	$C_{10}H_{17}Cl$	172 69
4950	**Isobutane** ..	2-methylpropane*, trimethylmethane	$(CH_3)_3CH$	58 12
	Isobutyl. For isobutyl derivatives see the parent compounds (e.g., for isobutyl benzene			
4951	**Isobutyl alcohol**	2-methyl-1-propanol*, isopropylcarbinol	$(CH_3)_2CHCH_2OH$	74 12
4952	**Isobutyl aldehyde.**	See *Isobutyraldehyde*		
4953	**Isobutylamine**	1-amino-2-methylpropane	$(CH_3)_2CHCH_2NH_2$	73 14
4954	——, *N*-**methyl-** .	.	$CH_3NHCH_2CH(CH_3)_2$	87 16
4954M	——, *N*-**phenyl-.**	See *Aniline, N-isobutyl-.*		
4955	**Isobutyl arsenite** .	triisobutyl (ortho)arsenite	$As[OCH_2CH(CH_3)_2]_3$	294 25
4956	**Isobutyl borate.**	triisobutyl borate ..	$B(OC_4H_9)_3$	230 16
4957	**Isobutyl bromide**	1-bromo-2-methylpropane*..	$(CH_3)_2CHCH_2Br$	137 03
4958	**Isobutyl chloride**	1-chloro-2-methylpropane*	$(CH_3)_2CHCH_2Cl$	92 57
4959	**Isobutyl cyanide.**	See *Isovaleronitrile*		
4960	**Isobutylene.**	See *Propene, 2-methyl-**		
4960M	**Isobutylene bromide**	See *Propane, 1,2-dibromo-2-methyl-**		
4961	**Isobutylene glycol.**	See *1,2-Propanediol, 2-methyl-**		
4962	**Isobutylene oxide.**	See *Ethylene oxide, α, α-dimethyl-.*		
4963	**Isobutyl ether**	(2-methyl-1-β-methylpropoxy)propane*, diisobutyl ether	$[(CH_3)_2CHCH_2]_2O$	130 23
4964	**Isobutyl fluoride**	1-fluoro-2-methylpropane*	$(CH_3)_2CHCH_2F$	76 11
4966	**Isobutyl iodide** . .	1-iodo-2-methylpropane* ..	$(CH_3)_2CHCH_2I$	184 03
4967	**Isobutyl isocyanide**	β-methylpropylcarbylamine*	$(CH_3)_2CHCH_2NC$	83 13
4968	**Isobutyl mercaptan.**	See *1-Propanethiol, 2-methyl-**		
4969	**Isobutyl mustard oil.**	See *Isothiocyanic acid, isobutyl ester.*		
4970	**Isobutyl nitrate** ..	β-methylpropyl nitrate*	$(CH_3)_2CHCH_2ONO_2$	119 12
4971	**Isobutyl nitrite**	β-methylpropyl nitrite*	$(CH_3)_2CHCH_2ONO$	103 12
4972	**Isobutyl sulfate**	diisobutyl sulfate	$[(CH_3)_2CHCH_2]_2SO_4$	210 29
4973	**Isobutyl sulfide**	diisobutyl sulfide, 2-methyl-1-(β-methylpropylthio)propane*	$[(CH_3)_2CHCH_2]_2S$	146 29
4974	**Isobutyraldehyde.**	2-methylpropanal*; isobutyl aldehyde	$(CH_3)_2CHCHO$	72 10
4975	——, oxime	2-methylpropanal oxime; isobutyraldoxime	$(CH_3)_2CHCH.NOH$	87 12
4976	**Isobutyraldoxime.**	See *Isobutyraldehyde, oxime.*		
4977	**Isobutyramide** .	2-methylpropanamide*; isobutyric amide	$(CH_3)_2CHCONH_2$	87 12
4978	**Isobutyric acid** . .	2-methylpropanoic acid*, dimethylacetic acid; α-methylpropionic acid	$(CH_3)_2CHCOOH$	88 10

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
4947	cr		179–80				4.1^{12} bz.
4948							
4949	col. feath. cr		148–50 (157)		i	s	s. eth
4950	col. gas	liq 0.603^{0}	−145	−10.2	13^{17}_{772} cm^3	1320^{17}_{775} cm^3	2790^{18}_{772} cm^3 eth.
	see *Benzene, isobutyl–*). For isobutyl esters of organic acids see the acids.						
4951	col. inflam liq., 1.3968$^{17.5}$	0.8169 (.802)	108	108.39 (106–8)	9.5^{18}	∞	∞ eth.
4952							
4953	col. liq., 1.39878$^{17.6}$	0.736	−85.5	68 (67.9)	∞	∞	∞ eth
4954	col. liq	0.722^{18}		76–8			
4954M							
4955				242			
4956	col. liq., 1.408	0.864^{0}_{4}		212	d	∞	∞ eth
4957	col. liq., 1.436	1.264	−118.5	91.5	0.0589^{16}	∞	∞ eth
4958	col. liq., 1.3960	0.875	131.2	68.9	0.092$^{17.5}$	∞	∞ eth.
4959							
4960							
4960M							
4961							
4962							
4963	col. liq.	0.7616^{15}_{4}		122.5	sl. s.	∞	∞ eth.
4964	col. gas	2.58^{21}		16	i	v. s.	v. s. eth.
4966	col. liq., 1.49597	1.605	−93.5	120.4	i	∞	∞ eth.
4967	col. liq	0.7873^{4}	<−60	114–7	sl. s.	s	s. eth.
4968							
4969							
4970	col. liq., 1.40130$^{23.3}$	1.0168^{20}_{20}		122.9	i	∞	∞ eth.
4971	liq., 1.37151$^{22.1}$	0.8702^{20}_{20}		67	i	s	s. eth.
4972	1.415	1.012^{23}		133–4^{19}			....
4973	col. liq	0.8386^{16}_{4}		172–3	i	v. s.	v. s. eth.
4974	col. liq., 1.37302	0.7938	−65.9	61 (61.5–3.5)	11	∞	∞ eth.
4975	col. oil, 1.43022$^{20.5}$	0.8943^{20}_{4}	<−80	139	sl. s.		. .
4976							
4977	col. monocl. f. bz. or chl	1.013	129 (123–4)	220	v. s.	v. s.	sl. s. eth
4978	col. liq., 1.39300	0.949^{20}_{4}	−47.0	154.4	20^{20}	∞	∞ eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
4979	**Isobutyric acid**, allyl ester	allyl isobutyrate, 2-propenyl 2-methylpropanoate*	$(CH_3)_2CH$-$COOC_3H_5$	128 17
4980	——, amyl ester	pentyl 2-methylpropanoate*	$(CH_3)_2CHCOO$-$(CH_2)_4CH_3$	158 24
4981	——, ethyl ester	ethyl isobutyrate, ethyl 2-methylpropanoate*	$(CH_3)_2CH$-$COOC_2H_5$	116 16
4982	——, isoamyl ester	γ-methylbutyl 2-methylpropanoate*	$(CH_3)_2CH$-$COOC_5H_{11}$	158 24
4983	——, isobutyl ester	β-methylpropyl 2-methylpropanoate*	$(CH_3)_2CHCOO$-$CH_2CH(CH_3)_2$	144 21
4984	——, isopropyl ester		$(CH_3)_2CHCOO$-$CH(CH_3)_2$	130 18
4985	——, methyl ester	methyl 2-methylpropanoate*, methyl isobutyrate	$(CH_3)_2CHCOO$-CH_3	102 13
4986	——, piperazinium salt		$C_4H_{10}N_2\ 2C_3H_7$-$COOH$	262 35
4987	——, propyl ester	n-propyl isobutyrate	$(CH_3)_2CH$-$COOC_3H_7$	130 18
4988	——, **α-amino-**	2-amino-2-methylpropanoic acid*	$(CH_3)_2C(NH_2)$-$COOH$	103 12
4989	——, **α-bromo-**	2-bromo-2-methylpropanoic acid*	$(CH_3)_2CBrCOOH$	167 01
4990	——, ——, ethyl ester	ethyl 2-bromo-2-methylpropanoate*	$(CH_3)_2CBr$-$COOC_2H_5$	195 07
4991	——, **α-hydroxy-**	2-hydroxy-2-methylpropanoic acid*, acetonic acid	$(CH_3)_2COHCOOH$	104 10
4992	——, **α-methoxy-** 3-p-menthyl ester	menthol α-methoxyisobutyrate	$(CH_3)_2C(OCH_3)$-$COOC_{10}H_{19}$	256 38
4993	**Isobutyric amide.**	See *Isobutyramide*		
4994	**Isobutyric anhydride**		$[(CH_3)_2CHCO]_2O$	158 19
4995	**Isobutyronitrile**	2-methylpropanenitrile*, isopropyl cyanide	$(CH_3)_2CHCN$	69 10
4996	——, **α-hydroxy-**	2-hydroxy-2-methylpropanenitrile*, isopropyl cyanohydrin, acetone cyanohydrin	$(CH_3)_2C(OH)CN$	85 10
4997	**Isobutyrophenone**	isopropyl phenyl ketone	$(CH_3)_2CHCOC_6H_5$	148 20
4998	——, **α-bromo-2,4,6-trimethyl-**	α-bromoisopropyl 2-mesityl ketone, α-bromoisobutyrylmesitylene	$(CH_3)_2CBrCOC_6$-$H_2(CH_3)_3$	269 18
4999	**Isobutyryl bromide**	2-methylpropanoyl bromide*	$(CH_3)_2CHCOBr$	151 01
5000	**Isobutyryl chloride**	2-methylpropanoyl chloride*	$(CH_3)_2CHCOCl$	106 55
5001	**Isocalycanthine**		$C_{11}H_{14}N_2\ \frac{1}{2}H_2O$	183 25
5002	**Isocamphane.**	2,2,3-trimethylnorcamphane, isohydrocamphene, 2,2,3-trimethylbicyclo(2,2,1)-heptane	$C_{10}H_{18}$	138 25
5003	***dl*-Isocamphoric acid**	*dl-trans*-1,2,2-trimethyl-1,3-cyclopentanedicarboxylic acid	$C_8H_{14}(COOH)_2$	200 23
5004	**Isocapric alcohol.**	See 1-*Hexanol*, 3-*isopropyl*-5-*methyl*-*.		
5005	**Isocaproic acid**	4-methylpentanoic acid*, isobutylacetic acid	$(CH_3)_2CH(CH_2)_2$-$COOH$	116 16
5006	——, **α-amino-.**	See *Leucine.*		
5007	——, **α-hydroxy.**	See *Leucic acid*		
5008	**Isocaprone.**	See 5-*Nonanone, 2,8-dimethyl*-*		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
4979	liq	....	....	133 5	v. sl. s.	∞	∞ eth.
4980	liq., 1.4076	0 8592[18]	.	155	sl. s	∞	∞ eth.
4981	col. liq., 1.3903	0 86930$\frac{20}{4}$	-88 2	111 7	sl. s.	∞	∞ eth.
4982	col. liq ...	0 876$\frac{0}{4}$	.	168 8	v. sl s.	s.	s. eth.
4983	col. liq., 1.3999	0 875$\frac{0}{4}$	-80 7	148 7	v. sl s	s.	∞ eth.
4984	col. liq .	0 869$\frac{0}{4}$		120 8	i.	s.	s eth.
4985	col liq , 1 3840	0 891	-84 7	92 6	sl s.	∞	∞ eth.
4986	wh. cr		121-2		s	s.	i eth.; s. h. dioxane
4987	col. liq	0 884$\frac{0}{4}$	.	135 4	v sl. s		
4988	col. monocl. pl or pr.		203 d.	subl. 280	s	sl s	i. eth.
4989	pl	liq 1 5255[60]	48	198-200	v s	s.	s. eth
4990	col. liq	1 311$\frac{25}{4}$	. ...	164 d.	i	s.	∞ eth.
4991	col hyg pr. f. bz.		79	212	v s	v. s	v. s. eth.; v. sl. s. bz.
4992	liq	0 9466	..	124-6[10]		s.	s eth.
4993							
4994	col liq	0 950	-53 5	182 5	d	d	∞ eth
4995	col liq	0 773		107-8	sl. s.	v s	v s eth.
4996	col liq , 1 3996	0 932[19]	-19	120 d ; 82[23]	v s	v s.	v s eth.; v. sl. s. pet eth.
4997	col liq , 1 51919[16 6]	0 984		217	i.	s.	s. eth.
4998	cr		27	160-70[24]			s eth.
4999		1 4067[15]		116-8		.	. ...
5000	col liq , 1 4079	1 017$\frac{20}{4}$	-90 0	92	d.	d.	s. eth.
5001	rhomb		235			s.	. . .
5002		0 8276$\frac{20}{4}$	64 5	164			. ..
5003	cr		191	.		v. s.	v. s. eth.
5004							
5005	col oily liq	0 925$\frac{20}{4}$	-35	207 7 (110-1[25])	sl. s.	s.	s. eth
5006							
5007							
5008							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
5009	**Isocapronitrile**	4-methylpentanenitrile*, isoamyl cyanide, isobutylacetonitrile	$(CH_3)_2CH(CH_2)_2CN$	97.16
5010	**Isocaprophenone**	isoamyl phenyl ketone	$(CH_3)_2CH(CH_2)_2COC_6H_5$	176.25
5011	**Isocaprylic acid, α-hydroxy-**	2-hydroxy-6-methylheptanoic acid*	$(CH_3)_2CH(CH_2)_3CHOHCOOH$	160.21
5012	**Isocarbostyril**	1-isoquinolinol or 1(2)-isoquinolone	C_9H_7NO	145.15
5013	**Isocholesterol**	isocholesterin	$C_{27}H_{45}OH$	386.64
5014	—, benzoate		$C_6H_5COOC_{27}H_{45}$	490.75
5015	**Isochrysene.**	See *Triphenylene*		
5016	**Isocinchomeronic acid**	2,5-pyridinedicarboxylic acid*	$C_5H_3N(COOH)_2 \cdot H_2O$	185.13
5018	**Isocinnamic acid** (of Liebermann)	*cis*-β-phenylacrylic acid (one form), *cis*-benzenepropenoic acid (one form)	$C_6H_5CH{:}CHCOOH$	148.15
5019	**Isocitric acid**	1-hydroxy-1,2,3-propanetricarboxylic acid*, α-hydroxytricarballylic acid	$COOHCH(OH)CH(COOH)CH_2COOH$	192.12
5020	**Isocodeine**		$C_{18}H_{21}NO_3$	299.36
5021	**Isocorybulbine**		$C_{21}H_{25}NO_4$	355.42
5022	**Isocorydaline**		$C_{22}H_{27}NO_4$	369.45
5023	**Isocotoin**	2,4-dihydroxy-6-methoxybenzophenone	$C_{14}H_{12}O_4$	244.24
5024	**Isocoumarin**	2,1-benzopyrone, *o*-β-hydroxyvinylbenzoic acid lactone	$C_6H_4COOCH{:}CH$	146.14
5025	**Isocrotonic acid**	*cis*(?)-2-butenoic acid* β-(or liquid)crotonic acid, allocrotonic acid, *cis*(?)-β-methylacrylic acid, quartenylic acid	$CH_3CH{:}CHCOOH$	86.09
5026	**—, α-methyl-.**	See *Angelic acid*		
5027	**Isocyanic acid,** ethyl ester		C_2H_5NCO	71.08
5027M	—, isobutyl ester	isobutyl isocyanate	$(CH_3)_2CHCH_2NCO$	99.13
5028	—, phenyl ester	phenyl isocyanate, phenylcarbonimide, carbanil	$C_6H_5N{:}CO$	119.12
5029	—, *o*-tolyl ester	*o*-tolylcarbonimide	$CH_3C_6H_4NCO$	133.14
	Isocyanides.	See *Ethyl isocyanide, Methyl isocyanide, etc.*		
5030	**Isocyanuric acid.**	See *Fulminuric acid*		
5031	—, trimethyl ester	tricarbonimide trimethyl ester	$C_3O_3(NCH_3)_3$	171.16
5032	**Isocymene.**	See *m-Cymene.*		
5033	**Isoderritol**		$C_{21}H_{20}O_5$	352.37
5034	**Isodextrosamine.**	See D-*Fructosamine*		
5035	**Isodibutol.**	See 2-*Pentanol*, 2,4,4-*trimethyl*-*.		
5036	**Isodurene**	1,2,3,5-tetramethylbenzene	$(CH_3)_4C_6H_2$	134.21
5037	**—, 4-amino-.**	See *Isoduridine*		
5038	**Isodurenol**	2,3,4,6-tetramethylphenol(?), 4-hydroxyisodurene(?)	$(CH_3)_4C_6HOH$	150.21
5039	**Isoduridine**	2,3,4,6-tetramethylaniline, 4-aminoisodurene	$(CH_3)_4C_6HNH_2$	149.23
5040	**α-Isodurylic acid**	3,4,5-trimethylbenzoic acid	$(CH_3)_3C_6H_2COOH$	164.20
5041	**β-Isodurylic acid**	2,4,6-trimethylbenzoic acid, mesitylene-*eso*-carboxylic acid	$(CH_3)_3C_6H_2COOH$	164.20

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5009	col. liq., 1.406	0.806^{20}_{4}	-51.1	155.5	i.	s.	∞ eth.
5010	col. liq	0.962^{15}_{4}	24.7	242.5	i.	v. s.	v. s. eth.
5011	need f. eth.	...	152-3 d. (110-1)	192-3 d.	sl. s.	s.	s. eth.
5012	col. monocl. f bz.	....	208-9	subl.	sl. s.	v. s.	sl. s eth., bz.; s chl
5013	need f. eth.	..	138			s.	s eth, h ac a.
5014	need ..	. .	191-5			s	v s eth.
5015							
5016	col leaf. f w	.	236-7 (anh)	subl.	v sl. s	v sl s	v sl s. eth; s. h HCl
5018	lng monocl pr f lgr		58 (42)	265→*trans* form	0.937^{25}	s.	v s eth; s. chl, lgr, ac. a.
5019	pr		d 100	.	v. sl s.	v sl s	v. sl. s. eth.
5020	1.607, 1.642, 1.675	.	144	d.			
5021	col leaf	.	180		i	s.	
5022		.	136			.	.
5023			162	.			. .
5024	pl f bz ..		47	286	i.	s.	s. eth, CS_2, v. s bz.
5025	col need f. pet eth, 1.4157	1.0312^{15}_{4}	14-5	171.9 d.	40	s.	.
5026							
5027	liq, 1.3794_{He}	0.898^{20}_{4}		60	i	∞	∞ eth.
5027M				101.5			.. .
5028	liq, $1.53684^{19.6}$	1.095^{20}_{4}		165.6	d.	d	v. s. eth.
5029	liq			186	i, d h.	d. h.	s. eth.
5030							
5031	pr		175	295	. .		......
5032							
5033			149		.		....
5034				.			
5035							
5036	liq .	0.896^{0}_{1}	-24	197	i.	s.	v. s eth.
5037							
5038	cr		79-81	230-50		s.	s eth.
5039	cr .	0.978^{24}	23-4	255		s.	. . .
5040	need f. w .		215	. . .	v. sl. s. h.	s.	s. eth
5041	col cr f. al .		152		v. sl. s.	v s.	v s. eth.; s. chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
5042	**γ-Isodurylic acid** . . .	2,3,5-trimethylbenzoic acid.	$(CH_3)_3C_6H_2COOH$	164 20
5043	**Isoephedrine.**	See *Pseudoephedrine.*		
5044	**Isoerucic acid.**	See *Brassidic acid*		
5045	**Isoeugenol.**	4-propenylguaiacol.	$CH_3CH{\cdot}CHC_6H_3$-$(OCH_3)OH$	164 20
5046	——, acetate.	. .. .	$CH_3CH{\cdot}CHC_6H_3$-$(OCH_3)OOCCH_3$	206 23
5047	——, benzyl ether.	1-benzyloxy-2-methoxy-4-propenylbenzene	$CH_3CH{:}CHC_6H_3$-$(OCH_3)OC_7H_7$	254 32
5048	——, ethyl ether .	1-ethoxy-2-methoxy-4-propenylbenzene	$CH_3CH.CHC_6H_3$-$(OCH_3)OC_2H_5$	192 25
5049	——, methyl ether.	See *Veratrole, 4-propenyl-.*		
5050	——, **γ-hydroxy-.**	See *Coniferyl alcohol.*		
5051	***l*-Isofenchyl alcohol** .	*l*-6-fenchanol	$C_{10}H_{17}OH$.	154 25
5052	**Isoferulic acid.** . . .	3-hydroxy-4-methoxycinnamic acid, hesperetic acid	$HO(CH_3O)C_6H_3$-$CH{\cdot}CHCOOH$	194 18
5052M	**Isogeraniolene.**	See 1,3-*Heptadiene,* 2,6-*dimethyl-**.		
5053	**Isoglucosamine.**	See D-*Fructosamine.*		
5054	**α,β-Isoheptenic acid.**	See 2-*Hexenoic acid, 5-methyl-**.		
5055	**Isoheptyl alcohol.**	See 1-*Hexanol,* 5-*methyl-**		
5056	**Isoheptylic acid.**	See *Caproic acid, δ-methyl-.*		
5057	**Isohexacosane.**	See *Cerane.*		
5058	**α-Isohexenic acid.**	See 2-*Pentenoic acid,* 4-*methyl-**		
5059	**Isohexylamine** . .	(4-methylamyl)amine; 1-amino-4-methylpentane	$(CH_3)_2CH(CH_2)_3$-NH_2	101 19
5059M	**Isohydroanisoin**	*p,p'*-dimethoxyhydrobenzoin, (one form)	$(p\text{-}CH_3OC_6H_4$-$CHOH\text{-})_2$	274 31
5060	**Isohydrobenzoin.**	1,2-diphenyl-1,2-ethanediol (one form)	$C_{14}H_{12}(OH)_2$. . .	214 25
5061	**Isohydrocamphene.**	See *Isocamphane.*		
5062	**1,3-Isoindoledione.**	See *Phthalimide.*		
5063	**1-Isoindolinone.**	See *Phthalimidine.*		
5065	***dl*-Isoleucine**	*dl*-α-amino-β-methylvaleric acid; *dl*-2-amino-3-methylpentanoic acid*	$CH_3CH_2CH(CH_3)$-$CH(NH_2)COOH$	131 17
5066	***d*-Isoleucine** . . .	*d*-2-amino-3-methylpentanoic acid*, *d*-α-amino-β-methylvaleric acid	$CH_3CH_2CH(CH_3)$-$CH(NH_2)COOH$	131 17
5067	***d-allo*-Isoleucine**	*d-allo*-α-amino-β-methylvaleric acid	$CH_3CH_2CH(CH_3)$-$CH(NH_2)COOH$	131 17
5068	***l-allo*-Isoleucine** .	*l-allo*-α-amino-β-methylvaleric acid	$CH_3CH_2CH(CH_3)$-$CH(NH_2)COOH$	131 17
5069	**α-Isomalic acid.** . . .	2-hydroxy-2-methylpropanedioic acid*, α-hydroxyisosuccinic acid	$CH_3C(OH)$-$(COOH)_2$	134 09
5070	**Isomannide** . .	.	$C_6H_{10}O_4$ . . .	146 14
5071	**α-Isomorphine**	.	$C_{17}H_{19}NO_3$ . .	285 33
5072	**Isonaphthazarin**	2,3(or 3,4)-dihydroxy-1,4-naphthoquinone	$C_{10}H_4O_2(OH)_2$ . .	190 15
5073	**Isonicoteine.** . . .	. . . .	$C_{10}H_{12}N_2$ . . .	160 21
5074	**Isonicotine**	. . . . . .	$C_{10}H_{14}N_2$	162 23
5075	**Isonicotinic acid** . . .	4-pyridinecarboxylic acid*	C_5H_4NCOOH. .	123 11
5076	**Isonicotinic anhydride**	. .	$(C_5H_4NCO)_2O$.	228 20
	Isonitriles.	See *Ethyl isocyanide, Methyl isocyanide, etc.*		
5077	**Isoöctane.**	See *Heptane, 2-methyl-**, *Pentane, 2,2,4-trimethyl-**.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5042	pl. f. lgr.....		127	....		s	..
5043							
5044							
5045	pa. yel. liq., 1.5680^{18}	$1.0839\frac{25}{25}$; $1.0852\frac{20}{4}$	-10	267 5	sl. s.	s	s. eth.
5046	need. f. bz..	.	79-80	282-3	i	..	s. eth.
5047	need. f. al....		58-9	.	i.	s	s. eth.
5048	cr. f. dil. al ..	. . .	64	...	i.	s	v. s. eth., bz.
5049							
5050							
5051	need.......	$0\ 961\frac{15}{4}$	62	204	i.	v s	v s. eth.
5052	wh need .		228		sl. s c, s. h.	s	s eth ; i. lgr.
5052M							
5053							
5054							
5055							
5056							
5057							
5058							
5059	wh.-yel. liq..	$0\ 758\frac{25}{4}$	94 4	123 9	sl s	∞	∞ eth.
5059M	col. pr		110		.....	v s.	v s. eth.
5060	col. monocl. f. al.		121	$133^{0.02}$	$0\ 19^{15}$	v s	v. s. eth.
5061							
5062							
5063							
5065	rhomb. or monocl. pl. f. dil. al.		292 d.		$2\ 19^{25}$, 4.83^{75}	s h	i. eth.; s. h. ac. a.
5066	greasy rhomb leaf. f. al.		283-4 d.		$4\ 12^{25}$; $6\ 08^{75}$	i, sl s h.	i eth.; s. h. ac. a.
5067	greasy leaf .	.	280 1 d		$2\ 9^{20}$		i eth.
5068	greasy leaf...	.....	278 d.			$0\ 82^{20}$ 80% $0\ 12^{20}$	... .
5069	col. cr...	.....	160 d. (142)	d 170±	v s	v. s.	v. s eth.
5070	col. monocl.	..	87	274 d.	v s.	sl. s.	i eth.
5071	.. ..	. . .	247			.	. . . .
5072	or.-red leaf...	.	280	subl.	sl s.	s.	sl s. eth., chl., bz.; s. alk., acet.
5073	liq, 1.5749..	$1\ 098\frac{20}{4}$	. ..	293	∞		∞ eth.
5074	cr		78	260 d.	..		
5075	col. need ..		317	subl. d.	sl s. c v. s. h.	v sl s	v sl s. eth.
5076	....		103-4	. ... .	.		.. .
5077							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
5078	**Isopentane.**	See *Butane, 2-methyl-**.		
5079	**Isophthalaldehyde** .	1,3-benzenedicarbonal*; *m*-phthalic aldehyde	$C_6H_4(CHO)_2$	134 13
5080	**Isophthalaldehydic acid**	*m*-formylbenzoic acid	$CHOC_6H_4COOH$	150 13
5081	—— , **2-hydroxy-**	3-formyl-2-hydroxybenzoic acid	$CHOC_6H_3(OH)$-$COOH$	166 13
5082	—— , **4-hydroxy-** .	3-formyl-4-hydroxybenzoic acid	$CHOC_6H_3(OH)$-$COOH$	166 13
5083	——, **6-hydroxy-**	5-formyl-2-hydroxybenzoic acid	$CHOC_6H_3(OH)$-$COOH$	166 13
5084	**Isophthalic acid**	1,3-benzenedicarboxylic acid*, *m*-phthalic acid	$C_6H_4(COOH)_2$	166 13
5085	——, diethyl ester	ethyl *m*-phthalate	$C_6H_4(COOC_2H_5)_2$	222 23
5086	——, dimethyl ester	dimethyl 1,3-benzenedicarboxylate*, methyl isophthalate	$C_6H_4(COOCH_3)_2$	194 18
5087	——, **4,6-dimethyl-.**	See *α-Cumidic acid*		
5088	—— , **2-hydroxy-**		$HOC_6H_3(COOH)_2$	182 13
5089	——, **4-hydroxy-**		$HOC_6H_3(COOH)_2$	182 13
5090	——, **5-hydroxy-**		$HOC_6H_3(COOH)_2$	182 13
5091	——, **5-methyl-.**	See *Uvitic acid.*		
5092	——, **5-nitro-**		$NO_2C_6H_3$-$(COOH)_2\ 1\frac{1}{2}H_2O$	238 15
5093	**Isophthalonitrile**	1,3-benzenedicarbonitrile*, 1,3-dicyanobenzene	$C_6H_4(CN)_2$	128 13
5094	**Isophthalyl chloride.**	1,3-benzenedicarbonyl chloride*, *m*-phthalyl dichloride	$C_6H_4(COCl)_2$	203 03
5095	**Isoprene** . . .	2-methyl-1,3-butadiene*, *β*-methylbivinyl, hemiterpene	CH_2 CHC-(CH_3) CH_2	68 11
5096	**Isopropenyl bromide.**	See *Propene, 2-bromo-**		
5097	**Isopropenyl chloride.**	See *Propene, 2-chloro-**		
	Isopropyl. For isopropyl derivatives see the parent compounds (e g , for isopropylben-			
5098	**Isopropyl alcohol** .	2-propanol*, dimethylcarbinol	$CH_3CHOHCH_3$	60 09
5099	**Isopropylamine**		$(CH_3)_2CHNH_2$	59 11
5100	**Isopropyl bromide**	2-bromopropane*	$CH_3CHBrCH_3$	123 00
5101	**Isopropyl chloride**	2-chloropropane*	$CH_3CHClCH_3$	78 54
5102	**Isopropyl cyanide.**	See *Isobutyronitrile*		
5103	**Isopropyl ether**	2-isopropoxypropane*, diisopropyl ether	$(CH_3)_2CHOCH$-$(CH_3)_2$	102 17
5104	**Isopropyl fluoride**	2-fluoropropane*	CH_3CHFCH_3	62 09
5105	**Isopropylidene chloride.**	See *Propane, 2,2-dichloro-**		
5105M	**Isopropylidene fluoride.**	See *Propane, 2,2-difluoro-**		
5106	**Isopropyl iodide** .	2-iodopropane*	CH_3CHICH_3	170 01
5107	**Isopropyl isocyanide.**		$(CH_3)_2CHNC$	69 10
5108	**Isopropyl mercaptan.**	See *2-Propanethiol**.		
5109	**Isopropyl mustard oil.**	See *Isothiocyanic acid, isopropyl ester.*		

*Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
5078							
5079	need......	....	89 5	.	sl s.	v s.	i. pet. eth.
5080	need. f. w	....	175 (164–6)		4 $94^{99.7}$	v. s	v. s. eth.
5081	need	....	179		6^{100}	s.	....
5082	pr ...	.....	243–4	subl.	s. h.	s.	s. eth.
5083	need		248–9	....	0 7^{100}	s.	s. eth.
5084	col need f h w	.	330; 312–4	subl.	0 013^{25} 0 22 h	s.	i bz.
5085	col liq	..	.	285			... .
5086	col need f dil al.	..	68	..	i.		. .
5087							
5088	col need f w	.	hyd. 239; anh 244	...	0 14, 2 5^{100}	v. s.	v. s eth ; sl. s. chl.
5089	col. need. f. w		310 (306)	d.	0 3^{24}	v. s.	v. s. eth , s. h. ac a ; i. chl.
5090	need. f. w	.	hyd $-2H_2O$ 100, anh 288	....	0 06, 18^{100}	v. s.	v. s. eth.; s. bz.
5091							
5092	col -grn. leaf		255 sl d	.	0 22^{25}	v s.	v. s eth.
5093	col need		161	subl.	sl. s.	s h.	s. eth., i. lgr.
5094	cr		41	276	d	d	s. eth.
5095	col liq., 1 $4221^{18.3}$	0 $6806\frac{20}{4}$	–120	34	i.	∞	∞ eth
5096							
5097	zene see *Benzene, isopropyl-*	) For isopr	opyl esters o	f organic	acids see	the acids.	
5098	col liq., 1 37757	0 $7854\frac{20}{4}$	–88 5 to –89 5	82 3	∞	∞	∞ eth.
5099	col liq., 1 $37698^{15.4}$	0 $694\frac{15}{4}$, 0 $690\frac{20}{4}$	–101 2	34	∞	∞	∞ eth.
5100	col liq , 1.42508	1 $310\frac{20}{4}$	–89	59 6	0 32^{20}	∞	∞ eth.
5101	col liq	0 $8590\frac{20}{4}$	–117	35 4 (34 8) (36 5)	0 $344^{12.5}$	∞	∞ eth.
5102							
5103	col. liq.	0 $7258\frac{20}{4}$	–60	67 5 (68 5–9 0)	0 2	∞	∞ eth.
5104	col. gas, 1.3240^{-20}	0 $7682^{-10.2}$	–133 4	–10 1	..	..	..
5105							
5105M							
5106	liq., 1.49969 .	1 $703\frac{20}{4}$	–90 8	89 5	0 14^{20}	∞	∞ eth
5107	col. liq	0 $7596\frac{0}{4}$		87 .	i.	∞	∞ eth.
5108							
5109							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
5110	**Isopropyl nitrate**	2-propanol nitrate	$(CH_3)_2CHNO_3$	105 09
5111	**Isopropyl nitrite**	2-propanol nitrite	$(CH_3)_2CHONO$	89 09
5112	**Isopropyl sulfide**	2-(isopropylthio)propane*; diisopropyl sulfide	$(CH_3)_2CHSCH(CH_3)_2$	118 23
5113	**Isopurpurin.**	See *Anthrapurpurin.*		
5114	**Isoquinoline**	benzo[c]pyridine; 2-benzazine; leucoline	$C_6H_4CH{\cdot}NCH{\cdot}CH$	129 15
5115	——, **nitro-**	...	$NO_2C_9H_6N$	174 15
5116	——, **1,2,3,4-tetrahydro-6-methoxy-1-methyl-7,8-methylenedioxy-.**			
5117	**1-Isoquinolinol, 1(2)-Isoquinolone.** See *Isocarbostyril.*			
5118	**Isosaccharic acid**	tetrahydro-3,4-dihydroxy-2,5-furandicarboxylic acid	$COOH{-}CH(CHOH)_2CH{-}COOH$ (—O—)	192 12
5119	**Isosafrole**	3,4-methylenedioxy-1-propenylbenzene	$CH_2(O_2)C_6H_3{-}CH\ CHCH_3$	162 18
5120	**Isosuccinic acid**	2-methylpropanedioic acid*, methylmalonic acid	$CH_3CH(COOH)_2$	118 09
5121	——, **α-hydroxy-.**	See *α-Isomalic acid.*		
5122	**Isothebaine** (*d*)		$C_{19}H_{21}NO_3$	311 37
5123	——, sulfate		$(C_{19}H_{21}NO_3)_2H_2SO_4$	720 81
5124	**Isothiocyanic acid,** allyl ester	2-propenyl isothiocyanate*, allyl mustard oil	$CH_2{:}CHCH_2NCS$	99 15
5125	——, amyl ester	*n*-amyl mustard oil	$CH_3(CH_2)_4NCS$	129 22
5126	——, benzyl ester	benzyl mustard oil	$C_6H_5CH_2NCS$	149 20
5127	——, *p*-biphenylyl ester	See "xenyl ester" below.		
5128	——, butyl ester	butyl mustard oil	$CH_3(CH_2)_2CH_2{-}NCS$	115 19
5129	——, *sec*-butyl ester	α-methylpropylisothiocyanate*, *sec*-butyl mustard oil	$C_2H_5CH(CH_3){-}NCS$	115 19
5130	——, *tert*-butyl ester	α, α-dimethylethylisothiocyanate*, *tert*-butyl mustard oil	$(CH_3)_3CNCS$	115 19
5131	——, ethyl ester	ethyl mustard oil	C_2H_5NCS	87 14
5132	——, isoamyl ester	γ-methylbutyl isothiocyanate*	$C_5H_{11}NCS$	129 22
5133	——, isobutyl ester	isobutyl mustard oil, β-methylpropyl isothiocyanate*	$(CH_3)_2CHCH_2{-}NCS$	115 19
5134	——, isopropyl ester	isopropyl mustard oil	$(CH_3)_2CHNCS$	101 16
5135	——, methyl ester	methyl mustard oil	CH_3NCS	73 11
5136	——, phenyl ester	phenyl mustard oil	C_6H_5NCS	135 18

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5110	liq........	$1.036\frac{20}{4}$	..	102	.		....
5111	liq	$0.844\frac{25}{4}$	.	45			.. .
5112	liq.	......	.	120.4	i.	s	s. eth.
5113							
5114	col. pl. or liq., 1.62233[25.1]	$1.0986\frac{20}{4}$	23	243	v. sl. s.		.. .
5115	need. f. w.		110		s. h.	s.	.
5116	See *Anhalonine*						
5117							
5118	rhomb.		185	d.	s.	s	v. sl. s. eth.
5119	(*cis*) 1.5632[15]	$1.107\frac{15}{4}$	<-18	242-3	i.	s.	. .
	(*trans*) 1.5736[15]	$1.123\frac{15}{4}$		248-52	i.	s	. .
5120	col. pr. or need.	$1.455\frac{20}{4}$	135 d. (129)		44.3[0], 66[20]	v. s.	v. s. eth.
5121							
5122	rhomb. f. al. or eth.		203-4				....
5123	...		120-1 d.				. .. .
5124	col. oil, 1.52212[24]	$1.0155\frac{15}{4}$	-100	150.7	0.2	v. s.	v. s. eth.; s. bz., CS_2
5125	liq.	.		193.4	v. sl. s.	v. s.	v. s. eth.
5126	liq.	$1.125\frac{15}{4}$		243; 125[12]	i.	∞	s. eth.
5127							
5128	liq.	$0.946\frac{20}{4}$		167	i.	v. s.	v. s. eth.
5129	liq. *d*: $[\alpha]$ 61.88$^{\circ 20}_{D}$	$0.944\frac{12}{4}$ $0.943\frac{20}{4}$		159.5 (159-63)	i.	s	s. eth.
5130	liq	$0.9187\frac{10}{4}$	10.5	140[770]	i.	s	s. eth.
5131	col. liq., 1.5134	$1.004\frac{15}{4}$, $0.995\frac{20}{4}$	-5.9	132 (131.2[733])	i	s.	s. eth.
5132	yel. liq. .	$0.942\frac{20}{4}$		182	v. sl. s.	v. s.	v. s. eth.
5133	liq., 1.5005[14].	0.9638[14], $0.943\frac{20}{4}$		162	i.	s.	∞ eth.
5134	liq	. .	. .	137-7.5	. .	.	...
5135	col. cr., 1.5258[37.2]	$1.069\frac{37}{4}$	35	119	v. sl. s.	∞	v. s. eth.
5136	col. liq., 1.64918[23.4]	$1.135\frac{16}{4}$; $1.1297\frac{24}{4}$	-21	218.5	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
5137	**Isothiocyanic acid,** propyl ester	*n*-propyl mustard oil	$CH_3CH_2CH_2NCS$	101 16
5138	——, *o*-tolyl ester	*o*-tolyl mustard oil	$CH_3C_6H_4NCS$	149 20
5139	——, *p*-tolyl ester	*p*-tolyl mustard oil	$CH_3C_6H_4NCS$	149 20
5140	——, xenyl ester	xenyl mustard oil, *p*-biphenylyl isothiocyanate; *p*-biphenylyl mustard oil	$C_6H_5C_6H_4NCS$	211 27
5141	**Isovaleraldehyde**	3-methylbutanal*, isoamyl aldehyde	$(CH_3)_2CHCH_2$-CHO	86 13
5142	——, oxime	3-methylbutanal oxime*	$(CH_3)_2CHCH_2$-CH NOH	101 15
5142M	**Isovaleramide**	3-methylbutanamide*, isopropylacetamide	$(CH_3)_2CHCH_2$-$CONH_2$	101 15
5143	**Isovaleric acid**	3-methylbutanoic acid*, isopropylacetic acid	$(CH_3)_2CHCH_2$-$COOH$	102 13
5144	——, allyl ester	allyl isovalerate, 2-propenyl 3-methylbutanoate*	$(CH_3)_2CHCH_2$-$CO_2C_3H_5$	142 19
5145	——, ethyl ester		$(CH_3)_2CHCH_2$-$COOC_2H_5$	130 18
5146	——, isoamyl ester	isoamyl isovalerate, γ-methylbutyl 3-methylbutanoate*	$(CH_3)_2CHCH_2$-$COOC_5H_{11}$	172 26
5147	——, isobutyl ester	isobutyl isovalerate; β-methylpropyl 3-methylbutanoate*	$(CH_3)_2CHCH_2$-$COOCH_2CH$-$(CH_3)_2$	158.24
5148	——, methyl ester	methyl 3-methylbutanoate*; methyl isovalerate	$(CH_3)_2CHCH_2$-$COOCH_3$	116 16
5149	——, *p*-phenylphenacyl ester	.	$(CH_3)_2CHCH_2CO$-$OCH_2COC_6H_4C_6H_5$	296 35
5150	——, piperazinium salt	.... .	$C_4H_{10}N_2$ $2C_4H_9$-$COOH$	290 40
5151	——, propyl ester	*n*-propyl isovalerate	$(CH_3)_2CHCH_2$-$COOC_3H_7$	144 21
5152	**——, α-amino-.**	See *Valine.*		
5153	**——, β-amino-**	3-amino-3-methylbutanoic acid*	$(CH_3)_2C(NH_2)$-CH_2COOH	117 15
5154	**——, α-bromo-**	2-bromo-3-methylbutanoic acid*	$(CH_3)_2CHCHBr$-$COOH$	181 04
5155	**——, α-hydroxy-**(*l*)	2-hydroxy-3-methylbutanoic acid*	$(CH_3)_2CHCHOH$-$COOH$	118 13
5156	**——, β-hydroxy-**	3-hydroxy-3-methylbutanoic acid*	$(CH_3)_2COHCH_2$-$COOH$	118 13
5157	**Isovalerone.**	See 4-*Heptanone, 2,6-dimethyl-*.		
5158	**Isovaleronitrile**	3-methylbutanenitrile*, isobutyl cyanide	$(CH_3)_2CHCH_2CN$	83 13
5159	**Isovalerophenone**	isobutyl phenyl ketone; 3-methyl-1-phenyl-1-butanone	$(CH_3)_2CHCH_2$-COC_6H_5	162 22
5160	**Isovaleryl chloride**	3-methylbutanoyl chloride*	$(CH_3)_2CHCH_2$-$COCl$	120 58
5161	***dl*-Isovaline**	*dl*-α-amino-α-methylbutyric acid; *dl*-2-amino-2-methylbutanoic acid*	$CH_3CH_2C(NH_2)$-$(CH_3)COOH$	117 15

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
5137	liq.	$0.9909\frac{0}{4}$; $0.978\frac{16}{4}$	.	152.7^{743}	v sl. s.	∞	∞ eth.
5138	col. oil	$1.104\frac{25}{25}$		239	i.	v s	∞ eth.
5139	need f. eth..	$1.087\frac{25}{25}$	26	237	i, d h.	v s., d. h.	v s eth.
5140	need f. eth.	....	58	. .			v s. eth.
5141	col liq, 1.3902	$0.803\frac{17}{4}$; $0.7845\frac{20}{20}$	-51	92.5	sl s.	s.	s. eth.
5142	$1.43645^{22.1}$	$0.8934\frac{20}{4}$	48 5	164-5	.....		. .
5142M	monocl pl f al.	$0.965\frac{20}{4}$	135	230-2	s.	s.	s. eth.
5143	col liq, $1.40178^{22.4}$	$0.937\frac{15}{4}$	-37 6 (-51)	176.7	4.2^{20}	∞	∞ eth ; s. chl.
5144	liq	. ..	..	155	v. sl s.	∞	∞ eth.
5145	col liq, $1.39671^{18.5}$	$0.8657\frac{20}{4}$	-99 3	135	0.17^{20}	∞	∞ eth., bz.
5146	col liq, 1.41311^{19}	$0.8584\frac{12}{0}$ (0.870^{0})		194	v sl. s	s.	s. eth.
5147	col. liq, 1 4060	$0.854\frac{20}{4}$		168 5	i.	∞	∞ eth.
5148	col liq . .	$0.881\frac{20}{4}$	.	116 7	v sl s	∞	∞ eth.
5149	. .		76	. ..			....
5150	wh. cr .		139-40	.	s.	s.	i. eth.; s. h. acet.
5151	col liq, 1 4036	$0.863\frac{20}{4}$		155 9	i	∞	∞ eth.
5152							
5153	pr .		217	subl. >180	s.	sl. s.	i. eth.
5154	col. pr. . .		44	230; 150^{40}	70-80 c	v. s.	s. eth.
5155	rhomb .	.	86	subl.	v s	v. s.	v. s. eth.
5156	syrup .	. ....	<-32	.	v s	v s	v. s. eth.
5157							
5158	col. liq.....	0 802	. . .	129 3	sl s.	∞	∞ eth.
5159	col liq., $1.51385^{15.5}$	0 967	.	225	i.	∞	∞ eth.
5160	col. liq, $1.41361^{24.5}$	$0.989\frac{20}{4}$; $0.9854\frac{24}{4}$	.	113	d.	d.	s. eth.
5161	monocl. pr .	..	307-8 (closed tube)	subl. 300	39	6 6 h.	s eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
5162	**Isovanillin**	3-hydroxyanisaldehyde protocatechualdehyde 4-methyl ether	$CH_3O(OH)C_6H_3$-CHO	152 14
5163	**Isoxylic acid**	2,5-dimethylbenzoic acid, 2,5-xylic acid; *p*-xylic acid	$(CH_3)_2C_6H_3COOH$	150 17
5164	**Isuretin.**	See *Formamide, oxime*		
5165	**Itaconic acid**	methylenebutanedioic acid*, methylenesuccinic acid	$HOOCC(\cdot CH_2)$-CH_2COOH	130 10
5166	——, **γ,γ-dimethyl-.**	See *Teraconic acid.*		
5167	**Itamalic acid,** γ-lactone.	See *Paraconic acid.*		
5168	**Japaconine, acetylben**	**zoyl-.** See *Japaconitine.*		
5169	**Japaconitine**	acetylbenzoyl, japaconine, same as aconitine?	$C_{34}H_{47}NO_{11}$ ..	645 73
5170	**Japan camphor.**	See *d-Camphor.*		
5171	**Jervine**	..	$C_{26}H_{37}NO_3\,2H_2O$	447 60
5172	**Juglone**	5-hydroxy-1,4-naphthoquinone; nucin	$C_{10}H_5O_2(OH)$	174 15
5173	**Kairoline**	1-methyl-1,2,3,4-tetrahydroquinoline	$C_9H_{10}NCH_3$.	147 21
5174	**Ketazine, dimethyl-.**	See *Acetone, azine*		
5175	**Ketene**	ethenone, carbomethene, keten	$CH_2{\cdot}CO$	42 04
5176	**Ketine**	2,5-dimethylpyrazine	N C(CH3)CH.NC-(CH3):CH	108 14
5176H	**Ketol, diethyl-.**	See *Propioin.*		
5176M	——, **ethyl-.**	See 2-*Butanone, 1-hydroxy-*		
5176R	**Ketone,aminodipheny**	**l-.** See *Benzophenone, 2-amino-*		
5177	——, **aminophenyl me**	**thyl.** See *Acetophenone, amino*	-	
5178	——, **aminophenyl ph**	**enyl.** See *Benzophenone, amin*	*o-.*	
5179	——, **amyl ethyl.**	See 3-*Octanone**		
5180	——, **amyl methyl.**	See 2-*Heptanone**.		
5181	——, ***p*-anisyl methyl.**	See *Acetophenone, p-methoxy-*		
5182	——, **benzyl ethyl.**	See 2-*Butanone, 1-phenyl-*		
5183	——, **benzyl methyl.**	See 2-*Propanone, 1-phenyl-*		
5184	——, **benzyl 1-naphthyl**	α-phenyl-1-acetonaphthone	$C_6H_5CH_2COC_{10}H_7$	246 29
5185	——, **benzyl 2-naphth**	**yl** .	$C_6H_5CH_2COC_{10}H_7$	246 29
5186	——, **benzyl phenyl.**	See *Desoxybenzoin*		
5187	——, **bisaminophenyl.**	See *Benzophenone, diamino-*		
5188	——, **bischloromethyl.**	See 2-*Propanone, 1,3-dichloro-*	*.	
5189	——, **bishydroxypheny**	**l.** See *Benzophenone, dihydroxy*	-	
5190	——, **α-bromoisopropy**	**l 2-mesityl.** See *Isobutyroph*	*enone, α-bromo-2,4,6*	*-tri-*
5191	——, **5-bromo-2-thienyl methyl**	2-acetyl-5-bromothiophene	$CH_3COC_4H_2BrS$.	205 08
5192	——, **butyl methyl.**	See 2-*Hexanone**.		
5193	——, **sec-butyl methyl**	. See 2-*Pentanone, 3-methyl-**.		
5194	——, ***tert*-butyl methy**	**l.** See *Pinacolin.*		
5195	——, **butyl phenyl.**	See *Valerophenone.*		
5196	——, **carvacryl methyl.**	See *Acetophenone, 5-isopropyl-*	*2-methyl-.*	
5197	——, **5-chloro-2-thienyl methyl.**	2-acetyl-5-chlorothiophene	$CH_3COC_4H_2ClS$	160 62
5198	——, **cinnamyl methyl**	. See *Acetone, benzylidene-*		
5199	——, **cyclobutyl phenyl**	benzoylcyclobutane; benzoyltetramethylene	$C_6H_5COCH(CH_2)_3$	160 21

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
5162	monocl. pr. or pl.	1.196	116	179^{15}	s h.	s.	s eth.; v. s chl.; sl. s. CS_2
5163	col. need. f. al.	$1.069\frac{20}{4}$	132 (104)	268 (270-5) subl.	v. sl. s. h.	v. s	s eth., acet., bz.
5164							
5165	rhomb	1 632	161 d.	d.	8 33^{70}	19 73^{15}, 88%	sl. s. eth.; v. sl. s. bz, chl., pet. eth.
5166							
5167							
5168							
5169	col need f. al, eth., or chl, [α] +17 3°_{D} in chl.	....	204 2 d	....	i.	s h	s. h eth, chl v. s. acet.; v. sl. s pet. eth.
5170							
5171	lng. grouped pr	. ..	238-42	....	i.	s.	sl. s. eth.; s. chl, acet.
5172	red-br. pr. f. chl.	. ....	153-4	d.	i.	sl. s. c	sl. s eth; v. s. chl; s. h. ac. a
5173	liq., 1 $4802^{23.1}$	1 021	.	245 5	.	v s	sl. s. eth.
5174							
5175	col. gas	....	-151	-56 (-41)	d	d	s eth, acet.
5176	col. liq., 1 $49921^{23.6}$	0 990	15	155	∞	∞	∞ eth.
5176H							
5176M							
5176R							
5177							
5178							
5179							
5180							
5181							
5182							
5183							
5184	pl f. al......	.. .	66-7		i.	s.	s. eth.
5185	col. need. f. al	....	99 5	....		s.	s. eth., chl, bz.
5186							
5187							
5188							
5189							
5190	*methyl-*.						
5191	col need......	....	94	....	....	sl. s. c., v. s. h.	....
5192							
5193							
5194							
5195							
5196							
5197	pl	....	52	....	. .	v. s.	v. s. eth.
5198							
5199	. .	. .	.. .	258	..	.	. . ....

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
5200	**Ketone, dibenzyl.**	See 2-Propanone, 1,3-diphenyl-	*.	
5201	**——, dibutyl.**	See 5-Nonanone*		
5202	**——, dichloromethyl**	**methyl.** See 2-Propanone, 1,	1-dichloro-*.	
5203	**——, dicinnamyl.**	See Styryl ketone		
5204	**——, diethyl.**	See 3-Pentanone*		
5205	**——, dihendecyl.**	See 12-Tricosanone*		
5206	**——, diheptadecyl.**	See 18-Pentatriacontanone*.		
5207	**——, diheptyl.**	See 8-Pentadecanone*.		
5208	**——, dihexyl.**	See 7-Tridecanone*		
5209	**——, 2,5-dihydroxyphe**	**nyl phenyl.** See Benzopheno	ne, 2,5-dihydroxy-.	
5210	**——, diisoamyl.**	See 5-Nonanone, 2,8-dimethyl-	*	
5211	**——, diisobutyl.**	See 4-Heptanone, 2,6-dimethyl-	*	
5212	**——, diisopropyl.**	See 3-Pentanone, 2,4-dimethyl-	*	
5213	**——, dimethyl.**	See Acetone		
5214	**——, dinaphthyl.**	See Naphthyl ketone		
5215	**——, dinonyl.**	See 10-Nonadecanone*.		
5216	**——, di-*n*-octyl.**	See 9-Heptadecanone*		
5217	**——, dipentadecyl.**	See 16-Hentriacontanone*		
5218	**——, dipentyl.**	See 6-Hendecanone*.		
5219	**——, diphenyl.**	See Benzophenone.		
5220	**——, diphenylene.**	See 9-Fluorenone*.		
5221	**——, dipropyl.**	See 4-Heptanone*		
5222	**——, distyryl.**	See Styryl ketone		
5223	**——, 2,2′-dithienyl-.**	See 2-Thienyl ketone		
5224	**——, di-*p*-tolyl.**	See Benzophenone, 4,4′-dimeth	yl-.	
5225	**——, diundecyl.**	See 12-Tricosanone*.		
5226	**——, ethyl butyl.**	See 3-Heptanone*.		
5227	**——, ethyl heptyl.**	See 3-Decanone*.		
5228	**——, ethyl hexyl.**	See 3-Nonanone*.		
5229	**——, ethyl isoamyl.**	See 3-Heptanone, 6-methyl-*		
5230	**——, ethyl isobutyl.**	See 3-Hexanone, 5-methyl-*		
5231	**——, ethyl isopropyl.**	See 3-Pentanone, 2-methyl-*		
5232	**——, ethyl methyl.**	See 2-Butanone*.		
5233	**——, ethyl naphthyl.**	See Propionaphthone		
5234	**——, ethyl octyl.**	See 3-Hendecanone*		
5235	**——, ethyl phenyl.**	See Propiophenone		
5236	**——, ethyl propyl.**	See 3-Hexanone*		
5237	**——, 2-furyl methyl**	2-acetylfuran	$C_4H_3O\ COCH_3$	110 11
5238	**——, 2-furyl phenyl**	2-benzoylfuran	$C_4H_3O\ COC_6H_5$	172 17
5239	**——, hendecyl methyl.**	See 2-Tridecanone*.		
5239M	**——, heptadecyl phen**	**yl.** See Stearophenone.		
5240	**——, heptyl methyl.**	See 2-Nonanone*.		
5241	**——, hexyl methyl.**	See 2-Octanone*.		
5242	**——, hexyl propyl.**	See 4-Decanone*		
5243	**——, 1-hydroxy-2-nap**	**hthyl methyl.** See 2-Aceton	aphthone, 1-hydroxy-	
5244	**——, 1-hydroxy-2-nap**	**hthyl propyl.** See 2-Butyro	naphthone 1-hydroxy	-
5245	**——, 1-hydroxy-2-nap**	**hthyl styryl.** See 2-Acrylona	phthone,1-hydroxy-β-	phenyl-.
5246	**——, hydroxyphenyl h**	**ydroxyphenyl.** See Benzop	henone, dihydroxy-	
5247	**——, isoamyl methyl.**	See 2-Hexanone, 5-methyl-*.		
5248	**——, isoamyl phenyl.**	See Isocaprophenone		
5249	**——, isobutyl methyl.**	See 2-Pentanone, 4-methyl-*.		
5250	**——, isobutyl phenyl.**	See Isovalerophenone.		
5251	**——, isobutyl propyl.**	See 4-Heptanone, 2-methyl-*.		
5252	**——, α-isonitrosobuty**	**l methyl.** See 2,3-Hexanedio	ne, 3-oxime*.	
5253	**——, α-isonitrosoethyl**	**methyl.** See 2,3-Butanedion	e, mono-oxime*	
5254	**——, α-isonitrosoprop**	**yl methyl.** See 2,3-Pentaned	ione, 3-oxime*	
5255	**——, isopropyl methyl**	. See 2-Butanone, 3-methyl-*.		
5256	**——, isopropyl phenyl.**	See Isobutyrophenone.		
5257	**——, methyl naphthyl**	. See Acetonaphthone.		
5258	**——, methyl nonyl.**	See 2-Hendecanone*.		
5259	**——, methyl octyl.**	See 2-Decanone*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5200							
5201							
5202							
5203							
5204							
5205							
5206							
5207							
5208							
5209							
5210							
5211							
5212							
5213							
5214							
5215							
5216							
5217							
5218							
5219							
5220							
5221							
5222							
5223							
5224							
5225							
5226							
5227							
5228							
5229							
5230							
5231							
5232							
5233							
5234							
5235							
5236							
5237	col cr f. pet. eth.		33	173	i	s	s. eth.
5238	liq	$1.1839\frac{19}{19}$		285	i	s	s. eth.
5239							
5239M							
5240							
5241							
5242							
5243							
5244							
5245							
5246							
5247							
5248							
5249							
5250							
5251							
5252							
5253							
5254							
5255							
5256							
5257							
5258							
5259							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
5260	**Ketone, methyl phenacyl.** See *Acetone, benzoyl-*.			
5261	**——, methyl phenyl.**	See *Acetophenone*.		
5262	**——, methyl propyl.**	See 2-*Pentanone**		
5263	**——, methyl styryl.**	See *Acetone, benzylidene-*		
5264	**——, methyl 2-thienyl**	2-acetylthiophene, α-acetothienone	$CH_3COC_4H_3S$	126 17
5265	**——, methyl *p*-tolyl.**	See *Acetophenone, p-methyl-*		
5266	**——, 1-naphthyl phenyl**		$C_{10}H_7COC_6H_5$	232 27
5267	**——, 2-naphthyl phenyl**	.	$C_{10}H_7COC_6H_5$.. .	232 27
5268	**——, nitrophenyl phenyl.** See *Benzophenone, nitro-*			
5269	**——, phenyl propyl.**	See *Butyrophenone*		
5270	**——, phenyl styryl.**	See *Chalcone*.		
5271	**——, phenyl *o*-tolyl**		$C_6H_5COC_6H_4CH_3$	196 24
5272	**——, phenyl *m*-tolyl**		$C_6H_5COC_6H_4CH_3$.	196 24
5273	**——, phenyl *p*-tolyl**		$C_6H_5COC_6H_4CH_3$.	196 24
5274	**——, phenyl trityl.**	See *β-Benzopinacolin*		
5275	**Ketoxime, methyl ethyl.** See 2-*Butanone**, *oxime*			
5276	**——, methyl isopropyl.**	See 2-*Butanone, 3-methyl-**, *oxime*.		
5277	**——, methyl propyl.**	See 2-*Pentanone**, *oxime*		
5278	**Kojic acid**	5-hydroxy-2-(hydroxymethyl)-1,4-pyrone	OC(CH₂OH)·CH-COC(OH)·CH	142 11
5279	**Kynurenic acid** . . .	4-hydroxyquinaldic acid	$C_9H_5N(OH)COOH$	189 16
5280	**Kynurine.**	See 4-*Quinolinol*.		
5281	**Labordin.**	See *Analgen*		
5282	**Lactamide**	2-hydroxypropanamide*, lactic amide	$CH_3CHOHCONH_2$	89 09
5283	**Lactic acid**(*dl*)	ordinary lactic acid lactic acid of fermentation, 2-hydroxypropanoic acid*, α-hydroxypropionic acid	$CH_3CHOHCOOH$	90 08
5284	——, benzoate.	*O*-benzoyllactic acid	$CH_3CH(OOCC_6H_5)COOH$	194 18
5285	——, butyl ester	butyl lactate	$CH_3CHOHCOOC_4H_9$	146 18
5286	——, ethyl ester	ethyl 2-hydroxypropanoate*, ethyl lactate	$CH_3CHOHCOOC_2H_5$	118 13
5287	——, methyl ester	methyl 2-hydroxypropanoate*, methyl lactate	$CH_3CHOHCOOCH_3$	104 10
5288	——, *p*-phenylphenacyl ester		$CH_3CHOHCOOCH_2COC_6H_4C_6H_5$	284 30
5289	——, piperazinium salt		$C_4H_{10}N_2\cdot 2C_3H_6O_3$	266 29
5290	**Lactic acid**(*d*) .	*d*-2-hydroxypropanoic acid*, *d*-α-hydroxypropionic acid, sarcolactic acid, paralactic acid	$CH_3CHOHCOOH$	90 08
5291	**——, benzal-.**	See 3-*Butenoic acid 2-hydroxy-4-phenyl-*.		
5292	**——, *O*-benzoyl-.**	See *Lactic acid, benzoate*.		
5293	**——, α-phenyl-.**	See *Atrolactic acid*.		
5294	**——, β,β,β-trichloro-**		$CCl_3CHOHCOOH$	193 43
5295	**Lactic amide.**	See *Lactamide*		

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5260							
5261							
5262							
5263							
5264	col. oil ...	1 167[24]	9	213 5			v. s. eth
5265							
5266	rhomb f. al		75 5	385	i	2 4[12]	
5267	rhomb. need. f. al.		82	398[754]	i	2 01[12]	
5268							
5269							
5270							
5271	col. liq ...		<-18	316	i	∞	∞ eth.
5272	col. liq ...	1 088[18]	316 5		i	∞	∞ eth., chl., bz
5273	monocl., 1.717, 1 563		60	326 5	i	s	v. s eth., bz.
5274							
5275							
5276							
5277							
5278	col pris-matic need.		152–4		3 95[20], 6 90[35]	s.	sl s. eth.
5279	need		(-H_2O, 140–5) anh 257–8		0 9[100]	s h	sl s. eth.
5280							
5281							
5282	col. hyg. cr.	1 138[8]	74		v s	v s	
5283	col hyg. syrup, 1.4414	1 249[15]	18	122[15]	∞	∞	∞ eth.
5284	pl ...		112		0 25 c., s h	s	s. eth., hyd. by h. dil. H_2SO_4
5285	liq	0 968		160–90 (75–77[6])	sl s.	∞	∞ eth.
5286	col. liq .	1 031[20/4]		154 (150–2)	∞	v s.	v s eth
5287	col liq., 1.4156[16]	1 118[0/4], 1 08[16]		144 8	s d	s	s eth
5288	....		145				..
5289	wh cr ..		96–6 5		s	s h.	i eth., s. h. cellosolve
5290	hyg. pr. or syrup liq.	1 2485	26	d.	∞	∞	∞ eth.
5291							
5292							
5293							
5294	pr. f. eth		124	170[4]	v s	v. s.	v s eth., s chl.
5295							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
5296	**Lactic anhydride**	2-hydroxypropanoic anhydride*	$(CH_3CHOHCO)_2O$	162 14
5297	**Lactide**	3,6-dimethyl-2,5-*p*-dioxanedione	$OCOCH(CH_3)$-$OCOCH(CH_3)$	144 12
5298	**Lactobiose.**	See *Lactose*		
5298M	**Lactoflavin.**	See D-*Riboflavin*		
5299	**Lactonic acid.**	See *Galactonic acid.*		
5300	**Lactonitrile**	2-hydroxypropanenitrile*; acetaldehyde cyanohydrin; ethylidene cyanohydrin	$CH_3CH(OH)CN$	71 08
5301	**Lactose** .	milk sugar, lactobiose	$C_{12}H_{22}O_{11}$ H_2O	360 31
5302	**Lanthopine.**		$C_{20}H_{25}NO_4$	343 41
5303	**Lappaconatine**		$C_{31}H_{48}N_2O_8$ or $C_{32}H_{42}N_2O_9$	612 74 (598 68)
5304	**Laudanidine**	*l*-laudanine, tritopine	$C_{20}H_{25}NO_4$	343 41
5305	***dl*-Laudanine**... ..		$C_{20}H_{25}NO_4$	343 41
5306	***l*-Laudanine.**	See *Laudanidine*		
5307	***d*-Laudanosine**		$C_{21}H_{27}NO_4$	357 44
5308	**Lauraldehyde**	dodecanal*	$CH_3(CH_2)_{10}CHO$	184 31
5309	**Laurel camphor.**	See *d-Camphor*		
5310	**Laurent's acid.**	See 1-*Naphthylamine-5-sulfonic acid*		
5311	**Lauric acid**	dodecanoic acid*	$CH_3(CH_2)_{10}COOH$	200 31
5312	——, benzyl ester		$C_{11}H_{23}COOCH_2$-C_6H_5	290 43
5313	——, ethyl ester	ethyl dodecanoate*, ethyl laurate	$CH_3(CH_2)_{10}$-$COOC_2H_5$	228 37
5314	——, ethylene ester	See *Glycol, dilaurate*		
5314M	——, phenyl ester	phenyl laurate	$C_{11}H_{23}COOC_6H_5$	276 41
5315	——, *p*-phenylphenacyl ester		$CH_3(CH_2)_{10}COOC$-$H_2COC_6H_4C_6H_5$	394 54
5316	**Lauric anhydride**	dodecanoic anhydride*	$(C_{11}H_{23}CO)_2O$	382 61
5317	**Laurin.**	See *Glycerol, trilaurate*		
5318	**Laurone.**	See 12-*Tricosanone**		
5319	**Lauronitrile**....	dodecanenitrile*, *n*-undecyl cyanide	$CH_3(CH_2)_{10}CN$	181 31
5319M	**Lauroyl chloride**..	dodecanoyl chloride*, lauryl chloride	$CH_3(CH_2)_{10}COCl$	218 76
5320	**Lauryl alcohol** ...	See 1-*Dodecanol**.		
5321	**Lauryl bromide.**	See *Dodecane, 1-bromo-**		
5322	**Lauryl chloride.**	See *Lauroyl chloride.*		
5323	**Lauryl ketone.**	See 12-*Tricosanone**.		
5324	**Lauth's violet.**	See *Thionine*		
5325	**Lead, hexaethyldi-**.	hexaethyldiplumbane, diplumbic hexaethyl, lead triethide	$Pb_2(C_2H_5)_6$	588 78
5326	——, **tetraethyl-*** .	lead tetraethide	$Pb(C_2H_5)_4$	323 45

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5296	lt yel amor.		260 d.	d	v. sl. s.	v. s.	v. s. eth.
5297	col monocl. tab f al.	0.862^{10}_{4}	125	255	v sl s c	v sl s	.
5298							
5298M							
5299							
5300	col. liq......	0 992	-40	182-4 sl d	s.	s	s eth.; i. pet. eth.
5301	col rhomb, 1 517, 1 542, 1 555	1.525^{20}_{4}	anh 201 6	d	17 c, 40 h	i.	i eth., chl.
5302	cr		200			sl s	sl s. eth.
5303	hex. cr		205		sl s	s.	s eth.
5304	hex pr. f w +al.		166		i	s	sl s eth, s. bz, chl.
5305	sm trim. ylsh. wh pr		166			sl s	0.154^{18} eth., s. chl, bz
5306							
5307	need. f. bz., $[\alpha]+103.23^{\circ 15}_{D}$		89-90		i	s.	5.18^{16} eth; s. chl., h bz.
5308	col. leaf	0.8352^{15}_{4}	41 5	185^{100}	i.	s.	s eth.
5309							
5310							
5311	col need. f. al, $1.4183^{82.1}$	0 883, 0.8679^{50}_{4}	44 (48)	225^{100}	i	26^{0}, 134^{21}	v s eth, s. bz, 142^{21} me. al.
5312	liq	0.9457^{25}_{25}	8 5	$209\text{-}11^{12}$	i	s	v s. eth.
5313	oil, 1 4321	0.8615^{20}_{4}	-10 7 (-1 68)	269	i	v s	∞ eth
5314							
5314M	col cr			$159\text{-}161^{1}$	i	s	s eth.
5315	.		84				.
5316	col cr		41	166	i, d	s, d	v s. eth.
5317							
5318							
5319	oil	0.8373^{15}	4	198^{100}	i	sl s	v s eth.
5319M	col liq		-17	145^{18}	d	d	s eth.
5320							
5321							
5322							
5323							
5324							
5325	liq	1 471		d.	i		. .
5326	col liq, 1.5218^{18}	1.659^{18}		198-202	i	∞	∞ eth.,; s in all org. solv, i. dil. a, dil. alk.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
5327	**Lead, tetramethyl-**	tetramethylplumbane, lead tetramethyl	$Pb(CH_3)_4$ ...	267 35
5328	**——, tetraphenyl-***	tetraphenylplumbane..	$(C_6H_5)_4Pb$.	515 61
5329	**Lead triethide.**	See *Lead, hexaethyldi-.*		
5330	**Lecanoric acid**, monomethyl ether	See *Evernic acid.*		
5332	**Lepidine**	4-methylquinoline ..	$CH_3C_9H_6N$.	143 18
5333	**——, 2-(p-aminophenyl)-.**	See *Flavaniline.*		
5334	**2(1)-Lepidone.**	See *Carbostyril, 4-methyl-.*		
5335	***op*₂-Leucaniline......**	*o,p',p''*-methenyltrianiline; *o,p',p''*-triaminotriphenylmethane; 2,4',4''-triaminotritan	$CH(C_6H_4NH_2)_3$.	289 37
5336	***mp*₂-Leucaniline**	*m,p',p''*-methenyltrianiline, *m,p',p''*-triaminotriphenylmethane, 3,4',4''-triaminotritan, pseudoleucaniline	$CH(C_6H_4NH_2)_3$.	289 37
5337	***p*₃-Leucaniline**	paraleucaniline; *p,p',p''*-methenyltrianiline, *p,p',p''*-triaminotriphenylmethane, 4,4',4''-triaminotritan	$CH(C_6H_4NH_2)_3$	289 37
5338	**——, *N,N,N',N'*-tetramethyl-**	4-amino-4',4''-bisdimethylaminotriphenylmethane	$[(CH_3)_2NC_6H_4]_2$-$CHC_6H_4NH_2$	345 47
5339	**Leucaurin. ...**	*p,p',p''*-methenyltriphenol, leucoaurin	$CH(C_6H_4OH)_3$	292 32
5340	***l*-Leucic acid.. .**	2-hydroxy-4-methylpentanoic acid*, *α*-hydroxyisocaproic acid, leucinic acid	$(CH_3)_2CHCH_2$-$CHOHCOOH$	132 16
5341	***dl*-Leucine....**	*dl-α*-aminoisocaproic acid	$(CH_3)_2CHCH_2$-$CH(NH_2)COOH$	131 17
5342	***l*-Leucine.......**	*l*-2-amino-4-methylpentanoic acid*, *l-α*-aminoisocaproic acid	$(CH_3)_2CHCH_2$-$CH(NH_2)COOH$	131 17
5343	**Leucoindigo.**	See *Indigo white.*		
5344	**Leucoline.**	See *Isoquinoline.*		
5345	**Leucomalachite green.**	See *Aniline, p,p'-benzylidenebis-N,N-dimethyl-.*		
5346	**Levulin** (synthetic)	fructosin, levulosin .	$(C_6H_{10}O_5)_x$	$(162\text{-}14)_x$
5347	**Levulinaldehyde**	4-oxopentanal*, levulinic aldehyde; *γ*-ketovaleraldehyde	$CH_3COCH_2CH_2$-CHO	100 11
5348	**Levulinic acid**	4-oxopentanoic acid*; *γ*-ketovaleric acid; acetopropionic acid	$CH_3COCH_2CH_2$-$COOH$	116 11
5349	——, ethyl ester .	....	$CH_3CO(CH_2)_2$-$COOC_2H_5$	144 17
5350	**Levulose.**	See D-*Fructose.*		
5351	**Levulosin.**	See *Levulin (synthetic).*		
5352	**Licareol,** esters	See under *l-Linalool.*		
5353	**Lichenin..**	moss starch .	$(C_6H_{10}O_5)_x$	$(162\text{-}14)_x$
5354	**Lignoceric acid**	....	$C_{23}H_{47}CO_2H$	368 63
5355	***dl*-Limonene** .	dipentene; *dl*-1,8(9)-*p*-menthadiene	$C_{10}H_{16}$.	136 23
5356	***d*-Limonene.. . ...**	*d*-1,8(9)-*p*-menthadiene; citrene, carvene, hesperidene	$C_{10}H_{16}$	136 23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5327	col. liq., 1.5128	$1.9951\frac{20}{4}$	-27.5	110	i.	∞	∞ eth.
5328	wh. need. .	....	227.7				s. bz.
5329							
5330							
5332	col. liq... .	$1.086\frac{20}{4}$	<0	258-263	v. sl. s.	∞	∞ eth.; s. bz.
5333							
5334							
5335	col. cr. f. al.		165		v. sl. s. h.	v. s.	v. sl. s. eth.
5336	rosettes f. eth		150		i	s.	s. eth.; v. sl. s. lgr.
5337	col. leaf. f. w		148 (207)		i.	s.	s. bz.
5338	glit. cr. f. al.		151-2			v. sl. s	
5339	col. need. f. ac. a.		.		sl. s.	s.	s. ac. a., alk
5340	need. or pl. f eth.+pet eth		72.5 (*dl*, 76-7)	subl. 100	v. s.	v. s.	v. s. eth
5341	leaf. f. w .		332 d. (290)		0.99^{25}, 2.28^{75}	0.176^{25} 75%, 0.13^{25} 90%	
5342	hex. col. leaf. f. w., 1.525, 1.535, 1.560	$1.293\frac{18}{4}$	295 (*d.* 280 d.)	subl.	2.43^{25}, 3.82^{75}	0.072^{17} 99%	i. eth.; 10.9 gl. ac. a.
5343							
5344							
5345							
5346	deliq. amor..	.	140-5 d.	.	∞	10^{22} 84% v. sl. s	i. eth.
5347	col. liq., 1.4263	$1.018\frac{20}{4}$	<-21	186-8 d	∞	∞	∞ eth.
5348	col. leaf	$1.1395\frac{20}{4}$	37.2	246, 151^{14}	v. s.	v. s.	v. s. eth.
5349	col. liq .	$1.01346\frac{20}{4}$		205.2^{756}	v. s.	∞	∞ eth.
5350							
5351							
5352							
5353	wh. amor. powd.	....	....	....	s. h.	i.	i. eth.; s. conc HCl
5354	col. need. f. al	0.8207	81	......		s.	s. eth. bz., CS_2, ac. a.
5355	col. liq., 1.473	0.865^{18}; 0.845^{20}		176 (178-80)	i.	s.	s. eth.
5356	col. liq., $1.47489^{14.7}$	$0.842\frac{20}{4}$	-96.9	177	i.	∞	∞ eth

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
5357	**d-Linalool**	d-3,7-dimethyl-1,6-octadien-3-ol*, coriandrol	$C_{10}H_{18}O$	154 25
5358	**l-Linalool**, acetate	linalyl acetate, licareol acetate	$CH_3COO(C_{10}H_{17})$	196 28
5359	—, formate	l-linalyl formate	$HCOOC_{10}H_{17}$	182 26
5359M	**Linaloolene.**	See 1,6-*Octadiene, 3,7-dimethyl*-*.		
5360	**Linalyl esters.**	See under *Linalool*		
5361	**Linoleic acid** ...	9,12-octadecadienoic acid*, linolic acid	$C_{18}H_{32}O_2$	280 44
5362	—, ethyl ester	ethyl linoleate, ethyl linolate	$C_{17}H_{31}COOC_2H_5$	308 49
5363	—, methyl ester	methyl linolate	$C_{17}H_{31}COOCH_3$	294 47
5364	—, tetrabromide	See *Stearic acid, θ,ι,λ,μ-tetrabromo-*.		
5365	**Linolenic acid**, ethyl ester		$C_{17}H_{29}COOC_2H_5$	306 48
5366	**α-Linolenic acid** .	9,12,15-octadecatrienoic acid* (one form)	$C_{17}H_{29}COOH$	278 42
5367	—, hexabromide	See *Stearic acid, θ,ι,λ,μ,ξ,o-hexabromo-*.		
5369	**Lithofellic acid** ..	lithofellinic acid	$C_{20}H_{36}O_4$	340 49
5370	**Lobeline**		$C_{21}H_{23}NO_2$	321 40
5371	**l-Lobeline**		$C_{22}H_{27}NO_2$ or $C_{21}H_{23}NO_2$	337 45 (321 40)
5372	**Lophine**.............	2,4,5-triphenylimidazole	$C_{21}H_{16}N_2$	296 36
5373	**Luminal.**	See *Phenobarbital*		
5374	**Luminol**.............	5-amino-2,3-dihydro-1,4-phthalazinedione, 3-aminophthalhydrazide	$NH_2C_6H_3CONH$-NHCO	177 16
5375	**dl-Lupanine**		$C_{15}H_{24}N_2O$	248 36
5376	**d-Lupanine** ..		$C_{15}H_{24}N_2O$	248 36
5377	**Lupinidine.**	See *Sparteine*		
5378	**Lupinine** . .		$C_{21}H_{40}N_2O_2$	352 55
5379	—, hydrochloride		$C_{10}H_{19}NO \cdot HCl$	205 73
5380	**—, methyl-** .		$C_{10}H_{18}NO \cdot CH_3$	183 29
5381	**2,4-Lutidine**	2,4-dimethylpyridine*, αγ-lutidine	$(CH_3)_2C_5H_3N$	107 15
5382	**2,6-Lutidine**	2,6-dimethylpyridine*, αα'-lutidine	$(CH_3)_2C_5H_3N$	107 15
5383	**3,4-Lutidine** .	3,4-dimethylpyridine*, βγ-lutidine	$(CH_3)_2C_5H_3N$	107 15
5384	**Lutidinic acid**	2,4-pyridinedicarboxylic acid*	$C_5H_3N(COOH)_2$	167 12
5385	**—, 6-methyl-**	See *Uvitonic acid*		
5387	**Lyaconitine** . .		$C_{27}H_{34}N_2O_6 \cdot 2H_2O$	518 59
5388	**Lycine.**	See *Betaine.*		
5389	**l-Lycorine**...... ...		$C_{16}H_{17}NO_4$	287 31
5390	**d-Lysine** .. .	d-α,ε-diaminocaproic acid, d-2,6-diaminohexanoic acid*	$NH_2(CH_2)_4CH(NH_2)COOH$	146 19

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
5357	col liq, 1 4623	0 $8622\frac{20}{4}$, d 0 $8702\frac{20}{4}$		198 3	v sl. s.	∞	∞ eth.
5358	col liq, 1.4460	0 $895\frac{20}{4}$	.	220	v sl s	∞	∞ eth.
5359	..			$100\text{–}3^{10}$	i.	s.	s. eth.
5359M							
5360							
5361	col-yel oil	0 $9025\frac{20}{4}$	-11	230^{16}	i	∞	∞ eth.
5362	col-yel oil	0 8865^{20}		$270\text{–}5^{180}$	i	s.	s eth.
5363	col.-yel. oil	0 889^{18}		$207\text{–}8^{11}$	i	s.	v s eth.
5364							
5365	oil	0 8919	.	123-33 $^{0.1}$	i	s.	s. eth.
5366	col liq	0 905^{20}_{4}		$230\text{–}2^{17}$	i	∞	∞ eth.
5367							
5369	micr cr		206	d	i	s.	. .
5370	yel. syrup				sl s	v s	v. s eth.; s. bz, chl.
5371	col. need		130-1		d h		.
5372	need		275		i	0 88^{21}	0 32^{20} eth.
5373							
5374	yel		ca. 280		i	sl s	sl. s. eth.
5375	need f pet eth.		99		v s	v s	v s eth., s. chl.
5376	col. need		44		s.	v s.	v. s. eth.; s. chl, lgr.
5377							
5378	col rhomb, $[\alpha]\text{–}190^{\circ 17}_{D}$		68 5-9 2	256	s c.	s.	s eth, chl.
5379	lg rhomb. cr, $[\alpha]\text{–}14^{\circ}_{D}$		212-3		s	s.	. . . . . .
5380	oily liq. .			$145\text{–}6^{15}$		s.	s. eth.
5381	col liq .	0 $9493\frac{0}{4}$		157 1 (159)	20	s.	s. eth.
5382	col liq	0 $942\frac{0}{4}$		143	∞ c, less s h	s.	s. eth.
5383	col liq .		.	163 5-4 5		s.	s. eth.
5384	leaf or pr. f. w.	0 942	248-50		s	s.	i. eth.
5385							
5387	ylsh-wh resinous	. .	112-5		sl. s.	s.	sl. s. eth.; s. chl., CS_2, pet. eth.
5388							
5389	col. pr	.	250 d.		i	sl s.	sl s eth, chl; s a.
5390	need. or hex. pl. f. al.		224 d.				..

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
5391	**l-Lysine**	l-2,6-diaminohexanoic acid*, l-α,ε-diaminocaproic acid	$NH_2(CH_2)_4CH(NH_2)COOH$	146 19
5392	—, picrate		$C_6H_{14}N_2O_2·C_6H_3N_3O_7$	375 30
5392H	**D-Lyxosazone.**	See D-*Xylose.*		
5392R	**D-Lyxose, (α)**		$C_5H_{10}O_5$	150 13
5393	**Maclurin**	2,4,6,3',4'-pentahydroxybenzophenone, moringatannic acid, moringatannin	$C_{13}H_{10}O_6·H_2O$	280 23
5395	**Malachite green, leuco.**	See *Aniline, p,p'-benzylidenebis-N,N-dimethyl-.*		
5396	**Malamide**	2-hydroxybutanediamide*, malic amide	$C_2H_3(OH)(CONH_2)_2$	132 12
5397	**Malay camphor.**	See *d-Borneol.*		
5398	**Maleamic acid**	maleamidic acid, maleic acid monoamide	$H_2NCOCH:CHCOOH$	115 09
5399	**Maleic acid**	cis-butenedioic acid*; cis-1,2-ethylenedicarboxylic acid	$HOOCCH:CHCOOH$	116 07
5400	—, diethyl ester	diethyl maleate, ethyl maleate	$(CHCOOC_2H_5)_2$	172 18
5401	—, dimethyl ester	methyl maleate	$(CHCOOCH_3)_2$	144 12
5402	—, monoamide	See *Maleamic acid.*		
5403	—, p-phenylphenacyl ester		$(CHCOOCH_2COC_6H_4C_6H_5)_2$	504 51
5404	**—, bromo-**		$BrC(COOH):CHCOOH$	194 98
5405	**—, chloro-**		$ClC(COOH):CHCOOH$	150 52
5406	**—, methyl-.**	See *Citraconic acid*		
5407	**Maleic anhydride**	cis-butenedioic anhydride*, 2,5-furandione	$OCOCH:CHCO$	98 06
5408	**—, bromo-**		$OCOCBr:CHCO$	176 96
5409	**—, chloro-**		$OCOCCl:CHCO$	132 51
5410	**—, methyl-.**	See *Citraconic anhydride*		
5411	**Malic acid(dl)**		$HOOCCH(OH)CH_2COOH$	134 09
5412	**Malic acid(l)**	ordinary malic acid; l-hydroxybutanedioic acid*, l-hydroxysuccinic acid	$HOOCCH(OH)CH_2COOH$	134.09
5413	—, acetate	acetoxysuccinic acid, O-acetylmalic acid	$CH_3COOCH(COOH)CH_2COOH$	176 12
5414	—, diethyl ester	diethyl hydroxybutanedioate*; ethyl malate	$CH_2(COOC_2H_5)CHOHCOOC_2H_5$	190 19
5415	—, dimethyl ester	methyl malate; methyl hydroxysuccinate	$CH_3OOCCH(OH)CH_2COOCH_3$	162 14
5416	—, dipropyl ester	dipropyl hydroxybutanedioate*; propyl malate	$C_3H_7OOCCHOHCH_2COOC_3H_7$	218 25

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5391	flat need. f. w., hex. pl f al.		224 d.		v s.	v. sl. s.	i eth.
5392	need .		266 exp.		0 54 c.	i.	i. eth.
5392 H							
5392 R	col. monocl , biaxial cr. (hygr.) 1 532[20], 1 541[20], 1 549[20]; $[\alpha]_D^{20}$+5 5° init.,-14° on standing	1 545$\frac{20}{4}$	106-7 (101)		v s.	2 11	.
5393	col -yel. pr. f. w.		220 d	d	0 5[15]	s.	s. eth.
5395							
5396	pr f. w		156–8		s.	..	. .
5397							
5398	pl		152–3		v s.	s. h.	i. eth.
5399	col monocl. pr	1 590$\frac{20}{4}$	130 5	135 d.	78 8[25], 392 6[97.5]	69 9[29.7]	8[25] eth.; s. glac. ac a., acet ; v sl. s bz
5400	col. liq	1 064[25.2]		225; 105–6[14]	i	s.	s eth.
5401	col. liq	1 1606$\frac{20}{4}$	- 19	205, 102[17]	i		s. eth.
5402							
5403	..		168				.
5404	need. or pr		128; 138–41	d	v s	v s	v. s. eth.
5405	col. pr f eth -chl		108 (114); sinters 96		s h	v s	v. s. eth.; s. ac. a.; sl. s. bz, chl ;i pet. eth.
5406							
5407	col. rhomb need. f. chl	0 934$\frac{20}{4}$	53 (57–60)	202 (196)	16.32[29 7]	v sl s	v sl s. CCl_4
5408	liq	.		215			
5409	liq . .	1 54$\frac{25}{25}$	33	196.3; 95[20]			
5410							
5411	col. cr	1 601$\frac{20}{4}$	128 5	150 d.	144[26], 411[79]	v. s	sl s.
5412	col. need .	1 595	100	140 d.	v s	v. s.	6 0 c. eth.
5413	cr		134	d.	s, d h		i bz.
5414	col liq , 1.4362	1 128		253	s.	∞	∞ eth.
5415	col. liq., 1.4425	1 2226$\frac{20}{4}$		242	v s	∞	∞ eth.
5416	liq., 1.4380 .	1 075	10 5	151[10]			. .

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
5417	**Malic acid, *O*-acetyl-.**	See *Malic acid, acetate.*		
5418	——, **α-methyl-.**	See *Citramalic acid.*		
5419	**Malic amide.**	See *Malamide*		
5420	**Malonamide**........	propanediamide*; malonic diamide	$CH_2(CONH_2)_2$.	102 09
5421	**Malonic acid**.........	propanedioic acid*; methanedicarboxylic acid	$HOOCCH_2COOH$	104 06
5422	——, diethyl ester	diethyl propanedioate*, ethyl malonate, malonic ester	$CH_2(COOC_2H_5)_2$	160 17
5423	——, dimethyl ester .	methyl malonate; dimethyl propanedioate*	$CH_2(COOCH_3)_2$	132 11
5424	——, dipropyl ester	dipropyl propanedioate*, propyl malonate	$CH_2(COOC_3H_7)_2$	188 22
5425	——, monoethyl ester, piperazinium salt		$C_4H_{10}N_2$·2HOOC-$CH_2COOC_2H_5$	350 37
5426	——, piperazinium salt		$C_4H_{10}N_2$·$C_3H_4O_4$.	190 20
5427	——, **acetyl-**, diethyl ester	ethyl acetylmalonate; diethyl acetylpropanedioate*	CH_3COCH-$(COOC_2H_5)_2$	202 20
5428	——, **allyl-**	2-propenylpropanedioic acid*, 3-butene-1,1-dicarboxylic acid*	COOHCH-(CH_2CH:CH_2)-COOH	144 12
5429	——, ——, diethyl ester	ethyl allylmalonate, diethyl (2-propenyl)propanedioate*, diethyl 3-butene-1,1-dicarboxylate*	CH_2:$CHCH_2CH$-$(COOC_2H_5)_2$	200 23
5430	——, **amino-**.........	2-aminopropanedioic acid*	COOHCH(NH_2)-COOH	119 08
5431	——, **amyl-**, diethyl ester	ethyl amylmalonate	$CH_3(CH_2)_4CH$-$(COOC_2H_5)_2$	230 30
5432	——, **anilino-**, ethyl ester	anilinomalonic ester; diethyl anilinomalonate	C_6H_5NHCH-$(COOC_2H_5)_2$	251 28
5433	——, **benzylidene-**. .	2-phenyl-1,1-ethylenedicarboxylic acid	C_6H_5CH:C-$(COOH)_2$	192 16
5434	——, **benzyl-**, diethyl ester	diethyl benzylpropanedioate*, ethyl benzylmalonate	$C_6H_5CH_2CH$-$(COOC_2H_5)_2$	250 29
5435	——, **bromo-**	bromopropanedioic acid*	$BrCH(COOH)_2$	182 97
5436	——, ——, diethyl ester .	diethyl bromopropanedioate*	$BrCH(COOC_2H_5)_2$	239 08
5437	——, **butyl-**, diethyl ester	ethyl *n*-butylmalonate	$CH_3(CH_2)_3CH$-$(COOC_2H_5)_2$	216 27
5438	——, *sec*-**butyl-**, diethyl ester	ethyl *sec*-butylmalonate	$C_2H_5(CH_3)CHCH$-$(COOC_2H_5)_2$	216 27
5439	——, **chloro-**	chloropropanedioic acid*	$CHCl(COOH)_2$	138 51
5440	——, **dibenzyl-**, diethyl ester	diethyl 1,3-diphenyl-2,2-propanedicarboxylate	$(C_6H_5CH_2)_2C$-$(COOC_2H_5)_2$	340 40
5441	——, **dibromo-**, diethyl ester	diethyl dibromopropanedioate*	$CBr_2(COOC_2H_5)_2$.	317 98
5442	——, **diethyl-**, diethyl ester	diethyl diethylpropanedioate*	$(C_2H_5)_2C$-$(COOC_2H_5)_2$	216 27
5443	——, ——, piperazinium salt	. . . .	$C_4H_{10}N_2$·$(C_2H_5)_2$-$C(COOH)_2$	246 30
5444	——, **dihydroxy-.**	See *Mesoxalic acid.*		
5445	——, **dimethyl-**, diethyl ester	diethyl dimethylpropanedioate*	$(CH_3)_2C$-$(COOC_2H_5)_2$	188 22

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5417							
5418							
5419							
5420	col monocl. need.		170	.	8 3^{8}	i.	i. eth.
5421	col tricl .	1 631^{15}_{4}	135 6	d	61 1^{0}, 73 5^{20}, 92 6^{50}	57^{20}	5 7^{15} eth.
5422	col. liq., 1.4143^{20}	1 055^{20}_{4}	-49 8	198 9 ($94\text{–}6^{18}$)	2 08^{20}	∞	∞ eth ; s. chl, bz.
5423	col liq, 1 41490^{17}	1 1544^{20}_{4}	-62	181	v sl. s	∞	∞ eth.
5424	col liq .	1 027^{0}_{0}		228 3			.
5425	wh cr		144		s	s h.	i. eth.
5426	wh cr		180 (d.)		s.	s h.	i. eth.
5427	liq .	1 080^{23}		240 (120^{17})			s. Na_2CO_3 sol.
5428	tricl f eth		103–5	d 180	s	s	s. eth, bz.
5429	col liq	1 01475^{14}		222–3 ($110\text{–}2^{14}$)	i	v s	v s eth.
5430	col cr ($+1H_2O$) f w		109 d.		sl s	sl s.	
5431	col liq, 1 4253	.	$121\text{–}3^{6}$		i.	v s	v. s. eth.
5432	need		44–5			v. s	s eth.
5433	pr f w		d 195 to cinnamic acid		s h	s.	sl. s eth., CS_2, ac. a., chl., bz, lgr ; s. acet., et. acetate
5434	liq	1 077^{15}_{15}		296–8	i		....
5435	need f eth...		112–3 d.			v s.	v. s. eth.
5436	liq .	1 4022^{25}_{4}	-54	235 ($125\text{–}7^{15}$)	i.	∞	∞ eth.
5437	col liq, 1 425			235–40; $130\text{–}5^{20}$	i.	v. s.	v. s. eth.
5438	col liq, 1.4248	0 988^{15}		224–5, $94\text{–}5^{5}$	v sl s	v. s.	v. s. eth.
5439	pr .		133		v s	v. s.	v. s. eth.
5440	thk oil	1 093	13	$243\text{–}6^{18}$		s.	s. eth.
5441	liq			250–6 d. ($103\text{–}6^{4}$)		.	
5442	col liq, 1 $42516^{16\ 6}$	0 985^{20}_{4} (0 990)		223	v sl s (1)	∞	∞ eth.
5443	wh cr .		80–1		s	s.	i. eth ; s. h. acet
5444							
5445	col liq., 1 $41049^{24\ 1}$	0 9910^{25}_{4}		196 5^{753}	i.	∞	∞ eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
5446	**Malonic acid, ethyl-**	ethylpropanedioic acid*; 1,1-propanedicarboxylic acid*	$C_2H_5CH(COOH)_2$	132 11
5447	——, ——, diethyl ester	ethyl ethylmalonate; ethylmalonic ester	$C_2H_5CH(COOC_2H_5)_2$	188 22
5448	——, **ethylene-.**	See *Vinaconic acid.*		
5449	——, **(α-ethylpropyl)-**, diethyl ester	ethyl *sec*-amylmalonate	$(C_2H_5)_2CHCH(COOC_2H_5)_2$	230 30
5450	——, **heptyl-**	heptylpropanedioic acid*; 1,1-octanedicarboxylic acid	$CH_3(CH_2)_6CH(COOH)_2$	202 25
5451	——, **hydroxy-.**	See *Tartronic acid.*		
5452	——, **isoamyl-**, diethyl ester	ethyl isoamylmalonate	$(CH_3)_2CH(CH_2)_2CH(COOC_2H_5)_2$	230 30
5453	——, **isobutyl-**	3-methyl-1,1-butanedicarboxylic acid*	$(CH_3)_2CHCH_2CH(COOH)_2$	160 17
5454	——, ——, diethyl ester	ethyl isobutylmalonate	$(CH_3)_2CHCH_2CH(COOC_2H_5)_2$	216 27
5455	——, **isopropyl-**, diethyl ester	ethyl isopropylmalonate	$(CH_3)_2CHCH(COOC_2H_5)_2$	202 25
5456	——, **keto-.**	See *Mesoxalic acid.*		
5457	——, **methyl-.**	See *Isosuccinic acid.*		
5458	——, ——, diethyl ester	ethyl isosuccinate	$CH_3CH(COOC_2H_5)_2$	174 19
5459	——, ——, dimethyl ester	dimethyl methylpropanedioate*; methyl isosuccinate	$CH_3CH(COOCH_3)_2$	146 14
5459M	——, **oxo-.**	See *Mesoxalic acid.*		
5460	——, **propyl-.**	propylpropanedioic acid*; 1,1-butanedicarboxylic acid*	$C_3H_7CH(COOH)_2$	146 14
5461	——, ——, diethyl ester		$C_3H_7CH(COOC_2H_5)_2$	202 25
5462	**Malonic anhydride** (so-called). See *Carbon suboxide.*			
5463	**Malonic diamide.**	See *Malonamide.*		
5464	**Malonic dinitrile.**	See *Malononitrile.*		
5465	**Malonic ester, anilino-.** See *Malonic acid, anilino-, ethyl ester.*			
5466	——, **ethyl-.**	See *Malonic acid, ethyl-, diethyl ester.*		
5467	**Malonic mononitrile.**	See *Acetic acid, cyano-.*		
5468	——, **methyl-.**	See *Propionic acid, α-cyano-.*		
5469	**Malononitrile**	propanedinitrile*, methylene cyanide; malonic dinitrile	$CH_2(CN)_2$	66 06
5470	**Malourea.**	See *Barbital.*		
5471	**Maltobiose.**	See *Maltose*		
5472	**Maltonic acid.**	See D-*Gluconic acid*		
5473	**Maltose**	malt sugar; maltobiose	$C_{12}H_{22}O_{11}\cdot H_2O$	360 31
5474	**Malt sugar.**	See *Maltose*		
5475	**Mandelic acid** (*dl*)	*dl*-phenylglycolic acid; *dl*-α-hydroxy-α-toluic acid	$C_6H_5CH(OH)(COOH)$	152 14
5476	——, gentiobioside.	See *Amygdalic acid.*		
5477	——, ***o*-amino-**, lactam	See *Oxindole, 3-hydroxy-*		
5478	——, ***p*-isopropyl-** (*l*)	*l*-*p*-isopropylphenylglycolic acid	$(CH_3)_2CHC_6H_4CHOHCOOH$	194 22
5479	**Mandelonitrile** (*dl*)	*dl*-benzaldehyde cyanohydrin	$C_6H_5CH(OH)CN.$	133 14
5480	——, gentiobioside	See *Amygdalin.*		
5481	D-**Mannitol**	*d*-mannite	$CH_2OH(CHOH)_4CH_2OH$	182 17
5482	——, hexanitrate	nitromannite	$C_6H_8(NO_3)_6$	452 17
5483	D-**Mannoheptitol.**	See *Perseitol.*		
5484	D-**Mannoheptose**		$C_6H_7(OH)_6CHO$	210 18

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
5446	col rhomb cr		111 5	160 d	s	s.	s. eth., bz., chl., et. acetate.
5447	col. liq., $1.41802^{14.8}_{\alpha}$	$1.004\frac{20}{20}$	. . . .	211^{748}; $95\text{-}7^{15}$	v sl s.	v. s	v. s. eth.
5448							
5449	col. liq., 1 4275		. . . .	242-5; 130^{16}	v. sl s	v s	v. s. eth
5450	cr. f bz	.	95		i.	v s	v. s. eth., acet.
5451							
5452	col. liq., 1 4255			240-2; $160\text{-}5^{44}$	i.	v s	v. s eth.
5453	cr		107		v s.	v s	v. s. eth.
5454	col liq	0.983^{17}		225; $113\text{-}6^{1}$	v sl s.	v s	v s. eth
5455	col liq, 1 418	$0.984\frac{25}{4}$		211-5	v sl s	v s	v. s. eth.
5456							
5457							
5458	col liq, $1.41369^{18.7}$	$1.0192\frac{19}{4}$	.	201 4	v sl s	v s	v. s. eth.
5459	col liq	$1.028\frac{25}{25}$		179	v sl s	∞	∞ eth.
5459M							
5460	pl f bz		96	d	45.6^{0}	s	s. eth., chl.; sl s bz.
5461	col liq	0 993		221	v sl s	v s	v s. eth.
5462							
5463							
5464							
5465							
5466							
5467							
5468							
5469	col cr, $1.41463^{34.2}$	1.049^{34}	32 1	220	13 3	40	20 eth ; 6 7 bz.
5470							
5471							
5472							
5473	fine col need	1 540	102 5 d		108^{25}	v sl s. c	i. eth.
5474							
5475	col rhomb. f bz.	1.361^{4}, $1.300\frac{20}{4}$	118 1	d	16^{20}	$53.6^{16.5}$	s. eth.
5476							
5477							
5478	.		158	.			. . . .
5479	yel oily liq	1 124	-10 (22)	d 170	i.	s.	s. eth.
5480							
5481	col rhomb. need.	$1.489\frac{20}{4}$	166 1	$295^{3.5}$	15.6^{18}	0.06^{14}	i eth.
5482	need	1.604^{0}	112	exp. 120	i.	2.9^{13}	2.86^{9} eth.
5483							
5484	need		134-5		v. s.	sl s.	. .

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
5485	D-**Mannose**	seminose; carubinose	$CH_2OH(CHOH)_4$-CHO	180.16
5486	——, phenylhydrazone		$C_6H_{12}O_5NNHC_6H_5$	270 28
5487	**Margaric acid**	heptadecanoic acid*; *n*-heptadecoic acid, *n*-heptadecylic acid	$CH_3(CH_2)_{15}COOH$	270.45
5488	**Margaronitrile**	heptadecanenitrile*, cetyl cyanide; *n*-hexadecyl cyanide	$CH_3(CH_2)_{15}CN$.	251 45
5489	**Marsh gas.**	See *Methane**.		
5490	**Meconic acid**	3-hydroxy-4-keto-1,4-pyran-2,6-dicarboxylic acid	$C_7H_4O_7\cdot 3H_2O$	254 15
5491	**Meconidine**		$C_{21}H_{23}NO_4$	353 40
5492	**Meconin**	5,6-dimethoxyphthalide	$C_{10}H_{10}O_4$	194.18
5493	**Melam**	...	$C_6H_9N_{11}$	235 22
5494	**Melamine**	2,4,6-triamino-s-triazine, cyanurotriamide	N:C(NH$_2$)N·C-(NH$_2$)N C(NH$_2$)	126 13
5495	**Melampyrin.**	See *Dulcitol.*		
5496	**Melaniline.**	See *Guanidine, diphenyl-.*		
5497	**Melene**	...	$C_{30}H_{60}$	420 79
5498	**Meletin.**	See *Quercetin.*		
5498M	**Melibiose**		$C_{12}H_{22}O_{11}$	342 30
5499	**Melilotic acid**	*o*-hydroxyhydrocinnamic acid; *o*-hydrocoumaric acid	$HOC_6H_4CH_2CH_2$-COOH	166 17
5500	**Melissic acid**	.	$C_{30}H_{61}COOH$	466 81
5501	**Melissyl alcohol.**	See *Myricyl alcohol*		
5502	**Mellitic acid**	benzenehexacarboxylic acid*	$C_6(COOH)_6$	342 17
5503	**——, hexahydro-.**	See 1,2,3,4,5,6-*Cyclohexanehexacarboxylic acid**.		
5504	**Mellophanic acid.**	1,2,3,4-benzenetetracarboxylic acid*	$C_6H_2(COOH)_4$	254 15
5505	**1,8(9)-*m*-Menthadiene.**	See *Sylvestrene.*		
5506	**1,3-*p*-Menthadiene.**	See *α-Terpinene.*		
5507	**1,4(8)-*p*-Menthadiene.**	See *Terpinolene.*		
5508	**1,5-*p*-Menthadiene.**	See *α-Phellandrene.*		
5509	**1(7),2-*p*-Menthadiene.**	See *β-Phellandrene.*		
5510	**1,8(9)-*p*-Menthadiene.**	See *Limonene.*		
5511	**3,6-*p*-Menthadiene-2,5-dione.**	See *Thymoquinone.*		
5512	**6,8(9)-*p*-Menthadien-2-one.**	See *Carvone*		
5513	***p*-Menthane**	4-isopropyl-1-methylcyclohexane, hexahydro-*p*-cymene, terpane; menthonaphthene	$CH_3C_6H_{10}CH$-$(CH_3)_2$	140 26
5514	**——, 1,4-epoxy-.**	See 1,4-*Cineole.*		
5515	**——, 1,8-epoxy-.**	See *Cineole*		
5516	**1,8-*p*-Menthanediol.**	See *Terpinol.*		
5517	**2-*p*-Menthanol.**	See *Carvomenthol.*		
5518	**3-*p*-Menthanol.**	See *Menthol.*		
5519	**3-*p*-Menthanone.**	See *Menthone.*		
5520	***d*-Menthene**	*d*-3-*p*-menthene; *d*-4-isopropyl-1-methyl-3-cyclohexene	$C_{10}H_{18}$.	138 25
5521	**1-*p*-Menthene.**	See *Carvomenthene.*		
5522	**——, 6,8-epoxy-.**	See *dl-Pinol.*		
5523	***i*-1-*p*-Menthene-6,8-diol.**	See *Pinol, hydrate.*		
5524	**1-*p*-Menthen-8-ol.**	See *α-Terpineol.*		
5525	**8(9)-*p*-Menthen-2-ol.**	See *Carveol, dihydro-.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5485	col rhomb. pr f al.	1 539	132		248^{17}	v sl s.	i. eth
5486	nearly col	....	186-8		i	s h.	. .
5487	col. pl . .	0 $8578\frac{60}{4}$	60 66 (58-9)	227^{100}	i	25 2^{28}	v. s. eth.
5488	col cr	1 $4448\frac{25}{0}$	34-35 5		i	sl. s.	sl s. eth.
5489							
5490	rhomb. tab		$-3H_2O$, 100	d	25^{100}	sl s	sl s. eth.; v. sl. s. chl.
5491	yel amor		58		i		
5492	col need		101	155 subl.	0 14 c; 4 5 h	s.	s eth., bz., chl., amyl al.
5493	or powd		d.		i.	sl s	s. KOH
5494	monocl. pr, 1 490, 1 743, 1 872	1 573^{250}	<250	subl.	sl s.	v sl s h.	i eth
5495							
5496							
5497	col	0 890	63	380	i	3 6^{78}	v. sl s eth., bz.
5498							
5498M	cr .		85				. . .
5499	pr. f. w .		83		5^{18}	s.	s. eth.
5500	col. sc. or need f. al.		91 9-2 1		i	sl. s. c., s. h.	v. sl. s. eth.
5501							
5502	col. need. f. al		286	d	v s	s.	s. H_2SO_4
5503							
5504	cr f. w .		238 d.		s		.
5505							
5506							
5507							
5508							
5509							
5510							
5511							
5512							
5513	col liq, 1 437	0 $793\frac{20}{0}$		169-70 (164-7)	i	v. s.	v. s. eth.
5514							
5515							
5516							
5517							
5518							
5519							
5520	col liq, 1 $44813^{20.4}$	0 8073		168		s.	s. eth., bz.
5521							
5522							
5523							
5524							
5525							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
5526	**3-*p*-Menthen-2-one.**	See *Carvenone*		
5527	**8(9)-*p*-Menthen-2-one.**	See *Carvone, dihydro-*.		
5528	**4(8)-*p*-Menthen-3-one.**	See *Pulegone.*		
5529	***l*-Menthol**	*l*-3-*p*-menthanol, *l*-hexahydrothymol	$C_{10}H_{19}OH$	156 26
5530	——, *α*-methoxyisobutyrate.	See *Isobutyric acid α-methoxy-, 3-p-menthyl ester.*		
5531	**Menthonaphthene.**	See *p-Menthane*		
5532	***l*-Menthone**	*l*-3-*p*-menthanone	$C_{10}H_{18}O$	154 25
5533	**Merchurochrome 220 soluble**	dibromohydroxymercurifluorescein disodium salt	$C_{20}H_8Br_2HgNa_2O_6 \cdot 3H_2O$	804 75
5534	**Mercury, diethyl-**	mercury diethyl; mercury ethyl	$Hg(C_2H_5)_2$	258 73
5535	——, **di-2-furyl-**	2,2′-mercuridifuran	$C_4H_3O\ Hg\ C_4H_3O$	334 74
5536	——, **diisobutyl-**		$[(CH_3)_2CHCH_2]_2Hg$	314 84
5537	——, **dimethyl-**[k]	mercury methyl	$Hg(CH_3)_2$	230 68
5538	——, **di-1-naphthyl-**[Y]	mercury di-*α*-naphthyl	$Hg(C_{10}H_7)_2$	454 92
5539	——, **diphenyl-**[k]	mercury diphenyl, mercury phenyl	$(C_6H_5)_2Hg$	354 81
5540	——, **dipropyl-**[a]		$(CH_3CH_2CH_2)_2Hg$	286 78
5541	——, **di-*o*-tolyl-**		$(CH_3C_6H_4)_2Hg$	382 86
5542	——, **di-*p*-tolyl-**		$Hg(C_6H_4CH_3)_2$	382 86
5542M	**Mercury chloride, *n*-butyl-**	*n*-butylmercuric chloride	n-C_4H_9HgCl	293 18
5543	——, **ethyl-**[k]	ethylmercuric chloride	C_2H_5HgCl	265 13
5544	——, **methyl-**[a]		CH_3HgCl ..	251 10
5545	——, **phenyl-**	chloromercuribenzene	C_6H_5HgCl	313 17
5546	——, ***p*-tolyl-**	*p*-chloromercuritoluene	$CH_3C_6H_4HgCl$	327 19
5547	**Mercury mercaptide**		$Hg(SC_2H_5)_2$	322 85
5548	**Mesaconic acid**	methylfumaric acid	$HOOC(CH_3)$-$C:CHCOOH$	130 10
5549	**Mescaline**	mezcaline	$C_{11}H_{17}NO_3$.	211 26
5550	**Mesidine**	2,4,6-trimethylaniline	$(CH_3)_3C_6H_2NH_2$	135 20
5551	**Mesitol**	2,4,6-trimethylphenol, 2-hydroxymesitylene	$(CH_3)_3C_6H_2OH$	136 19
5552	**Mesitylene**	1,3,5-trimethylbenzene, *sym*-trimethylbenzene	$(CH_3)_3C_6H_3$.	120 19
5553	——, ***α*-bromoisobutyryl-**.	See *Isobutyrophenone, α-bromo-2,4,6-trimethyl-*.		
5554	——, **2,4-dihydroxy-.**	See *Mesorcinol*		
5555	——, **2,4-dinitro-**	1,3,5-trimethyl-2,4-dinitrobenzene	$(NO_2)_2C_6H(CH_3)_3$	210 19
5556	——, **hexahydro-.**	See *Cyclohexane, 1,3,5-trimethyl-*		
5557	——, **2-hydroxy-.**	See *Mesitol*		
5558	——, **2-nitro-**	1,3,5-trimethyl-2-nitrobenzene	$(CH_3)_3C_6H_2NO_2$	165 19
5559	——, **2,4,6-tribromo-**		$Br_3C_6(CH_3)_3$	356 91

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5526							
5527							
5528							
5529	col. trim.; liq., 1.460^{22}; solid, 1.497, 1.476	$0.890\frac{15}{15}$	35.5; 42.5	215	0.04 c.	v. s.	v. s. eth.; s. chl., pet. eth., glac. ac. a.
5530							
5531							
5532	col. liq.	0.896	-6.6	207	sl. s.	∞	∞ eth., CS_2+ bz.
5533	irid. grn. sc.		. .		s.	0.015	i. eth., chl.
5534	$1.53990^{23.2}$. .	2.4660^{20}	. .	$159; 57^{16}$	i.	sl. s.	s. eth.
5535	col. cr. f. w.-acet		114	156^{7}	s. h. +acet	.	. . . .
5536	col. liq.	1.835^{15}	volat. 100	205-7	v. sl. s.	s.	s. eth.
5537	col. liq., $1.5327^{22.2}$	$2.95412\frac{22.2}{4}$		95	i	s.	s. eth., lgr.
5538	leaf f. bz	1.944	243	d.	i	sl. s. h	sl. s. eth.; s. chl., CS_2
5539	rhomb. need.	2.318	121.8	204^{10} >306 d.	i	sl. s. h.	sl. s. eth.; s. bz., chl., CS_2
5540	col. mobile liq.	2.121^{10}		189-91	i	s.	v. s. eth.
5541	tricl. f. bz		107	219^{14}			s. h. bz.
5542	col. need. f. bz		235-9	d	i	sl. s.	i. eth.; s. CS_2, h. bz.
5542M	wh. silv. irid. leaf.		127		i	sl. s. c.	s. eth.
5543	silv. irid. leaf	3.5	192.5		i	sl. s. c., v. s. h.	s. eth.
5544	wh. cr., disagreeable odor	4.063	170	volat. 100			
5545	wh. satiny leaf		251			sl. s. h.	sl. s. eth., bz., pyr.
5546	rhomb. silky tab.		233		i.	sl. s. h.	i. eth.; sl. s. bz., chl., acet., pyr.
5547	leaf f. al		76	d	v. sl. s	5.29 h	6.7^{36} eth.
5548	col. need. f. w. or al.	1.466	202-4	250 d	2.7^{18}, 118^{100}	24.14^{17} 90%	s. eth.; v. sl. s. bz., chl., CS_2, pet. eth.
5549	col. alk. oil .	.	. . . .	180^{12}	s	s	i. eth.; s. chl., bz.
5550	liq.	0.963	<-15	233			.
5551	need. . .	.	69 (72)	220	v. sl. s.	v. s.	v. s. eth.
5552	rhomb., col. liq., 1.4967	$0.8634\frac{20}{4}$	-52.7	164.6	i.	s.	s. eth.
5553							
5554							
5555	rhomb. f. al	.	86		i.	s. h.	
5556							
5557							
5558	rhomb. pr. f. al.	.	44	255	.	v. s. h.	. . .
5559	tricl. need. f. al.		224		i.	v. sl. s. h.	s. bz.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
5560	**Mesitylene, 2,4,6-trinitro-**		$(NO_2)_3C_6(CH_3)_3$	255.19
5561	**Mesitylene-eso-carboxylic acid.** See *β-Isodurylic acid*			
5562	**Mesitylenic acid** .	3,5-dimethylbenzoic acid, 3,5-xylic acid, *sym-m-*xylic acid	$(CH_3)_2C_6H_3COOH$	150.17
5563	**Mesityl oxide**.	4-methyl-3-penten-2-one*, isopropylideneacetone	$(CH_3)_2C:CH\text{-}COCH_3$	98.14
5564	**Mesocystine.**	See *Cystine, meso-*.		
5565	**Mesorcinol**	2,4,6-trimethylresorcinol, 2,4-dihydroxymesitylene	$(CH_3)_3C_6H(OH)_2$	152.19
5566	**Mesotartaric acid.**	See *i-Tartaric acid*		
5567	**Mesoxalic acid**	dihydroxy- or oxopropanedioic acid*, dihydroxy- or ketomalonic acid	$(HO)_2C(COOH)_2$ or $OC(COOH)_2$	136.06 (118.05)
5568	——, diethyl ester	diethyl oxopropanedioate*, ethyl ketomalonate, ethyl mesoxalate	$CO(COOC_2H_5)_2$	174.15
5569	——, diethyl ester hydrate	diethyl dihydroxypropanedioate*, ethyl dihydroxymalonate	$(HO)_2C\text{-}(COOC_2H_5)_2$	192.17
5570	**Metaacetaldehyde.**	See *Metaldehyde*		
5572	**Metacrolein** .		$(C_3H_4O)_3$	168.19
5573	**Metadiazine.**	See *Pyrimidine*		
5574	**Metaformaldehyde.**	See *Polyoxymethylene.*		
5575	**Metaldehyde** .	metaacetaldehyde	$(C_2H_4O)_{4\text{-}6}$ ...	$(44.05)_{4\text{-}6}$
5576	**Metanilic acid** ..	*m*-aminobenzenesulfonic acid, *m*-anilinesulfonic acid	$NH_2C_6H_4SO_3H\ 1\frac{1}{2}H_2O$	200.21
5577	**Metastyrene**... .		$(C_8H_8)_x$	$(104.14)_x$
5578	**Metathiazole.**	See *Thiazole*		
5579	**Methacetin.**	See *p-Acetaniside*		
5579M	**Methacrolein.**	See *Acrolein, α-methyl-*		
5580	**Methacrylic acid** ...	2-methylpropenoic acid*, α-methylacrylic acid	$CH_2:C(CH_3)\text{-}COOH$	86.09
5580D	——, butyl ester .	*n*-butyl methacrylate	$CH_2:C(CH_3)\text{-}COOC_4H_9$	142.19
5580G	——, ethyl ester	ethyl methacrylate	$CH_2:C(CH_3)\text{-}COOC_2H_5$	114.14
5580K	——, isobutyl ester	isobutyl methacrylate	$CH_2:C(CH_3)COO\text{-}CH_2CH(CH_3)_2$	142.19
5580N	——, isopropyl ester	isopropyl methacrylate	$CH_2:C(CH_3)\text{-}COOCH(CH_3)_2$	128.17
5580R	——, methyl ester	methyl methacrylate	$CH_2:C(CH_3)\text{-}COOCH_3$	100.11
5580U	——, propyl ester	propyl methacrylate	$CH_2:C(CH_3)\text{-}COOC_3H_7$	128.17
5581	**Methanal*.**	See *Formaldehyde*		
5582	**Methanamide*.**	See *Formamide*		
5583	**Methanamidine, amino-*.** See *Guanidine.*			
5584	**Methane***	marsh gas, methyl hydride	CH_4	16.04
5585	——, **acetylbenzoyl-.**	See *Acetone, benzoyl-.*		
5586	——, **amino-.**	See *Methylamine*.*		
5587	——, **4-amino-4′,4″-bisdimethylaminotriphenyl-.** See *p-Leucaniline,*			
5588	——, **aminodiphenyl-.**	See *Aniline, benzyl-.*		
5589	——, **α-aminodiphenyl-.** See *Benzohydrylamine*			

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc
5560	tricl need f.al.		230–2	exp 415		i c, sl s. h.	sl. s h.eth., acet.
5561							
5562	monocl f. al.		166	subl	v. sl s.	v s	v. s. eth.
5563	col. oily liq., 1.446^{16}	0.8539_{4}^{20}	-59	128 7 (131 4)	3 0	∞	∞ eth.
5564							
5565	leaf.	. .	150	275 5	sl. s. c.	v. s.	v. s. eth.
5566							
5567	col deliq. need.		121 sl. d	.	v s.	s.	s. eth.
5568	lt. yel -grn oil, $1.41865^{15.6}$	1.119_{20}^{20}	*ca.*-30	*ca.*-220; 115^{29}		s	s eth.
5569	col pl. f bz		57	*ca.* 200	i.		.
5570							
5572	need .	.	46	170	v sl s h.	s	s. eth.
5573							
5574							
5575	col tetr. need or pr. f. al., 1 530, 1.430	....	246 2 (sealed tube)	subl. 112-5	i	1.8^{70}	0 535 eth.
5576	need (anh.); tricl pr		d.		0.67^{20}	$2.92^{12.5}$	v sl s. eth.
5577	vitreous	1.054^{13}	d.		i.	i	v sl s eth.
5578							
5579							
5579M							
5580	col pr., 1 43143	1.015_{4}^{20}	16	163	s.	∞	∞ eth.
5580D	col. liq., $1.425^{15.6}$	0.895_{4}^{20}		163	i	∞	∞ eth.
5580G	col. liq., 1.414^{20}	0.907_{4}^{20}		117	v. sl s	∞	∞ eth.
5580K	col liq., 1.418^{24}	$0.889_{15.6}^{15.6}$		155	i	∞	∞ eth.
5580N	col liq, 1.412^{24}	0.890_{4}^{20}		127	i.	∞	∞ eth.
5580R	col liq, 1.413^{20}	0.936_{4}^{20}	*ca* -50	100	v. sl. s	∞	∞ eth
5580U	col liq, $1.420^{15.6}$	$0.902_{15.6}^{15.6}$		141	i	∞	∞ eth.
5581							
5582							
5583							
5584	col gas	0.415^{-164} 0.7168^{0} g/l	-184	-161.5	9^{20} cm³	60 cm³	91^{20} cm³ eth.
5585							
5586							
5587	*N,N,N',N',* tetra	*methyl-.*					
5588							
5589							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
5590	**Methane, aminotriphenyl-.**	See *Aniline, benzohydryl-*.		
5591	——, **amyldimethyl-.**	See *Heptane, 2-methyl-**		
5592	——, **amylethylmethyl-.**	See *Octane, 3-methyl-**.		
5593	——, **benzoyltriphenyl-.**	See *β-Benzopinacolin*		
5594	——, **benzyltriphenyl-.**	See *Ethane, 1,1,1,2-tetraphenyl-*.		
5595	——, **4,4′-bisdimethylaminotriphenyl-.**	See *Aniline, p,p′-benzylidenebis-N.*		
5596	——, **bis(2,4-dinitrophenyl)-**	2,2′4,4′-tetranitroditan	$[(NO_2)_2C_6H_3]_2CH_2$	348.23
5597	——, **bromo-*.**	See *Methyl bromide.*		
5598	——, **bromotrichloro-***	.	$CBrCl_3$ ..	198.30
5599	——, **butylethylmethyl.**	See *Heptane, 3-methyl-**		
5600	——, **sec-butylethylmethyl-.**	See *Hexane, 3,4-dimethyl-**.		
5601	——, **tert-butyltrimethyl-.**	See *Butane, 2,2,3,3-tetramethyl-**.		
5602	——, **isobutyltrimethyl-.**	See *Pentane, 2,2,4-trimethyl-**.		
5603	——, **chloro-*.**	See *Methyl chloride.*		
5604	——, **chloro(chloromethoxy)-*.**	See *Ether, bischloromethyl*		
5604M	——, **chlorodifluoro-***		$CHClF_2$	86.48
5605	——, **chloroethylmethyl-.**	See *sec-Butyl chloride*		
5606	——, **chloromethoxy-*.**	See *Ether, chloromethyl methyl*		
5606M	——, **chlorotrifluoro-***		$CClF_3$	104.47
5607	——, **chlorotrimethyl-.**	See *tert-Butyl chloride.*		
5608	——, **chlorotriphenyl-**	..	$(C_6H_5)_3CCl$	278.77
5609	——, **cyclohexyl-.**	See *Cyclohexane, methyl-*		
5610	——, **4,4′-diaminodiphenyl-.**	See *Aniline, p,p′-methylenedi-.*		
5611	——, **p,p′-diaminotriphenyl-**	p,p′-benzaldianiline, 4,4′-diaminotritan	$C_6H_5CH(C_6H_4NH_2)_2$	274.35
5613	——, **diazo-*.........**	azimethylene	CH_2N_2	42.04
5614	——, **dibenzoyl-.......**	1,3-diphenyl-1,3-propanedione	$(C_6H_5CO)_2CH_2$	224.25
5615	——, **dibromo-*.**	See *Methylene bromide*		
5616	——, **dichloro-*.**	See *Methylene chloride*		
5617	——, **dichlorodifluoro-***	difluorodichloromethane*	CCl_2F_2	120.92
5618	——, **dichlorodimethyl-.**	See *Propane, 2,2-dichloro-**		
5619	——, **dichlorofluoro-***		$CHCl_2F$	102.93
5620	——, **diethoxy- ......**	formaldehyde diethylacetal, methylene diethyl ether, diethyl formal; ethylal	$CH_2(OC_2H_5)_2$	104.15
5621	——, **diethyldimethyl-.**	See *Pentane, 3,3-dimethyl-**.		
5622	——, **diethylisopropyl-.**	See *Pentane, 3-ethyl-2-methyl-**.		
5623	——, **diethylmethyl-.**	See *Pentane, 3-methyl-**.		
5624	——, **diethylpropyl-.**	See *Hexane, 3-ethyl-**.		
5624M	——, **difluoro-*.**	See *Methylene fluoride.*		
5625	——, **4,4′-dihydroxydiphenyl-**	p,p′-methylenediphenol	$HOC_6H_4CH_2C_6H_4OH$	200.23
5626	——, **diisobutyl-.**	See *Heptane, 2,6-dimethyl-**		
5627	——, **diisopropyl-.**	See *Pentane, 2,4-dimethyl-**.		
5628	——, **dimethoxy-*** .	formaldehyde dimethylacetal, methylene dimethyl ether, formal, methylal	$CH_2(OCH_3)_2$	76.09
5629	——, **dimethyl-.**	See *Propane**.		
5630	——, **dimethylene.**	See *Propadiene**		
5631	——, **dimethylpropyl-.**	See *Pentane, 2-methyl-**.		
5632	——, **di-1-naphthyl-.**	.	$(C_{10}H_7)_2CH_2$.	268.34
5633	——, **di-2-naphthyl-.**	....	$(C_{10}H_7)_2CH_2$.	268.34
5634	——, **dinitro-*.......**	.... . .	$CH_2(NO_2)_2$	106.04

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5590							
5591							
5592							
5593							
5594							
5595	*N-dimethyl-.*						
5596	yel pr. f glac. ac. a.		172			i.	i. eth.; s. alk.; sl. s bz.
5597							
5598	col liq., 1.5300	1 959^{15}	21	104 07	i	∞	∞ eth.
5599							
5600							
5601							
5602							
5603							
5604							
5604M	col gas	3 87^{0}	146	-40 8	s.		....
5605							
5606							
5606M	col gas ..		-181	-80	.....		...
5607							
5608	col need		112 (106-9)	310	i., d.	sl s	sl s eth.; v. s. CS_2, bz.
5609							
5610							
5611	col cr f eth		139 (136-7)		v. sl s.	v s.	v. s eth.; s. chl., lgr.
5613	yel pois gas at ord. temp		-145	-23; exp. 200	d.	s.	s. eth.
5614	rhomb		72-3, 78	219-21^{18}	v. sl. s.	4 43$^{19.5}$	v. s eth.; s. chl
5615							
5616							
5617	col. gas . .	1 486^{-30}	-160	-28	i.	s	s. eth.
5618							
5619	col liq or gas	1 421^{0}	-127	8 9	i.	s.	s eth.
5620	.	0 83465^{15}	-66 5	89	9 1^{18}		...
5621							
5622							
5623							
5624							
5624M							
5625	leaf or need. f. h w.		158	subl.		s	s eth, alk, chl; i. CS_2
5626							
5627							
5628	col liq, 1.35344	0 8560	-104 8	44	v s.	∞	∞ eth.
5629							
5630							
5631							
5632	sm pr f. al		109 (107-8)	270^{14}; dist. >360	0 83, 6 67^{78}	..	s eth, chl., bz.
5633	need. f. al. or eth.		93	.	i.	v. s.	s. bz.
5634	yel. unst. oil.		liq at-15	100 exp	s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
5635	**Methane, diphenyl-**	benzylbenzene, ditan	$(C_6H_5)_2CH_2$	168 23
5636	——, ——, *o*-carboxylic acid	See *Benzoic acid, o-benzyl-*.		
5637	——, **diphenylene-.**	See *Fluorene*		
5638	——, **diphenyl-*m*-tolyl-**	3-methyltritan	$CH_3C_6H_4CH-(C_6H_5)_2$	258 35
5639	——, **diphenyl-*p*-tolyl-**	4-methyltritan	$CH_3C_6H_4CH-(C_6H_5)_2$	258 35
5640	——, **dipropoxy-*.**	formaldehyde dipropyl acetal, methylene dipropyl ether	$CH_2(OC_3H_7)_2$	132 20
5641	——, **ethyldimethyl-.**	See *Butane, 2-methyl-**		
5642	——, ***p*-ethyldiphenyl-.**	See *Benzene, 1-benzyl-4-ethyl-*		
5643	——, **ethyldipropyl-.**	See *Heptane, 4-ethyl-*.*		
5644	——, **ethylisobutyl-.**	See *Hexane, 2-methyl-**		
5645	——, **ethylisobutylmet**	**hyl-.** See *Hexane, 2,4-dimethyl*	*-*.*	
5646	——, **ethylisopropylme**	**thyl-.** See *Pentane, 2,3-dimeth*	*yl-*.*	
5647	——, **ethylmethylprop**	**yl-.** See *Hexane, 3-methyl-*.*		
5648	——, **ethyltrimethyl-.**	See *Butane, 2,2-dimethyl-**		
5649	——, **fluoro-*.**	See *Methyl fluoride*		
5650	——, ***p*-hydroxydiphen**	**yl-.** See *Phenol, p-benzyl-.*		
5651	——, **iodo-*.**	See *Methyl iodide.*		
5652	——, **isopropyldimeth**	**yl-.** See *Butane, 2,3-dimethyl-**	.	
5653	——, **isopropylmethyl**	**propyl-.** See *Hexane, 2,3-dim*	*ethyl-*.*	
5654	——, **isopropyltrimeth**	**yl-.** See *Butane, 2,2,3-trimethy*	*l-*.*	
5655	——, **methoxy-*.**	See *Methyl ether.*		
5656	——, **methyldipropyl-.**	See *Heptane, 4-methyl-*.*		
5657	——, **methyldithio-*.**	See *Methyl disulfide*		
5657H	——, **methylsulfinyl-*.**	See *Methyl sulfoxide*		
5657R	——, **methylsulfonyl-***	**.** See *Methyl sulfone*		
5658	——, **methylthio-*.**	See *Methyl sulfide*		
5659	——, **1-naphthyl-phenyl-**	1-benzylnaphthalene	$C_{10}H_7CH_2C_6H_5$	218 28
5660	——, **2-naphthyl-phenyl-**	2-benzylnaphthalene	$C_{10}H_7CH_2C_6H_5$	218 28
5661	——, **nitro-*.**		CH_3NO_2	61 04
5662	——, **oxo-.**	See *Formaldehyde*		
5663	——, ***α*-oxodiphenyl-.**	See *Benzophenone*		
5664	——, **phenyl-.**	See *Toluene*		
5665	——, **phenyldi-*p*-tolyl-**	4,4′-dimethyltritan	$C_6H_5CH-(C_6H_4CH_3)_2$	272 37
5666	——, **phenyl-*m*-tolyl-**	*m*-benzyltoluene	$C_6H_5CH_2C_6H_4CH_3$	182 25
5667	——, **phenyl-*p*-tolyl-**	*p*-benzyltoluene	$C_6H_5CH_2C_6H_4CH_3$	182 25
5668	——, **tetrabromo-*.**	See *Carbon tetrabromide.*		
5669	——, **tetrachloro-*.**	See *Carbon tetrachloride.*		
5670	——, **tetraethoxy-*.**	See *Orthocarbonic acid, tetraeth*	*yl ester.*	
5670M	——, **tetrafluoro-*.**	See *Carbon tetrafluoride*		
5671	——, **tetraiodo-*.**	See *Carbon tetraiodide.*		
5672	——, **tetramethyl-.**	See *Propane, 2,2-dimethyl-*.*		
5673	——, ***p,p′*-tetramethyl**	**diaminodiphenyl-.** See *An*	*iline, p,p′-methyleneb*	*is [N,N-*
5674	——, ***p*-tetramethyldi**	**aminotriphenyl-.** See *An*	*iline, p,p′-benzylidene*	*bis-N,N-*
5675	——, **tetranitro-*.**		$C(NO_2)_4$	196 04
5676	——, **tetraphenyl-** .		$(C_6H_5)_4C$	320 41
5677	——, **tetrapropoxy-.**	See *Orthocarbonic acid, tetrapro*	*pyl ester.*	
5678	——, **triaminotriphen**	**yl-.** See *Leucaniline*		

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5635	col rhomb. need., 1 57884^{17}	1 0008$^{26}_{4}$	26-7	261-2 (264 7)	i.	s.	s. eth., chl.
5636							
5637							
5638	pr f al	1 07^{16}	62	354^{706}		sl. s.	v. s eth.; s. bz., chl , ac. a , lgr
5639	pr. f me al		71	360	i	s	v s eth., bz , ac a ; s. lgr.
5640	. .	0 835$^{20}_{4}$		137-40			. .
5641							
5642							
5643							
5644							
5645							
5646							
5647							
5648							
5649							
5650							
5651							
5652							
5653							
5654							
5655							
5656							
5657							
5657H							
5657R							
5658							
5659	monocl. leaf. f. al	1.165^{0}	59	350		1 26^{16} 2 62^{78}	35.7 c. eth.; s. bz., CS_2, chl.
5660	monocl. pr. f. al.	1 176	35 5	350	i.	2 3^{15}	v. s. bz.
5661	col liq., 1.3818^{20}	1 130$^{20}_{4}$	frz -29	101	9-10 cc	s.	s eth., alk.
5662							
5663							
5664							
5665	need. f. me al		56			s.	v. s. eth., CS_2, bz., chl.
5666	liq . .	0 997$^{17.5}$		275^{747}		s.	s. eth.
5667	liq . . .	0 995$^{17.5}$	-30	285-6 (279-80)		s	s. eth.; v.s. chl.
5668							
5669							
5670							
5670M							
5671							
5672							
5673	*dimethyl-.*						
5674	*dimethyl-.*						
5675	col. liq., 1.43976$^{16.9}_{He}$	1 650^{13}	13	125 7	i.	s.	s. eth.
5676	col. rhomb. f. bz.	.. .	285	431	i.	i.	i. eth., lgr., ac. a.; s. h. bz.
5677							
5678							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
5679	**Methane, tribenzoyl-.**		$(C_6H_5CO)_3CH$.	328.35
5680	**——, tribromo-*.**	See *Bromoform*		
5681	**——, tribromonitro-*.**	See *Bromopicrin*.		
5682	**——, trichloro-*.**	See *Chloroform*		
5683	**——, trichlorofluoro-***		CCl_3F	137.38
5684	**——, trichloronitro-*.**	See *Chloropicrin*		
5685	**——, triethoxy-*.**	See *Orthoformic acid, triethyl ester*		
5686	**——, triethyl-.**	See *Pentane, 3-ethyl-**.		
5687	**——, triethylmethyl-.**	See *Pentane, 3-ethyl-3-methyl-**		
5688	**——, trifluoro-*.**	See *Fluoroform*		
5689	**——, triiodo-*.**	See *Iodoform*		
5690	**——, triisopropoxy-.**	See *Orthoformic acid, triisopropyl ester.*		
5691	**——, trimethoxy-.**	See *Orthoformic acid, trimethyl ester.*		
5692	**——, trimethyl-.**	See *Isobutane*		
5693	**——, trimethylpropyl-.**	See *Pentane, 2,2-dimethyl-**.		
5694	**——, trinitro-*.**	See *Nitroform*		
5695	**——, p_3-trinitrotriphenyl-.**	See *Methane tris(p-nitrophenyl)-.*		
5696	**——, triphenoxy-.**	See *Orthoformic acid, triphenyl ester*		
5697	**——, triphenyl-**		$(C_6H_5)_3CH$	244.32
5698	——, ——, *o*-carboxylic acid.	See *Benzoic acid, o-benzohydryl-*		
5699	**——, tripropoxy-.**	See *Orthoformic acid, tripropyl ester.*		
5699H	**——, tris(hydroxymethyl)amino-.**	See 1,3-*Propanediol, 2-amino-2-hydroxy-*		
5699M	**——, tris(hydroxymethyl)nitro-.**	See 1,3-*Propanediol, 2-hydroxymethyl-2-nitro-**		
5700	**——, tris(*p*-nitrophenyl)-**	p_3-trinitrotriphenylmethane	$(NO_2C_6H_4)_3CH$	379.32
5701	**Methanearsonic acid** .	methylarsinic acid	$CH_3AsO(OH)_2$	139.96
5702	**Methaneazobenzene.**	See *Benzeneazomethane*		
5703	**Methanecarbothiolic acid.**	See *Acetic acid, thiol-*		
5704	**Methanedicarboxylic acid.**	See *Malonic acid*		
5705	**Methanediol***, esters.	See "methylene diester" under the different acids		
5706	**——, 2-furyl-,** diacetate	See *Furfural, diacetate*		
5707	**Methanedisulfonic acid*.**	See *Methionic acid*		
5708	**Methane oxide, diphenyl-.**	See *Xanthene*		
5709	**Methanephosphonic acid**	methylphosphinic acid	$CH_3PO(OH)_2$	96.03
5710	**Methanesiliconic acid**	silicoacetic acid	CH_3SiOOH	76.10
5711	**Methanestannonic acid**	methylstannonic acid, methylstannic acid	CH_3SnOOH	166.74
5712	**Methanesulfonic acid***	methylsulfonic acid	CH_3SO_3H	96.10
5713	**Methanesulfonyl chloride***		CH_3SO_2Cl	114.55
5714	**Methanethial*.**	See *Formaldehyde, thio-*		
5715	**Methanethiol***.	methyl mercaptan	CH_3SH	48.10
5716	**——, 2-furyl-.**	See *Furfuryl mercaptan*		
5717	**Methanethiolic acid, amino-***, ethyl ester	See *Carbamic acid, thiol-, ethyl ester*		
5718	**Methanoic acid*.**	See *Formic acid*		
5719	**Methanol***.	methyl alcohol, carbinol, wood alcohol	CH_3OH	32.04
5720	**Methenamine.**	See *Hexamethylenetetramine*		
5721	**Methenyl amidoxime.**	See *Formamide, oxime*		
5722	**Methionic acid**.	methanedisulfonic acid*, methylenedisulfonic acid	$CH_2(SO_3H)_2$	176.16

*Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5679	need f. al	...	224-5	subl.		v sl. s.	v. sl. s. eth.; sl. s.acet ; s. CS_2
5680							
5681							
5682							
5683	col. liq .	1 494$^{1.2}$	-111	24 1	i.	s	s. eth.
5684							
5685							
5686							
5687							
5688							
5689							
5690							
5691							
5692							
5693							
5694							
5695							
5696							
5697	col rhomb. leaf, 1.5839^{99}	1 014$\frac{99}{4}$	92 5	359 2		sl s c, v s h	v s eth.; s. bz, chl.
5698							
5699							
5699H	*methyl-.*						
5699M							
5700	sc f bz		212 5 (207)				v sl s. eth, bz, glac. ac a.
5701	monocl. leaf. f al.		161		s	s	. ...
5702							
5703							
5704							
5705							
5706							
5707							
5708							
5709	. .		105	.		.	. ....
5710	amor powd			.	i		s. eth., conc. KOH
5711	wh. amor. powd.		infus		i		s. a, alk ; i. org. solv.
5712	col. liq	1 481		167^{10} d.	v s	s	v. s eth.
5713	liq	1 51		160	i	s.	s. eth.
5714							
5715	liq or gas . .	0 868$\frac{20}{4}$, 0 8599$\frac{25}{4}$	-123 1 (-121)	7 6, 5 8^{752}	sl. s., d.	v s	v s. eth.
5716							
5717							
5718							
5719	col. liq., 1.33118$^{14.50}$	0 79609^{15}; 0 7928$\frac{20}{4}$ (0 7917$\frac{20}{4}$)	-97 8	64 65	∞	∞	∞ eth.
5720							
5721							
5722	hyg. need . .	.....		.	s.	s	.. ..

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
5723	***dl*-Methionine** .	*dl*-α-amino-γ-methylmercaptobutyric acid, *dl*-2-amino-4-methylthiobutanoic acid*	$CH_3SCH_2CH_2CH(NH_2)COOH$	149 21
5724	***l*-Methionine** . .	.	$CH_3SCH_2CH_2CH(NH_2)COOH$	149 21
5725	**Methoxyamine*** .	α-methylhydroxylamine	CH_3ONH_2	47 06
	Methyl. For methyl deriva	tives see the parent compounds	(e.g , for methylarsi	ne see
5726	-- , **triphenyl-** . .	trityl	$(C_6H_5)_3C-$	243 31
5727	**Methylal.**	See *Methane, dimethoxy-**.		
5728	**Methyl alcohol.**	See *Methanol**.		
5729	**Methylamine**	aminomethane	CH_3NH_2	31 06
5730	——, hydrochloride		$CH_3NH_2\cdot HCl$	67 52
5731	——, ***tert*-butyl-.**	See *Propylamine, β, β-dimethy*	*l-**.	
5732	——, **naphthyl-.**	See *Naphthylamine, N-methyl-*		
5733	**Methyl borate** . .	trimethyl borate, trimethoxyboron	$B(OCH_3)_3$	103 92
5734	**Methyl bromide**	bromomethane*	CH_3Br.	94 95
5735	——, ***tert*-butyl-.**	See *Propane*, 1-*bromo-2,2-dime*	*thyl-**	
5736	**Methyl carbitol.**	See *Diethylene glycol, monomet*	*hyl ether.*	
5737	**Methyl cellosolve.**	See *Ethanol, 2-methoxy-**		
5738	**Methyl chloride**	chloromethane*	CH_3Cl. . .	50 49
5739	**Methyl cyanide.**	See *Acetonitrile*		
5740	——, **allyl-.**	See 4-*Pentenenitrile**.		
5741	**Methyl disulfide** .	methyldithiomethane*, dimethyl disulfide	CH_3SSCH_3	94 19
5742	**Methylene blue** .	3,9-bisdimethylaminophenazothionium chloride	$C_{16}H_{18}N_3SCl\cdot 3H_2O$	373 90
5743	**Methylene bromide**	dibromomethane*	CH_2Br_2	173 86
5744	**Methylene chloride**	dichloromethane*	CH_2Cl_2 . .	84 94
5745	**Methylene cyanide.**	See *Malononitrile.*		
5746	**Methylenedisulfonic a**	**cid.** See *Methionic acid.*		
	Methylene esters.	See "methylene diester" under	the different acids	
5746M	**Methylene fluoride**	difluoromethane*	CH_2F_2	52 03
5747	**Methylene iodide**	diiodomethane* .	CH_2I_2	267 87
5748	**Methylenimine, bis(*p*-**	**dimethylaminophenyl)-**	. See *Auramine (bas*	*e)*
5749	**Methyl ether**	methoxymethane*, dimethyl ether	$(CH_3)_2O$	46 07
5750	**Methyl fluoride**	fluoromethane* .	CH_3F	34 03
5751	**Methyl hydride.**	See *Methane**		
5752	**Methyl iodide**	iodomethane*	CH_3I	141 95
5753	- - -, ***tert*-butyl-.**	See *Propane*, 1-*iodo-2,2-dimeth*	*yl-**	
5754	**Methyl isocyanide**	methylcarbylamine, methyl isonitrile	CH_3NC .	41 05
5755	**Methyl mercaptan.**	See *Methanethiol**.		
5756	——, **perchloro-**	thiocarbonyl tetrachloride, trichloromethylsulfur chloride	CCl_3SCl. . .	185 90
5757	**Methyl mustard oil.**	See *Isothiocyanic acid, methyl*	*ester.*	

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5723	....	... .	281	.	3 38^{25}, 10 52^{75}	.	. ... ..
5724	hex. pl	. .....	283 d.		s c	.	i. eth.
5725	cr	. .		49–50			
	Arsine, methyl-). For methyl esters of organic acids see the acids						
5726	col -yel trans. cr.	...	145–7	d	i	v sl s	sl s eth.; v s. chl, CS_2
5727							
5728							
5729	col gas, $1\ 432^{17\ 5}$	$0\ 7691\frac{-70}{4}$	-92 5	6 5	1153 9 ml $^{12\ 50}$	s.	∞ eth.
5730	deliq leaf. f al	.	226	230^{15}	v s	23^{78}	i. eth.
5731							
5732							
5733	col liq	0 915		65	d	∞	∞ eth.
5734	col liq. or gas	$1.732\frac{0}{0}$	−93.66	3.56	0.09	v s	v. s. eth.; s chl., CS_2, bz
5735		3.974^{25} g/l					
5736							
5737							
5738	col gas	$0\ 991^{-25}$, $2\ 31^{0}$ g/l	−97.7	−24.22	400 cm^3	3500 cm^3	s. eth , chl., ac a
5739							
5740							
5741	liq	$1\ 057\frac{16}{4}$		116 8	i	∞	∞ eth
5742	grn. cr powd	.	$-2H_2O$ 100, $-3H_2O$ 150		s	s	. .
5743	col liq	$2\ 4953\frac{20}{4}$	-52 8	98 2	$1\ 15^{20}$	∞	∞ eth.
5744	col liq , 1 4237	1 336	-96 7	40 1	2^{20}	∞	∞ eth.
5745							
5746							
5746M	col gas			-51 6	i	s	
5747	col liq , leaf at 0°C, $1.7559^{10\ 5}$	3 325	5–6	180 d	$1\ 42^{20}$	∞	s eth. .
5748							
5749	col gas	2 091 g/l	-138 5	-23 65	3700^{18} cm^3	s.	s. eth.
5750	col gas...	$0\ 8774\frac{-75.6}{4}$	-141 8	-78.6	166^{15} cm^3	v. s.	v. s. eth.
5751							
5752	col -br. liq., $1.5293^{21.6}$	2 279	-66 1	42 5	$1\ 4^{20}$	∞	∞ eth.
5753							
5754	col liq .	$0\ 756^{4}$; $0\ 7464\frac{20}{4}$	-45	59 6	10^{15}	s	∞ eth.
5755							
5756	yel. liq	1 700		149 sl. d.	i.	.	... .
5757							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
5758	**Methyl nitrate** ..	...	CH_3NO_3	77 04
5759	**Methyl nitrite** .		CH_3ONO	61 04
5760	**Methyloglycolic acid.**	See *Acetic acid, methoxy-*		
5761	**Methyl orange**......	*p*-(*p*-dimethylaminophenyl-azo)benzenesulfonic acid, sodium salt	$(CH_3)_2NC_6H_4$-N $NC_6H_4SO_3Na$	327 33
5762	**Methyl phosphate**. .	trimethyl phosphate .	$(CH_3)_3PO_4$.	140 08
5763	**Methyl selenide** .	dimethyl selenide	$(CH_3)_2Se$	109 03
5764	**Methyl sulfate**	dimethyl sulfate .	$(CH_3)_2SO_4$	126 13
5765	——, **acid.**	See *Methylsulfuric acid.*		
5766	**Methyl sulfide** ...	methylthiomethane*, dimethyl sulfide	$(CH_3)_2S$	62 13
5767	**Methyl sulfite**	dimethyl sulfite .	$(CH_3)_2SO_3$	110 13
5767M	**Methyl sulfone**.....	methylsulfonylmethane*, dimethyl sulfone	$CH_3SO_2CH_3$	94 13
5768	**Methylsulfonic acid.**	See *Methanesulfonic acid**.		
5768M	**Methyl sulfoxide**	methylsulfinylmethane*, dimethyl sulfoxide	CH_3SOCH_3	78 13
5769	**Methylsulfuric acid**	hydrogen methyl sulfate; acid methyl sulfate	CH_3HSO_4 .	112 10
5770	**Methyl telluride** ..	dimethyl telluride .	$(CH_3)_2Te$	157 68
5771	**Metol.**	See *Phenol, p-methylamino-, sulfate.*		
5772	**Mezcaline.**	See *Mescaline*		
5773	**Miazine.**	See *Pyrimidine*		
5774	**Michler's hydrol.**	See *Benzohydrol, p,p'-bisdimethylamino-.*		
5775	**Michler's ketone.**	See *Benzophenone, p,p'-bisdimethylamino-.*		
5776	**Milk sugar.**	See *Lactose*		
5777	**Monoacetin.**	See *Glycerol, monoacetate*		
5778	**α-Monolaurin.**	See *Glycerol, 1-monolaurate*		
5778M	**Monoölein.**	See *Glycerol, 1-monooleate*		
5779	**α-Monopalmitin.**	See *Glycerol, 1-monopalmitate.*		
5780	**Monosilane.**	See *Silicane*		
5781	**α-Monostearin.**	See *Glycerol, 1-monostearate*		
5782	**Morin** . .	3,5,7,2',4'-pentahydroxyflavone	$C_{15}H_{10}O_7$...	302 23
5783	**Moringatannic acid. Moringatannin.**	See *Maclurin*		
5784	**Morphine**		$C_{17}H_{19}NO_3$ H_2O	303 35
5785	——, acetate (*l*)		$C_{17}H_{19}NO_3$ $C_2H_4O_2$ $3H_2O$	399 43
5786	——, hydrochloride	.	$C_{17}H_{19}NO_3$ HCl $3H_2O$	375 85
5787	——, methyl ether	See *Codeine.*		
5789	——, sulfate	.. . .	$(C_{17}H_{19}NO_3)_2$-$H_2SO_4 \cdot 5H_2O$	758 82
5790	——, **diacetyl-**.. .	heroin	$C_{17}H_{17}(OOCCH_3)_2$-NO	369 40

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5758	liq . . .	1 217[15]; 1 206$^{20}_{4}$	.	65 exp.	sl. s.	s.	s eth.
5759	gas	0 991[15]	-17 0	-12	. . . . . .	s.	s eth.
5760							
5761	or. yel. powd. .	. . . .	. . . .	. . . .	v. s.	s.	i eth.
5762	liq	1 220[15]		193	100[25]	s.	s. eth.
5763	liq . . .	1 4077$^{14\ 6}_{4}$	.	58 2	i.	v s.	v. s. eth.
5764	col. liq, 1.3874[20]	1 3322$^{20}_{4}$	-31 8; frz. -27	188; 76[15]	v. sl. s.	∞	s. eth., bz.
5765							
5766	col. liq.	0 8458$^{21}_{4}$	-83 2	37 5-38	i.	s.	s. eth.
5767	col. liq . .	1 242$^{0}_{0}$		126 (122)	s d.	s.	s eth.
5767M	pr., 1.4226		109	238	s	s.	s bz.
5768							
5768M	oil or thick syrup	.	0	d. 100	s.	s.	s. eth.
5769	oil		<-30	d.	v. s.	s	∞ eth.
5770	ylsh. liq . .		.	82	i.	v s	v s. eth.
5771							
5772							
5773							
5774							
5775							
5776							
5777							
5778							
5778M							
5779							
5780							
5781							
5782	col need		(anh) 285		0 025	s.	sl s eth.; s. aq a, alk.
5783							
5784	col rhomb. pr, fine need or cr. powd., 1 580, 1.625, 1 645, $[\alpha]^{\circ 23}_{D}$ -130 9	1 317	anh. 254 d.	191-3 vac.	0.03	0 39	0 02 eth.; s. chl
5785	cr or amor. powd.		200 d	. .	44 4	4 63	i. eth., s. chl.
5786	silky need f. w., $[\alpha]^{\circ 25}_{D}$ -111 5		250 d		5 72	2 38	i. eth., chl; s. glyc.
5787							
5789	wh need, cubic f w.		d 250	.	6. 66	0 22	i. eth., chl.
5790	wh. cr. powd., 1.560, 1.600, 1 610		171-2		0 058	4 0	1 4 eth; s. chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
5791	**Morphine, diacetyl-,** hydrochloride		$C_{21}H_{23}NO_5 \cdot HCl \cdot H_2O$	423 89
5792	——, **ethyl-**, hydrochloride	dionin	$C_{19}H_{23}NO_3 \cdot HCl \cdot 2H_2O$	385 88
5793	**Morphol**	3,4-phenanthrenediol	$C_{14}H_8(OH)_2$.	210 22
5794	——, dimethyl ether	See *Phenanthrene, 3,4-dimetho*	*xy-**.	
5795	**Morpholine**	tetrahydro-1,4-oxazine, diethylenimide oxide	$OCH_2CH_2NH-CH_2CH_2$	87 12
5796	——, **4-(β-ethoxyethyl)-**	ethyl β-4-morpholylethyl ether	$O(CH_2CH_2)_2-NCH_2CH_2OC_2H_5$	159 23
5797	**4-Morpholineëthanol**	diethylene oxide 2-iminoethyl alcohol	$O(CH_2CH_2)_2-NCH_2CH_2OH$	131 17
5798	**Moss starch**	See *Lichenin*.		
5799	**Mucic acid**	2,3,4,5-tetrahydroxyhexanedioic acid* (one form)	$COOH(CHOH)_4-COOH$	210 14
5800	——, p-phenylphenacyl ester		$C_{34}H_{30}O_{10}$	598 58
5801	**Muconic acid**	2,4-hexadienedioic acid*.	$HOOCCH{:}CH-CH{:}CHCOOH$	142 11
5802	**Murexan.**	See *Uramil*		
5803	**Murexide**	ammonium purpurate	$C_8H_4O_6N_5NH_4 \cdot H_2O$	302 21
5804	**Musk, artificial.**	See *Toluene, 3-tert-butyl-2,4,6-t*	*rinitro-*	
5805	**Musk C, Musk ketone.**	See *Acetophenone, 4-tert-butyl-*	*2-methyl-3,6-dinitro-*	
5806	**Musk xylene.**	See *Benzene, 1-tert-butyl-3,5-di*	*methyl-2,4,6-trinitro-*.	
5807	**Mustard gas.**	See *Sulfide, β,β'-dichloroethyl*		
5808	**Mustard oil acetic acid.**	See *Acetic acid, isothiocyano-*		
5809	**Mustard oils.**	See the different esters under *I*	*sothiocyanic acid*	
5810	**Myrcene**	2-methyl-6-methylene-2,7-octadiene*	$(CH_3)_2C{:}CHCH_2-CH_2C({:}CH_2)-CH{:}CH_2$	136 23
5810M	——, **dihydro-.**	See *2,6-Octadiene, 2,6-dimethyl-*		
5811	**Myricyl alcohol**	melissyl alcohol	$C_{31}H_{63}OH$	452 83
5812	——, palmitate.	See *Palmitic acid, myricyl ester*		
5813	**Myristaldehyde,** oxime	tetradecanal oxime*, myristinaldoxime	$C_{13}H_{27}CH{:}NOH$.	227 38
5814	**Myristamide**	tetradecanamide*, myristic amide	$CH_3(CH_2)_{12}-CONH_2$	227 38
5815	**Myristic acid**	tetradecanoic acid*	$CH_3(CH_2)_{12}COOH$	228 37
5816	——, benzyl ester	.. .	$C_{13}H_{27}COOCH_2-C_6H_5$	318 49
5817	——, ethyl ester	ethyl tetradecanoate*	$CH_3(CH_2)_{12}-COOC_2H_5$	256 42
5818	——, ethylene ester	See *Glycol, dimyristate*		
5819	——, glyceryl ester	See *Glycerol, trimyristate*		
5820	**Myristic alcohol.**	See *1-Tetradecanol**		
5821	**Myristic anhydride**	tetradecanoic anhydride*	$(C_{13}H_{27}CO)_2O$	438 72
5822	**Myristicin**	5-methoxysafrole	$C_3H_5C_6H_2(O_2CH_2)-OCH_3$	192 21
5823	**Myristinaldoxime.**	See *Myristaldehyde, oxime.*		
5824	**Myristonitrile**	tetradecanenitrile*	$C_{13}H_{27}CN$.	209 37
5825	**Myristoyl chloride**	tetradecanoyl chloride*; myristyl chloride	$CH_3(CH_2)_{12}COCl$.	246 82
5826	**Napelline.**	See *Benzaconine*.		
5827	**Naphthacetol.**	See *1-Naphthol, 4-acetamido-*.		
5828	**Naphthalane.**	See *Naphthalene, decahydro-**.		
5829	**1-Naphthaldehyde.**	1-naphthalenecarbonal, α-naphthoic aldehyde	$C_{10}H_7CHO$....	156 17

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
5791	wh. cr. powd.		230–1	. .	50	s.	i. eth., chl.
5792	wh. micr.-cr. powd.		125 d.	.	14.3	50	i. eth.; sl. s. chl.
5793	col. need. . .		143		i.	s	s. eth., alk.
5794							
5795	col. hygr. oil	0.9998		126–30	∞	s	s. eth.; ∞ ord. solv.
5796	col. liq......	0.963		206	∞	.	....
5797	col. liq. . .	1.071		225.5	∞		....
5798							
5799	col. cr. or wh. powd.	.	206 d. (213–4)	255	0.33^{14}	i.	v. sl. s. eth.; s. dil. alk.
5800			149.5 d	.	..		. . . .
5801	need. f. w		298 d.	*ca.* 320	0.02	sl. s.	sl. s. eth.; s. h. ac. a.
5802							
5803	purp. powd..				sl. s	i	i. eth.
5804							
5805							
5806							
5807							
5808							
5809							
5810	liq.	0.802		167			...
5810M							
5811	col. need. f. eth.	0.777^{95}	88		i.	s. h	s. eth.; v. s. bz.
5812							
5813	need. f. al.	. . .	82	.	i	s	v. s. eth., chl.
5814	leaf	.	103	217^{12}	i	sl. s.	sl. s. eth.
5815	col. leaf, 1.4308^{60}	0.858^{60}	58	250.5^{100}	i.	44.9^{21}	sl. s. eth.; s. chl., glac. ac. a.
5816	liq.	$0.9321\frac{25}{25}$	20.5	229.31^{11}	i	s.	v. s. eth.
5817	col. cr. .	$0.8589\frac{20}{4}$	10.5 (11.93)	295	i.	s	sl. s. eth.
5818							
5819							
5820							
5821	col. cr. ...	0.8502^{70}	53.4	198	i.	s	s. eth.
5822	pa. yel. oil...	1.1425^{19}	<−20	149.5^{15}	.	s.	s. eth.
5823							
5824	liq. or cr.....	$0.8281\frac{19}{4}$	19	226.5^{100}	i.	sl. s.	v. s. eth.
5825	liq.	.. .	−1	168^{15} ($159–61^{11}$)	d.	d.	s. eth.
5826							
5827							
5828							
5829	liq., $1.65464^{19.3}$	$1.148\frac{20}{4}$		291.6	i.	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
5830	**1-Naphthaldehyde, 2-hydroxy-**	2-hydroxy-1-naphthalenecarbonal*; β-naphthol-1-aldehyde	$HOC_{10}H_6CHO$	172 17
5831	**2-Naphthaldehyde**	2-naphthalenecarbonal; β-naphthoic aldehyde	$C_{10}H_7CHO$	156 17
5832	**——, 1-hydroxy-**	1-hydroxy-2-naphthalenecarbonal*; α-naphthol-2-aldehyde	$HOC_{10}H_6CHO$	172 17
5833	**Naphthalene**		$C_{10}H_8$	128 16
5834	——, hexahydride.	See *Naphthalene, hexahydro-*.		
5835	——, tetrachloride.	See *Naphthalene, 1,2,3,4-tetrachloro-1,2,3,4-tetrahydro-*.		
5836	**——, 1,1′-azoxydi-.**	See *1,1′-Azoxynaphthalene*		
5837	**——, 1-benzyl-.**	See *Methane 1-naphthylphenyl-*.		
5838	**——, 2-benzyl-.**	See *Methane, 2-naphthylphenyl-*.		
5839	**——, 2-benzyloxy-*.**	See *Ether, benzyl 2-naphthyl*		
5840	**——, 1-bromo-***		$C_{10}H_7Br$	207 07
5841	**——, 2-bromo-***		$C_{10}H_7Br$	207 07
5842	**——, 1-chloro-***		$C_{10}H_7Cl$	162 61
5843	**——, 2-chloro-***		$C_{10}H_7Cl$	162 61
5844	**——, 1-chlorodecahydro-***	1-chlorodecalin	$C_{10}H_{17}Cl$	172 69
5845	**——, 1-chloro-4-nitro-***		$C_{10}H_6Cl(NO_2)$	207 61
5846	**——, 7-chloro-1-nitro-***		$C_{10}H_6Cl(NO_2)$	207 61
5847	**——, decahydro-***	decalin, bicyclo [4,4,0]-decane; naphthalane; naphthane	$C_{10}H_{18}$	138 25
5848	**——, diamino-.**	See *Naphthylenediamine*		
5849	**——, diazoamino-.**	See *Diazoaminonaphthalene*		
5850	**——, 1,2-dichloro-*.**		$C_{10}H_6Cl_2$	197 06
5851	**——, 1,3-dichloro-*.**	δ-dichloronaphthalene	$C_{10}H_6Cl_2$	197 06
5852	**——, 1,4-dichloro-*.**	β-dichloronaphthalene	$C_{10}H_6Cl_2$	197 06
5853	**——, 1,5-dichloro-***	γ-dichloronaphthalene	$C_{10}H_6Cl_2$	197 06
5854	**——, 1,6-dichloro-*.**	η-dichloronaphthalene	$C_{10}H_6Cl_2$	197 06
5855	**——, 1,7-dichloro-*.**	δ'-dichloronaphthalene	$C_{10}H_6Cl_2$	197 06
5856	**——, 1,8-dichloro-*.**	peri-dichloronaphthalene; ζ-dichloronaphthalene	$C_{10}H_6Cl_2$	197 06
5857	**——, 2,3-dichloro-*.**	ι-dichloronaphthalene	$C_{10}H_6Cl_2$	197 06
5858	**——, 2,6-dichloro-***	ϵ-dichloronaphthalene	$C_{10}H_6Cl_2$	197 06
5859	**——, 2,7-dichloro-*.**	δ-dichloronaphthalene	$C_{10}H_6Cl_2$	197 06
5860	**——, 1,4-dihydro-***		$C_{10}H_{10}$	130 18
5861	**——, dihydrodiketo-.**	See *Naphthoquinone*		

*Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5830	br. need ..		82	192	i.	s.	s. eth.
5831	col leaf f w., 1 6211$^{99.4}$	1 078^{99}	60 5	. ..	s. h.	v. s.	v. s. eth.
5832	yel. grn. need.	..	59–60	.	i.	s.	s eth.
5833	col monocl, 1.58218$^{99.6}$	1 145	80 22	217 9	0 003	4 18 c	v s eth, chl., CS_2, 40 21$^{15.6}$ bz.
5834							
5835							
5836							
5837							
5838							
5839							
5840	col. oil or pr., 1 65876$^{19.4}$	1 4875$\frac{20}{4}$	6 2, 0.2–0 7	281 1 (146–9^{16})	s h.	∞	∞ eth., bz.
5841	rhomb leaf. f al	1 605^{0}	59 (56–7)	281–2	i	6	s eth., CS_2, chl, bz.
5842	col liq, 1.63321^{20}	1 1938$\frac{20}{4}$	....	263 (250–2)	i	s	s eth, bz., CS_2
5843	col leaf f al	liq 1 138$\frac{70}{4}$	55–6	264–6	i.	s	s eth., chl., CS_2, bz
5844	..			114–6^{20}	..		.
5845	brnsh -yel need f al.	...	85		i.	s.	s eth.
5846	yel need f al		116		i.	s.	s eth.
5847	col liq., (*cis*) 1 4828 (*trans*) 1 46994^{18}	0 8963 0 8699	-43 26 -31 47	194 6 185 5	i. .	s.	s eth. ....
5848							
5849							
5850	monocl pl f al, 1 63375$^{48.5}$	liq, 1 315$\frac{48.5}{4}$	37	282		s.	s eth.
5851	need f. al		61 5	291^{755}		s	..
5852	need f al, 1.62282$^{75.9}$	1 300^{76}	67–8	287^{740}	i.	sl s	s. eth, acet., ac a.
5853	leaf f al. or ac a		107	subl	i	sl s.	s eth.
5854	need f al; volat. in steam		48–9	subl	.		..
5855	need f ac a, 1.60921$^{99.5}$	1 261$\frac{100}{4}$	63–4	286		v s	s eth, ac a., bz.
5856	rhomb cr. f al., 1.62357$^{99.8}$	1 292$\frac{100}{4}$	88 (83)	d			. .
5857	col lust sc f al		120	. .		s. h.	s. eth.
5858	col. monocl. need. or leaf f. al	..	140–41 (135)	285	. .	sl s	v. s. eth, chl, bz.
5859	col. pl. f al.	1 62845^{0}	114			s h	.
5860	col. liq, 1 58317$^{18.3}$	0 998	24 5–25 (15 5)	212 (94 5^{17})	i	v. s.	v s eth
5861							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
5862	**Napthalene, dihydroxy-**. See *Naphthalenediol*			
5863	**——, 1,4-dimethyl-***	α-dimethylnaphthalene	$C_{10}H_6(CH_3)_2$	156 22
5864	**——, 2,3-dimethyl-***.	See *Guaiene.*		
5865	**——, 1,3-dinitro-***		$C_{10}H_6(NO_2)_2$	218 16
5866	**——, 1,5-dinitro-***	....	$C_{10}H_6(NO_2)_2$	218 16
5867	**——, 1,8-dinitro-***	....	$C_{10}H_6(NO_2)_2$	218 16
5868	**——, ethoxy-***.	See *Ether, ethyl naphthyl.*		
5869	**——, 1-ethyl-**	α-naphthylethane, α-ethylnaphthalene	$C_{10}H_7C_2H_5$	156 22
5870	**——, 2-ethyl-**	β-naphthylethane, β-ethylnaphthalene	$C_{10}H_7C_2H_5$	156 22
5870K	**——, 1-fluoro-***	α-fluoronaphthalene	$C_{10}H_7F$	146 16
5870M	**——, 2-fluoro-***	β-fluoronaphthalene	$C_{10}H_7F$	146 16
5871	**——, hexahydro-**	naphthalene hexahydride	$C_{10}H_{14}$	134 21
5872	**——, hydrazodi-.**	See *Hydrazine, dinaphthyl-.*		
5873	**——, hydroxy-.**	See *Naphthol.*		
5874	**——, 1-iodo-***		$C_{10}H_7I$	254 08
5875	**——, 2-iodo-***		$C_{10}H_7I$	254 08
5876	**——, methoxy-.**	See *Ether, methyl naphthyl*		
5877	**——, 1-methyl-**	α-methylnaphthalene	$C_{10}H_7CH_3$	142 19
5878	**——, 2-methyl-**	β-methylnaphthalene	$C_{10}H_7CH_3$	142 19
5879	**——, 1-(γ-methylbutoxy)-***. See *Ether, isoamyl 1-naphthyl*			
5880	**——, 2-(γ-methylbutoxy)-***. See *Ether, isoamyl 2-naphthyl*			
5881	**——, naphthoxy-.**	See *Naphthyl ether.*		
5882	**——, 1-(2-naphthoyl)-.**	See *1,2'-Naphthyl ketone*		
5883	**——, 1-nitro-***	α-nitronaphthalene	$C_{10}H_7NO_2$	173 16
5884	**——, 2-nitro-***	β-nitronaphthalene	$C_{10}H_7NO_2$	173 16
5885	**——, 1-phenyl-**		$C_6H_5C_{10}H_7$	204 26
5886	**——, 2-phenyl-**		$C_6H_5C_{10}H_7$	204 26
5887	**——, 2-(2-propenoxy)-***. See *Ether, allyl 2-naphthyl*			
5888	**——, propoxy-***.	See *Ether, naphthyl propyl*		
5889	**——, 1,2,3,4-tetrachloro-1,2,3,4-tetrahydro-***	naphthalene tetrachloride	$C_{10}H_8Cl_4$	269 99
5890	**——, 1,2,3,4-tetrahydro-***	tetralin, naphthalene 1,2,3,4-tetrahydride	$C_{10}H_{12}$	132 20
5891	**——, 1,3,5,8-tetranitro-***	γ-tetranitronaphthalene	$C_{10}H_4(NO_2)_4$	308 16
5892	**——, 1,3,6,8-tetranitro-***	β-tetranitronaphthalene	$C_{10}H_4(NO_2)_4$	308 16
5893	**——, 1,5,?,?-tetranitro-***	α-tetranitronaphthalene	$C_{10}H_4(NO_2)_4$	308 16
5894	**——, 1,2,5-trinitro-***.		$C_{10}H_5(NO_2)_3$	263 16
5895	**——, 1,3,5-trinitro-***		$C_{10}H_5(NO_2)_3$	263 16

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5862							
5863	liq, $1.6156^{7?}$	1.016^{20}_{4}	<-18	264 3	i.	v. s.	∞ eth.
5864							
5865	ylsh. need f bz		144-5	subl	i	s	
5866	hex need f ac a		217 5 (216)	subl	i.	sl. s.	v. s. eth.; s. h. bz., h. pyr., ac. a; v. sl s. CS_2
5867	yel rhomb pl f chl	.	173-3 5 (170)	d	i	0.188^{19} 88%	0.72^{19}bz.; s. pyr, sl. s chl.
5868							
5869	col liq	1.018^{20}_{4}	<-14	258 d.	i.	∞	∞ eth.
5870	col liq	1.008^{0}	-19	251	i	∞	∞ eth.
5870 K	col liq., $1.59389^{19.5}$	1 1340	-13 (-9)	212	i.	s.	s eth.
5870M	wh need		61	211.5^{737}	i	s	s eth
5871	col liq, $1.53311^{18.4}$	0 934		205 5			
5872							
5873							
5874	oil, 1.70540^{14}	1.7344^{15}_{4}		305	i.	∞	∞ eth.
5875	cr leaf, $1.6617^{99.4}$		54 5	308-10	i.	v s	v s eth.
5876							
5877	col liq, 1.618	1 025	-22	240-3	i.	v s.	v s. eth.
5878	col monocl f. al, $1.60263^{39.9}$	1.029^{20}_{4}	35 1	245	i	v s.	v s eth.
5879							
5880							
5881							
5882							
5883	yel. need f al	1.331^{4}_{4}	58 8 (56-7)	304	i	s.	v. s eth., chl, CS_2
5884	col rhomb need f al		79	165^{15}	i	v. s	v. s. eth.
5885	col liq or waxy solid		ca 45	325	i	v. s.	v. s eth., bz
5886	col leaf. f al		102 5	345		v. s.	v. s. eth., bz.
5887							
5888							
5889	cr f. eth		182-3		i.	v. sl s h.	s. h. eth.
5890	col. liq, $1.54614^{20.2}$	0 971	-30	207 2	i.	v s	v. s. eth.
5891	yel tetr f. acet.		195	.		sl. s.	v. s. acet., s. HNO_3; sl s. chl.
5892	long need. f al.		203	exp.	i.	sl. s.	..... .
5893	lt. yel need f chl		259	exp.	v. sl. s.	v. sl. s.	v. sl. s eth
5894	col. need f al		113			s	.....
5895	yel rhomb. (monocl) f. chl		123		i.	v. s.	sl. s. eth., v. s. acet, s chl., ac. a

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
5896	**Naphthalene,1,3,8-trinitro-*.** . . .	. . .	$C_{10}H_5(NO_2)_3$	263 16
5897	**——, 1,4,5-trinitro-***. . .	. . . .	$C_{10}H_5(NO_2)_3$	263 16
5898	**Naphthalenecarbonal.**	See *Naphthaldehyde.*		
5899	**α-Naphthalenecarboxy**	**lic acid.** See 1-*Naphthoic acid*	.	
5900	**β-Naphthalenecarboxy**	**lic acid.** See 2-*Naphthoic acid*		
5901	**Naphthalenediamine*.**	See *Naphthylenediamine.*		
5902	**1,2-Naphthalenedicarboxylic acid**	.	$C_{10}H_6(COOH)_2$	216 18
5903	**1,4-Napthalenedicarbo**	**xylic acid, 1,2,3,4-tetrah**	**ydro-1-phenyl-.**	See α-
5904	**1,8-Naphthalenedicarb**	**oxylic acid.** See *Naphthalic*	*acid*	
5905	**1,2-Naphthalenediol*.**	1,2-dihydroxynaphthalene; β-hydronaphthoquinone; β-naphthohydroquinone	$C_{10}H_6(OH)_2$	160 16
5906	**1,3-Naphthalenediol*.**	1,3-dihydroxynaphthalene; naphthoresorcinol	$C_{10}H_6(OH)_2$	160 16
5907	**1,4-Naphthalenediol***	1,4-dihydroxynaphthalene; α-hydronaphthoquinone, α-naphthohydroquinone	$C_{10}H_6(OH)_2$	160 16
5908	**1,5-Naphthalenediol*.**	1,5-dihydroxynaphthalene	$C_{10}H_6(OH)_2$	160 16
5909	**1,6-Naphthalenediol*.**	1,6-dihydroxynaphthalene.	$C_{10}H_6(OH)_2$	160 16
5910	**1,7-Naphthalenediol*.**	1,7-dihydroxynaphthalene	$C_{10}H_6(OH)_2$	160 16
5911	**1,8-Naphthalenediol*.**	1,8-dihydroxynaphthalene	$C_{10}H_6(OH)_2$	160 16
5912	**2,3-Naphthalenediol*.**	2,3-dihydroxynaphthalene	$C_{10}H_6(OH)_2$.	160 16
5913	**2,6-Naphthalenediol*.**	2,6-dihydroxynaphthalene	$C_{10}H_6(OH)_2$	160 16
5914	**2,7-Naphthalenediol*.**	2,7-dihydroxynaphthalene	$C_{10}H_6(OH)_2$	160 16
5915	**1,3-Naphthalenedisulf**	**onic acid, 7-amino-.** See	*Naphthylamine*-6,8-	*disul-*
5916	**1,5-Naphthalenedisulfonic acid**	. . . .	$C_{10}H_6(SO_3H)_2$	288 28
5917	**——, 3-amino-.**	See 2-*Naphthylamine*-4,8-*disul*	*fonic acid*	
5918	**——, 4-amino-.**	See 1-*Naphthylamine*-4,8-*disul*	*fonic acid*	
5919	**1,6-Naphthalenedisulfonic acid**		$C_{10}H_6(SO_3H)_2$	288 28
5920	**2,7-Naphthalenedisulfonic acid**	α-naphthlenedisulfonic acid	$C_{10}H_6(SO_3H)_2$	288 28
5921	**——, 4,5-dihydroxy-.**	See *Chromotropic acid.*		
5922	**Naphthalenesulfonic a**	**cid, amino-.** See *Naphthyla*	*minesulfonic acid.*	
5923	**1-Naphthalenesulfonic**	**acid** α-naphthalenesulfonic ac	id $C_{10}H_7SO_3H\ H_2O$	226 24
5924	**——, 4-amino-.**	See *Naphthionic acid.*		
5925	**2-Naphthalenesulfonic acid**	β-naphthalenesulfonic acid .	$C_{10}H_7SO_3H$.	208 22
5926	**1-Naphthalenesulfonyl chloride**	. . . .	$C_{10}H_7SO_2Cl$	226 67
5927	**2-Naphthalenesulfonyl chloride**	. . . .	$C_{10}H_7SO_2Cl$	226 67
5928	**Naphthalenethiol*.**	See *Naphthol, thio-.*		
5929	**Naphthalic acid** . . .	1,8-naphthalenedicarboxylic acid	$C_{10}H_6(COOH)_2$	216 18
5930	**1-Naphthamide**	1-naphthalenecarbonamide*; α-naphthoamide	$C_{10}H_7CONH_2$	171 19

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
5896	monocl f chl		218		i	$0\ 046^{25}$ 88%	v sl. s. eth., chl
5897	yel leaf		247 (154)		i	$0\ 12^{18}$	$0\ 88^{18}$ eth.; s. bz., 0 64 chl.
5898							
5899							
5900							
5901							
5902	need f al		175 d		s h.	i	i. eth
5903	*Isatropic acid*						
5904							
5905	col leaf or need f CS_2, leaf $(+1H_2O)$ f. w		anh 103-4, $+1H_2O$, 58-60		sl s	s	s eth, alk.
5906	leaf f w		124		s	s	s eth, ac a; sl s. bz, lgr, yel in alk sol.
5907	lng monocl col need		176		s h	s	s eth, ac. a. v. sl s CS_2, lgr, c bz.
5908	sm pr f w		265 (258)	d	sl s	s	s eth, acet, ac a; i. bz, pet eth
5909	col pr f bz		138 (135)		sl s	sl s	v. s eth; s. bz, acet.
5910	col need f bz		178		s	v s	v s. eth, s bz.
5911	leaf or need f w		140		sl s h	s h	v. s eth.; s bz, sl s lgr
5912	monocl (rhomb) leaf f w		160-1		s h	v s	v s eth.; s. bz, lgr.
5913	rhomb pl f w		218	subl	sl s	s	s eth, me al, acet, sl s. bz, i lgr.
5914	need f w		190	subl	s	s	s eth, chl, bz, i lgr
5915	*Ionic acid*						
5916	leaf, 1.493, 1 675, 1 739		d.		102^{20}	s	i eth
5917							
5918							
5919	cr		125 d		164^{20}	s	i eth
5920	hyg need				s		sl s. c HCl
5921							
5922							
5923	cr		90		v s	s	sl. s. eth.
5924							
5925	col-wh deliq pl		102	d	76 96^{30}	s	s eth; 0 2 h. bz.
5926	leaf f eth		68	195^{13}	i	s	v. s eth
5927	wh cr powd or leaf		76	201^{13}	i	s	v s. eth; s. bz., chl, CS_2
5928							
5929	col. need f al		270 d		v sl s	sl s	sl s eth
5930	col. need f al		202		v sl s	v sl s	.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
5931	**2-Naphthamide** . .	2-naphthalenecarbonamide*, β-naphthoamide	$C_{10}H_7CONH_2$	171 19
5932	**Naphthane.**	See *Naphthalene, decahydro-**.		
5933	**Naphthazarin**.........	5,8-dihydroxy-1,4-naphthoquinone	$C_{10}H_4O_2(OH)_2$...	190 15
5934	**Naphthionic acid**....	1-naphthylamine-4-sulfonic acid, 4-amino-1-naphthalenesulfonic acid	$NH_2C_{10}H_6SO_3H\cdot\frac{1}{2}H_2O$	232 25
5935	**α-Naphthoamide.**	See 1-*Naphthamide.*		
5936	**β-Naphthoamide.**	See 2-*Naphthamide*		
5937	**α-Naphthohydroquinone.**	See 1,4-*Naphthalenediol**.		
5938	**β-Naphthohydroquinone.**	See 1,2-*Naphthalenediol**		
5939	**1,2-Naphthohydroquinone.**	See 1,2-*Naphthalenediol**		
5940	**1,4-Naphthohydroquinone.**	See 1,4-*Naphthalenediol**.		
5941	**1-Naphthoic acid**...	α-naphthalenecarboxylic acid, α-naphthoic acid	$C_{10}H_7COOH$.	172 17
5942	——, **2-hydroxy-**	..	$HOC_{10}H_6COOH$	188 17
5943	——, **5-hydroxy-**...		$HOC_{10}H_6COOH$	188 17
5944	——, **6-hydroxy-**		$HOC_{10}H_6COOH$	188 17
5945	——, **7-hydroxy-**		$HOC_{10}H_6COOH$	188 17
5946	——, **8-hydroxy-**		$HOC_{10}H_6COOH$	188 17
5947	——, **8-nitro-** .		$NO_2C_{10}H_6COOH$	217 17
5948	**2-Naphthoic acid** ..	β-naphthalenecarboxylic acid, β-naphthoic acid	$C_{10}H_7COOH$	172 17
5949	——, **1-hydroxy-** ..		$HOC_{10}H_6COOH$	188 17
5950	——, **3-hydroxy-**		$HOC_{10}H_6COOH$	188 17
5951	——, **5-hydroxy-**		$HOC_{10}H_6COOH$	188 17
5952	——, **7-hydroxy-**		$HOC_{10}H_6COOH$.	188 17
5953	**α-Naphthoic aldehyde.**	See 1-*Naphthaldehyde*		
5954	**β-Naphthoic aldehyde.**	See 2-*Naphthaldehyde*		
5955	**1-Naphthol** .. .	α-naphthol, 1-hydroxynaphthalene	$C_{10}H_7OH$	144 16
5956	——, acetate . .	α-naphthyl acetate .	$CH_3COOC_{10}H_7$	186 20
5957	——, **4-acetamido-**	*N*-(4-hydroxy-1-naphthyl)-acetamide, naphthacetol	$CH_3CONHC_{10}H_6$-OH	201 22
5958	——, **2-aceto-.**	See 2-*Acetonaphthone, 1-hydroxy-*.		
5959	——, **2-acetyl-4-bromo-.**	See 2-*Acetonaphthone, 4-bromo-1-hydroxy-*		
5960	——, **2-amino-**	1-hydroxy-2-naphthylamine	$NH_2C_{10}H_6OH$	159 18
5961	——, **4-amino-** . .	4-hydroxy-1-naphthylamine	$NH_2C_{10}H_6OH$	159 18
5962	——, **5-amino-** .	5-hydroxy-1-naphthylamine	$NH_2C_{10}H_6OH$.	159 18
5963	——, **7-amino-**	8-hydroxy-2-naphthylamine	$NH_2C_{10}H_6OH$.	159 18
5964	——, **8-amino-** . . .	8-hydroxy-1-naphthylamine	$NH_2C_{10}H_6OH$.	159 18
5965	——, **4-bromo-2-propionyl-.**	See 2-*Propionaphthone, 4-bromo-1-hydroxy-*.		
5966	——, **2-butyryl-.**	See 2-*Butyronaphthone, 1-hydroxy-*		
5967	——, **2-cinnamyl-.**	See 2-*Acrylonaphthone, 1-hydroxy-β-phenyl-*.		
5968	——, **2,4-dibromo-**		$Br_2C_{10}H_5OH$	301 98
5969	——, **2,4-dichloro-** .		$Cl_2C_{10}H_5OH$.	213 06
5970	——, **2,4-dinitro-** ..		$(NO_2)_2C_{10}H_5OH$...	234 16
5971	——, **2-nitro-**...		$NO_2C_{10}H_6OH$	189 16
5972	——, **4-nitro-** ..		$NO_2C_{10}H_6OH$	189 16
5973	——, **2-nitroso-** ..	1,2-naphthoquinone 2-oxime	$NOC_{10}H_6OH$.	173 16

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
5931	col tab f al		192		sl s.	sl s	s. eth , bz , chl
5932							
5933	red br need f al.		276–80	subl.	sl s h	s	v sl s eth , bz ; s alk.
5934	col need. f w		d		0 026^{0}, 0 22^{100}	v sl s	v sl s eth
5935							
5936							
5937							
5938							
5939							
5940							
5941	col need f. dil al		160	300	v sl s h	v s h	s eth., chl , NH_4OH
5942	need f al and eth		156–7 d.		sl s h	v s	v s eth ; s bz.
5943	lng need f w		234–7	subl	sl s. h.	v s	s eth , ac a
5944	sm need f w		187		s h	v. s.	
5945	need f w		245–7 d		s. h.	s	
5946	need f eth.		169		s h	v s	s eth.
5947	pr f al		215		0 04c.	4 6	sl. s eth , bz
5948	col monocl need f lgr	1 077$^{100}_{4}$	185	>300	0 0068^{25}	v. s	v s eth.; s. NaOH sol
5949	need f al or eth		186–8		sl s	s	s eth , bz.
5950	yel rhomb need f w		216 (211–4)		s h	s	s eth , bz , chl
5951	need f w. or al.		211–2		s h	s	
5952	leaf ..		262		s.	s	s. eth.
5953							
5954							
5955	yel monocl , 1 6206$^{98.7}$	1 224^{4}; 1 099^{99}	96	288 (280)	sl s h , i c	v s	v s eth ; s bz
5956	need or pl. f al		44 8		sl s h	s	v s. eth.
5957	need f al		187		s h	s.	s NH_4OH, Na_2CO_3
5958							
5959							
5960	need				sl s		..
5961	need				sl s	s.	s. eth.
5962	cr		170 d		sl s	s.	s. eth
5963	cr (sc) f chl		158		sl s.	s.	s. eth.
5964	wh need.		95–7 d		v s h , sl s c		s. alk , HCl
5965							
5966							
5967							
5968	wh. need f. al		105 (111)		i.	s	s eth , ac. a.
5969	wh need f al or bz.		107	d 180	i.	s.	s. eth , bz.
5970	yel. need f h. al or chl.		138		v. sl. s. h	sl. s.	sl s. eth., bz , s. ac a.
5971	yel need. or leaf f al		128		v sl s	sl s.	..
5972	yel. need f. w		164	.	s h	v s	v. s. ac a.
5973	yel need f bz		152	. ..	v sl s c	v. s.	s. eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
5974	**1-Naphthol, 4-nitroso-**	1,4-naphthoquinone 1-oxime	$NOC_{10}H_6OH$	173.16
5975	**——, 1,2,3,4-tetra-hydro-**	*α*-naphthol 1,2,3,4-tetra-hydride, *ac*-tetrahydro-*α*-naphthol	$C_6H_4:C_4H_7OH$	148.20
5976	**——, 5,6,7,8-tetra-hydro-**	*α*-naphthol 5,6,7,8-tetra-hydride, *ar*-tetrahydro-*α*-naphthol	$C_4H_8:C_6H_3OH$	148.20
5977	**——, thio-**	1-naphthalenethiol*, *α*-naphthyl mercaptan	$C_{10}H_7SH$	160.22
5978	**2-Naphthol**	*β*-naphthol, 2-hydroxynaph-thalene	$C_{10}H_7OH$	144.16
5979	——, acetate	*β*-naphthyl acetate	$CH_3COOC_{10}H_7$	186.20
5980	——, benzoate	*β*-naphthyl benzoate	$C_{10}H_7OOCC_6H_5$	248.27
5981	**——, 1-acetamido-**	*N*-(2-hydroxy-1-naphthyl)-acetamide	$CH_3CONHC_{10}H_6OH$	201.22
5982	**——, 1-amino-**	2-hydroxy-1-naphthylamine	$NH_2C_{10}H_6OH$	159.18
5983	**——, 3-amino-**	3-hydroxy-2-naphthylamine.	$NH_2C_{10}H_6OH$	159.18
5984	**——, 5-amino-**	6-hydroxy-1-naphthylamine.	$NH_2C_{10}H_6OH$	159.18
5985	**——, 6-amino-**	6-hydroxy-2-naphthylamine	$NH_2C_{10}H_6OH$	159.18
5986	**——, 7-amino-**	7-hydroxy-2-naphthylamine	$NH_2C_{10}H_6OH$	159.18
5987	**——, 8-amino-**	7-hydroxy-1-naphthylamine	$NH_2C_{10}H_6OH$	159.18
5988	**——, 1-bromo-**		$BrC_{10}H_6OH$	223.07
5989	**——, 6-bromo-1-methyl-**		$CH_3C_{10}H_5BrOH$	237.10
5990	**——, 1-chloro-**		$ClC_{10}H_6OH$	178.61
5991	**——, 1,6-dibromo-**		$Br_2C_{10}H_5OH$	301.98
5992	**——, 1,6-dinitro-**		$(NO_2)_2C_{10}H_5OH$	234.16
5993	**——, 1-methyl-**		$CH_3C_{10}H_6OH$	158.19
5994	**——, 1-nitro-**		$NO_2C_{10}H_6OH$	189.16
5995	**——, 5-nitro-**		$NO_2C_{10}H_6OH$	189.16
5996	**——, 8-nitro-**		$NO_2C_{10}H_6OH$	189.16
5997	**——, 1-nitroso-**	1,2-naphthoquinone 1-oxime	$NOC_{10}H_6OH$	173.16
5998	**——, 1-*p*-phenylazo-**	*p*-nitrobenzeneazo-*β*-naph-thol, paranitraniline red	$NO_2C_6H_4N:NC_{10}H_6OH$	293.27
5999	**——, 1,2,3,4-tetra-hydro-**	*β*-naphthol 1,2,3,4-tetra-hydride, *ac*-tetrahydro-*β*-naphthol	$C_6H_4:C_4H_7OH$	148.20
6000	**——, 5,6,7,8-tetra-hydro-**	*β*-naphthol 5,6,7,8-tetra-hydride; *ar*-tetrahydro-*α*-naphthol	$C_4H_8:C_6H_3OH$	148.20
6001	**——, thio-**	2-naphthalenethiol*; *β*-naphthyl mercaptan	$C_{10}H_7SH$	160.22
6002	**Naphtholaldehyde.**	See *Naphthaldehyde, hydroxy-*		
6003	**β-Naphtholdisulfonic acid R.** See 2-*Naphthol*-3,6-di*sulfonic acid*			
6004	**1-Naphthol-3,6-disul-fonic acid, 8-amino-**	H acid	$H_2N(OH)C_{10}H_4(SO_3H)_2$	319.30
6005	**2-Naphthol-3,6-disul-fonic acid**	*β*-naphtholdisulfonic acid R, *β*-naphthol-*α*-disul-fonic acid; R acid	$HOC_{10}H_5(SO_3H)_2$	304.28
6006	**2-Naphthol-6,8-disul-fonic acid**	*β*-naphthol-*γ*-disulfonic acid, G acid	$HOC_{10}H_5(SO_3H)_2$	304.28
6007	**β-Naphthol-α-monosulfonic acid.** See *Croceic acid.*			
6008	**1-Naphthol-2-sulfonic acid**	*α*-naphtholsulfonic acid of Schaeffer	$HOC_{10}H_6SO_3H$	224.22

*Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
5974	yel. need . .		. . . . .	194 d.	i	v s	v s eth
5975	col. liq, 1 5671[17]	1 090		140^{17}	v sl s	v s	v s eth
5976	wh monocl pl		68	265 3	sl s h	v s	v s eth.
5977	liq	$1\ 155^{20}_{4}$		161^{20}, 285 d	i.	v s	v s eth.
5978	col monocl leaf.	$1\ 217^{4}$	122	294 85 (286)	$0\ 074^{25}$	$12\ 5^{25}$	$76\ 9^{25}$ eth.; s. chl., oils, alk, glyc.
5979	sm. need f al		68 5		i	s.	s. eth., chl.
5980	need f al		110 (107-8)		i	v s h	sl. s eth.
5981	leaf. f. w, al		235 d	subl		s.	s. eth., h. ac. a, v s NaOH; sl. s bz.
5982	leaf unst..				sl s h	. . . . .	sl s, fluores. eth.
5983	need. f. w		234		s.	v s.	sl. s eth, bz.
5984	need or sc f w		186		s	s	s eth.
5985	sc f h w		190-5 d		s	s	. . . .
5986	need f al		201		sl s	v s	v s eth.
5987	need f. w or eth		205-7		s	s	sl. s. eth.
5988	rhomb pr		84	d 130	i	s.	s. eth.
5989	need		129		i.	s.	s. eth.
5990	pl f w, or need f. lgr		70		sl s	s	s. eth., chl, bz, ac a.; sl. s. c. lgr.
5991	need f ac a		106		i	s	s eth.
5992	pa yel need		195 d		v sl s	s	s. eth., chl.
5993	need		112		sl s	s	s eth
5994	yel need f al		103 (98-100)		v sl s	sl s	v s. eth.
5995	yel need f w		147		v s h	v s	v. s eth.
5996	yel need. f w		145		s	v. s	s. eth., bz., chl.
5997	yel need. f bz		110 (105-7)		0 02 c	$2\ 4^{18}$ v s. h	v. s eth.; s. bz., glac. ac. a.
5998	or. to br pl		252		i	i	. . . . .
5999	oil	1 071		265 5	v sl s.	v s.	v. s eth.
6000	need f al		57 5	276	v sl s	v s.	v. s eth.
6001	glit sc f. al	1 550	81	288 d	sl s	v. s.	v. s eth.
6002							
6003							
6004	col cr				sl s	. . . . . .	. . . . .
6005	deliq col need.		d		v. s	v. s.	i. eth
6006	. . . . . .				s	.	. . .
6007							
6008	col. rhomb. tab f. w		>250	. . . .	s.	s.	i. eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
6009	**1-Naphthol-3-sulfonic acid**	.	$HOC_{10}H_6SO_3H$	224 22
6010	**1-Naphthol-4-sulfonic acid**	Nevile-Winther acid ..	$HOC_{10}H_6SO_3H$	224 22
6011	**1-Naphthol-5-sulfonic acid**	α-naphtholsulfonic acid L.	$HOC_{10}H_6SO_3H$	224 22
6012	——, **8-amino-**	S acid ..	$C_{10}H_9NO_4S$	239 24
6013	**1-Naphthol-7-sulfonic acid**	.	$HOC_{10}H_6SO_3H$	224 22
6014	**1-Naphthol-8-sulfonic acid**	α-naphtholsulfonic acid S	$HOC_{10}H_6SO_3H$	224 22
6015	——, inner anhydride	naphthosulfone	$C_{10}H_6OSO_2$	206 21
6016	**2-Naphthol-6-sulfonic acid**	Schaffer's acid, β-naphtholsulfonic acid S	$C_{10}H_6(OH)SO_3H$	224 22
6017	——, **1-amino-**, sodium salt	eikonogen	$H_2N(OH)C_{10}H_5$-SO_3Na	261 23
6018	**2-Naphthol-7-sulfonic acid**	β-naphtholsulfonic acid F	$C_{10}H_6(OH)SO_3H$	224 22
6019	**2-Naphthol-8-sulfonic acid.**	See *Croceic acid*		
6020	**1-Naphthonitrile** ...	1-naphthalenecarbonitrile*; α-naphthyl cyanide	$C_{10}H_7CN$	153 17
6021	**2-Naphthonitrile** ...	2-naphthalenecarbonitrile*, β-naphthyl cyanide	$C_{10}H_7CN$	153 17
6022	**α β-Naphthophenazine.**	See *Benzo[a]phenazine*		
6023	**α-Naphthoquinaldine.**	See *Benzo[h]quinoline, 2-methyl-.*		
6024	**β-Naphthoquinaldine.**	See *Benzo[f]quinoline, 3-methyl-.*		
6025	**Naphtho(2,3-*f*)quinoline**	α-anthraquinoline	$C_{17}H_{11}N$. .	229 27
6026	**α-Naphthoquinoline.**	See *Benzo[h]quinoline*		
6027	**β-Naphthoquinoline.**	See *Benzo[f]quinoline*		
6028	**1,2-Naphthoquinone**	1,2-dihydro-1,2-diketonaphthalene, β-naphthoquinone	$C_{10}H_6O_2$...	158 15
6029	——, 1-oxime	See 2-*Naphthol*, 1-*nitroso-*.		
6030	——, 2-oxime.	See 1-*Naphthol*, 2-*nitroso-*		
6031	——, **6-hydroxy-**. .		$HOC_{10}H_5O_2$	174 15
6032	——, **7-hydroxy-** . .		$HOC_{10}H_5O_2$	174 15
6033	**1,4-Naphthoquinone** .	1,4-dihydro-1,4-diketonaphthalene, α-naphthoquinone	$C_{10}H_6O_2$	158 15
6034	——, 1-oxime.	See 1-*Naphthol*, 4-*nitroso-*.		
6035	——, **2,3(or 3,4)-dihydroxy-**	See *Isonaphthazarin*		
6036	——, **5,8-dihydroxy-.**	See *Naphthazarin*		
6037	——, **2-hydroxy-** ..		$HOC_{10}H_5O_2$.	174 15
6038	——, **5-hydroxy-.**	See *Juglone.*		
6038M	——, **2-hydroxy-3-methyl-.**	See *Phthiocol.*		
6039	**2,6-Naphthoquinone**..	2,6-dihydro-2,6-diketonaphthalene, *amphi*-naphthoquinone	$C_{10}H_6O_2$	158 15
6040	**Naphthoresorcinol.**	See 1,3-*Naphthalenediol**.		
6041	**Naphthosulfone.**	See 1-*Naphthol*-8-*sulfonic acid, inner anhydride.*		
6042	**Naphthylamine, hydroxy-.**	See *Naphthol, amino-.*		
6043	**1-Naphthylamine**	α-naphthylamine	$C_{10}H_7NH_2$	143 18
6044	——, hydrochloride		$C_{10}H_7NH_2\cdot HCl$	179 65
6045	——, ***N*-acetyl-**........	*N*-1-naphthylacetamide; 1-acetonaphthalide	$C_{10}H_7NHCOCH_3$	185 22
6046	——, ***N*-acetyl-*N*-methyl-**	*N*-methyl-*N*-1-naphthylacetamide	$(CH_3CO)(CH_3)$-$NC_{10}H_7$	199 24

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
6009	need .				s		.
6010	col. pl f w.		170 d		v s	..	
6011	wh hyg. cr.		120		s		
6012	wh. need				sl s.	i.	i eth
6013	cr				v s	v s	.
6014	cr		107	$-H_2O$, 180	v s	.	..
6015	pr f bz		154	360	sl s.	sl s.	v s. chl ; s. bz.; sl. s CS_2
6016	col leaf		125		v s	v s.	i eth
6017	wh powd				s		
6018	need f HCl.		89	d 150	v s.	v. s.	i eth., bz.
6019							
6020	col. need f lgr.	$1\ 117\frac{5}{5}$	33 5	296 5	i	v s.	v s eth.; s lgr
6021	col leaf f lgr	$1\ 094\frac{60}{60}$	66 5	305	i	s	s eth , lgr
6022							
6023							
6024							
6025	col. leaf or tab		170	446	i	v. s	v s eth , s bz.
6026							
6027							
6028	yel -red need f eth		d 115-120		s	s.	s eth., H_2SO_4, bz.
6029							
6030							
6031	brick red lvs f acet		165 d.		s	s	s. eth.
6032	br -red need		194			s	i. eth., bz.; s. ac. a.
6033	yel tricl f lgr	1 422	125	subl 100	sl s.	s	v. s. eth., CS_2, glac. ac. a.; s. bz , chl.
6034							
6035							
6036							
6037	yel. need .	.	190 d	subl.	sl s h.	s	s eth.
6038							
6038M							
6039	or pr ..	.	135			s.	v sl s. eth , s. alk.
6040							
6041							
6042							
6043	col rhomb. need f dil al., $1.6703^{51\ 2}$	1 131	50	301	0 17	v. s.	v. s. eth.
6044	sm need				$3\ 77^{20}$	v s.	s. eth.
6045	col. cr		159-60		s.	4^{25}	v. sl. s. eth.
6046	pr . . .		95	..	sl. s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
6047	**1-Naphthylamine, *N*, *N*-diethyl-**	.	$C_{10}H_7N(C_2H_5)_2$	199 29
6048	**——, *N,N*-dimethyl-. .**		$C_{10}H_7N(CH_3)_2$	171 23
6049	**——, *N*-ethyl-........**		$C_{10}H_7NHC_2H_5$	171 23
6050	**——, *N*-methyl-......**	*α*-naphthylmethylamine	$C_{10}H_7NHCH_3$	157 21
6051	**——, 4-(1-naphthyl-azo)-**	4-amino-1,1′-azonaphthalene	$C_{10}H_7N{:}NC_{10}H_6\text{-}NH_2$	297 35
6052	**——, 6-nitro-. .... ..**		$NO_2C_{10}H_6NH_2$	188 18
6053	**——, *N*-phenyl-... .**		$C_{10}H_7NHC_6H_5$	219 27
6054	**——, 4-phenylazo-**	4-benzeneazo-*α*-naphthylamine	$C_6H_5N{:}C_{10}H_6NH_2$	247 29
6055	**——, *N*-propyl- .**		$C_{10}H_7NHCH_2\text{-}CH_2CH_3$	185 26
6056	**——, 5,6,7,8-tetra-hydro-**	*α*-naphthylamine 5,6,7,8-tetrahydride, *ar*-tetrahydro-*α*-naphthylamine	$C_4H_8{\cdot}C_6H_3NH_2$	147 21
6057	**——, *N*-*o*-tolyl-**	*N*-1-naphthyl-*o*-toluidine	$C_{10}H_7NHC_6H_4CH_3$	233 30
6058	**——, *N*-*p*-tolyl-. .**	*N*-1-naphthyl-*p*-toluidine	$C_{10}H_7NHC_6H_4CH_3$	233 30
6059	**2-Naphthylamine.. ..**	*β*-naphthylamine...	$C_{10}H_7NH_2$.	143 18
6060	——, hydrochloride		$C_{10}H_7NH_2{\cdot}HCl$	179 65
6061	**——, *N*-acetyl-**	*N*-2-naphthylacetamide, 2-acetonaphthalide	$C_{10}H_7NHCOCH_3$	185 22
6062	**——, *N,N*-dimethyl-**		$C_{10}H_7N(CH_3)_2$	171 23
6063	**——, *N*-ethyl- ..**		$C_{10}H_7NHC_2H_5$	171 23
6064	**——, *N*-methyl- . .**	*β*-naphthylmethylamine	$C_{10}H_7NHCH_3$	157 21
6065	**——, 1-nitro-. .**		$NO_2C_{10}H_6NH_2$	188 18
6066	**——, 5-nitro-... .**		$NO_2C_{10}H_6NH_2$	188 18
6067	**——, 8-nitro-**	.	$NO_2C_{10}H_6NH_2$	188 18
6068	**——, 1-nitroso-**		$NOC_{10}H_6NH_2$	172 18
6069	**——, *N*-phenyl-**		$C_{10}H_7NHC_6H_5$	219 27
6070	**——, 1,2,3,4-tetra-hydro-**	*β*-naphthylamine 1,2,3,4-tetrahydride, *ac*-tetrahydro-*β*-naphthylamine	$C_6H_4{:}C_4H_7NH_2$	147 21
6071	**——, *N*-*o*-tolyl-.**	*N*-2-naphthyl-*o*-toluidine	$C_{10}H_7NHC_6H_4CH_3$	233 30
6072	**——, *N*-*p*-tolyl-.......**	*N*-2-naphthyl-*p*-toluidine	$C_{10}H_7NHC_6H_4CH_3$	233 30
6073	**1-Naphthylamine-4,8-disulfonic acid**	4-amino-1,5-naphthalenedisulfonic acid; *α*-naphthylaminedisulfonic acid S	$NH_2C_{10}H_5(SO_3H)_2$	303 30
6074	**2-Naphthylamine-4,8-disulfonic acid**	3-amino-1,5-naphthalenedisulfonic acid, *β*-naphthylaminedisulfonic acid; C acid; acid IV	$H_2NC_{10}H_5(SO_3H)_2$	303 30
6075	**2-Naphthylamine-6,8-disulfonic acid**	amino G acid; 7-amino-1,3-naphthalenedisulfonic acid	$H_2NC_{10}H_5(SO_3H)_2$	303 30
6076	**α-Naphthylaminemonosulfonic acid S.** See 1-*Naphthylamine-8-sulfonic acid*			
6077	**β-Naphthylaminemonosulfonic acid I (of Dahl).** See 2-*Naphthylamine-8-*			
6078	**α-Naphthylaminesulfonic acid.** See 1-*Naphthylamine-5-sulfonic acid*			

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
6047	col -br oil, 1 59331[18 1]	1 005		290 (285)	i	s	s eth, bz.
6048	col liq with vlt fluores	1 0446 $\frac{15}{15}$	59 5-67	274 5	i	s.	s. eth
6049	col oil, 1 64773[15 1]	1 060 $\frac{20}{4}$		305 (187-90[70])	i	s	s eth
6050	red oil			293	i	v s.	v s eth, s CS_2
6051	redsh -br need		175 (183)		i	sl s	sl s eth, bz.
6052	yel pr f. al		143			s	.. ..
6053	col leaf or pr f al		62	335[258]	1 44[25]	s	v s eth, s bz, chl, ac a.
6054	red need f al		120 (123)			s	s eth, bz.
6055	oil ..			ca 317	i		
6056	oil, 1 58964[25 1]	1 054[25]		276 8	v sl s	s	s eth, dil a
6057	need f lgr		94 5		i	v s	v. s eth., bz
6058	pr f al		79	230[10]	i	s	v. s. eth.; s. bz, sl s h. pet eth
6059	leaf f w, 1 64927[98 4]	1 061 $\frac{98}{4}$	110 2	306 1	i	s	s eth, bz.
6060	leaf				v s	v s	s eth; sl s HCl
6061	lng flat need f w		132		s	s	sl s eth.
6062	dk red need, 1 64432[58 2]	1 029 $\frac{55}{4}$	52-53	305, 212 5[69]	i	s	s eth
6063	col oil, 1 65440[21 3]	1 057	<-15	315 6 (305 7)	i	s	s eth
6064	oil			308-10[761] (298)			
6065	or -yel need f al		127 (123-4)		s h	v s	s ac a
6066	red need f al		143			v s h	s bz, i lgr
6067	red need		105			v s	s eth, i lgr
6068	grn need f al		150-2		sl s h	v s	v s eth
6069	rhomb need f me al		108	399 5	i.	s	s eth, h. bz; v s chl.
6070	liq, 1 56039[22 2]	1 029[22]	38	278 5	s h	v s	v s eth
6071	leaf f. lgr		95-6	400 5		s	s eth, v s bz, lgr, chl, acet.
6072	red leaf f al		102-3			sl s	s. eth, bz; sl. s lgr.
6073	rhomb cr				v s		
6074					s		
6075	monocl. need				s		
6076							
6077	*sulfonic acid*						
6078							

For explanations and abbreviations see beginning of table

No.	Name	Synonyms	Formula	Mol Wt.
6079	**β-Naphthylaminesulfonic acid F.** See 2-*Naphthylamine-7-sulfonic acid*.			
6080	**β-Naphthylaminesulfonic acid III.** See 2-*Naphthylamine-5-sulfonic acid*			
6081	**1-Naphthylamine-2-sulfonic acid**	1-amino-2-naphthalenesulfonic acid	$NH_2C_{10}H_6SO_3H$	223 24
6082	**1-Naphthylamine-4-sulfonic acid.** See *Naphthionic acid*.			
6083	**1-Naphthylamine-5-sulfonic acid**	5-amino-1-naphthalenesulfonic acid, α-naphthylaminesulfonic acid; Laurent's acid	$NH_2C_{10}H_6SO_3H\cdot H_2O$	241 26
6084	**1-Naphthylamine-6-sulfonic acid**	5-amino-2-naphthalenesulfonic acid	$NH_2C_{10}H_6SO_3H$	223 24
6085	**1-Naphthylamine-7-sulfonic acid**	8-amino-2-naphthalenesulfonic acid	$NH_2C_{10}H_6SO_3H\cdot H_2O$	241 26
6086	**1-Naphthylamine-8-sulfonic acid**	8-amino-1-naphthalenesulfonic acid; α-naphthylaminemonosulfonic acid S; Schollkopf's acid	$NH_2C_{10}H_6SO_3H\cdot H_2O$	241 26
6087	**2-Naphthylamine-1-sulfonic acid**	Tobias' acid; 2-amino-1-naphthalenesulfonic acid	$NH_2C_{10}H_6SO_3H$	223 24
6088	**2-Naphthylamine-4-sulfonic acid**	3-amino-1-naphthalenesulfonic acid	$NH_2C_{10}H_6SO_3H\cdot H_2O$	241 26
6089	**2-Naphthylamine-5-sulfonic acid**	6-amino-1-naphthalenesulfonic acid, β-naphthylaminesulfonic acid III	$NH_2C_{10}H_6SO_3H$	223 24
6090	**2-Naphthylamine-6-sulfonic acid**	6-amino-2-naphthalenesulfonic acid, Bronner's acid	$NH_2C_{10}H_6SO_3H\cdot H_2O$	241 26
6091	**2-Naphthylamine-7-sulfonic acid**	7-amino-2-naphthalenesulfonic acid; β-naphthylaminesulfonic acid F	$NH_2C_{10}H_6SO_3H$ H_2O	241 26
6092	**2-Naphthylamine-8-sulfonic acid**	7-amino-1-naphthalenesulfonic acid; β-naphthylaminemonosulfonic acid I (of Dahl)	$NH_2C_{10}H_6SO_3H$	223 24
6093	**α-Naphthyl cyanide.**	See 1-*Naphthonitrile.*		
6094	**β-Naphthyl cyanide.**	See 2-*Naphthonitrile.*		
6095	**1,2-Naphthylenediamine**	1,2-naphthalenediamine*; 1,2-diaminonaphthalene	$C_{10}H_6(NH_2)_2$	158 20
6096	**1,4-Naphthylenediamine**	1,4-naphthalenediamine*; 1,4-diaminonaphthalene	$C_{10}H_6(NH_2)_2$	158 20
6097	**1,5-Naphthylenediamine**	1,5-naphthalenediamine*; 1,5-diaminonaphthalene	$C_{10}H_6(NH_2)_2$.	158 20
6098	**1,6-Naphthylenediamine**	1,6-naphthalenediamine*, 1,6-diaminonaphthalene	$C_{10}H_6(NH_2)_2$. . .	158 20
6099	**1,7-Naphthylenediamine**	1,7-naphthalenediamine*; 1,7-diaminonaphthalene	$C_{10}H_6(NH_2)_2$	158 20
6100	**1,8-Naphthylenediamine**	1,8-naphthalenediamine*; 1,8-diaminonaphthalene	$C_{10}H_6(NH_2)_2$.	158 20
6101	**2,3-Naphthylenediamine**	2,3-naphthalenediamine*; 2,3-diaminonaphthalene	$C_{10}H_6(NH_2)_2$	158 20
6102	**2,6-Naphthylenediamine**	2,6-naphthalenediamine*, 2,6-diaminonaphthalene	$C_{10}H_6(NH_2)_2$ . .	158 20
	Naphthyl esters.	See "naphthyl ester," under the names of the acids.		
6103	**1-Naphthyl ether** . .	1-(1-naphthoxy)naphthalene*; α-dinaphthyl ether	$(C_{10}H_7)_2O$	270 31
6104	**1,2′-Naphthyl ether** . .	α,β′-dinaphthyl ether; 1-(2-naphthoxy)naphthalene	$C_{10}H_7OC_{10}H_7$ . .	270 31
6105	**2-Naphthyl ether** . . .	2-(2-naphthoxy)naphthalene*; β-dinaphthyl ether	$(C_{10}H_7)_2O$ . . .	270 31

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc
6079							
6080							
6081	need f w		272 d		0 41^{20}, 3 1^{100}	i.	i. bz.
6082							
6083	sm pl		189 5		sl s	v sl s	v. sl. s. eth.
6084	col pl f w.		d		0 03^{20}	i	i eth.
6085	col need. f w				0 464^{25}	v sl s	v sl s. eth.
6086	need		$-H_2O$, 130		0 42^{100}, 0 02^{21}	v sl s	v sl s eth., s ac a
6087	leaf f h w				sl s c, s h	v sl s	v sl s. eth.
6088	need f w				sl s c	v. sl s	v sl s. eth.
6089	need f w				0 033^{20}	v sl s	v sl s eth.
6090	leaf				0 013^{20}, 0 16^{100}	v sl s	v sl s eth.
6091	col need				0 02^{20}, 0 28^{100}	v sl s.	v sl. s. eth.
6092	pr. f w				0 06^{20}	sl s.	v. sl s. eth.
6093							
6094							
6095	leaf f. w		96	$150\text{–}1^{0.5}$	s h	v s.	v s eth.
6096	pr. f. h. w.		120		sl s.	v s	v s eth.
6097	col. pr. f eth		189 5	subl	v sl s c	s h	v s eth, chl
6098	need f w, 1 $7083^{99.4}$	1 147^{99}	78		v sl s. c, s h	s. h	sl s. eth.
6099	leaf f bz; need. f. w		117 5		sl s.	v s	v. sl. s. eth.
6100	col cr f al, 1 $6828^{99.4}$	1 127^{99}	66 5	subl 205^{12}	sl s	v s	v. s. eth.
6101	leaf. f. eth		191			v. s.	s. eth.
6102	need. f. w .		216		v sl s h	v. sl s	v sl. s eth.
6103	col. leaf. ..		110	>360	i	s. h.	s. eth., bz., h. ac a
6104	need f al. +eth.		81	264^{15}	i.	sl. s.	s. eth., bz., chl.
6105	col. need f. al		105	250^{20} sl d	i	s. h.	v. s. eth.; s. bz, h. ac. a.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
6106	**1-Naphthyl ketone**	α, α-dinaphthyl ketone	$C_{10}H_7COC_{10}H_7$	282 32
6107	**1,2′-Naphthyl ketone**	α,β′-dinaphthyl ketone	$C_{10}H_7COC_{10}H_7$	282 32
6108	**2-Naphthyl ketone**	β, β′-dinaphthyl ketone	$C_{10}H_7COC_{10}H_7$	282 32
6109	**Naphthyl mercaptan.**	See *Naphthol, thio-*.		
6110	**2-Naphthyl salicylate.**	See *Betol*		
6111	**Narceine**		$C_{23}H_{27}NO_8 \cdot 3H_2O$	499 51
6112	——, bisulfate		$C_{23}H_{27}NO_8 \cdot H_2SO_4 \cdot 10H_2O$	723 69
6113	——, hydrochloride		$C_{23}H_{27}NO_8 \cdot HCl \cdot 3H_2O$	535 97
6114	**Narcotine**		$C_{22}H_{23}NO_7$	413 41
6115	——, hydrochloride		$C_{22}H_{23}NO_7 \cdot HCl \cdot H_2O$	467 90
6116	***dl*-Narcotine.**	See *Gnoscopine*.		
6117	**Narcotine hemipic acid.**	See *Hemipic acid*.		
6118	**Naringin**		$C_{23}H_{28}O_{12}$(?)	496-46(?)
6119	**Neohexane.**	See *Butane, 2,2-dimethyl-**.		
6120	**Neopentane.**	See *Propane, 2,2-dimethyl-**.		
6121	**Neopentyl alcohol.**	See *1-Propanol, 2,2-dimethyl-**		
6122	**Neral.**	See *Citral b*.		
6122M	**Nerol**	3,7-dimethyl-2,6-octadien-1-ol*	$C_{10}H_{17}OH$	154 25
6123	**Nerolin (new).**	See *Ether, ethyl 2-naphthyl*		
6124	**Nerolin (old).**	See *Ether, methyl 2-naphthyl*.		
6125	**Neurine**	trimethylvinylammonium hydroxide	$CH_2{:}CHN(CH_3)_3OH$	103 16
6126	**Nevile-Winther acid.**	See *1-Naphthol-4-sulfonic acid*.		
6127	**Ngai camphor.**	See *l-Borneol*.		
6128	**Nicoteine**		$C_{10}H_{12}N_2$	160 21
6128M	**Nicotinamide**	nicotinic amide; 3-pyridinecarboxamide*, pellagra-preventive vitamin, P.P. factor	$C_5H_4NCONH_2$	122 12
6129	**Nicotine**		$C_{10}H_{14}N_2$	162 23
6130	——, hydrochloride (*d*)		$C_{10}H_{14}N_2 \cdot 2HCl$	235 16
6131	——, picrate		$C_{10}H_{14}N_2 \cdot 2C_6H_3N_3O_7$	620 45
6132	——, salicylate		$C_{10}H_{14}N_2 \cdot C_7H_6O_3$	300 35
6133	——, tartrate	nicotine bitartrate	$C_{10}H_{14}N_2 \cdot 2C_4H_6O_6 \cdot 2H_2O$	498 44
6134	**Nicotinic acid**	3-pyridinecarboxylic acid*, pellagra-preventive vitamin; P P factor	C_5H_4NCOOH	123 11
6135	—— N-methylbetaine	See *Trigonelline*.		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6106	need f eth.	.	104	subl		s h.	sl s.eth, h. ac. a., lgr.; v s. bz.; s chl, H_2SO_4
6107	col need f. al		136–7 (135)	subl.		1 3^{14}	v. s eth.; s. bz.
6108	(1) need f eth		125 5		i	0 37^{19}	....
	(2) leaf f chl + eth		164 5		i	0 08^{19}	sl s eth; s. chl.
6109							
6110							
6111	col pr f w		anh 170		0 078^{13}	0 1	i eth, bz; s. alk., NH_4OH; sl. s. chl; 0 011^{17} CCl_4
6112	cr powd or need		d. → yel		s	s h.	s chl.
6113	yel cr f HCl	.	anh 192		sl s	s	s. me. al
6114	col. rhomb need. f al, [α]–207 35°D	1 374	175	d	0 004^{20}	1^{20}	0 8^{4}, 2 1^{35} eth; v. s chl; s. bz, CS_2, eth. ac, acet, pet. eth
6115	wh lust cr		197–8		s		s. chl.
6116							
6117							
6118	sm pr		anh 171		sl s c, s h	v s h	i eth.
6119							
6120							
6121							
6122							
6122M	oil	0 881^{15}		224–5^{745}			....
6123							
6124							
6125	syrup				s	s	s eth.
6126							
6127							
6128		1 078^{14}	..	267			..
6128M	wh. cr powd		129–31		100	66 6	sl s eth., bz.; 10 glyc.
6129	col. oil., 1 $52392^{22.4}$ [α]–161 55°	1 00924^{20}_{4}	<–80	247 3	s	∞	∞ eth., v. s. chl., pet eth., oils
6130	deliq cr .				s	s	.
6131	yel need or pr.		218				. .
6132	wh pl		117 5		s.	s.	s. eth.
6133	reddish-wh cr	.	88–90		v s	s	s. eth.
6134	col need		234–37	subl	sl s c., s h	0 73^{25}	v sl. s eth.
6135							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
6136	**Nicotinic acid, 2-hydroxy-**		$C_5H_3N(OH)COOH$	139.11
6137	**——, 1,2,5,6-tetrahydro-1-methyl-.** See *Arecaidine*			
6137M	**Nicotinic amide.**	See *Nicotinamide*		
6138	**Nicotyrine**...........	3-(1-methyl-2-pyrryl)pyridine; dipyridine	$C_{10}H_{10}N_2$	158.20
6139	**Niobe oil.**	See *Benzoic acid, methyl ester*		
6140	**Nitramine diethyl-.**	See *Diethylamine, N-nitro-*		
6141	**——, dimethyl-.**	See *Dimethylamine, N-nitro-.*		
6142	**——, methylpicryl-.**	See *Tetryl.*		
6143	**——, phenyl-.**	See *Aniline, N-nitro-.*		
6144	**——, *n*-propyl-.**	See *Propylamine, N-nitro-.*		
6145	**Nitranilic acid**....	2,5-dihydroxy-3,6-dinitroquinone	$(NO_2)_2C_6O_2(OH)_2$	230.09
6146	**Nitranilide.**	See *Aniline, N-nitro-.*		
6147	**Nitric diethylamide.**	See *Diethylamine, N-nitro-.*		
6148	**Nitric dimethylamide.**	See *Dimethylamine, N-nitro-.*		
6149	**Nitric ether.**	See *Ethyl nitrate.*		
	Nitro-. See the parent compounds (e.g., for nitrobenzene see *Benzene, nitro-*)			
6150	**Nitroerythrite.**	See *Erythritol, tetranitrate.*		
6151	**Nitroform**......	trinitromethane*	$CH(NO_2)_3$	151.04
6152	**Nitroglycerin**......	glycerol trinitrate; glyceryl nitrate, trinitrin, glonoin, etc.	$C_3H_5(ONO_2)_3$	227.09
6153	**Nitrolic acid, ethyl-.**	See *Acetonitrolic acid.*		
6154	**——, methyl-.**	See *Formonitrolic acid.*		
6155	**Nitromannite.**	See *Mannitol, hexanitrate.*		
6156	**Nitron**...........	4,5-dihydro-1,4-diphenyl-3,5-phenylimino-1,2,4-triazole	$C_{20}H_{16}N_4$	312.36
6157	**Nitrosamine, diethyl-.**	See *Diethylamine, N-nitroso-*		
6158	**——, diisopropyl-.**	See *Diisopropylamine, N-nitroso-.*		
6159	**——, dimethyl-.**	See *Dimethylamine, N-nitroso-*		
6160	**——, diphenyl-.**	See *Diphenylamine, N-nitroso-.*		
6161	**——, dipropyl-.**	See *Dipropylamine, N-nitroso-*		
6162	**——, methylphenyl-.**	See *Aniline, N-methyl- N-nitroso-.*		
	Nitroso-. See the parent compounds (e.g., for nitrosobenzene see *Benzene, nitroso-*).			
6163	**Nitrous diethylamide.**	See *Diethylamine, N-nitroso-*		
6164	**Nitrous diisopropylamide.** See *Diisopropylamine, N-nitroso-*			
6165	**Nitrous dimethylamide.** See *Dimethylamine, N-nitroso-.*			
6166	**Nitrous diphenylamide.** See *Diphenylamine, N-nitroso-*			
6167	**Nitrous dipropylamide.** See *Dipropylamine, N-nitroso-.*			
6168	**Nitrous ether.**	See *Ethyl nitrite*		
6168M	**1-Nonacosanol***	*n*-nonacosyl alcohol....	$n\text{-}C_{29}H_{59}OH$	424.78
6168R	***n*-Nonacosyl alcohol.**	See 1-*Nonacosanol.**		
6169	**Nonadecane***	*n*-nonadecane	$CH_3(CH_2)_{17}CH_3$	268.51
6170	**Nonadecanoic acid*.**	*n*-nonadecylic acid	$CH_3(CH_2)_{17}COOH$	298.50
6171	**1-Nonadecanol***	*n*-nonadecyl alcohol	$CH_3(CH_2)_{18}OH.$	284.51
6172	**10-Nonadecanone***	caprinone; dinonyl ketone	$(C_9H_{19})_2CO$	282.50
6173	***n*-Nonadecyl alcohol.**	See 1-*Nonadecanol**.		
6174	***n*-Nonadecylic acid.**	See *Nonadecanoic acid**.		
6175	**Nonamethylene glycol.**	See 1,9-*Nonanediol**.		
6176	**Nonanal,** oxime.	See *Pelargonaldehyde, oxime*		
6177	**Nonanamide*.**	See *Pelargonamide.*		
6178	**Nonane***...........	*n*-nonane....	$CH_3(CH_2)_7CH_3.$	128.25
6178M	**——, 1-amino-.**	See *Nonylamine**(*n*).		
6179	**Nonanedioic acid*.**	See *Azelaic acid.*		
6180	**1,9-Nonanediol*** ...	nonamethylene glycol; enneamethylene glycol	$CH_2OH(CH_2)_7\text{-}CH_2OH$	160.25

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6136	need f w		α256; β301-2 d	subl	sl. s. h	sl. s.	sl. s. eth.; v. sl. s. chl.
6137							
6137M							
6138	need. f. h. w.	1 124[18]	108	286-90[735] (280-1)	sl. s. c., s. h.	s.	s. eth.
6139							
6140							
6141							
6142							
6143							
6144							
6145	lng. yel. pl. f. acet.		100	170 d	v. s.	v s	i. eth.
6146							
6147							
6148							
6149							
6150							
6151	col. oil or wh. cr.	1 5967$\frac{24\ 3}{4}$	15	45-7[22] exp	s.		s. alk.
6152	col -yel. liq., 1 482[18 6]	1.601	2 9; 13 2	exp. 260	0 18[20]	25	∞ eth.; 7 me. al
6153							
6154							
6155							
6156	yel. need .		189 d.	.	i	s.	sl. s. eth.; s. bz., acet , chl., et. ac.
6157							
6158							
6159							
6160							
6161							
6162							
6163							
6164							
6165							
6166							
6167							
6168							
6168M			84 6-85 0	. .	. .	. . . .	. . . .
6168R							
6169	leaf , 1.436[34 6]	0 777[32]	32	330	i.	sl. s	s. eth.
6170	glit. leaf. f. al		66 5	299[100]	i.	sl. s.	s. eth.
6171	opaque cr		62				. . .
6172	leaf. f. al		58	>350	i.	s. h	s. eth.
6173							
6174							
6175							
6176							
6177							
6178	col. liq., 1 4056	0 7177[20]	-53 7 (-51 0)	150 72	i.	v. s.	v. s. eth.
6178M							
6179							
6180	. . . . . .	. . .	.	147-50[2]	sl s.	s.	i. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6181	**Nonanenitrile*.**	See *Pelargononitrile.*		
6182	**Nonanoic acid*.**	See *Pelargonic acid.*		
6183	**1-Nonanol***...........	*n*-nonyl alcohol	$CH_3(CH_2)_7CH_2OH$	144 25
6184	**——, 2-methyl-***......	2-heptyl-2-methylethanol.	$CH_3(CH_2)_6OH$-$(CH_3)CH_2OH$	158 28
6185	**2-Nonanol***......... .	heptylmethylcarbinol ..	CH_3CHOH-$(CH_2)_6CH_3$	144 25
6186	**3-Nonanol***...... . .	ethylhexylcarbinol ..	CH_3CH_2CHOH-$(CH_2)_5CH_3$	144 25
6187	**4-Nonanol***	amylpropylcarbinol...	$CH_3(CH_2)_2CH$-$OH(CH_2)_4CH_3$	144 25
6188	**5-Nonanol***	dibutylcarbinol	$(C_4H_9)_2CHOH$	144 25
6189	**——, 2,8-dimethyl-*.**	diisoamylcarbinol	$[(CH_3)_2CH$-$(CH_2)_2]_2CHOH$	172 30
6190	**2-Nonanone*.**	heptyl methyl ketone	$CH_3CO(CH_2)_6CH_3$	142 24
6191	**3-Nonanone*.** . . .	ethyl hexyl ketone	$C_2H_5CO(CH_2)_5$-CH_3	142 24
6192	**5-Nonanone***.......	dibutyl ketone	$(CH_3CH_2CH_2$-$CH_2)_2CO$	142 24
6193	**——, 2,8-dimethyl-*.**	diisoamyl ketone, isocaprone, diisopentyl ketone	$[(CH_3)_2CH$-$(CH_2)_2]_2CO$	170 29
6194	**Nonanoyl chloride*.**	See *Pelargonyl chloride*		
6195	**1-Nonene***...	*α*-nonylene	$CH_3(CH_2)_6$-$CH:CH_2$	126 24
6196	**1-Nonine.**	See 1-*Nonyne**.		
6197	***n*-Nonyl alcohol.**	See 1-*Nonanol**.		
6198	**Nonylamine*(*n*)**.....	1-aminononane	$CH_3(CH_2)_7CH_2$-NH_2	143 27
6199	***n*-Nonyl cyanide.**	See *Caprinitrile.*		
6200	***α*-Nonylene.**	See 1-*Nonene**.		
6201	***n*-Nonylic acid.**	See *Pelargonic acid.*		
6202	**Nonylone.**	See 9-*Heptadecanone**.		
6203	**Nonyl sulfate**	di-*n*-nonyl sulfate	$[CH_3(CH_2)_8]_2SO_4$	350 55
6204	**1-Nonyne***	1-nonine, *n*-heptylacetylene	$CH:C(CH_2)_6CH_3$	124 22
6205	**Norcamphane, 2,2-dim**	**ethyl-3-methylene-.** See	*Camphene.*	
6206	**——, 7,7-dimethyl-2-**	**methylene-.** See *α-Fenchen*	*e.*	
6207	**——, 2-keto-1,7,7-trim**	**ethyl-.** See *Camphor.*		
6208	**——, 1,7,7-trimethyl-.**	See *Camphane.*		
6209	**——, 2,2,3-trimethyl-.**	See *Isocamphane*		
6210	**2-Norcamphanone, 1,3**	**,3-trimethyl-.** See *Fenchon*	*e.*	
6211	***dl*-Norleucine**.........	*dl-α*-aminocaproic acid, *dl*-glycoleucine, *dl*-2-aminohexanoic acid*	$CH_3(CH_2)_3CH$-$(NH_2)COOH$	131 17
6212	***d*-Norleucine** . .	*d-α*-aminocaproic acid, *d*-2-aminohexanoic acid*; *d*-glycoleucine	$CH_3(CH_2)_3CH$-$(NH_2)COOH$	131 17
6213	***l*-Norleucine**.........	*l-α*-aminocaproic acid; *l*-2-aminohexanoic acid*, *l*-glycoleucine	$CH_3(CH_2)_3CH$-$(NH_2)COOH$	131 17
6214	**Normenthane.**	See *Cyclohexane, isopropyl-.*		
6215	**3-Nortropanol, 8-meth**	**yl-.** See *Tropine.*		
6216	**Nosophen.**	See *Phenolphthalein,* **3′,3″,5′,5**	**″-tetraiodo-.**	
6217	**Novocain.**	See *Procaine, hydrochloride.*		
6218	**Nucin.**	See *Juglone.*		
6219	**Ocimene**.............	3,7-dimethyl-1,3,6-octatriene* (one form)	$(CH_3)_2C\cdot CHCH_2$-$CH:C(CH_3)$-$CH.CH_2$	136 23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6181							
6182							
6183	col. liq., 1.43347^{20}	$0.8274\frac{20}{4}$	-5	213	i.	∞	∞ eth.
6184	liq	$0.849\frac{0}{4}$	.	118^{15}	i.	s.	s. eth.
6185	col. liq., 1.4290^{25}	$0.8190\frac{25}{4}$, $0.8471\frac{20}{4}$	-35	193–4 (198.3)	i.	s.	s. eth.
6186	liq	$0.825\frac{20}{4}$	-22	$194\text{–}5^{750}$	i.	s.	s. eth.
6187	liq . .	0.8282		192–3	i.	s.	s. eth.
6188	thick oil, 1.4289^{18}	0.823^{18}		194	i.	∞	∞ eth.
6189	liq . .	$0.8305\frac{12.6}{4}$		105^{9}	i.	s.	s. eth.
6190	liq	0.8317	-8.2 (-19)	194–6	i.	s	s. eth.
6191	pr. ...	0.840^{0}	-8	190	.	s.	s. eth.
6192	col. liq., 1.421^{15}	$0.8270\frac{13}{4}$	-5.9	186–7 (181–2)	v. sl. s	s.	s. eth.; v. s. chl., CS_2
6193	yel. oil.	$0.8208\frac{25}{4}$	14.6	226	i.	s.	s. eth.
6194							
6195	col. liq., 1.416	0.7302^{20}		149.9	i	s.	s. eth.
6196							
6197							
6198	col. liq			202.2	sl. s.	s.	s. eth.
6199							
6200							
6201							
6202							
6203			41.9–2.1				
6204	col. liq.	0.7924	-36	160^{745}	i	s.	s. eth.
6205							
6206							
6207							
6208							
6209							
6210							
6211	shiny leaf..		327 d.	1.18^{25}, 2.88^{75}		0.267^{25} 75%	....
6212	hex. leaf f. w		301 d.		1.5^{25}	i.	. . . . ..
6213	leaf. f. w		301 d.	.	1.6^{19}	.	. . . ..
6214							
6215							
6216							
6217							
6218							
6219	liq., 1.4883^{14}.	0.801^{15}		176–8		. .	. . ..

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6219B	**allo-Ocimene** (stereomer of preceding)	......	$C_{10}H_{16}$	136 23
6219M	**1-Octacosanol***	n-octacosyl alcohol	n-$C_{28}H_{57}OH$ ..	410 75
6219R	**n-Octacosyl alcohol.**	See *1-Octacosanol*		
6220	**9,12-Octadecadienoic acid*.** See *Eleostearic acid*			
6221	**9,13-Octadecadienoic acid*(?).** See *Eleomargaric acid.*			
6222	**Octadecanal*.**	See *Stearaldehyde.*		
6223	**Octadecanamide*.**	See *Stearamide.*		
6224	**Octadecane***	n-octadecane..	$CH_3(CH_2)_{16}CH_3$	254 49
6224F	**——, 1-amino-.**	See *Octadecylamine*(n).*		
6224M	**——, 1-bromo-***	n-octadecyl bromide...	$CH_3(CH_2)_{17}Br$	333 40
6224T	**——, 1-iodo-***	n-octadecyl iodide ...	$CH_3(CH_2)_{17}I$	380 40
6225	**Octadecanenitrile*.**	See *Stearonitrile.*		
6226	**Octadecanoic acid*.**	See *Stearic acid.*		
6227	**Octadecanoic anhydride*.** See *Stearic anhydride.*			
6228	**1-Octadecanol***......	n-octadecyl alcohol.	$CH_3(CH_2)_{16}CH_2$-OH	270 49
6228M	**1-Octadecanone, 1-phenyl-.** See *Stearophenone*			
6229	**Octadecanoyl chloride*.** See *Stearoyl chloride.*			
6230	**9,12,15-Octadecatrienoic acid*** See *α-Linolenic acid.*			
6231	**9-Octadecenamide*.**	See *Oleamide*		
6232	**9-Octadecenoic acid*.**	See *Elaidic acid, Oleic acid.*		
6233	**——, 12-hydroxy-*.**	See *Ricinoleic acid.*		
6233M	**9-Octadecen-1-ol*, cis-**	cis-9-octadecenyl alcohol; oleyl alcohol	$CH_3(CH_2)_7CH:CH$-$(CH_2)_8OH$	268 47
6233T	**9-Octadecenyl alcohol.**	See *9-Octadecen-1-ol*.*		
6234	**n-Octadecyl alcohol.**	See *1-Octadecanol*.*		
6234H	**Octadecylamine*(n)** ..	1-aminooctadecane	$CH_3(CH_2)_{17}NH_2$	269 50
6234R	**n-Octadecyl bromide.**	See *Octadecane, 1-bromo-*.*		
6235	**n-Octadecylic acid.**	See *Stearic acid.*		
6235M	**n-Octadecyl iodide.**	See *Octadecane, 1-iodo-*.*		
6236	**Octadecyl sulfate**	di-n-octadecyl sulfate	$[CH_3(CH_2)_{17}]_2SO_4$	603 02
6236M	**1-Octadecyne***	hexadecylacetylene	$CH:C(CH_2)_{15}CH_3$	250 46
6237	**9-Octadecynoic acid*.**	See *Stearolic acid.*		
6238	**Octadiene.**	See *Conylene.*		
6238F	**1,6-Octadiene, 3,7-dimethyl-***	linaloölene	$C_{10}H_{18}$.......	138 25
6238M	**2,6-Octadiene, 2,6-dimethyl-**	dihydromyrcene..	$C_{10}H_{18}$ ..	138 25
6238T	**2,4-Octadiene, 7-methyl-***	....	C_9H_{16} .	124 22
6239	**2,7-Octadiene, 2-methyl-6-methylene-*.** See *Myrcene.*			
6240	**2,6(and 2,7)-Octadienoic acid, 3,7-dimethyl-*.** See *Geranic acid.*			
6241	**1,6-Octadien-3-ol, 3,7-dimethyl-*.** See *Linaloöl.*			
6241H	**2,6-Octadien-1-ol, 3,7-dimethyl-*.** See *Geraniol; Nerol.*			
6242	**Octamethylene glycol.**	See *1,8-Octanediol*.*		
6243	**Octanal*.**	See *Caprylaldehyde.*		
6244	**Octanamide*.**	See *Caprylamide.*		
6245	**Octane***	n-octane.	$CH_3(CH_2)_6CH_3$.	114 23
6246	**——, 1-amino-.**	See *Octylamine*.*		
6247	**——, 2-amino-.**	See *Heptylamine, α-methyl-.*		
6248	**——, 1-bromo-***.......	n-octyl bromide	$CH_3(CH_2)_6CH_2Br$	193.13
6249	**——, 2-bromo-*(l).** ...	l-sec-n-octyl bromide......	$CH_3CHBr(CH_2)_5$-CH_3	193 13
6250	**——, 1-chloro-***......	n-octyl chloride...	$CH_3(CH_2)_6CH_2Cl$	148 67

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6219B	liq., 1.5447^{21}	0 8133	.	188^{759}; 81^{12}	. .	... ..	....
6219M	.....		83 2-83 4	..	...	.	. ....
6219R							
6220							
6221							
6222							
6223							
6224	cr f al., $1.4349^{85\ 3}$	$0\ 7768^{28}_{4}$	28	317	i.	sl. s.	s. eth.
6224F							
6224M	col. cr		28 5		i	s	s. eth.
6224T	col. cr		34	$169^{0.5}$	i.	sl. s.	sl. s. eth.
6225							
6226							
6227							
6228	leaf f al	$0\ 8124^{59}_{4}$	59 (57 85)	$210\ 5^{15}$	i.	s	s eth.
6228M							
6229							
6230							
6231							
6232							
6233							
6233M	col liq	$0\ 8489^{20}_{4}$		$205\text{-}10^{15}$	i	s	s. eth.
6233T							
6234							
6234H	col. cr .			$232\ 0^{82}$; $176\ 1^{2}$	i.	s.	s eth.
6234R							
6235							
6235M							
6236	..	....	70 2-0 7				.
6236M	cr	$0\ 796^{30}$	26	180^{15}	..		..
6237							
6238							
6238F	liq	$0\ 788^{20}$		165-8			..
6238M	liq	$0\ 775^{21}_{4}$		171 5-3 5			....
6238T	liq	$0\ 752^{18}_{4}$		149	i.	..	. . .
6239							
6240							
6241							
6241B							
6242							
6243							
6244							
6245	col liq, 1.3975	0 7036	-56 5	125 8 (124.6)	0.0015^{16}	sl. s.	s. eth.
6246							
6247							
6248	liq., $1\ 4503^{25}$	1.1160^{15}_{4}, $1\ 118^{20}_{4}$	-55	202-3 (201.5)	i.	∞	∞ eth.
6249	liq . .	$1\ 099^{22}$	.	191 $(91\text{-}3^{20})$	i.	∞	∞ eth.
6250	liq	$0\ 8745^{20}_{4}$		184 6	i.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6251	**Octane, 2-chloro-***	*sec*-octyl chloride	$CH_3(CH_2)_5CHCl$-CH_3	148 67
6252	**——, 2,7-dimethyl-***	biisoamyl	$(CH_3)_2CH(CH_2)_4$-$CH(CH_3)_2$	142 28
6253	**——, 1-ethoxy-*.**	See *Ether, ethyl octyl.*		
6254	**——, 1-iodo-***	*pri-n*-octyl iodide	$CH_3(CH_2)_7I$	240 14
6255	**——, 3-methyl-***, (*d*)-	*d*-amylethylmethylmethane	$CH_3CH_2CH(CH_3)$-$(CH_2)_4CH_3$.	128 25
6256	**——, 1-octyloxy-*.**	See *Octyl ether.*		
6257	**——, 1-phenoxy-*.**	See *Ether, octyl phenyl.*		
6258	**1,1-Octanedicarboxylic**	**acid.** See *Malonic acid, heptyl*	-.	
6259	**Octanedioic acid*.**	See *Suberic acid.*		
6260	**1,8-Octanediol***	octamethylene glycol.	$CH_2OH(CH_2)_6$-CH_2OH	146 23
6261	**4,5-Octanediol***	octylene glycol (one form).	$[CH_3(CH_2)_2CHOH]_2$	146 23
6262	**Octanenitrile*.**	See *Caprylonitrile.*		
6263	**Octanoic acid*.**	See *Caprylic acid.*		
6264	**Octanoic anhydride*.**	See *Caprylic anhydride.*		
6265	**1-Octanol***	heptylcarbinol; *pri-n*-octyl alcohol	$CH_3(CH_2)_6CH_2OH$	130 23
6266	——, acetate	*n*-octyl acetate	$CH_3COO(CH_2)_7$-CH_3	172 26
6267	——, esters of other organic a	cids See "octyl ester" under th	e corresponding acid	s.
6268	——, nitrate.	See *Octyl nitrate.*		
6269	——, nitrite.	See *Octyl nitrite.*		
6270	**——, 3,7-dimethyl-***(*i*)	tetrahydrogeraniol.	$(CH_3)_2CH(CH_2)_3$-$CH(CH_3)CH_2$-CH_2OH	158 28
6271	**2-Octanol***	methylhexylcarbinol; *sec-n*-octyl alcohol	CH_3CHOH-$(CH_2)_5CH_3$	130 23
6272	**——, 2-methyl-***	hexyldimethylcarbinol	$(CH_3)_2COH$-$(CH_2)_5CH_3$	144 25
6273	**3-Octanol, 3-ethyl-*.**	amyldiethylcarbinol; *tert*-decyl alcohol	$(C_2H_5)_2COH$-$(CH_2)_4CH_3$	158 28
6274	**2-Octanone***	hexylmethyl ketone	$CH_3COC_6H_{13}$	128 21
6275	**3-Octanone***	amyl ethyl ketone	$C_2H_5CO(CH_2)_4$-CH_3	128 21
6276	**Octanoyl chloride*.**	See *Caprylyl chloride.*		
6277	**1,3,6-Octatriene, 3,7-di**	**methyl-*.** See *Ocimene.*		
6278	**6-Octen-1-ol, 3,7-dime**	**thyl-*.** See *Rhodinol.*		
6279	**Octine.**	See *Octyne.*		
6280	***n*-Octoic acid.**	See *Caprylic acid.*		
6281	***n*-Octoic anhydride.**	See *Caprylic anhydride.*		
6282	***n*-Octyl acetate.**	See 1-*Octanol*, acetate.*		
6283	***pri-n*-Octyl alcohol.**	See 1-*Octanol**.		
6284	***sec-n*-Octyl alcohol.**	See 2-*Octanol**.		
6285	***n*-Octyl aldehyde.**	See *Caprylaldehyde.*		
6286	**Octylamine***(*n*)	1-aminoöctane; *pri-n*-octylamine	$CH_3(CH_2)_6CH_2$-NH_2	129 24
6287	***sec-n*-Octylamine.**	See *Heptylamine, α-methyl-**		
6288	***n*-Octyl bromide.**	See *Octane, 1-bromo-*.*		
6289	***sec-n*-Octyl bromide.**	See *Octane, 2-bromo-*.*		
6290	***n*-Octyl chloride.**	See *Octane, 1-chloro-*.*		
6291	***sec-n*-Octyl chloride.**	See *Octane, 2-chloro-*.*		
6292	***n*-Octyl cyanide.**	See *Pelargononitrile.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6251	liq	0 871$\frac{15}{4}$	...	173	i.	v. s.	s eth.
6252	mobile liq, 1.40924$^{18.1}$; 1.41049^{15}	0 7479^{20}	-52 5	159 66	i.	s.	s eth, ac a.
6253							
6254	liq., 1 489 . . .	1 341^{15} (1 3531^{15})	-45 9	255 5	i.	s.	s eth.
6255	col. liq	0 7206^{17}	....	142-3	i.	i.	s. eth.
6256							
6257							
6258							
6259							
6260	need . .		63	172^{20}	sl. s	s.	i. eth.
6261	(α) liq . . .	.	.	112-5^{10}	i	.	....
	(β) .		123-4	115-8	i.	s.	sl. s. eth.
6262							
6263							
6264							
6265	col liq, 1 42920^{20}	0 8246$\frac{20}{4}$	-16 3	195	s.	∞	∞ eth.
6266	col liq	0 885$\frac{0}{4}$	-38 5	210	i.	s.	s. eth.
6267							
6268							
6269							
6270	liq.....	0 8333^{15}		221-3	i.	s	s eth.
6271	col. oily liq., 1.4260	0.8193	-38 6	178 5 (179)	i.	s.	s. eth.
6272	liq . .	..... .		178	i.	s.	s. eth.
6273	col. oil . .	0 8360$\frac{15}{4}$		199	i	s.	....
6274	col. liq, 1 41613	0 818	-20 9	173 5	i.	∞	∞ eth.
6275	col liq .	0 850$\frac{0}{4}$		168	i	∞	∞ eth.
6276							
6277							
6278							
6279							
6280							
6281							
6282							
6283							
6284							
6285							
6286	col. liq., 1.430	0 777^{27}		179 6	sl. s.	v. s.	v. s. eth.
6287							
6288							
6289							
6290							
6291							
6292							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6293	**Octylene**	caprylene	C_8H_{16}	112 21
6294	**Octylene glycol.**	See *4,5-Octanediol**.		
6295	**Octyl ether**	1-octyloxyoctane*, di-*n*-octyl ether	$(C_8H_{17})_2O$	242 44
6296	***n*-Octylic acid.**	See *Caprylic acid*		
6297	***pri-n*-Octyl iodide.**	See *Octane, 1-iodo-**.		
6298	**Octyl nitrate**	*n*-octyl nitrate.	$CH_3(CH_2)_7NO_3$.	175 23
6299	**Octyl nitrite**	*n*-octyl nitrite	$CH_3(CH_2)_7ONO$	159 23
6300	**Octyl sulfate**	di-*n*-octyl sulfate	$[CH_3(CH_2)_7]_2SO_4$	322 50
6301	**1-Octyne*.**	1-octine; *n*-hexylacetylene, caprylidene	$CH{:}C(CH_2)_5CH_3$.	110 19
6301F	**2-Octyne*.**	2-octine, amylmethylacetylene	$CH_3C{:}C\ C_5H_{11}$	110 19
6301J	**3-Octyne*.**	3-octine; butylethylacetylene	$C_2H_5C{:}C(CH_2)_3$-CH_3	110 19
6301M	**4-Octyne*.**	4-octine; dipropylacetylene	$C_3H_7C{:}C\ C_3H_7$	110 19
6302	**2-Octynoic acid***, methyl ester	"methyl heptinecarbonate".	$CH_3(CH_2)_4C{:}C$-$COOCH_3$	154 20
	Oenanth-.	See *Enanth-*		
6303	**Oil of wintergreen**, artificial.	See *Salicylic acid, methyl ester.*		
6304	**Oleamide**	9-octadecenamide* (one form); oleic acid amide	$C_{17}H_{33}CONH_2$	281 47
6305	**Oleic acid**	9-octadecenoic acid* (*cis* form)	$C_8H_{17}CH{:}CH$-$(CH_2)_7COOH$	282 46
6306	——, benzyl ester		$C_{17}H_{33}COOCH_2$-C_6H_5	372 57
6307	——, butyl ester.	butyl 9-octadecenoate* (one form)	$C_8H_{17}CH{:}CHC_7$-$H_{14}COOC_4H_9$	338 56
6308	——, diethylene glycol ester.	See under *Diethylene glycol.*		
6309	——, ethyl ester		$C_8H_{17}CH{:}CH$-$(CH_2)_7COOC_2H_5$	310 51
6310	——, isoamyl ester		$C_{17}H_{33}COO(CH_2)_2$-$CH(CH_3)_2$	352 59
6311	——, methyl ester	methyl oleate	$C_{17}H_{33}COOCH_3$	296 48
6312	——, *p*-phenylphenacyl ester		$C_{17}H_{33}COOCH_2$-$COC_6H_4C_6H_5$	476 68
6313	**Olein.**	See *Glycerol, trioleate.*		
6313M	**Oleyl alcohol.**	See *9-Octadecen-1-ol*, cis-*.		
6314	**Opianic acid**	5,6-dimethoxyphthalaldehydic acid	$(CH_3O)_2C_6H_2$-$(CHO)COOH$	210 18
6315	**Orcein**		$C_{28}H_{24}N_2O_7$.	500 49
6316	**Orcinol**	5-methyl-1,3-benzenediol*, 5-methylresorcinol, 3,5-dihydroxytoluene	$CH_3C_6H_3(OH)_2$	124.13
6317	——, **2,4,6-trinitro-**		$(NO_2)_3C_6(CH_3)$-$(OH)_2$	259 13
6318	**β-Orcinol.**	See *Resorcinol, 2,5-dimethyl-*		
6319	**Orcinolphthalein**		$C_{22}H_{16}O_5$.	360 35
6320	**Orexin.**	See *Quinazoline, 3,4-dihydro-3-phenyl-*.		
6321	**Ornithine**	α, δ-diaminovaleric acid, 2,5-diaminopentanoic acid*	$CH_2(NH_2)(CH_2)_2$-$CH(NH_2)COOH$	132 16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6293	col. liq., 1.4087	0.722^{17}, $0.7155\frac{20}{4}$	104	123	i.	s.	s. eth.
6294							
6295	liq	$0.820\frac{0}{0}$; $0.805\frac{17}{17}$	. .	291.8	sl. s.	s.	s. eth.
6296							
6297							
6298	liq	$0.8419\frac{17}{17}$	. .	$110–2^{20}$	.	. .	. . . .
6299	grn. liq. . . .	0.862^{17}		174–5		.	. . . .
6300	1.4408^{25}	$0.9661\frac{25}{25}$	20.3	166.1^{3}		. .	. . . .
6301	col. liq., 1.4140^{25}	0.743^{25}		126; 50.8^{50}	i.	s.	s. eth.
6301F	col. liq., 1.4285^{25}	0.761^{25}	. .	137.2; 60.2^{50}	i	s.	s. eth.
6301J	col. liq., 1.4230^{25}	0.7501^{25}	. .	133, 56.7^{50}	i	s.	s. eth.
6301M	col. liq., 1.4225^{25}	0.7474^{25}		131; 55^{50}	i	s	s. eth.
6302		0.9524^{0}		107^{20}	i		. . . .
6303							
6304	cr .	. .	76		i	s.	s. eth.
6305	col. need., $1.463^{17.7}$	$0.895\frac{18}{4}$	14	286^{100}	i	∞	∞ eth.; s. bz., chl.
6306	. . .	$0.9330\frac{25}{25}$		237^{7}	i	s.	v. s. eth.
6307	liq.	0.868^{25}		$180–95^{2}$; $173–235^{75}$	i	s.	s. eth.
6308							
6309	liq. . . .	0.871^{15}; 0.8671^{25}		$205–8^{10}$	i.	∞	∞ eth.
6310	col. liq			$223–4^{10}$	i.	s.	v. s. eth.
6311	oil	0.879^{18}		$216–7^{20}$ ($189–91^{10}$)	i	∞	∞ eth.
6312			60.5				. . . .
6313							
6313M							
6314	need. f. w		150	160 d	0.25, 1.7^{100}	s.	s. eth.
6315	red-br. powd					s	i. eth., bz., chl., CS_2; s. acet., alk., ac. a.
6316	col. monocl. cr. f. chl	1.290^{4}	$+1H_2O$, 58; anh 107–8	289–90	s	v. s	v. s. eth.
6317	lng. yel. need.		163.5	exp.	i.	sl. s.	sl. s. eth.; v. s. h. bz.
6318							
6319	col. pr. f. acet		230 d	. . .	i.	s.	i. eth., bz.; s. h. ac. a., alk.
6320							
6321	syrup .			.	v. s.	v. s	sl. s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
6322	**Ornithine, N^{δ}-guanyl-**. See *Arginine*.			
6323	**Orsellinic acid,** 4-everninate. See *Evernic acid.*			
6324	——, 4-methyl ether.	See *Everninic acid*		
6325	**o-Orsellinic acid**	4,6-dihydroxy-*o*-toluic acid; orsellinic acid	$(HO)_2C_6H_2(CH_3)$-COOH	168 14
6326	**Orthanilic acid**	*o*-aminobenzenesulfonic acid, *o*-anilinesulfonic acid	$NH_2C_6H_4SO_3H$ $\frac{1}{2}H_2O$	182 19
6327	**Orthoacetic acid,** triethyl ester	1,1,1-triethoxyethane*	$CH_3C(OC_2H_5)_3$	162 23
6328	**Orthocarbonic acid,** tetraethyl ester	tetraethoxymethane*	$C(OC_2H_5)_4$.	192 25
6329	——, tetrapropyl ester	*n*-propyl orthocarbonate, tetrapropoxymethane	$C(OC_3H_7)_4$	248 36
6330	**Orthodiazine.**	See *Pyridazine*		
6331	**Orthoformic acid,** triethyl ester	triethoxymethane* . .	$HC(OC_2H_5)_3$.	148 20
6332	——, triisopropyl ester	isopropyl orthoformate; triisopropoxymethane	$HC[OCH(CH_3)_2]_3$.	190 28
6333	——, trimethyl ester	trimethoxymethane	$HC(OCH_3)_3$	106 12
6334	——, triphenyl ester	triphenoxymethane	$CH(OC_6H_5)_3$.	292 32
6335	——, tripropyl ester	*n*-propyl orthoformate, tripropoxymethane	$HC(OC_3H_7)_3$	190 28
6335H	**Oryzanin.**	See *Vitamin B_1*.		
6335R	**Ovoflavin.**	See D-*Riboflavin.*		
6336	**7-Oxabicyclo[2,2,1]heptane-2,3-dicarboxylic anhydride, 2,3-dimeth**			
6337	**6-Oxabicyclo[3,2,1]oct-3-ene, 4,7,7-trimethyl-.** See *Pinol*			
6338	**Oxalacetic acid,** diethyl ester	diethyl oxobutanedioate*, diethyl hydroxybutenedioate*	$C_2H_5OOCCOCH_2$-$COOC_2H_5$	188 18
6339	**Oxalaldehyde.**	See *Glyoxal*		
6340	**Oxalaldehydic acid.**	See *Glyoxylic acid.*		
6341	**Oxalamide.**	See *Oxamide.*		
6342	**Oxalan.**	See *Oxaluramide.*		
6343	**Oxalic acid.**	ethanedioic acid*	COOHCOOH $2H_2O$	126 07
6344	——, diallyl ester	di-2-propenyl ethanedioate*, allyl oxalate	$(COOC_3H_5)_2$	170 16
6345	——, dianilide.	See *Oxanilide*		
6346	——, dibutyl ester	dibutyl ethanedioate*, butyl oxalate	$(COOCH_2CH_2$-$CH_2CH_3)_2$	202 25
6347	——, diethyl ester	diethyl ethanedioate*; ethyl oxalate; oxalic ester	$(COOC_2H_5)_2$	146 14
6348	——, diisoamyl ester	isoamyl oxalate, bis(γ-methylbutyl)ethanedioate*	$(COOC_5H_{11})_2$	230 30
6349	——, diisobutyl ester	bis(β-methylpropyl)ethanedioate*, isobutyl oxalate	$(COOC_4H_9)_2$	202 25
6350	——, dimethyl ester	dimethyl ethanedioate*; methyl oxalate	$(COOCH_3)_2$.	118 09
6351	——, dipropyl ester	propyl oxalate; dipropyl oxalate	$(COOCH_2CH_2$-$CH_3)_2$	174 19
6352	——, ethyl methyl ester		$CH_3OOCCOOC_2$-H_5	132 11
6353	——, monoamide.	See *Oxamic acid.*		
6354	——, monoanilide.	See *Oxanilic acid*		

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6322							
6323							
6324							
6325	need. f. acet		$-H_2O$, 100; 176 d.		s.	s.	15 7[28] eth.; s. glyc.; sl. s. bz.
6326	col. pr . .		d.	.	1 57[19]	v. sl. s.	v. sl. s. eth.
6327	col liq	0 $8847\frac{25}{4}$		142		∞	∞ eth.
6328	col liq, 1.393	0 $9197\frac{18}{4}$		159		∞	∞ eth.
6329	col liq . .	0 911[8]		224 2			. .
6330							
6331	col. liq.	0 $8971\frac{19}{4}$	-76 1	145 9 (143-5)	s d	s	s eth.
6332	liq..........	0 8621		166-8			.
6333	. ..	0 974[23]		101-2			
6334	cr		71	265[58]		s	s eth.
6335	liq . ..	0 8805		105[30]	2 1[22]		
6335H							
6335R							
6336	yl-. See Canth	aridin					
6337							
6338	col liq, 1 45614[16.6]	1 159		132[24]	i	∞	∞ eth, bz.
6339							
6340							
6341							
6342							
6343	col monocl; 1.440, 1.475, 1 625	1 653	101; 189 anh	subl 150	9 5[15], 120[90]	23 7[15]	1 37, anh. 16.9 eth.; i. chl., pet. eth., bz.
6344	oil .	1 055		217	i	s	.
6345							
6346	col liq . .	1 011		243 4	i	s	s eth.
6347	col liq, 1 41011	1 08426[15], 1 $0785\frac{20}{4}$	-40 6	185 4	sl s	∞	∞ eth., ord. org. solv.
6348	liq . .	0 $968\frac{11}{11}$		265	i	v s	v. s. eth.
6349	col liq....	1 002[14]		229	i	s	s eth.
6350	col monocl. tab, 1 379[82.1]	1 120[82], 1 1479[54]; 1 $422\frac{20}{4}$	54	163 3	6 18	s	s me. al.
6351	col liq. ..	1 02; 1 $038\frac{0}{0}$		214-5	sl s.	∞	s eth
6352	col. liq.	1 156[0]		173 7	i	v s	v s eth.
6353							
6354							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6355	**Oxalic acid**, monoureide.	See *Oxaluric acid.*		
6356	——, *p*-phenylphenacyl ester	. . .	$(COOCH_2COC_6H_4C_6H_5)_2$	478 48
6357	——, piperazinium salt .	. . . .	$C_4H_{10}N_2 \cdot C_2H_2O_4$. .	176 17
6357M	——, urea salt.	See *Urea, oxalate.*		
6358	**Oxalic ester.**	See *Oxalic acid, diethyl ester.*		
6359	**Oxalimide.**	See *Oximide.*		
6360	**Oxalonitrile.**	See *Cyanogen.*		
6361	**Oxaluramide**..	oxamic acid ureide, oxalan.	$NH_2CONHCOCONH_2$	131 09
6362	**Oxaluric acid**.	carbamyloxamic acid; oxalic monoureide	$NH_2CONHCOCOOH$	132 08
6363	**Oxalyl chloride**.	ethanedioyl chloride* .	COClCOCl .	126 93
6364	**Oxamethan.**	See *Oxamic acid, ethyl ester.*		
6365	**Oxamic acid**	oxalic acid monoamide	$NH_2COCOOH$	89 05
6366	——, ethyl ester ...	ethyl oxamate; oxamethan	$NH_2COCOOC_2H_5$	117 10
6367	——, ureide.	See *Oxaluramide.*		
6368	——, ***N*-acetyl-**, ethyl ester	ethyl acetyloxamate ..	$CH_3CONHCOCOOC_2H_5$	159 14
6369	——, **carbamyl-.**	See *Oxaluric acid.*		
6370	——, **phenyl-.**	See *Oxanilic acid.*		
6371	**Oxamide**	ethanediamide*, oxalamide	$NH_2COCONH_2$	88 07
6372	——, ***N,N'*-diethyl-** ..	*N,N'*-diethylethanediamide*, *sym*-diethyloxamide	$(CONHC_2H_5)_2$	144 17
6373	——, ***N,N*-dimethyl-** ..	*unsym*-dimethyloxamide.	$(CH_3)_2NCOCONH_2$	116 12
6374	——, ***N,N'*-dimethyl-**	*sym*-dimethyloxamide	$(CONHCH_3)_2$	116 12
6375	——, ***N,N'*-diphenyl-.**	See *Oxanilide.*		
6376	**Oxanilic acid**. .	phenyloxamic acid, oxalic acid monoanilide	$C_6H_5NHCOCOOH$	165 14
6377	**Oxanilide**...........	*N,N'*-diphenyloxamide; oxalic acid dianilide	$(CONHC_6H_5)_2$	240 25
6378	**Oxanthranol**	9,10-anthradiol or 10-hydroxyanthrone, anthrahydroquinone	$C_6H_4(COH)_2C_6H_4$	210 22
6379	**1,2-Oxathietan-4-one,**	**2,2-dihydro-2,2-dimeth**	**yl-.** See *Thetin, dim*	*ethyl-.*
6380	**1,4-Oxazine, tetrahydr**	**o-.** See *Morpholine.*		
6381	**Oxazole, triphenyl-.** ..	benzilam; azobenzil	$OC(C_6H_5).NC-(C_6H_5)C(C_6H_5)$	297 34
6382	**Oximide**.............	oxalimide	NCOHCO	71 04
6383	**Oxindole**	2(3) indolone; *o*-amino-*α*-toluic acid lactam	$C_6H_4NHCOCH_2$.	133 14
6384	——, **3-hydroxy-**.....	dioxindole, *o*-aminomandelic acid lactam	$C_6H_4NHCOCHOH$	149 14
6385	——, **3-imino-.**	See *Imesatin.*		
6386	**Oxirane.**	See *Ethylene oxide.*		
6387	——, **(chloromethyl)-.**	See *Epichlorohydrin.*		
6388	——, **(iodomethyl)-.**	See *Epiiodohydrin.*		
6389	——, **methyl-.**	See *Propene oxide.*		
6390	**Oxiraneacetonitrile.**	See *Epicyanohydrin.*		
6391	**Oxirene, methyl-.**	See *Propene*, 1,2 *epoxy-**.		
6392	**Oxyacanthine** .. .	vinetine.. .	$C_{19}H_{21}NO_3$.....	311 37

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6355							
6356	....	....	165 5 d.			.	
6357	wh. cr..... ..	.. .	>300		s. h.	v. sl. s.	i. eth.
6357M							
6358							
6359							
6360							
6361	cr		d		i	s	s. H_2SO_4, KOH
6362	cr powd		187		v sl s		
6363	col fum. liq., 1.43395$^{12.9}$	1 488^{13}	−12	64	d	d.	s. eth.
6364							
6365	col cr		210 d		1 4^{14}	v sl. s	v sl s. eth
6366	rhomb. leaf	0 808^{19}	115		s h	s.	s eth , v sl s bz
6367							
6368	need		54		i , d h	s	s eth
6369							
6370							
6371	wh powd. monocl	1 667	419 d.		0 04$^{7.8}$	v. sl s	v. sl s. eth.
6372	col. need f al	1 169^{4}	190	179	sl. s	s.	v. sl. s. eth.
6373	col pl. f. bz		104		v. s	v. s	v sl. s eth.
6374	col. leaf or need f w.	1 3^{4}	217 (209–10)	subl	2 5$^{9.4}$	sl. s.	v. sl. s. eth.
6375							
6376	rhomb. need. f bz.		150		s. h.	v. s.	v. s. eth.
6377	lust sc. f bz		250 (246–7)	320	i.	v. sl. s h.	i. (sl. s. h.) eth.
6378	ylsh. need. unst	.	180	.	i.	s.(grn. fluores.)	s. alk.
6379							
6380							
6381	rhomb. pr. f. al-eth.	.	115			sl s.	sl. s. eth.
6382	col. pr....	.	.		v sl s , d. h		sl. s. NH_4OH
6383	col need. f. w	.	120	d	v. s h.	s.	s. eth., alk.
6384	rhomb pr. f. al.	..	180	195 d.	7 7 c., 16 7h	6 6	s alk.
6385							
6386							
6387							
6388							
6389							
6390							
6391							
6392	wh. need. f. al. or eth., $[\alpha]+131.6_D^{\circ 15}$		202–14	...	s.	s.	s. eth., chl., bz , pet. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6393	**Oxyacanthine**, hydrochloride		$C_{19}H_{21}NO_3{\cdot}HCl\ 2H_2O$	383 87
6394	—, nitrate	. . .	$C_{19}H_{21}O_3N{\cdot}HNO_3{\cdot}2H_2O$	410 42
6395	**Oxynarcotine**....	. .	$C_{22}H_{23}NO_8$	429 41
6396	**Oxyneurine.**	See *Betaine.*		
6397	**Oxysparteine** .		$C_{15}H_{24}N_2O$	248 36
6398	—, hydrochloride		$C_{15}H_{24}N_2O{\cdot}HCl{\cdot}4H_2O$	356 89
6399	**Paeonol.**	See *Peonol.*		
6400	**Palmitaldehyde**, oxime	hexadecanal oxime*	$CH_3(CH_2)_{14}$-CH.NOH	255 44
6401	**Palmitamide**. .	hexadecanamide*, palmitic amide	$CH_3(CH_2)_{14}CONH_2$	255 44
6402	**Palmitic acid**. .	hexadecanoic acid*; *n*-hexadecylic acid	$CH_3(CH_2)_{14}COOH$	256 42
6403	—, benzyl ester .		$C_{15}H_{31}COOCH_2$-C_6H_5	346 54
6404	—, cetyl ester.	cetyl palmitate, hexadecyl hexadecanoate*	$C_{15}H_{31}COOC_{16}H_{33}$	480.84
6405	—, ethyl ester.	ethyl hexadecanoate*.	$CH_3(CH_2)_{14}$-$COOC_2H_5$	284 47
6406	—, ethylene ester	See *Glycol, dipalmitate*		
6407	— glyceryl ester.	See *Glycerol, tripalmitate.*		
6408	—, methyl ester	methyl hexadecanoate*; methyl palmitate	$C_{15}H_{31}COOCH_3$	270 45
6409	—, myricyl ester		$C_{15}H_{31}COOC_{31}H_{63}$	691 23
6410	**Palmitic amide.**	See *Palmitamide.*		
6411	**Palmitin.**	See *Glycerol, tripalmitate.*		
6412	**Palmitolic acid**	7-hexadecynoic acid*	$CH_3(CH_2)_7C{:}C$-$(CH_2)_5COOH$	252 39
6413	**Palmitone.**	See 16-*Hentriacontanone**.		
6414	**Palmitonitrile** ...	hexadecanenitrile*	$CH_3(CH_2)_{14}CN$	237 42
6415	**Palmitoyl chloride, Palmityl chloride**	hexadecanoyl chloride*	$CH_3(CH_2)_{14}COCl$	274.87
6415M	**Pantothenic acid** ..	*N*-(α,γ-dihydroxy-β,β-dimethylbutyryl)-β-alanine, chick antidermatitis factor	$C_9H_{17}NO_5$	219 24
6416	**Papaverine**..		$C_{20}H_{21}NO_4$... .	339 38
6417	—, hydrochloride..	. .	$C_{20}H_{21}NO_4{\cdot}HCl$	375 84
6418	**Paraacetaldehyde.**	See *Paraldehyde.*		
6419	**Parabanic acid**.... ..	oxalylurea..	NHCONHCOCO	114 06
6420	—, **dimethyl-.**	See *Cholestrophan.*		
6421	**Parabutyraldehyde** . .	.	$(C_3H_7CHO)_3$.	216 31
6422	**Paraconic acid**... .	tetrahydro-5-oxo-3-furancarboxylic acid; itamalic acid γ-lactone	CH_2COOCH_2CH- COOH	130 10
6423	—, **2,2-dimethyl-.**	See *Terebic acid.*		
6425	**Paracyanogen**		$(CN)_x$	$(26.02)_x$
6426	**Paradiazine.**	See *Pyrazine.*		
6427	**Paraformaldehyde.**	See *Polyoxymethylene.*		
6428	**Paralactic acid.**	See *d-Lactic acid.*		
6429	**Paraldehyde**........ .	2,4,6-trimethyl-1,3,5-trioxane; paraacetaldehyde	$OCH(CH_3)OCH$-$(CH_3)OCHCH_3$	132 16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6393	sm. need., $[\alpha]$-163 $6^{\circ 15}_{D}$	... .	.. .	. . .	.. .	...	... .
6394	need		195-200		sl. s.	......	....
6395	need ...		....	....	..	s.	....
6396							
6397	wh. hyg need		84	.	v. s.	v. s.	v. s. eth.; s. chl.
6398	wh cr		48-50	. ..	s.	s.	....
6399							
6400	need. f. al		89 5	.	i.	s.	v. s. eth.
6401	col. leaf .		106	236^{13}	i.	sl. s.	sl. s. eth.
6402	col need., $1.4273^{79\ 8}$	liq 0 853^{62}	64	339-56 d.	i.	9 3^{20}	s. eth.
6403	cr	0 $9136\frac{38}{25}$	36 0	.	i	s.	v. s. eth.
6404	pl f. eth. or ac. a., 1 4398^{70}	0 832^{50}	55 5	d.	i	i. c, s. h.	s. eth., acet., bz., chl., CS_2
6405	col. need 1 $4347^{34\ 3}$	0 $8577\frac{25}{4}$	24 2 (19-20)	185 5^{19}	i.	s.	s. eth.
6406							
6407							
6408	col., $1.4175^{80\ 7}$		29 5	196^{15}	i	s.	s. eth.
6409	feath cr		72		i.	i.	s. eth.
6410							
6411							
6412	col. need. f. w		47	240^{15}	i.	v. s.	v. s. eth.
6413							
6414	col hex. tab.	liq. 0 822^{31}	31	251 5^{100}	i	s	s. eth.
6415	col. liq. or cr		11-2	194 5^{17}	d	d.	v. s. eth.
6415M							
6416	col. rhomb. need. f. al., α1 625, γ1.690	1 337	147	d	v sl s c, s. h.	v. s.	0 39^{18} eth.; s. h. chl., h. bz.
6417	monocl. pl .	. . .	231		2 7^{18}	s.	. . . .
6418							
6419	col monocl. pl. f. w.	.	243 (227) d		4 7^{8}	v. s.	sl. s. eth.
6420							
6421	...	0 918	. .	$98\text{-}100^{35}$	.	... .	... .
6422	deliq. cr .	. .	58		s		.. ..
6423							
6425	br. powd. ...	....	....	subl.	i.	i.	s. KOH
6426							
6427							
6428							
6429	col. liq., 1.40486	0 $9943\frac{20}{4}$	12 6 (10 5)	124 4^{752}	5 88^{100}; 12^{13}	∞	∞ eth., chl., oils

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6430	**Paraldol**	. .	$(C_4H_8O_2)_2$	176 21
6431	**Paraleucaniline.**	See *ps-Leucaniline*		
6432	**Param.**	See *Guanidine, 1-cyano-.*		
6433	**Paramorphine.**	See *Thebaine.*		
6434	**Paranitraniline red.**	See *2-Naphthol, 1-p-phenylazo-*		
6435	**Pararosaniline**	tris(p-aminophenyl)carbinol; p,p′,p″-triaminotriphenylcarbinol	$(H_2NC_6H_4)_3COH$	305 37
6436	——, **hexamethyl-.**	See *Crystal violet (base).*		
6437	**Pararosolic acid.**	See *Aurin.*		
6438	**Paraxylic acid.**	See *3,4-Xylic acid.*		
6439	**Parsley camphor.**	See *Apiole.*		
6440	**α-Parvoline**	2-ethyl-3,5-dimethylpyridine	$C_9H_{13}N$	135 20
6441	**β-Parvoline**	tetramethylpyridine, parvuline	$C_5H(CH_3)_4N$	135 20
6442	**Parvuline.**	See *β-Parvoline*		
6443	**Paucine**	. . .	$C_{27}H_{39}N_5O_5 \cdot 6\frac{1}{2}H_2O$	630.73
6444	**Pectinose.**	See *dl-Arabinose.*		
6445	**Pelargonaldehyde,** oxime	nonanal oxime*	$CH_3(CH_2)_7$-CH.NOH	157 25
6446	**Pelargonamide.**	nonanamide*	$CH_3(CH_2)_7CONH_2$	157.25
6447	**Pelargone.**	See *9-Heptadecanone*.*		
6448	**Pelargonic acid**	nonanoic acid*, n-nonylic acid	$CH_3(CH_2)_7COOH$	158.24
6449	——, ethyl ester	ethyl nonanoate*, ethyl n-nonoate	$CH_3(CH_2)_7CO$-OC_2H_5	186.29
6450	——, methyl ester	methyl nonanoate*; methyl pelargonate	$CH_3(CH_2)_7CO$-OCH_3	172.26
6451	**Pelargononitrile**	nonanenitrile*; n-octyl cyanide	$CH_3(CH_2)_7CN$	139.24
6452	**Pelargonyl chloride**	nonanoyl chloride*	$CH_3(CH_2)_7COCl$	176 68
6452M	**Pellagra-preventive vitamin.** See *Nicotinamide, Nicotinic acid.*			
6453	**Pelletierine**	punicine	$C_8H_{15}NO$	141 21
6454	——, sulfate		$(C_8H_{15}NO)_2 \cdot H_2SO_4$	380 50
6455	**Pellotine**		$C_{13}H_{19}NO_3$	237 29
6456	**Pentadecanal,** oxime*		$CH_3(CH_2)_{13}$-CH.NOH	241 41
6457	**Pentadecane***	n-pentadecane	$CH_3(CH_2)_{13}CH_3$	212 41
6457H	——, **1-amino-.**	See *Pentadecylamine*(n)*		
6457R	——, **2,5,8,11,14-pentoxa-*.** See *Tetraethyleneglycol, dimethyl ether.*			
6458	**1-Pentadecanol***	n-pentadecyl alcohol.	$CH_3(CH_2)_{14}OH$.	228 41
6459	**8-Pentadecanone***	diheptyl ketone, caprylone	$[CH_3(CH_2)_6]_2CO$.	226 39
6460	**n-Pentadecyl alcohol.**	See *1-Pentadecanol*.*		
6460M	**Pentadecylamine*(n)**	1-aminopentadecane.	$CH_3(CH_2)_{14}NH_2$.	227.43
6461	**1,2-Pentadiene***	ethylallene	CH_2:C:$CHCH_2$-CH_3	68.11
6462	**1,3-Pentadiene***	piperylene, α-methylbivinyl	CH_2:CHCH:CH-CH_3	68 11
6463	**1,4-Pentadiene***	. .	CH_2:$CHCH_2$-CH·CH_2	68.11
6464	**2,3-Pentadiene***		CH_3CH:C:$CHCH_3$	68.11
6465	**2,4-Pentadienoic acid***	β-vinylacrylic acid, αγ-pentadienic acid	CH_2:CHCH:CH-COOH	98 10

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6430	wh. tricl. cr. .	1 345$\frac{15.6}{4}$	82	90^{15}	s.	20.5^{25}	3 6^{25} eth
6431							
6432							
6433							
6434							
6435	col.-red leaf	... .	189	..	i.	s.	s. eth.
6436							
6437							
6438							
6439							
6440	liq	0 9338^{0}		188	sl s.	s.	. ...
6441	liq	0 916		220	. ..	....	. ..
6442							
6443	yel leaf		d 126	.	i.	i.	i. eth.
6444							
6445	leaf. f dil al		63		i	s	s eth.
6446	col		99-100		i.	sl. s.	sl. s. eth.
6447							
6448	col oily liq., 1.4330	0 9055$\frac{20}{4}$	12	254	v. sl. s.	s.	s. eth., chl.
6449	col liq., 1 42200^{20}	0 8657$\frac{20}{4}$	-36.7 (-44 5)	227 5	i.	s.	∞ eth.
6450	liq	0 877^{18}		214	i	s.	s eth
6451	col liq	0 8331^{0}; 0 786^{16}	-34 2	224 0	i	sl. s.	s eth.
6452	col. liq., 1.4380^{15}	0.9590$\frac{0}{4}$; 0.946$\frac{20}{4}$	-60 5	215 35 (108-10^{22})	d	d.	s. eth.
6452M							
6453	col oil .	0 $988^{15.5}$		195 d.	5	∞	∞ eth ; s chl.
6454	br. syrupy liq or cr. mass, $[\alpha]$-30°D		..		v s	s.	. .
6455	pl. f. al.		110	.	i.	v. s.	v. s. eth.
6456	need. f. dil al		86		i.	sl. s.	v. s. eth.; sl. s. bz.
6457	col liq	0 7689$\frac{20}{4}$	10	270 5	i	v. s	v. s. eth.
6457H							
6457R							
6458	cr		43 84 (45-6)			.	.. ..
6459	cr f al		40	178		s.	
6460							
6460M	col. cr .			307 6; 132 3^{2}	i	s.	s eth.
6461	...	... .		45		.....	......
6462	liq., $1.4402^{16.5}$	0 696	. . .	43 (42-4)	....	.... .	.... ..
6463	1.3880. .	0.6594$\frac{20}{4}$	.	25 8-6 2		.	. . .
6464	liq . .	0 702$\frac{20}{0}$		49-51	....	...	. ...
6465	pr. f. eth.		80	d 110-5	s. h.	v. s.	v. s. eth.; sl. s. pet. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6466	**2,4-Pentadienoic acid*, 5-(3,4-methylenedioxy phenyl)-.** See *Piperic acid.*			
6467	**1,4-Pentadien-3-one, 1,5-diphenyl-*.** See *Styryl ketone.*			
6468	**Pentaerythritol**.	pentaerythrite, 2,2-bishydroxymethyl-1,3-propanediol*	$C(CH_2OH)_4$ . .	136.15
6469	**Pentaglycerine, Pentaglycerol.** See 1,3-*Propanediol, 2-hydroxymethyl-2-methyl-*.*			
6470	**Pentamethylene.**	See *Cyclopentane**		
6471	——, **keto-.**	See *Cyclopentanone*.*		
6472	**Pentamethylenediamine.** See *Cadaverine.*			
6473	**Pentamethylene dibromide.** See *Pentane*, 1,5-*dibromo-*.*			
6474	**Pentamethylene dichloride.** See *Pentane*, 1,5-*dichloro-*.*			
6475	**Pentamethylene glycol.** See 1,5-*Pentanediol*.*			
6476	**Pentamethylene oxide.**	See *Pyran, tetrahydro-.*		
6477	**Pentamethylenimine.**	See *Piperidine*		
6478	**Pental*.**	See *Valeraldehyde*		
6479	——, **4-oxo-*.**	See *Levulinaldehyde.*		
6480	**Pentanamide*.**	See *Valeramide.*		
6481	**Pentane***	*n*-pentane	$CH_3(CH_2)_3CH_3$	72 15
6482	——, **1-amino-.**	See *Amylamine.*		
6483	——, **2-amino-.**	See *Butylamine, α-methyl-.*		
6484	——, **3-amino-.**	See *Propylamine, α-ethyl-*		
6485	——, **1-amino-4-methyl-.** See *Isohexylamine.*			
6486	——, **3,3-bisethylsulfonyl-*.** See *Tetronal.*			
6487	——, **1-bromo-*.**	See *Amyl bromide.*		
6488	——, **1-chloro-*.**	See *Amyl chloride.*		
6489	——, **2-chloro-*** .		$CH_3CHClCH_2CH_2$-CH_3	106 60
6490	——, **3-chloro-*** .		$CH_3CH_2CHClCH_2$-CH_3	106 60
6490M	——, **3-cyano-.**	See *Butyronitrile, α-ethyl-.*		
6491	——, **1,5-dibromo-***	pentamethylene dibromide	$CH_2Br(CH_2)_3CH_2$-Br	229 96
6492	——, **1,5-dichloro-*.**	pentamethylene dichloride	$Cl(CH_2)_5Cl$	141 05
6493	——, **2,2-dimethyl-***	trimethylpropylmethane	$(CH_3)_3CCH_2CH_2$-CH_3	100 20
6494	——, **2,3-dimethyl-*** .	ethylisopropylmethylmethane	$CH_3CH(CH_3)CH$-$(CH_3)CH_2CH_3$	100 20
6495	——, **2,4-dimethyl-***	diisopropylmethane	$(CH_3)_2CHCH_2$-$CH(CH_3)_2$	100 20
6496	——, **3,3-dimethyl-***	diethyldimethylmethane	$CH_3CH_2C(CH_3)_2$-CH_2CH_3	100 20
6497	——, **1-ethoxy-*.**	See *Ether, amyl ethyl.*		
6498	——, **3-ethyl-*** .	triethylmethane	$(C_2H_5)_3CH$	100 20
6499	——, **3-ethyl-2-methyl-***	diethylisopropylmethane	$(CH_3)_2CHCH$-$(C_2H_5)_2$	114 23
6500	——, **3-ethyl-3-methyl-***	triethylmethylmethane	$CH_3CH_2C(CH_3)$-$(C_2H_5)CH_2CH_3$	114 23
6500M	——, **1-fluoro-*.**	See *Amyl fluoride* (*n*)		
6501	——, **1-iodo-*.**	See *Amyl iodide.*		
6502	——, **1-methoxy-***.	amyl methyl ether	$CH_3(CH_2)_4OCH_3$	102 17
6503	——, **2-methyl-***. . . .	dimethylpropylmethane . . .	$(CH_3)_2CH(CH_2)_2$-CH_3	86 17
6504	——, **3-methyl-*.**	diethylmethylmethane	$CH_3CH_2CH(CH_3)$-CH_2CH_3	86 17
6505	——, **3-methylene-*.**	See 1-*Butene, 2-ethyl-*.*		
6506	——, **2-methyl-3-methylene-.** See 1-*Butene, 2-ethyl-3-methyl-*.*			
6506M	——, **3-methylol-.**	See 1-*Butanol, 2-ethyl-*.*		
6507	——, **4-methyl-1-phenyl-.** See *Benzene, isohexyl-.*			

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
6466							
6467							
6468	tetrag. cr., 1.559, 1.548	.. ...	253 (260 5)	. .	5 56^{15}	.	. ..
6469							
6470							
6471							
6472							
6473							
6474							
6475							
6476							
6477							
6478							
6479							
6480							
6481	col liq, $1.3570^{15\ 7}$	$0.626\frac{20}{4}$, 0 $6214\frac{25}{4}$	-131 5 (-129 9)	36 2 (34-5 5)	0 036^{16}	∞	∞ eth.
6482							
6483							
6484							
6485							
6486							
6487							
6488							
6489	liq, 1 4060	0 $870\frac{20}{4}$		96-7	i	s	s eth
6490	1 4163^{15}	0 $8967\frac{15}{4}$		104-5			
6490M							
6491	col. arom liq	1 $702\frac{18}{0}$	-35	224	i.		....
6492		1 $0940\frac{25}{4}$	. . .	178	i.	s.	s eth
6493	col liq	0 6737	-125	78 9	i	s.	s eth.
6494	col liq .	0 6959	.	89 4	i.	s.	s. eth.
6495	col liq	0 6745	-123 4	80 8	i.	s.	s. eth.
6496	col liq . .	0 6934		86 0	i.	s	s eth.
6497							
6498	col. liq	0 6984	-94 5 (-125 6)	93 3	i.	s	s. eth.
6499	col liq., 1.4016	0 7078	.. ...	114 0	i.	sl. s.	s. eth.
6500	liq.	0 712	. .. ...	119 0	i.	.....	3 eth.
6500M							
6501							
6502	liq .	0 754	....	88.5	....	. .	. .
6503	col. liq., 1.372.	0.654	....	60	i.	s.	s. eth.
6504	col. liq.......	0 $676\frac{20}{4}$	....	64	i.	∞	s. eth.
6505							
6506							
6506M							
6507							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6508	**Pentane, pentyloxy-*.**	See *Amyl ether.*		
6509	**——, 1-phenyl-.**	See *Benzene, amyl-.*		
6510	**——, 2-phenyl-.**	See *Benzene, (α-methylbutyl)-*		
6511	**——, 2,2,4-trimethyl-***	isobutyltrimethylmethane, "isoöctane"	$(CH_3)_3CCH_2CH(CH_3)_2$	114 23
6512	**3-Pentanecarboxylic ac**	**id.** See *Butyric acid, α-ethyl-.*		
6513	**1,5-Pentanediamine*.**	See *Cadaverine.*		
6514	**Pentanedinitrile*.**	See *Glutaronitrile.*		
6515	**Pentanedioic acid*.**	See *Glutaric acid*		
6516	**——, 3-oxo-*.**	See *Acetonedicarboxylic acid.*		
6517	**1,2-Pentanediol***	α-*n*-amyleneglycol......	$CH_3CH_2CH_2CH(OH)CH_2OH$	104 15
6518	**1,4-Pentanediol***	γ-pentylene glycol.. .	$CH_3CHOHCH_2CH_2CH_2OH$	104 15
6519	**1,5-Pentanediol***.. ...	pentamethylene glycol.	$CH_2OHCH_2CH_2CH_2CH_2OH$	104 15
6520	**2,3-Pentanediol*** .	methylethylethylene glycol, β-*n*-amylene glycol	$CH_3CH_2CH(OH)CH(OH)CH_3$	104 15
6521	**2,4-Pentanediol, 2-methyl-***	α,α,α′-trimethyltrimethylene glycol	$(CH_3)_2COHCH_2CHOHCH_3$	118 17
6522	**1,4-Pentanedione, 1-p**	**henyl-.** See *Valerophenone, γ*	*-oxo-.*	
6523	**1,5-Pentanedione, 1,2,**	**3,4,5-pentaphenyl-.** See *B*	*enzamarone; Isobenza*	*marone.*
6524	**2,3-Pentanedione,** 3-oxime*	α-isonitrosopropyl methyl ketone	$CH_3COC(:NOH)C_2H_5$	115 13
6525	**2,4-Pentanedione*** ..	acetylacetone .	$CH_3COCH_2COCH_3$	100 11
6526	**Pentanenitrile*.**	See *Valeronitrile*		
6527	**——, 4-methyl-*.**	See *Isocapronitrile.*		
6528	**1,2,3,4,5-Pentanepento**	**l*.** See *Arabitol.*		
6529	**1-Pentanethiol*** ...	amyl mercaptan.. . .	$CH_3(CH_2)_4SH$	104 21
6530	**Pentanoic acid*.**	See *Valeric acid.*		
6531	**——, 4-methyl-*.**	See *Isocaproic acid.*		
6532	**——, 4-oxo-*.**	See *Levulinic acid.*		
6533	**Pentanoic anhydride*.**	See *Valeric anhydride.*		
6534	**1-Pentanol*** . .	butylcarbinol, *pri-n*-amyl alcohol	$CH_3(CH_2)_3CH_2OH$	88 15
6535	**——, 2-methyl-***	2-methyl-2-propylethanol	$CH_3(CH_2)_2CH(CH_3)CH_2OH$	102 17
6536	**——, 3-methyl-***	active hexyl alcohol	$(C_2H_5)(CH_3)CHCH_2CH_2OH$	102 17
6537	**——, 4-methyl-***	isoamylcarbinol	$(CH_3)_2CH(CH_2)_2CH_2OH$	102 17
6538	**2-Pentanol***....	methylpropylcarbinol, *sec-act*-amyl alcohol	$CH_3CH_2CH_2CHOHCH_3$	88 15
6539	**——, 2,4-dimethyl-***...	isobutyldimethylcarbinol	$(CH_3)_2COHCH_2CH(CH_3)_2$	116 20
6540	**——, 2-methyl-***	dimethylpropylcarbinol	$(CH_3)_2COH(CH_2)_2CH_3$	102.17
6541	**——, 4-methyl-***	isobutylmethylcarbinol	$(CH_3)_2CHCH_2CHOHCH_3$	102.17
6542	——, ——, acetate..	α, γ-dimethylbutylacetate	$CH_3CH(OOCCH_3)CH_2CH(CH_3)_2$	144 21
6543	——, ——, butyrate .	α-methylisoamyl butyrate ..	$(CH_3)_2CHCH_2CH(OOCC_3H_7)CH_3$	172.26

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6508							
6509							
6510							
6511	col. liq., 1.3916	0.6918	f. p. −107.4	99.3	i.	sl. s.	s. eth.
6512							
6513							
6514							
6515							
6516							
6517	col. liq.	$0.980\frac{20}{20}$		211.8	∞	∞	∞ eth.
6518	liq	$0.9954\frac{18}{18}$		$131–3^{18}$	∞	∞	v. sl. s. eth.
6519	thick liq., 1.4499	$0.994\frac{20}{20}$		239.4	∞	∞	sl. s. eth.
6520	liq	0.9945^{0}		187	s.	s	
6521	liq	$0.9240\frac{17}{4}$		$196; 96–8^{10}$	s.	s	s. eth.
6522							
6523							
6524	leaf f. lgr		56–7	183–7	sl. s.	v. s	v. s. eth., chl.
6525	col. inflam. liq., $1.45178^{18.5}$	0.976	−23.2	139^{746}	12.5, 51.5^{80}	∞	∞ eth.; s. bz., chl., acet., glac. ac. a.
6526							
6527							
6528							
6529	liq., 1.44366	0.857	−75.7	126	i	∞	∞ eth.
6530							
6531							
6532							
6533							
6534	col. liq., 1.40994^{20}	$0.8144\frac{20}{4}$	−78.5	138	2.7^{22}	∞	∞ eth.
6535	.	$0.831\frac{15.6}{15.6}$	.	148			
6536	liq	0.8262, $0.8205\frac{25}{4}$		153.7–54.1	i.	s.	s. eth.
6537	liq., 1.4490	0.8243^{0}; $0.8156\frac{20}{4}$		147–8, 151.8–2.8	v. sl. s. (i.)	s.	s. eth.
6538	col. liq., 1.4053	$0.809\frac{20}{4}$		119.28	5.3^{30}	∞	∞ eth.
6539	col. liq., 1.4172	0.8158	<−20	132.8–3.4 (129–30)	i.	s.	s. eth.
6540	liq ..	. . . .	4 (<−38)	122.5–3.5	v. sl. s.	s.	∞ eth.
6541	col. liq., 1.409	0.806 ($0.813\frac{20}{4}$)		131.4	1.8	∞	∞ eth.
6542	col. liq .	$0.8580\frac{20}{4}$		146	0.082^{25}		
6543	col. liq	0.853	−48	183	0.8^{35}		

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
6544	**2-Pentanol, 2,4,4-tri-methyl-(?)**	isodibutol	$(CH_3)_3CCH_2COH(CH_3)_2$	130 23
6545	**3-Pentanol***	diethylcarbinol	$CH_3CH_2CHOHCH_2CH_3$	88 15
6546	**——, 2,3-dimethyl-***	ethylisopropylmethylcarbinol	$(CH_3)_2CHCOH(CH_3)CH_2CH_3$	116 20
6547	**——, 2,4-dimethyl-***	diisopropylcarbinol	$(CH_3)_2CHCHOHCH(CH_3)_2$	116 20
6548	**——, 2,4-dimethyl-3-phenyl-**	diisopropylphenylcarbinol	$[(CH_3)_2CH]_2COHC_6H_5$	192 29
6549	**——, 3-ethyl-***	triethylcarbinol	$(C_2H_5)_3COH$	116 20
6550	**——, 3-ethyl-2-methyl-***	diethylisopropylcarbinol	$(CH_3)_2CHCOH(C_2H_5)CH_2CH_3$	130 23
6551	**——, 2-methyl-***	ethylisopropylcarbinol	$(CH_3)_2CHCHOHCH_2CH_3$	102 17
6552	**——, 3-methyl-***	diethylmethylcarbinol	$CH_3CH_2COH(CH_3)CH_2CH_3$	102 17
6553	**2-Pentanone***	methyl propyl ketone	$CH_3CO(CH_2)_2CH_3$	86 13
6554	——, oxime	methyl propyl ketoxime	$CH_3C(\cdot NOH)(CH_2)_2CH_3$	101 15
6555	**——, 4-hydroxy-4-methyl-***	diacetone alcohol	$CH_3COCH_2C(OH)(CH_3)_2$	116.16
6556	**——, 3-methyl-***	*sec*-butyl methyl ketone, *asym*-ethylmethylacetone	$CH_3COCH(CH_3)CH_2CH_3$	100.16
6557	**——, 4-methyl-***	isobutyl methyl ketone	$CH_3COCH_2CH(CH_3)_2$	100 16
6558	**3-Pentanone***	diethyl ketone; *sym*-dimethylacetone; propione; ethyl ketone	$C_2H_5COC_2H_5$	86 13
6559	**——, 2,4-dimethyl-***	diisopropyl ketone	$(CH_3)_2CHCOCH(CH_3)_2$	114 18
6560	**——, 2-methyl-***	ethyl isopropyl ketone	$C_2H_5COCH(CH_3)_2$	100 16
6561	**Pentanoyl chloride***	See *Valeryl chloride*.		
6562	**Pentatriacontane***	*n*-pentatriacontane	$CH_3(CH_2)_{33}CH_3$	492 93
6563	**18-Pentatriacontanone***	diheptadecyl ketone; stearone	$(C_{17}H_{35})_2CO$	506 92
6564	**1-Pentene***	propylethylene; α-*n*-amylene	$CH_3CH_2CH_2CH:CH_2$	70 13
6565	**——, 2,3-dimethyl-***	1-*sec*-butyl-1-methylethylene	$CH_2:C(CH_3)CH(CH_3)CH_2CH_3$	98 18
6566	**——, 2,4-dimethyl-***	1-isobutyl-1-methylethylene	$CH_2:C(CH_3)CH_2CH(CH_3)_2$	98 18
6567	**——, 3,3-dimethyl-***	.. .	$CH_2:CHC(CH_3)_2CH_2CH_3$	98 18
6568	**——, 2-ethyl-***	1-ethyl-1-propylethylene; 3-methylenehexane*	$CH_2:C(C_2H_5)CH_2CH_2CH_3$	98 18
6569	**——, 2-methyl-***	1-methyl-1-propylethylene	$CH_2:C(CH_3)CH_2CH_2CH_3$	84 16
6570	**——, 3-methyl-***	*sec*-butylethylene	$CH_2:CHCH(CH_3)CH_2CH_3$	84 16
6571	**——, 4-methyl-***	isobutylethylene	$CH_2:CHCH_2CH(CH_3)_2$	84 16

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
6544	col. liq., 1 42085	0 8417^{0}; 0 8228$\frac{20}{4}$	-20	147 5 (152-4)	i.	sl s.	s. eth.
6545	col. liq., 1 4077^{25}	0 815^{25}	.	115.6	sl s.	s.	s. eth.
6546	liq .	0 8329^{21}	<-30	138-40^{75}	i.	s.	s eth.
6547	col liq., 1.42259	0 8288$\frac{20}{4}$	<70	140	v sl. s.	s.	s. eth.
6548	yel. liq . .	0 959	60 5	157^{50}; 229^{755}	sl. s.	i.	s eth.
6549	col. oil, 1 4314	0 83892		140-2	i	s.	s eth.
6550	liq	0 8463^{0}, 0 8295$\frac{20}{4}$		159-61^{750}	i	s	s eth.
6551	liq . .	0 826$\frac{18}{4}$		127 5^{721}	v sl s	∞	∞ eth.
6552	col. liq., 1.4196	0 824; 0 8233$\frac{25}{4}$	-22 (<-38)	122.8-3 0	sl. s.	∞	∞ eth.
6553	col. liq., 1 38946$^{20.2}$	0 812$\frac{15}{15}$	-77 8	101 7	v. sl. s	∞	∞ eth.
6554	col. liq., 1.4450	0 909		168	s.	∞	∞ eth.
6555	col liq , 1 4300^{9}	0 9306$\frac{25}{4}$; 0 938$\frac{20}{4}$	-54 to -57	164-6	∞	∞	∞ eth.
6556	col. liq. . . .	0 818$\frac{14}{4}$		118	sl s	∞	∞ eth.
6557	col liq	0 8017$\frac{20}{4}$	-84 7	119 (115-8)	1 9	∞	∞ eth , bz.
6558	col inflam. liq , 1 3939$^{16.6}$	0 8159$\frac{19}{4}$	-42	102 7	4 7^{20}; 3 8^{100}	∞	∞ eth.
6559	col liq	0 8062$\frac{20}{4}$		123 7	i.	∞	∞ eth.; s. bz.
6560	col liq	0 830^{0}		114 5	v sl s	v s	∞ eth.
6561							
6562	cr	0 782$\frac{75}{4}$	74 7	331^{15}			. . .
6563	leaf f lgr	liq 0 793^{95}	88		i	sl s h	sl. s h. eth.
6564	col. liq	0 6454$\frac{25}{4}$	-138	40 (32-7)	i	∞	∞ eth.; v s. dil H_2SO_4
6565		0 7054	.	84 1-4 3			
6566		0 6937		80 9-1 3			
6567	1 3991 .	0 6961		76 9			.
6568		0 7079		93 9-4 3	. . . . .		.
6569		0 6817		61 5-2 0	. .		
6570		0 6700		53 6-4 0			.
6571		0 6646		53 6-3 9			.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6572	**2-Pentene***...........	*sym*-methylethylethylene; β-*n*-amylene	$CH_3CH_2CH{:}CH\text{-}CH_3$	70 13
6573	**——, 2,3-dimethyl-***.	ethyltrimethylethylene .	$(CH_3)_2C{\cdot}C(CH_3)\text{-}CH_2CH_3$	98 18
6574	**——, 2,4-dimethyl-***...	isopropyldimethylethylene .	$(CH_3)_2C{:}CHCH\text{-}(CH_3)_2$	98 18
6575	**——, 3,4-dimethyl-***.	1-isopropyl-1,2-dimethyl-ethylene	$CH_3CH{\cdot}C(CH_3)\text{-}CH(CH_3)_2$	98 18
6576	**——, 4,4-dimethyl-***...	....	$CH_3CH{:}CHC\text{-}(CH_3)_3$	98.18
6577	**——, 3-ethyl-***...... .	1,1-diethyl-2-methyl-ethylene	$CH_3CH{\cdot}C(C_2H_5)_2$	98 18
6578	**——, 2-methyl-***......	2-ethyl-1,1-dimethylethylene	$(CH_3)_2C{:}CHCH_2\text{-}CH_3$	84.16
6579	**——, 3-methyl-***.....	1-ethyl-1,2-dimethylethylene	$CH_3CH{\cdot}C(CH_3)\text{-}CH_2CH_3$	84 16
6580	**——, 4-methyl-***.. . .	1-isopropyl-2-methylethylene	$CH_3CH{:}CHCH\text{-}(CH_3)_2$	84 16
6582	**2-Pentene-3-carboxylic acid***. See *Crotonic acid, α-ethyl-*.			
6583	**4-Pentenenitrile*** ..	allylacetonitrile; allylmethyl cyanide	$CH_2{:}CHCH_2CH_2\text{-}CN$	81.11
6584	**2-Pentenoic acid, 4-methyl-***	β-isopropylacrylic acid; α-isohexenic acid	$(CH_3)_2CHCH{\cdot}CH\text{-}COOH$	114 14
6585	**4-Pentenoic acid***...	allylacetic acid . . .	$CH_2{:}CHCH_2CH_2\text{-}COOH$	100.11
6586	**1-Penten-3-ol***...... .	ethylvinylcarbinol....	$CH_2{:}CHCHOH\text{-}CH_2CH_3$	86 13
6587	**3-Penten-2-ol***......	dimethylpropenylcarbinol	$C_5H_{11}OH$. . .	100.16
6588	**4-Penten-1-ol***.......	β-allylethyl alcohol	$CH_2\ CHCH_2CH_2\text{-}CH_2OH$	86 13
6589	**4-Penten-2-ol***......	allylmethylcarbinol....	$CH_2{:}CHCH_2\text{-}CHOHCH_3$	86 13
6590	**——, 2-methyl-***	. ...	$CH_2{\cdot}CHCH_2\text{-}COH(CH_3)_2$	100 16
6591	**3-Penten-2-one***....	ethylideneacetone .	$CH_3CH{:}CH\text{-}COCH_3$	84.11
6592	**——, 4-methyl-***.	See *Mesityl oxide*.		
6592M	**4-Pentenylamine, 1,2-dimethyl-**	5-amino-4-methyl-1-hexene	$CH_2{:}CHCH_2CH\text{-}(CH_3)CH(CH_3)\text{-}NH_2$	113 20
6593	**Pentine.**	See *Pentyne**.		
	Pentyl*.	See *Amyl*.		
6594	**1-Pentyne***...........	1-pentine, *n*-propylacetylene	$HC{\vdots}CCH_2CH_2CH_3$	68 11
6595	**2-Pentyne***..........	2-pentine, ethylmethylacetylene; valerylene	$CH_3C{\vdots}CCH_2CH_3$	68 11
6596	**2-Pentynoic acid***....	ethylpropiolic acid; ethyl-acetylenecarboxylic acid	$CH_3CH_2C{\vdots}CCOOH$	98 10
6596H	**1-Pentyn-3-ol, 3,4-dimethyl-***	ethynyl isopropylmethyl carbinol	$HC{\vdots}C\ C(OH)\text{-}(CH_3)CH(CH_3)_2$	112 17
6596R	**——, 3-methyl-***	ethylethynylmethylcarbinol.	$HC{\cdot}C{\cdot}C(OH)\text{-}(CH_3)C_2H_5$	98 14
6597	**Peonol**	2-hydroxy-4-methoxyaceto-phenone, resacetophenone 4-methyl ether, paeonol	$CH_3COC_6H_3\text{-}(OCH_3)OH$	166 17
6598	**Perbenzoic acid**..... .	benzoyl hydroperoxide	$C_6H_5COO_2H$......	138 12
6599	**Perchloromethyl formate.** See *Diphosgene*			
6600	**Pereirine**......		$C_{19}H_{24}N_2O$......	296.40

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
6572	col. inflam. liq.	0 651	-139	36.4	i	∞	∞ eth ; v s. dil. H_2SO_4
6573	liq . .	0 719	.	95.1	i	s.	s. eth.
6574	liq., 1.4020	0 $6947\frac{20}{4}$	..	82 6	i	s.	s. eth.
6575	1.4052 .	0 $7126\frac{20}{4}$	. . .	86 2-6.4			. . . .
6576	1.3986.. . .	0 $6881\frac{20}{4}$	. . .	76 0	.	. . .	
6577	.	0 7172		94.8-4 9			
6578		0 6904	. ....	67 2-7.5		.	. . ....
6579		(1) 0 6956 (2) 0 6940	.	67 6-8 2 65 7-6 2		.	. . ..
6580	.	(1) 0 6709 (2) 0.6702	.	57.7-8.5 54.2-5.2			... .
6582							
6583	liq........ .	1 18^{18}	.	140	i.	∞	∞ eth
6584	liq., 1.4506^{16}..	0 959		108^{12}		s.	..
6585	col. liq., $1.4341^{7.5}$	0.984^{18}	<-18	189	sl. s.	v. s.	v s eth
6586	. . . . .	0 $840\frac{20}{4}$		114-5	sl s.	∞	∞ eth.
6587	col liq., 1.4302	$0.8347\frac{20}{4}$		112	10^{10}	∞	∞ eth.
6588	col. liq.......	0 $863\frac{0}{4}$	.	140-2			....
6589	col. liq..........	0 $834\frac{20}{4}$		116.4	12 5	∞	∞ eth.
6590	liq.............	0.8430^{9}	.	119 5	sl s.		. .
6591	col liq., $1.43903^{19.6}$	0.856	.	122-4	s	...	. .. .,
6592							
6592M	.	0 793^{15}	..	133 6	s.		.
6593							
6594	col. liq , 1 407^{18}	0 7221^{9}; $0.6882\frac{25}{4}$	-95	40	i.	v s.	∞ eth.
6595	liq , 1 40044...	0.687; 0 $7127^{17.2}$	-101	56	i.	v. s.	∞ eth.
6596	cr	....	50	....	v. s.	. ... .	. . . .
6596H	col liq., 1.459^{15}	0 876^{15}	..... .	133	s.	s.	s eth.
6596R	col. liq., 1.4310^{20}	0 8688^{20}	. .	118-21	s.	s.	s eth
6597	.	....	50	. .....	i.	s.	s eth.
6598	leaf	..... .	42	exp. 80-100	sl s.	s.	s. eth.
6599							
6600	br. amor. powd.	.. .	118-24	.	i.	v. s.	v. s. eth.; s. chl

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
6601	**Peroxide, dibenzoyl.**	See *Benzoyl peroxide*		
6602	**Perseitol**	*d*-mannoheptitol, perseite	$C_7H_9(OH)_7$	212.20
6603	**Peucedanin**	imperatorin . . .	$C_{16}H_{16}O_4$	272.29
6604	**Phaseomannitol.**	See *i-Inositol.*		
6605	**α-Phellandrene**.......	1,5-*p*-menthadiene; 5-isopropyl-2-methyl-1,3-cyclohexadiene	$C_{10}H_{16}$.	136.23
6606	**β-Phellandrene**.......	1(7),2-*p*-menthadiene; 3-isopropyl-6-methylene-cyclohexene	$C_{10}H_{16}$	136.23
6607	**Phenacetin.**	See *p-Acetophenetide.*		
6608	**Phenacyl alcohol.**	See *Acetophenone, α-hydroxy-.*		
6609	**Phenacyl bromide.**	See *Acetophenone, α-bromo-.*		
6610	**Phenacyl chloride.**	See *Acetophenone, α-chloro-.*		
6611	**Phenanthrahydroquinone.**	See 9,10-*Phenanthrenediol.*		
6612	**Phenanthraquinone.**	See *Phenanthrenequinone.*		
6613	**Phenanthrene**.......	.. ....	$C_{14}H_{10}$.	178.22
6614	**——, amino-.**	See *Phenanthrylamine.*		
6615	**——, ?-benzyl-**.......	... .	$C_6H_5CH_2C_{14}H_9$	268.34
6616	**——, 9,10-dihydro-9,10-dioxo-.**	See *Phenanthrenequinone*		
6617	**——, 3,4-dimethoxy-**	morphol dimethyl ether .	$C_{14}H_8(OCH_3)_2$	238.27
6618	**——, 9,10-dimethyl-.**	....	$C_{14}H_8(CH_3)_2$	206.27
6619	**——, 9,10-diphenyl-**		$C_{14}H_8(C_6H_5)_2$	330.41
6620	**——, hydroxy-.**	See *Phenanthrol.*		
6621	**——, 7-isopropyl-1-methyl-.**	See *Retene.*		
6622	**——, 1-methyl-** ..	... . .	$CH_3C_{14}H_9$.	192.25
6623	**——, 3-methyl-** .		$CH_3C_{14}H_9$	192.25
6624	**——, 3,4,5-trihydroxy-.**	See 3,4,5-*Phenanthrenetriol.*		
6625	**3,4-Phenanthrenediol.**	See *Morphol*		
6626	**9,10-Phenanthrene-diol**	phenanthrahydroquinone	$C_{14}H_8(OH)_2$	210.22
6627	**Phenanthrenequinone**	9,10-dihydro-9,10-dioxo-phenanthrene; phenanthraquinone	$C_6H_4COCOC_6H_4$	208.20
6628	**——, 2,7-dinitro-.** .	. . .	$NO_2C_6H_3(CO)_2$-$C_6H_3NO_2$	298.20
6629	**——, 2-nitro-**.........	. . . . ..	$NO_2C_6H_3(CO)_2$-C_6H_4	253.20
6630	**3,4,5-Phenanthrene-triol**	3,4,5-trihydroxyphenanthrene	$C_{14}H_7(OH)_3$	226.22
6631	**2-Phenanthrol**........	2-hydroxyphenanthrene	$C_{14}H_9OH$	194.22
6632	**3-Phenanthrol**........	3-hydroxyphenanthrene .	$C_{14}H_9OH$.	194.22
6633	**4-Phenanthrol.**	4-hydroxyphenanthrene .	$C_{14}H_9OH$.	194.22
6634	**9-Phenanthrol**.......	.	$C_{14}H_9OH$	194.22
6635	**2-Phenanthrylamine**	2-aminophenanthrene. ..	$C_{14}H_9NH_2$	193.24
6636	**3-Phenanthrylamine** .	3-aminophenanthrene....	$C_{14}H_9NH_2$ . . .	193.24
6637	**9-Phenanthrylamine** .	9-aminophenanthrene.. ..	$C_{14}H_9NH_2$.	193.24
6638	**Phenazine**....	. ...	$C_6H_4NC_6H_4N$.	180.20
6639	**——, 5,10-dihydro-** ..	hydrazophenylene...	$C_6H_4NHC_6H_4NH$	182.22

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6601							
6602	col need	.	188	.	5 5[18]	sl. s c.	. . .
6603	rhomb pr	.	75	. . . .	i.	s h.	s. eth., pet. eth., KOH
6604							
6605	liq	0 843		175		i.	s. eth
6606	liq., 1.4788	0 852		171 2	i	i.	s. eth
6607							
6608							
6609							
6610							
6611							
6612							
6613	col monocl. leaf. f. al., 1 6567[129]	1 025; liq. 1 063[100]	100 (97 5–8 5)	340 2	i.	2[14], 10.0[78]	8 93[15.5] eth.; s. bz, chl., ac. a, CS_2
6614							
6615	need f bz. or leaf f al		91–2 (155–6)	.	i	sl s.	sl s. bz.
6616							
6617	leaf. f al +w		44	298–303[112]	i.	v. s.	v s. eth.
6618	pr f. dil. ac. a		139	subl.	.	v. sl. s.	v. s. bz., chl.; s ac. a.
6619	col. need. f. al		235	270 subl.	i	v. sl. s.	s. eth., bz.
6620							
6621							
6622	leaf f al		123		i.	s	..
6623	cr. f. al..		65		i.	s.	....
6624							
6625							
6626	col. need		147–8	.	s h.	v. s.	v. s. eth., bz.
6627	yel.-or. need.	1 405	207 (203–5)	360	sl s	v. s.	v s eth; 0 54[20] bz.
6628	yel. gold need f. ac a		301–3		i.	v. sl. s.	sl. s. ac. a.
6629	yel leaf. f. ac a.		257		. . .	i.	sl. s. ac. a.
6630	leaf. f. w .		148		i.	v. s.	v. s. eth.
6631	leaf f dil al		168		sl s	v s.	v. s. eth.
6632	need. f dil al		122 (118–9)		i c., sl s. h	v. s.	v. s. eth.
6633	cr	.	108		i.	s.	s eth.
6634	col need. f. lgr	. .	153	. . . .	i.	v. s.	v. s. eth., chl.; bz., h. lgr.
6635	lt. yel. cr. f. lgr	.	85	..	i.	s.	s. eth.
6636	cr. f. lgr......	. .	α, 143; β, 87 5	.	sl s	v.s.(vlt. fluores)	s dil. HCl
6637	lt. yel. pr.....	.	137–8; 104	subl.	..	v. s.	v. s. eth., bz., chl
6638	yel need		171	>360 subl.	v. sl. s.	2 c.	sl. s. eth.
6639	rhomb. leaf..		d		i.	v. sl. s. h.	i. bz.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6640	**Phenazine, 2-methyl-**	.	$C_6H_4 \cdot N_2 \cdot C_6H_3CH_3$	194 23
6641	**2(10)-Phenazinone, 10-**	**phenyl-.** See *Aposafranone*		
6642	**Phenazone.**	See *Antipyrine.*		
6643	**Phenazothionium chlo**	**ride, 3,9-bisdimethylam**	**ino-.** See *Methylen*	*e blue.*
6644	**Phene*.**	See *Benzene*.*		
6645	**Phenethyl alcohol...**	2-phenylethanol; benzyl-carbinol	$C_6H_5CH_2CH_2OH$	122 16
6646	**Phenethylamine....**	β-phenylethylamine; 1-amino-2-phenylethane	$C_6H_5CH_2CH_2NH_2$	121 18
6647	——, ***p*-hydroxy-.**	See *Tyramine*		
6648	——, ***p*-hydroxy-*N*,*N*-d**	**imethyl-.** See *Hordenine.*		
6649	**Phenetidine, *N*-acetyl-**	. See *Acetophenetide.*		
6650	***o*-Phenetidine.. ..**	*o*-ethoxyaniline; *o*-amino-phenetole	$C_2H_5OC_6H_4NH_2$	137 18
6651	***m*-Phenetidine ..**	*m*-ethoxyaniline.. .	$C_2H_5OC_6H_4NH_2$	137 18
6652	***p*-Phenetidine ..**	*p*-ethoxyaniline	$C_2H_5OC_6H_4NH_2$	137 18
6653	——, ***N*,*N*-diacetyl-.**	See *Diacetanilide, p-ethoxy-.*		
6654	——, **2-nitro-(NH_2=1)**	4-ethoxy-2-nitroaniline, 4-amino-3-nitrophenetole	$NO_2(C_2H_5O)C_6H_3$-NH_2	182 18
6655	**Phenetole ... .**	ethoxybenzene*, ethyl phenyl ether	$C_2H_5OC_6H_5$	122 16
6656	——, ***o*, *m*, or *p*-amino-**	. See *Phenetidine.*		
6657	——, **azodi-.**	See *Azophenetole.*		
6658	——, **β-bromo-**	β-bromoethyl phenyl ether.	$C_6H_5OCH_2CH_2Br$	201 07
6659	——, ***o*-chloro- . .**	1-chloro-2-ethoxybenzene*; *o*-chlorophenyl ethyl ether	$ClC_6H_4OC_2H_5$.	156 61
6660	——, ***p*-chloro- ..**	1-chloro-4-ethoxybenzene*, *p*-chlorophenyl ethyl ether	$ClC_6H_4OC_2H_5$	156 61
6661	——, ***o*-nitro-**	ethyl *o*-nitrophenyl ether.	$NO_2C_6H_4OC_2H_5$	167 16
6662	——, ***m*-nitro-. .**	..	$NO_2C_6H_4OC_2H_5$	167 16
6663	——, ***p*-nitro- .. ..**	.	$NO_2C_6H_4OC_2H_5$	167 16
6664	**Phenmiazine.**	See *Quinazoline*		
6665	**Phenobarbital.. ....**	5-ethyl-5-phenylbarbituric acid; luminal	NHCONHCOC-(C₂H₅)(C₆H₅)CO	232.23
6666	**Phenocoll .... .**	α-amino-*p*-acetophenetide.	NH_2CH_2CONH-$C_6H_4OC_2H_5$	194 23
6667	**Phenol .. ..**	carbolic acid; hydroxybenzene	C_6H_5OH	94 11
6668	——, acetate	phenyl acetate, acetyl-phenol	$CH_3COOC_6H_5$	136 14
6669	——, **acetamido-.**	See *Acetanilide, hydroxy-.*		
6670	——, **acetyl-.**	See *Phenol, acetate.*		
6671	——, **acetylamino-.**	See *Acetanilide, hydroxy-.*		
6672	——, ***o*-(acetylmethyla**	**mino)-.** See *Acetanilide, o-hy*	*droxy-N-methyl-.*	
6673	——, ***p*-allyl-.**	See *Chavicol*		
6674	——, ***o*-amino- .... .**	*o*-hydroxyaniline	$NH_2C_6H_4OH$.	109 12
6675	——, ***m*-amino-.... .**	*m*-hydroxyaniline..	$NH_2C_6H_4OH$	109 12
6676	——, ***p*-amino-. .....**	*p*-hydroxyaniline; rodinal ...	$NH_2C_6H_4OH$ . .	109 12
6677	——, **2-amino-4,6-dini**	**tro-.** See *Picramic acid.*		
6678	——, ***p*-(β-aminoethyl**	**)-.** See *Tyramine.*		
6679	——, **2-amino-3-nitro-**	. . . . . .	$NH_2(NO_2)C_6H_3OH$	154 12
6680	——, **2-amino-4-nitro-**	. . . .	$NH_2(NO_2)C_6H_3OH$	154.12

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
6640	need.........	....	117	350 d.	sl. s. h.	sl. s.	sl. s. eth.; s. chl., H_2SO_4
6641							
6642							
6643							
6644							
6645	col. liq., 1.5240	1.0235^{15}	-27	219–21	1.6^{20}	∞	∞ eth.
6646	liq., 1.575....	0.958^{24}	.....	195 (198)	s.	v. s.	v. s. eth.
6647							
6648							
6649							
6650	liq		<-21	229.2	v sl s	s.	s eth.
6651	liq ...	.	......	248	v. sl s.	s.	s. eth.
6652	liq	1.0613^{15}	2 4	254.2	v. sl s.	s.	s eth.
6653							
6654	red pr. f. al.	..	112–3	....	.	v. sl. s c, s h	s eth.
6655	col. liq., 1.5076^{21}	$0.9666\frac{20.2}{4}$	-30.2	172; $60^{9.12}$	i.	s.	∞ eth.
6656							
6657							
6658	....		35 (30–1)	240–50 d.	v v. sl. s.	s.	s. eth.
6659	col. liq ...	....	......	208	..	s.	s. eth., bz.
6660	cr., 1.5227^{19} .	....	21	212	.....	s.	s. eth.
6661	yel liq., 1.5425^{20}	1.19^{15}	2 1 (5–6)	268 (275); 149 3^{6}	i.	s.	s. eth.
6662	yel. need		34 (31–2)	284, 169^{70}	i.	s.	s. eth.
6663	col. monocl. pr. f. eth.	1.18^{15}	60	283	i.	s. h.	v. s. eth.
6664							
6665	wh. lust ...	.....	174	......	s. h.	s.	s eth.
6666	col. need. ...	.....	anh. 100.5	....	sl s.	s.	s. eth.
6667	col. rhomb. need., $1.54247^{40.6}$	1.072	41	182	6.7^{16}, ∞^{66}	∞	v. s eth.; s. chl., glyc., CS_2
6668	col. liq., 1.503.	$1.077\frac{20}{4}$	....	195 5	0 0318	∞	∞ eth., chl., glac. ac. a.
6669							
6670							
6671							
6672							
6673							
6674	col. rhomb. pl. or need.	....	170 (174)	subl.	1.7^{0}	4.4^{0}	sl s. eth.
6675	col. pr. f. tol.	....	122–3	....	2.6	v. s.	v s eth.; sl. s. bz., lgr.
6676	wh. leaf .	....	184 d.	subl.	1.1^{0}	4.5^{0}	sl s eth.; i. bz.
6677							
6678							
6679	red need	.	216–7	subl.	s.	.	....
6680	or. pr	....	143	....	sl. s.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6681	**Phenol, 2-amino-5-nitro-**		$NH_2(NO_2)C_6H_3OH$	154.12
6682	——, **2-amino-6-nitro-**		$NH_2(NO_2)C_6H_3OH$	154.12
6683	——, **3-amino-4-nitro-**	.	$NH_2(NO_2)C_6H_3OH$	154.12
6684	——, **3-amino-5-nitro-**	.	$NH_2(NO_2)C_6H_3OH$	154.12
6685	——, **4-amino-2-nitro-**	.	$NH_2(NO_2)C_6H_3OH$	154.12
6686	——, **4-amino-3-nitro-**		$NH_2(NO_2)C_6H_3OH$	154.12
6687	——, **5-amino-2-nitro-**	3-amino-6-nitrophenol	$NH_2(NO_2)C_6H_3OH$	154 12
6688	——, **o-aminothio-**.	2-aminobenzenethiol*, *o*-aminophenyl mercaptan, *o*-mercaptoaniline	$NH_2C_6H_4SH$	125.18
6689	——, ***m*-aminothio-**	3-aminobenzenethiol*; *m*-aminophenyl mercaptan, *m*-mercaptoaniline	$NH_2C_6H_4SH$	125.18
6690	——, ***p*-aminothio-**	4-aminobenzenethiol*; *p*-aminophenyl mercaptan; *p*-mercaptoaniline	$NH_2C_6H_4SH$	125.18
6691	——, ***o*-amoxy-**.....	pyrocatechol monoamyl ether	$CH_3(CH_2)_4OC_6H_4$-OH	180.24
6692	——, ***m*-amoxy-**. ..	resorcinol monoamyl ether	$CH_3(CH_2)_4OC_6H_4$-OH	180.24
6693	——, ***p*-amoxy-**....	hydroquinone monoamyl ether	$CH_3(CH_2)_4OC_6H_4$-OH	180.24
6694	——, ***p*-amyl-**.... .	.	$CH_3(CH_2)_4C_6H_4$-OH	164 24
6695	——, ***p*-*tert*-amyl-**	*p*-(α,α-dimethylpropyl)-phenol	$CH_3CH_2C(CH_3)_2$-C_6H_4OH	164.24
6696	——, ***o*-anilino-**....	*o*-hydroxydiphenylamine	$C_6H_5NHC_6H_4OH$.	185 22
6697	——, ***m*-anilino-**.. .	*m*-hydroxydiphenylamine	$C_6H_5NHC_6H_4OH$.	185.22
6698	——, ***p*-anilino-**...	*p*-hydroxydiphenylamine	$C_6H_5NHC_6H_4OH$.	185.22
6699	——, **azodi-**.	See *Azophenol.*		
6700	——, ***p*-benzalamino-**.	See *Phenol, p-benzylideneamino-*.		
6701	——, **benzenylaminothio-**.	See *Benzothiazole, 2-phenyl-*.		
6702	——, ***o*-benzyl-** . .	.... . .	$C_6H_5CH_2C_6H_4OH$	184.23
6703	——, ***p*-benzyl-** .	*p*-hydroxydiphenylmethane	$C_6H_5CH_2C_6H_4OH$	184 23
6704	——, ***p*-benzylamino-**.	. .	$C_6H_5CH_2NHC_6H_5$-OH	200 25
6704M	——, ***p*-benzylidene-amino-**	*N*-benzal-*p*-hydroxyaniline	$C_6H_5CH{:}NC_6H_4$-OH	197.23
6705	——, ***o*-bromo-**...	. .	BrC_6H_4OH. .	173.02
6706	——, ***m*-bromo-**... ...	.	BrC_6H_4OH....	173.02
6707	——, ***p*-bromo-**	.. .	BrC_6H_4OH.	173.02
6708	——, ***o*-butoxy-** . .	pyrocatechol monobutyl ether	$CH_3(CH_2)_3OC_6H_4$-OH	166.21
6709	——, ***m*-butoxy-** .	resorcinol monobutyl ether	$CH_3(CH_2)_3OC_6H_4$-OH	166.21
6710	——, ***p*-butoxy-**.... .	hydroquinone monobutyl ether	$CH_3(CH_2)_3OC_6H_4$-OH	166.21
6711	——, ***o*-butyl-**........	. .. . .	$C_4H_9C_6H_4OH$	150.21
6712	——, ***m*-butyl-**.	.	$C_4H_9C_6H_4OH$.	150.21

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6681	br. need. f. w.		202			s. h.	....
6682	red need. f. al		111	.	sl s. h	v. s.	v. s. eth., bz., chl.
6683	or. need.....		185-6	. .	sl. s. h.	s.	v. s. eth., bz., chl.
6684	yel. cr.....	.	165		..	v. s.	v s eth.; v. sl. s bz, chl
6685	red need. f. al		131 (142-3)			.	.
6686	red pr. f. eth		154		s	s	s eth
6687	or.-yel. need.		163			.	. .
6688	need .		26	234			.
6689	oily liq...		.	180-90[16]	s.	s	i eth.
6690	wh. gran cr. mass		46	140-5[16]	s.	s.	s eth.
6691				104-6[4]			
6692				140[5]			.
6693	.		49-50				.....
6694	col liq ..		<0	262	v sl s h.	s.	s. eth., NaOH
6695	col need		92-3	248-50; 138-9[15]	v sl s	v. s	v. s. eth.
6696	pr. f. w		69-70	180-9[20]	sl. s h	s.	s. eth.; sl. s. bz.
6697	leaf. f w		82	340	sl s h	s.	s. eth., alk.; sl. s. lgr.
6698	leaf. f. w. .		70	330	s h.	s.	s. eth., chl., alk.
6699							
6700							
6701							
6702			21	312	v. s. h.	v. s.	v. s. eth.
6703	col. need. f al		83-4	320-2 (308)	s. h.	s.	s. eth.
6704	leaf .		90 (84-5)	.	i.	v. s.	v. s. bz.
6704M	leaf. f. dil. al.	.	183 (185-6)	. ...	i.	v. s.	...
6705	col. oily liq. ..	$1\ 4924\frac{20}{4}$	5 6 (4-5)	194-5	v. sl. s.	s.	s. eth., alk.
6706	leaf . .		33	236 5, 135-40[12]	v sl. s.	v. s.	v. s. eth.; s. chl., alk.
6707	tetr	1 840[15], 1 588[80]	63 5	238	1 42[15]	v. s.	v. s. eth.; s. chl., ac. a.
6708	1.5113[25].	1 020[25]		231-4; 159[69]			.
6709				130[5]			
6710	.		64-5	.			. ..
6711	col., 1.496[15]	$0\ 975\frac{20}{4}$		234-7	v. sl s.	s.	s. eth.
6712	col	$0\ 974\frac{20}{4}$		247-9[758]	v sl s.	s	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6713	**Phenol, *p*-butyl-**		$C_4H_9C_6H_4OH$	150 21
6714	**——, *p*-sec-butyl-**		$C_2H_5(CH_3)CHC_6H_4OH$	150 21
6715	**——, *p*-*tert*-butyl-**	4-(α,α-dimethylethyl)-phenol	$(CH_3)_3CC_6H_4OH$	150.21
6716	**——, *o*-chloro-**	1-chloro-2-hydroxybenzene	ClC_6H_4OH	128.56
6717	**——, *m*-chloro-**	1-chloro-3-hydroxybenzene	ClC_6H_4OH	128.56
6718	**——, *p*-chloro-**	1-chloro-4-hydroxybenzene	ClC_6H_4OH	128.56
6719	**——, 2-chloro-4-nitro-**		$Cl(NO_2)C_6H_3OH$	173.56
6720	**——, 2-chloro-5-nitro-**	6-chloro-3-nitrophenol	$Cl(NO_2)C_6H_3OH$	173.56
6721	**——, 4-chloro-2-nitro-**		$Cl(NO_2)C_6H_3OH$	173 56
6722	**——, 5-chloro-2-nitro-**	3-chloro-6-nitrophenol	$Cl(NO_2)C_6H_3OH$	173 56
6723	**——, *p*-cyclohexyl-**		$C_6H_{11}C_6H_4OH$	176 25
6724	**——, 2,4-diamino-**		$(NH_2)_2C_6H_3OH$	124.14
6725	——, ——, dihydrochloride	diamol; amidol (one form)	$(NH_2)_2C_6H_3OH\cdot 2HCl$	197.07
6726	**——, 2,5-diamino-**		$(NH_2)_2C_6H_3OH$	124.14
6727	**——, 3,4-diamino-**		$(NH_2)_2C_6H_3OH$	124 14
6728	**——, 3,5-diamino-**		$(NH_2)_2C_6H_3OH$	124.14
6729	**——, 2,4-dibromo-**		$Br_2C_6H_3OH$	251 92
6730	**——, 2,6-dibromo-**		$Br_2C_6H_3OH$	251 92
6731	**——, 2,6-dibromo-4-nitro-**		$Br_2(NO_2)C_6H_2OH$	296 92
6732	**——, 2,3-dichloro-**		$Cl_2C_6H_3OH$	163.01
6733	**——, 2,4-dichloro-**		$Cl_2C_6H_3OH$	163.01
6734	**——, 2,5-dichloro-**		$Cl_2C_6H_3OH$	163.01
6735	**——, 2,6-dichloro-**		$Cl_2C_6H_3OH$	163 01
6736	**——, 3,4-dichloro-**		$Cl_2C_6H_3OH$	163 01
6737	**——, 3,5-dichloro-**		$Cl_2C_6H_3OH$	163 01
6738	**——, 2,6-dichloro-4-nitro-**		$Cl_2(NO_2)C_6H_2OH$	208 01
6739	**——, *m*-diethylamino-**		$(C_2H_5)_2NC_6H_4OH$	165.23
6740	**——, 2,4-diiodo-**		$I_2C_6H_3OH$	345.93
6741	**——, 2,6-diiodo-**		$I_2C_6H_3OH$	345.93
6742	**——, 2,3-dimethoxy-**	pyrogallol 1,2-dimethyl ether	$(CH_3O)_2C_6H_3OH$	154.16
6743	**——, 2,6-dimethoxy-**	pyrogallol 1,3-dimethyl ether	$(CH_3O)_2C_6H_3OH$	154.16
6744	**——, 3,5-dimethoxy-**	phloroglucinol dimethyl ether	$(CH_3O)_2C_6H_3OH$	154.16
6745	**——, dimethyl-**	See *Xylenol.*		
6746	**——, *m*-dimethyl-amino-**	*m*-hydroxy-*N*,*N*-dimethyl-aniline	$(CH_3)_2NC_6H_4OH$	137.18
6747	**——, *p*-(α,α-dimethylpropyl)-.** See *Phenol, p-tert-amyl-.*			

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6713	col liq	0.978^{20}_{4}		246–50[751]	v sl s	s.	s. eth.
6714	col need	..	59	240.5[750]	v sl s	s.	v s eth.
6715	need. f. w	$0.9081\frac{114}{4}$	99	236–8	s.	s.	s eth.
6716	col liq., 1.5473[40]	$1.241\frac{18}{15}$	α 7; β 0; γ-4.1	175.6	2.85[20]	s.	s. eth.
6717	col liq. or need 1.5565[40]	liq 1.245[45] 1.268[25]	32.8	214	2.60[20]	s.	s. eth.; 512[30] bz.
6718	need f al, 1.5579[40]	1.306	43 (39–40)	217	2.71[20]	v. s	v s. eth.; 272[20] bz.; s alk.
6719	lng. col. need f. al. or w.		111	. .	s h	v s.	v s. eth.; s. chl.
6720	yel need. f w		118–9	.	sl s		s chl.
6721	yel. monocl need f al		87		v sl s	s	s. eth., chl.
6722	yel. pr. f w		38.9	subl	sl s	s.	s eth., ac. a.
6723	col need		133		i	sl s.	s eth.
6724	col leaf .		78–80 d			s	sl s. eth., chl.; s acet., alk., ac. a.
6725	gray-wh cr		168–70		s	sl. s	sl. s. eth.
6726	need ..		68		v s		. ...
6727	cr .		167–8 d.				....
6728	pr		168–70	.	s		sl s. eth.
6729	col. need		40 (35–6)	177[17]; 238–9	0.19[15]	v s	v. s. eth.; s. CS_2, bz., alk.
6730	col need f h. w		56–7	162[21]	sl s	v s	v. s. eth.
6731	yel pr f al		144	d >144	v sl s	s h	s. eth., CS_2, et. ac., chl.; sl. s. ac a.
6732	col. cr f pet eth		57			s	s. eth.
6733	col need f bz		45	210	0.46[20]	s	s eth, chl., bz.
6734	col pr. f. pet eth		58	211[744]	sl s	s	s. eth, bz.
6735	col need		67	219–20		s	s eth.
6736	col need. f. bz.		68	253.5[767]			.
6737			68	233–4		s	.
6738	yel. monocl leaf. f al.	1.822	125 d	subl <100 exp.	sl s.	s h	s. eth., chl, bz.
6739	rhomb f. CS_2+lgr		78	276–80; 201[25]	s	s	s eth., CS_2, i. lgr
6740	col need f. w		72	subl. 100	sl s	s	s. eth.; sl s. chl, bz.
6741	col. cr		68	.....		s.	. . .
6742	col liq			233–4; 124–5[17]			. .. ..
6743	monocl. pr f w		55–56	258 (262.7)	1.75[13]	v. s	v. s. eth.
6744	cr		36–8	172-5[17]		.	... .
6745							
6746	need f lgr		85–7	265–8	v sl. s h	v. s	v. s. eth.; s. bz, acet, alk., min a
6747							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
6748	**Phenol, 2,3-dinitro-**	1-hydroxy-2,3-dinitrobenzene	$(NO_2)_2C_6H_3OH$.	184 11
6749	——, **2,4-dinitro-** ..		$(NO_2)_2C_6H_3OH$.	184 11
6750	——, ——, dimethylthiolthio	nocarbamate. See *Carbamic aci*	*d, dimethylthiolthiono*	-, 2,4-
6751	——, **2,6-dinitro-**.....		$(NO_2)_2C_6H_3OH$.	184 11
6752	——, **3,4-dinitro-**......	.	$(NO_2)_2C_6H_3OH$.	184 11
6753	——, **3,5-dinitro-**	.	$(NO_2)_2C_6H_3OH$.	184 11
6754	——, **ethenylamino-.**	See *Benzoxazole, 2-methyl-.*		
6755	——, **ethenylaminothi**	**o-.** See *Benzothiazole, 2-methyl-*		
6756	——, ***o*-ethoxy-**	pyrocatechol monoethyl ether, guaethol; catechol monoethyl ether	$C_2H_5OC_6H_4OH$	138 16
6757	——, ***m*-ethoxy-** .	resorcinol monoethyl ether	$C_2H_5OC_6H_4OH$.	138 16
6758	——, ***p*-ethoxy-** . ..	hydroquinone monoethyl ether	$C_2H_5OC_6H_4OH$	138 16
6759	——, ***o*-ethyl-.**	See *Phlorol.*		
6760	——, ***m*-ethyl-**......	. .	$C_2H_5C_6H_4OH$	122 16
6761	——, ***p*-ethyl-**	.	$C_2H_5C_6H_4OH$	122 16
6762	——, ***o*-ethylamino-** ..	*N*-ethyl-2-hydroxyaniline	$C_2H_5NHC_6H_4OH$	137 18
6763	——, ***m*-ethylamino-**	*N*-ethyl-3-hydroxyaniline	$C_2H_5NHC_6H_4OH$.	137 18
6764	——, ***p*-ethylamino-**	*N*-ethyl-4-hydroxyaniline	$C_2H_5NHC_6H_4OH$.	137 18
6765	——, ***p*-heptyloxy-**	hydroquinone monoheptyl ether	$CH_3(CH_2)_6OC_6H_4$-OH	208 29
6766	——, **hexahydro-.**	See *Cyclohexanol.*		
6767	——, ***p*-hexyloxy-**..	hydroquinone monohexyl ether	$CH_3(CH_2)_5OC_6H_4$-OH	194 27
6768	——, ***o*-iodo-**....... ..	. . ..	IC_6H_4OH.....	220 02
6769	——, ***m*-iodo-** . .		IC_6H_4OH .	220 02
6770	——, ***p*-iodo-** .		IC_6H_4OH	220 02
6771	——, ***p*-isoamyl-**.		$C_5H_{11}C_6H_4OH$	164.24
6772	——, ***o*-isopropyl-**	*o*-cumenol	$(CH_3)_2CHC_6H_4OH$	136 19
6773	——, ***p*-isopropyl-**		$(CH_3)_2CHC_6H_4OH$	136 19
6774	——, ***p,p',p''*-methenyl**	**tri-.** See *Leucaurin.*		
6775	——, ***o*-methoxy-.**	See *Guaiacol.*		
6776	——, ***m*-methoxy-**	resorcinol monomethyl ether	$CH_3OC_6H_4OH$.	124 13
6777	——, ***p*-methoxy-**. . .	hydroquinone monomethyl ether	$CH_3OC_6H_4OH$..	124 13
6778	——, **2-methoxy-4-met**	**hyl-.** See *Creosol.*		
6779	——, **methyl-.**	See *Cresol.*		
6780	——, ***o*-methylamino-**		$CH_3NHC_6H_4OH$.	123 15
6781	——, ***p*-methylamino-,** sulfate	metol; photol; pictol	$(CH_3NHC_6H_4$-$OH)_2 H_2SO_4$	344 38
6782	——, ***p,p'*-methylenedi**	**-.** See *Methane, 4,4'-dihydroxyd*	*iphenyl-.*	
6783	——, ***o*-nitro-**...	.	$NO_2C_6H_4OH$	139 11
6784	——, ***m*-nitro-**. ..	... .	$NO_2C_6H_4OH$..	139.11
6785	——, ***p*-nitro-**. .		$NO_2C_6H_4OH$	139 11

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
6748	yel. monocl. need f w.	1 681[20]	144		sl s.	v. s h.	v. s. eth.
6749	yel rhomb. pl. f. w.	1 683[24]	111 6, 114		0 56[18], 4 3[100]	3.9[19]	3 065[15] eth.; s. bz., chl.
6750	dinitrophenyl ester.						
6751	pa yel rhomb. need or leaf f. w.	...	63-4 (61 8)		v sl. s. c, v. s. h.	v. s h.	v. s. eth.; s. bz, chl
6752	col tricl. need. f. w.	1 672	134			s	s. eth.
6753	monocl. leaf. f dil. HCl	1 702	123			s	s. eth., chl., bz.; sl. s pet. eth.
6754							
6755							
6756	oily liq .		29	217	sl. s.	∞	∞ eth.
6757	col-pa yel. liq			246-7	i	s	s. eth
6758	leaf f w		66	247	sl s. c, s h.	v. s	v. s. eth.
6759							
6760	liq	1 025[0]	-4	214[752]	sl s	v. s	v. s. eth.
6761	col need		46	219	sl s.	v. s	v. s. eth.
6762	rhomb. pl		107 5 (108-9)		i	s.	sl. s. eth; s. h. bz.
6763	cr f bz		62	176[12]	s h	s.	s. eth.; v. s. chl.; sl. s. lgr.
6764	need f w		100		s h	s.	s. eth.
6765			60				...
6766							
6767			48				....
6768	need. or pl	1 8757[80]	43 (40 4)	186-7[160]	s. h.	v. s	v. s. eth.; s. CS_2
6769	need f lgr		40	d.	sl s.	s	s eth.
6770	col need f w	1 857[112]	94	d	sl s	v s.	v. s. eth.
6771	need. f. h. w		93	255	v. sl s h.	v s.	v. s. eth.
6772	col	1 028[18]	16	204	sl. s.	s	s. eth.
6773	need		61	229 3[758]	sl. s.	s.	...
6774							
6775							
6776	liq	>1	<-17 5	244 3	sl. s.	∞	∞ eth.
6777	rhomb. leaf. f w.		53	243	s.	v. s.	v. s. eth., bz.
6778							
6779							
6780	pl. f bz.		86-7	..	i.	s.	s. bz.
6781	wh. cr. powd		250-60 d.	....	5 c., 16.67 h.	s.	.. .. .
6782							
6783	lt. yel. monocl. need. or pr.	1 657[20]	45	214 5 (217 25)	0.21[20], 1.08[100]	46 0[25]	v. s. eth.; s. alk.
6784	col.-yel. monocl. f eth.	1 485	96	194[70]	1.35[25], 13.3[90]	195.0[25]	v. s. eth.; s. bz., alk.
6785	col-ylsh. monocl. pr	1 479[20]	114	279 d.	1.6[25], 26 9[90]	189 5[25]	v. s. eth.; s. chl

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6786	**Phenol, *p*-nitroso-**	quinone monoxime	NOC_6H_4OH or $HON\ C_6H_4{\cdot}O$	123 11
6787	**——, *p*-octyloxy-**	hydroquinone monooctyl ether	$CH_3(CH_2)_7OC_6H_4$-OH	222 32
6788	**——, pentabromo-**		C_6Br_5OH	488 65
6789	**——, pentachloro-**		Cl_5C_6OH	266 35
6790	**——, pentamethyl-**		$(CH_3)_5C_6OH$	164 24
6791	**——, *o*-phenyl-**	*o*-hydroxybiphenyl	$C_6H_5C_6H_4OH$	170 20
6792	**——, *m*-phenyl-**	*m*-hydroxybiphenyl	$C_6H_5C_6H_4OH$	170 20
6793	**——, *p*-phenyl-**	*p*-hydroxybiphenyl	$C_6H_5C_6H_4OH$	170 20
6794	**——, phenylazo-.**	See *Azobenzene, hydroxy-.*		
6795	**——, *p*-propenyl-.**	See *Anol*		
6796	**——, *o*-propoxy-**	pyrocatechol monopropyl ether	$CH_3CH_2CH_2OC_6$-H_4OH	152 19
6797	**——, *m*-propoxy-**	resorcinol monopropyl ether	$CH_3CH_2CH_2OC_6$-H_4OH	152 19
6798	**——, *p*-propoxy-**	hydroquinone monopropyl ether	$CH_3CH_2CH_2OC_6$-H_4OH	152 19
6799	**——, *o*-propyl-**		$C_3H_7C_6H_4OH$	136 19
6800	**——, *m*-propyl-**		$C_3H_7C_6H_4OH$	136 19
6801	**——, *p*-propyl-**		$C_3H_7C_6H_4OH$	136 19
6802	**——, *p*-salicyloyl-.**	See *Benzophenone, 2,4′-dihydroxy-*		
6803	**——, 2,3,4,6-tetranitro-**		$(NO_2)_4C_6HOH$	274 11
6804	**——, thio-**	benzenethiol*; phenyl mercaptan	C_6H_5SH	110 17
6805	**——, 2,4,6-triamino-**		$(NH_2)_3C_6H_2OH$	139 16
6806	**——, 2,4,6-tribromo-**	*sym*-tribromophenol	$Br_3C_6H_2OH$	330 83
6807	**——, 2,3,5-trichloro-**		$Cl_3C_6H_2OH$	197 46
6808	**——, 2,4,6-trichloro-**	*sym*-trichlorophenol	$Cl_3C_6H_2OH$	197 46
6809	**——, 2,4,6-triiodo-**		$I_3C_6H_2OH$	471 84
6810	**——, 2,4,5-trimethyl-.**	See *Pseudocumenol.*		
6811	**——, 2,4,6-trimethyl-.**	See *Mesitol.*		
6812	**——, 2,3,6-trinitro-**	γ-trinitrophenol	$(NO_2)_3C_6H_2OH$	229 11
6813	**——, 2,4,5-trinitro-**	β-trinitrophenol	$(NO_2)_3C_6H_2OH$	229 11
6814	**——, 2,4,6-trinitro-**	See *Picric acid.*		
6815	**——, *o*-vinyl-**	*o*-hydroxystyrene	$CH_2{:}CHC_6H_4OH$	120 14
6816	**——, *m*-vinyl-**	*m*-hydroxystyrene	$CH_2{:}CHC_6H_4OH$	120 14
6817	**Phenolphthalein**	2,2-bis(*p*-hydroxyphenyl)-phthalide	$C_{20}H_{14}O_4$	318 31
6818	**——, 3′,3″,5′,5″-tetraiodo-**	nosophen; iodophen	$C_{20}H_{10}I_4O_4$	821 96
6819	**1-Phenol-2-sulfonic acid**	*o*-phenolsulfonic acid; aseptol; sozolic acid	$HOC_6H_4SO_3H$	174 17

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6786	yel rhomb. need.	.	126 d.	. ..	s.	v. s.	v s eth.; s. acet., dil. alk. sol.
6787	...		60–1	.			.
6788	col monocl need f. al.		225	d subl.	i.	s. h	sl s eth.; s. h. bz.
6789	monocl pr	1 978	191	310 d	i	v s.	v. s. eth.
6790	need f al		125	267	0 15 h	s	
6791	need f pet eth		56	275	sl s	v. s	v s eth , s. lgr
6792	need f pet eth or h w		78 (76–7)	>300	sl s	v s	s KOH, bz.
6793	col need or leaf f dil al		165	308	sl s	s	s eth , chl , NH_4OH
6794							
6795							
6796	1.5176^{25}	1.0523^{25}		223–6; 140^{68}			... .. .
6797				120^{5}			....
6798	.. .		56–7				....
6799	liq . .	1.015^{0}, $1.000\frac{15}{15}$		220 (226 6)	sl. s.	s.	s eth.
6800	col liq		26	228	v sl s	s	s eth.
6801	cr	1 009	22 (61)	232.6^{758}	sl s.	s	...
6802							
6803	yel need f chl		140 d.	exp.	v s		v sl. s bz., lgr
6804	col liq., $1.58613^{23.2}$	$1.078\frac{20}{4}$		169 5	i	v s.	∞ eth.
6805	need unst		..	257	v s	v s	v. s. eth.
6806	col monocl pr f dil al. or bz	$2.55\frac{20}{20}$	96	subl.	0 007	v s.	s eth., glyc., chl.
6807	lng col need f. al		62	253	sl s h	s	s eth , lgr
6808	rhomb. need	$1.490\frac{75}{4}$	68	244 5	0.082^{25}, 0.243^{96}	v s	v. s. eth.
6809	col. need f al		156–8	subl d.	i	1 58	s eth , acet.
6810							
6811							
6812	need		118		sl s.	v s	v. s. eth ; s. bz.
6813	need		96		sl. s.	v s	v. s. eth ; s. bz.
6814							
6815	need	$1.061\frac{19.2}{4}$	29	108^{15}	s.	v s.	v. s eth
6816	oil		..	$114–6^{16}$			.
6817	rhomb need f. dil al.	1.277^{32}, $1.300\frac{20}{4}$	261	.	0.018^{20}	20 9	5 92 eth.
6818	cr or amor. grn powd.		225 d.	.. ..	i.	v. sl. s.	s. eth , chl., alk ; i a.
6819	col. liq. ..	1.155^{15}	50	.... .	s.	s.	s glyc.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6820	**1-Phenol-4-sulfonic acid**	*p*-phenolsulfonic acid	$HOC_6H_4SO_3H$	174.17
6821	**——, 2-amino-**	aminophenolsulfonic acid II	$HO(NH_2)C_6H_3SO_3H$	189.18
6822	**——, 2-amino-6-nitro-**		$HO(NH_2)(NO_2)C_6H_2SO_3H$	234.18
6823	**——, 2-nitro-**		$HOC_6H_3(NO_2)SO_3H$	219.17
6824	**Phenol-2,4,6-tricarboxylic acid.** See *Trimesic acid, hydroxy-*.			
6825	**Phenosuccin.**	See *Succinamide, N-p-phenetyl-*		
6826	**Phenothiazine**	phenthiazine, thiodiphenylamine	$C_6H_4NHC_6H_4S$	199.26
	Phenyl. For phenyl derivatives see the parent compounds (e.g., for phenylacridine see			
6827	**Phenylamine.**	See *Aniline*.		
6828	**Phenyl bromide.**	See *Benzene, bromo-**.		
6828M	**Phenyl cellosolve.**	See *Ethanol, 2-phenoxy-*.		
6829	**Phenyl chloride.**	See *Benzene, chloro-**.		
6830	**Phenyl cyanide.**	See *Benzonitrile*.		
6831	**Phenyl disulfide**	phenyldithiobenzene*; diphenyl disulfide	$(C_6H_5)_2S_2$	218.32
6832	**Phenylene, diphenyl-.**	See *Terphenyl*.		
6833	***p*-Phenylene cyanide.**	See *Terephthalonitrile*.		
6834	***p*-Phenylene diacetate.**	See *Hydroquinone, diacetate*		
6835	**Phenylenediamine, *N*-acetyl-.** See *Acetanilide, amino-*.			
6836	***o*-Phenylenediamine.**	1,2-benzenediamine*, 1,2-diaminobenzene	$C_6H_4(NH_2)_2$	108.14
6837	**——, *N,N'*-diacetyl-**	1,4-diacetamidobenzene	$C_6H_4(NHCOCH_3)_2$	192.21
6838	**——, *N,N*-dimethyl-.**	*o*-amino-*N, N*-dimethylaniline; 1-amino-2-dimethylaminobenzene	$(CH_3)_2NC_6H_4NH_2$	136.19
6839	**——, *N*-phenyl-**	*o*-aminodiphenylamine	$NH_2C_6H_4NHC_6H_5$	184.23
6840	***m*-Phenylenediamine**	1,3-benzenediamine*; 1,3-diaminobenzene	$C_6H_4(NH_2)_2$	108.14
6841	**——, 4-(3-aminophenylazo)-**	2,4,3'-triaminoazobenzene	$NH_2C_6H_4N_2C_6H_3(NH_2)_2$	227.27
6842	**——, *N,N*-dimethyl-.**	*m*-amino-*N,N*-dimethylaniline; 1-amino-3-dimethylaminobenzene	$(CH_3)_2NC_6H_4NH_2$	136.19
6843	**——, *N,N'*-di-*p*-tolyl-**		$C_6H_4(NHC_6H_4CH_3)_2$	288.38
6844	**——, 4-phenylazo-.**	See *Chrysoidine. (base)*.		
6845	***p*-Phenylenediamine.**	1,4-benzenediamine*; 1,4-diaminobenzene	$C_6H_4(NH_2)_2$	108.14
6846	**——, *N,N*-diethyl-**	*p*-amino-*N, N*-diethylaniline; 1-amino-4-diethylamino-benzene	$(C_2H_5)_2NC_6H_4NH_2$	164.25
6847	**——, *N,N*-dimethyl-**	*p*-amino-*N,N*-dimethylaniline; 1-amino-4-dimethylamino-benzene	$(CH_3)_2NC_6H_4NH_2$	136.19
6848	**——, *N*-methyl-**	*p*-methylaminoaniline; *p*-amino-*N*-methylaniline	$CH_3NHC_6H_4NH_2$.	122.17
6849	**——, *N*-phenyl-**	*p*-aminodiphenylamine.	$C_6H_5NHC_6H_4NH_2$	184.23
6850	**——, *N,N,N',N'*-tetramethyl-**		$C_6H_4[N(CH_3)_2]_2$	164.25
6851	***m*-Phenylene dimercaptan.** See *Resorcinol, dithio-*.			
6852	***p*-Phenylene dimercaptan.** See *Hydroquinone, dithio-*.			
6853	**Phenyl ether**	phenoxybenzene*; diphenyl ether	$(C_6H_5)_2O$.	170.20

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6820	deliq need			.	s	s.	... .
6821	rhomb .		d.		0 7[14]	i.	i. eth.
6822					s.		
6823	need f w	.	141	d.	s.	v. s.	v. s chl.
6824							
6825							
6826	yel rhomb leaf. f. al.		180	371 d.	. ..	sl s.	sl. s. eth.; s. bz.
	Acridine, phenyl -)	For phe	nyl esters of	organic acid	s see the	acids.	
6827							
6828							
6828M							
6829							
6830							
6831	need f al	.	61	310 d	i	s	s eth, CS_2, bz.
6832							
6833							
6834							
6835							
6836	brnsh yel. monocl cr or tab f chl	..	102	252 (256–8)	4 15[35], 733[81]	v s.	v. s. eth.; s. chl.
6837	need f w		186	.	v s. h.	v s.	v. sl. s. eth.
6838	col oil		....	218[751]	sl s.	v s.	v. s. eth.
6839	need f. w	......	79–80	.. .	s	..	s. bz., acet., chl; sl. s. lgr.
6840	col rhomb need, 1 63390[57.7]	1 13895; 1 107[78]	62.8	287 (282–4)	35 1[25]	s.	s. eth.
6841	or-red monocl. f w	..	143 5	...	i	v s	v. s. eth.
6842	oil	0 995[25]	<–20	268–70 (258)	sl s.	v s.	v. s. eth.
6843	lng need f al	......	138–9	d.	i.	sl s.	sl. s. eth., bz., ac. a.
6844							
6845	col. monocl. f w or eth	. ....	139 7 (139–41)	267	3 8[24], 669[107]	s.	s. eth., chl.
6846	liq	.	..	261–2	s.	v. s	v. s. eth.
6847	col. need......	1 036$\frac{20}{4}$; liq, 1 0168[90]	53 (41)	262	s.	v s.	v.s.eth.; s. chl.
6848	leaf .. .		35 5[0]	259 5	v. s.	v. s.	v. s. eth.
6849	need. f. al	. ...	66–7; 75	354 in H_2	sl. s.	v. s.	v. s. eth.
6850	leaf. f. dil. al	. ..	51	260	v. sl. s h.	v. s.	v. s. eth., chl.
6851							
6852							
6853	col. monocl. (rhombic) 1 5826[24]	1 0728[20]	28	259	v. sl. s.	4.97[10] 87%	s. eth., ac. a., bz.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6853M	**Phenyl fluoride.**	See *Benzene, fluoro-**.		
6854	**Phenyl iodide.**	See *Benzene, iodo-**		
6855	**Phenyl isocyanide**	phenylcarbylamine	C_6H_5NC	103 12
6856	**Phenyl ketone.**	See *Benzophenone.*		
6857	**Phenyl mercaptan.**	See *Phenol, thio-.*		
6858	**Phenyl mustard oil.**	See *Isothiocyanic acid, phenyl*	*ester.*	
	***p*-Phenylphenacyl este**	**rs.** See under the correspondin	g acids	
6859	**Phenyl sulfide**.	diphenyl sulfide; phenylthiobenzene*, benzene sulfide	$(C_6H_5)_2S$. .	186 26
6859M	**Phenylsulfonamide**	See *Benzenesulfonamide.*		
6860	**Phenyl sulfone**	diphenyl sulfone; phenylsulfonylbenzene*; benzene sulfone, sulfobenzide	$(C_6H_5)_2SO_2$	218 26
6861	**Phenzoline.**	See *Quinazoline, 3,4-dihydro-3-*	*phenyl-.*	
6862	**Phloretic acid** .	*p*-hydroxyhydrocinnamic acid; *α*, *β*-dihydro-*p*-coumaric acid	$HOC_6H_4CH_2CH_2$-COOH	166 17
6863	——, phloroglucinol monoest	er. See *Phloretin.*		
6864	**Phloretin**.	phloroglucinol monophloretate	$C_{15}H_{14}O_5$	274 26
6865	**Phlorizin** . . .	phloridzin ..	$C_{21}H_{24}O_{10}\ 2H_2O$	472 44
6866	**Phloroglucinol** ..	1,3,5-benzenetriol, *sym*-trihydroxybenzene	$C_6H_3(OH)_3$	126 11
6867	——, dimethyl ether.	See *Phenol, 3,5-dimethoxy-.*		
6867M	——, monomethyl ether.	See *Resorcinol, 5-methoxy-.*		
6868	——, monophloretate.	See *Phloretin.*		
6869	——, triethyl ether.	See *Benzene, 1,3,5-triethoxy-**		
6870	——, trimethyl ether	See *Benzene, 1,3,5-trimethoxy-**		
6871	——, trioxime.	See *1,3,5-Cyclohexanetrione, tr*	*ioxime.*	
6872	**Phloroglucinolcarboxy**	**lic acid.** See *Benzoic acid, 2,4*	*,6-trihydroxy-*	
6873	**Phlorol**.	*o*-ethylphenol	$C_2H_5C_6H_4OH$	122 16
6874	**Phlorone**	*p*-xyloquinone, 2,5-dimethylquinone	$(CH_3)_2C_6H_2O_2$	136 14
6874M	**——, 3,6-dibromo-**	. .	$(CH_3)_2C_6Br_2O_2$	293 96
6875	**Phorone**	diisopropylideneacetone; 2,6-dimethyl-2,5-heptadien-4-one*	$CO[CH{:}C(CH_3)_2]_2$	138 20
6876	**Phosgene**	carbonyl chloride; chloroformyl chloride	$COCl_2$.	98 92
6877	**——, phenylimino-.**	See *Aniline, N-(dichloromethyl*	*ene)-*	
6878	**——, thio-** . .	thiocarbonyl chloride	$CSCl_2$.	114 98
6879	**Phosphaniline.**	See *Phosphine, phenyl-*		
6880	**Phosphenyl chloride.**	See *Phosphine, dichlorophenyl-*		
6881	**Phosphine, dichlorophenyl-**	phosphenyl chloride	$C_6H_5PCl_2$	178.99
6882	**——, diethyl-***. .		$(C_2H_5)_2PH$	90 11
6883	**——, dimethyl-***		$(CH_3)_2PH$	62 06
6884	**——, ethyl-***	phosphinoethane	$C_2H_5PH_2$	62 06
6885	**——, ethyldiphenyl-**		$(C_6H_5)_2PC_2H_5$	214 24
6886	**——, methyl-***		CH_3PH_2	48 03
6887	**——, phenyl-** .	phosphaniline	$C_6H_5PH_2$	110 10
6888	**——, triethyl*-**. . .	. . . ..	$(C_2H_5)_3P$	118 16
6889	——, ——, oxide	.. .	$(C_2H_5)_3PO$	134.16
6890	——, ——, sulfide	. ..	$(C_2H_5)_3PS$.	150.22
6891	**——, trimethyl-*** . .	..	$(CH_3)_3P$	76.08

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
6853M							
6854							
6855	col.-grnsh. liq.	0.9775^{15}		166 d.	d	d.	s. eth.
6856							
6857							
6858							
6859	col liq, $1\ 635^{18}$	$1\ 1185\frac{15}{15}$	<-40	296	i.	s.	∞ eth., CS_2, bz.
6859M							
6860	monocl. pr. f. bz., pl f. al., need f w.	$1\ 252\frac{20}{4}$	125	377 8; 232^{18}	i. c, sl s. h.	s. h.	s. eth., bz.
6861							
6862	monocl. f. eth		129		s. h	s.	s. eth.
6863							
6864	sm leaf		255 d		sl. s. h.	∞	0 81 eth.; ∞ ac. a.
6865	silky need	$1\ 4298^{19}$	$2H_2O$ 108–9, anh 170d		0 1 c., v. s. h	25	v sl. s. eth.; i. chl.
6866	rhomb		anh 219	subl d.	$1\ 13^{25}$	v. s.	v. s. eth.
6867							
6867M							
6868							
6869							
6870							
6871							
6872							
6873	col liq	$1\ 0374^{12}$	<-18	207 5	sl s.	v s.	v s eth; s. bz.
6874	yel. tricl f al	.....	125	subl.	sl s. h.	s	s eth., bz., chl.
6874M	yel. sc		185–86	...	i	s.	s. eth.
6875	yel. cr., 1.49982	0 885	28	198 5	sl s (i)	s	s. eth.
6876	pois gas	$1\ 392\frac{19}{4}$	-118 (-104)	8 3	d	d	v. s. eth.; s. bz., ac. a., tol.
6877							
6878	red liq., 1.5442	$1\ 5085^{15}$		73 5	d	d	s. eth.
6879							
6880							
6881	fum. liq., 1.6053^{7}	1 319		224 6	d.		∞ bz., CS_2
6882	col. liq. ..	<1		85	i	s.	∞ eth.
6883	col. liq., ign	<1		25	i	s.	s. eth.
6884	col. liq. ..	<1		25	d		....
6885	liq	...		293		s	s bz.
6886	col. gas			-14	sl s	sl s	v s eth.
6887	liq	$1\ 001^{15}$		160			. ....
6888	col. liq., 1.446	$0\ 801\frac{20}{4}$	.	128	i.	s.	s eth.
6889	col. deliq. need.	.	52 9	242 9	s h	s.	s. eth.; i. KOH
6890	hex. pr., 1.590, 1 650		94	subl.; ign. 70	s. h.	s.	s. eth.
6891	col liq	<1		42	i		s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6892	**Phosphine, triphenyl-**	. . . .	$(C_6H_5)_3P$.	262.28
6892M	——, ——, oxide	. . . .	$(C_6H_5)_3PO$..	278 28
6893	**Phosphinic acid, dimethyl-**	. . .	$(CH_3)_2POOH$..	94 06
6894	**——, methyl-.**	See *Methanephosphonic acid*		
6895	**Phosphoric acid, diethyl-.**	See *Diethylphosphoric acid*.		
6896	**Phosphorobenzene** .	phosphobenzene .	$C_6H_5P{:}PC_6H_5$.	216 16
6896M	**Photoanethole.**	See *Stilbene*, 4,4′-*dimethoxy-*.		
6897	**Photol.**	See *Phenol, p-methylamino-, sulfate.*		
6898	**Phthalaldehyde**......	1,2-benzenedicarbonal*; *o*-phthalic aldehyde	$C_6H_4(CHO)_2$	134 13
6899	**Phthalaldehydic acid** .	*o*-formylbenzoic acid....	$CHOC_6H_4COOH$	150 13
6900	**——, 5,6-dimethoxy-.**	See *Opianic acid.*		
6901	**Phthalamide** .	phthalic diamide	$C_6H_4(CONH_2)_2$	164 16
6902	**Phthalandione.**	See *Phthalic anhydride.*		
6903	**Phthalanil** . .	*N*-phenylphthalimide	$C_6H_4(CO)_2NC_6H_5$	223 22
6904	**1,4-Phthalazinedione, 5-amino-2,3-dihydro-.**	See *Luminol.*		
6905	**Phthalhydrazide, 3-amino-.**	See *Luminol.*		
6906	**Phthalic acid**........	1,2-benzenedicarboxylic acid*, *o*-phthalic acid	$C_6H_4(COOH)_2$	166 13
6907	——, dibenzyl ester. .	.. .. .	$C_6H_4(COOCH_2\text{-}C_6H_5)_2$	346 37
6908	——, dibutyl ester ..	dibutyl 1,2-benzenedicarboxylate*, butyl phthalate	$C_6H_4(COOC_4H_9)_2$	278 34
6909	——, diethyl ester..	.	$C_6H_4(COOC_2H_5)_2$	222 23
6910	——, dimethyl ester	dimethyl 1,2-benzenedicarboxylate*; methyl phthalate	$C_6H_4(COOCH_3)_2$	194 18
6911	——, diphenyl ester .	phenyl phthalate	$C_6H_4(COOC_6H_5)_2$	318 31
6912	——, monoethyl ester	ethyl hydrogen 1,2-benzenedicarboxylate*	$C_6H_4(COOC_2H_5)\text{-}COOH$	194 18
6913	**——, 3-benzoyl-** .	2,3-benzophenonedicarboxylic acid	$C_6H_5COC_6H_3\text{-}(COOH)_2$	270 23
6914	**——, 4-benzoyl-**	3,4-benzophenonedicarboxylic acid	$C_6H_5COC_6H_3\text{-}(COOH)_2$	270 23
6915	**——, 3-bromo-**..... .	3-bromo-1,2-benzenedicarboxylic acid*	$BrC_6H_3(COOH)_2$	245 04
6916	**——, 4-chloro-**..	4-chloro-1,2-benzenedicarboxylic acid*	$ClC_6H_3(COOH)_2$	200 58
6917	**——, 1,6-dihydro-**	2,4-cyclohexadiene-1,2-dicarboxylic acid*	$C_6H_6(COOH)_2$	168 14
6918	**——, 3,6-dihydro-** . .	1,4-cyclohexadiene-1,2-dicarboxylic acid*	$C_6H_6(COOH)_2$.	168.14
6919	**——, 4,5-dihydro-** ...	2,6-cyclohexadiene-1,2-dicarboxylic acid*	$C_6H_6(COOH)_2$.	168 14
6920	**——, 3,4-dimethoxy-.**	See *Hemipic acid.*		
6921	**——, hexahydro-.**	See 1,2-*Cyclohexanedicarboxylic acid.*		
6922	**——, 3-hydroxy-** . .	....	$HOC_6H_3(COOH)_2$	182 13
6923	**——, 4-hydroxy-**	.. ....	$HOC_6H_3(COOH)_2$	182 13
6924	**——, 3-nitro-**. . . .	... .. .	$NO_2C_6H_3(COOH)_2$	211 13
6925	**——, 4-nitro-**.........	. .... .	$NO_2C_6H_3(COOH)_2$	211.13

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
6892	monocl pr f eth.	1 194	79	>360	i	s	v s eth.; s. HCl, bz
6892M	wh cr	1 2124$^{22\ 6}$	156 (153)	>360	sl s h	v s	v s. bz.; sl s. eth., lgr.
6893	cr		76	subl	s	s	s eth.
6894							
6895							
6896	pa yel powd		149		i	i	i. eth.; v. s. h. bz
6896M							
6897							
6898	yel need		56		0 62^{25}, 1 63^{50}	s	s. eth.
6899	monocl f w	1 404	97 (98-9)	d	9 48^{46}	v s	v. s. eth
6900							
6901	col rhbdr		220		i	i	i. eth.
6902							
6903	col need f al		207	subl	i	i	∞ chl.
6904							
6905							
6906	col rhomb or monocl f w	1 593	206-8 d	d >191	0 54^{14}, 18^{99}	11 7^{18}	0 69^{15} eth, i. chl
6907			42-4	277^{15}	i	v s.	v. s. eth
6908	col oily liq.	1 0465		340	0 04^{25}	∞	∞ eth., acet., bz.
6909	col. liq, 1.5019	1 123$\frac{25}{4}$		296 1	i	∞	∞ eth.; s bz.
6910	col liq., 1 51546$^{20.8}$	1 189$\frac{25}{25}$		282	0 5		.
6911	col rhomb		69-70 (73-5)		i	sl s	sl s eth.
6912	liq		2	d	sl s	s	s eth
6913	pl or need. (+1H_2O) f w		-H_2O 100, 145-50 → anh		s h	s	v sl s bz
6914	cr		189		s	s.	.
6915	need f. w		-H_2O, 178 5, anh 188		s	s	s eth ; i. chl.
6916	need. f. al		150	-H_2O, >150	s.	s.	s. eth.
6917	monocl. pr. f w. or al		179-80		0.2^{10}, 2^{100}	s.	sl. s. eth.
6918	monocl. pr. f. w.		153		1 7^{6}		. . .
6919	tricl. ..		215		0 3^{25}	s.	s. acet.
6920							
6921							
6922	pr. f. w....		244		0.14^{24}, 2 5^{100}	v. s.	v. s. eth.
6923	col. rosettes f w.	•	181 d		3^{10}	v. s.	s. eth.
6924	yel. monocl. f eth.		220 (206)		2 05^{25}	v s.	v. s. eth.
6925	lt yel. need		164 (161)		s	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
6926	**Phthalic acid, tetrachloro-**		$C_6Cl_4(COOH)_2$	303 92
6927	**——, Δ¹-tetrahydro-.**	See 1-*Cyclohexene-1, 2-dicarboxylic acid.*		
6928	***m*-Phthalic acid.**	See *Isophthalic acid.*		
6929	***p*-Phthalic acid.**	See *Terephthalic acid.*		
6930	**Phthalic aldehyde.**	See *Phthalaldehyde.*		
6931	***m*-Phthalic aldehyde.**	See *Isophthalaldehyde*		
6932	***p*-Phthalic aldehyde.**	See *Terephthalaldehyde.*		
6933	**Phthalic anhydride**	phthalandione	$C_6H_4(CO)_2O$	148 11
6934	**Phthalic diamide.**	See *Phthalamide.*		
6935	**Phthalic imide.**	See *Phthalimide.*		
6936	**Phthalide**	1(3)-isobenzofuranone; α-hydroxy-*o*-toluic acid lactone	$C_6H_4COOCH_2$	134 13
6937	**——, benzal-.**	See *Phthalide, benzylidene-.*		
6938	**——, benzylidene-**	benzalphthalide	$C_6H_4COOC{:}CH\text{-}C_6H_5$	222 23
6939	**——, 2,2-bis(*p*-hydroxyphenyl)-**	See *Phenolphthalein.*		
6940	**——, 5,6-dimethoxy-.**	See *Meconin.*		
6941	**——, 3,3-diphenyl-**	triphenylcarbinol *o*-carboxylic anhydride, "phthalophenone"	$C_6H_4COOC(C_6H_5)_2$	286 31
6942	**——, 6-nitro-**	...	$NO_2C_6H_3COOCH_2$	179 13
6943	**Phthalimide**	1,3-isoindoledione; *o*-phthalic imide	$C_6H_4(CO)_2NH$	147 13
6944	**——, *N*-isobutyl.**	2-isobutyl-1,3-isoindoledione	$C_6H_4CON(C_4H_9)CO$	203 23
6945	**——, *N*-phenyl-.**	See *Phthalanil.*		
6946	**Phthalimidine**	1-isoindolinone	$C_6H_4CONHCH_2$.	133 14
6947	**Phthalonic acid**	*o*-carboxyphenylglyoxylic acid	$C_6H_4(COCOOH)\text{-}COOH$	194 14
6948	**Phthalophenone.**	See *Phthalide, 3,3-diphenyl-.*		
6949	**Phthalyl alcohol.**	See *o-Xylylene glycol.*		
6950	**Phthalyl chloride**	1,2-benzenedicarbonyl chloride*; *o*-phthalyl dichloride	$C_6H_4(COCl)_2$.	203 03
6951	***m*-Phthalyl dichloride.**	See *Isophthalyl chloride.*		
6952	***p*-Phthalyl dichloride.**	See *Terephthalyl chloride.*		
6952M	**Phthiocol**	2-hydroxy-3-methyl-1,4-naphthoquinone, vitamin K (one form)	$C_{11}H_8O_3$	188 17
6953	**Phycitol.**	See *i-Erythritol.*		
6954	**Physostigmine**	eserine ...	$C_{15}H_{21}N_3O_2$	275 34
6955	——, hydrochloride	.....	$C_{15}H_{21}N_3O_2\ HCl$	311 81
6956	——, salicylate.	....	$C_{15}H_{21}N_3O_2 \cdot C_7H_6O_3$	413 46
6957	——, sulfate	.	$(C_{15}H_{21}N_3O_2)_2 \cdot H_2SO_4$	648 76
6957M	**Phytadiene**	....	$C_{20}H_{38}$...	278 51
6958	**Phytol**	3,7,11,15-tetramethyl-2-hexadecen-1-ol*	$C_{20}H_{39}OH$.	296 52
6959	**Piazine.**	See *Pyrazine.*		
6960	**Picene**	dibenzo[*a,i*]phenanthrene	$C_{22}H_{14}$	278 33
6961	**2-Picoline**	2-methylpyridine; α-picoline	$CH_3C_5H_4N$	93 12

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6926	leaf or need. f w.	.	250 d		0 57^{14}, 3^{99}	v s.	v. s. eth., acet.; v. sl. s. chl.
6927							
6928							
6929							
6930							
6931							
6932							
6933	col. rhomb. need	1 527^{4}	130 8	284 5 subl	v sl. s	s	sl. s. eth.
6934							
6935							
6936	need f w, $1.53560^{99.1}$		73	290	v sl s	v. s	. . .
6937							
6938	col monocl pr. f. al.		108 (99)		i.	s h	. .
6939							
6940							
6941	leaf f al .		115	419–28 sl d.	d h	s	s H_2SO_4
6942	need f al		141		i c.	s.	s eth.; v. s. h. chl.; i. alk. carb.
6943	hex pr f eth		238 (234)	subl.	0 06^{25}	s.	sl s. eth.; s. caustic alk., ac. a ; v. sl. s. bz., chl.
6944			93	293–5			
6945							. .
6946	need .	.	150	337^{730}	s	v s	v. s eth., chl.
6947	pr f bz or al		138–40		115^{15}	s	s eth , sl. s. chl.
6948							
6949							
6950	col oily liq., 1 $57099^{15.5}$	1 408	(*sym*) 16; (*uns*) 89	281 275	d	d	s eth.
6951							. .
6952							
6952M	yel pr		173				. . . .
6953							
6954	col hyg trim f. bz., β 1 602		unst. 86–7, stab. 105–6		sl s	v. s	s. eth., bz., chl.
6955	wh cr				s		. . . .
6956	col -yel. acicular cr.		178 9		1 33	7 71	0 57 eth.; s. chl
6957	micro-cr. powd		140		v. s	v s.	0 083 eth.; s. chl.
6957M	liq . .	0 $826\frac{0}{4}$		$185–8^{22}$			∞ me. al., ac. a., pet. eth.
6958	col. oil, 1 46380	0 $864\frac{0}{4}$; 0 $852\frac{20}{4}$		$145^{.03–.04}$; $203–4^{9–10}$	i.	∞	∞ eth., me. al.
6959							
6960	col leaf. . .		364	520	i.	v. sl s.	v sl s. eth ; sl. s. chl., h. bz.
6961	col liq., $1.50293^{16.7}$	0 $950\frac{15}{4}$	-69 9	128	v. s	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
6962	**3-Picoline**	3-methylpyridine, β-picoline	$CH_3C_5H_4N$.	93 12
6963	**4-Picoline** .	4-methylpyridine, γ-picoline	$CH_3C_5H_4N$. .	93.12
6964	**2-Picoline-4,6-dicarboxylic acid.** See *Uvitonic acid.*			
6965	**Picolinic acid**	2-pyridinecarboxylic acid*. .	C_5H_4NCOOH.	123.11
6966	**Picraconitine.**	See *Benzaconine.*		
6967	**Picramic acid**.	2-amino-4,6-dinitrophenol*.	$NH_2(NO_2)_2C_6H_2$-OH	199.12
6968	**Picramide.**	See *Aniline, 2,4,6-trinitro-.*		
6969	**Picric acid**.	2,4,6-trinitrophenol. . . .	$(NO_2)_3C_6H_2OH$. .	229.11
6970	——, methyl ether.	See *Anisole, 2,4,6-trinitro-.*		
6971	**Picryl chloride**. . .	2-chloro-1,3,5-trinitrobenzene*	$(NO_2)_3C_6H_2Cl$.	247 56
6972	**Pictol.**	See *Phenol, p-methylamino-, sulfate.*		
6973	**Pilocarpidine**(*d*). .	. . . .	$C_{10}H_{14}N_2O_2$	194 23
6974	——, chloroplatinate	.	$(C_{10}H_{14}N_2O_2 HCl)_2PtCl_4 4H_2O$	870.51
6975	——, nitrate. . .		$C_{10}H_{14}N_2O_2 HNO_3$	257 25
6976	**Pilocarpine**.		$C_{11}H_{16}N_2O_2$.	208.26
6977	——, hydrochloride	. .	$C_{11}H_{16}N_2O_2 HCl$	244 72
6978	——, nitrate	. . . .	$C_{11}H_{16}N_2O_2 HNO_3$	271 27
6979	——, salicylate	. . .	$C_{11}H_{16}N_2O_2 \cdot C_7H_6O_3$	346 37
6980	——, sulfate	. . . .	$(C_{11}H_{16}N_2O_2)_2 \cdot H_2SO_4$	514.59
6981	***d*-Pimaric acid.** .		$C_{20}H_{30}O_2$	302 44
6982	**Pimelic acid** . .	heptanedioic acid*	$COOH(CH_2)_5$-COOH	160 17
6983	——, diethyl ester	ethyl pimelate	$CH_2(CH_2CH_2$-$COOC_2H_5)_2$	216 27
6984	——, **γ-keto-.**	See *Acetonediacetic acid.*		
6985	**Pimelic ketone.**	See *Cyclohexanone**		
6986	**Pinacol**.	2,3-dimethyl-2,3-butanediol*, tetramethylethylene glycol; pinacone	$(CH_3)_2C(OH)$-$COH(CH_3)_2$	118.17
6987	**Pinacolin**.	3,3-dimethyl-2-butanone*; *tert*-butyl methyl ketone	$CH_3COC(CH_3)_3$	100 16
6988	**Pinacolyl alcohol** . .	3,3-dimethyl-2-butanol*, methyl-*tert*-butylcarbinol	$(CH_3)_3CCHOH$-CH_3	102.17
6989	**Pinacone.**	See *Pinacol.*		
6990	**Pinene,** hydrochloride.	See *Bornyl chloride.*		
6991	***dl*-Pinene**.	*dl*-2,6,6-trimethylbicyclo-[3,1,1] hept-2-ene; *dl*-α-pinene	$C_{10}H_{16}$. .	136.23

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6962	col liq, 1 50432$^{24.0}$	0 9613$\frac{15}{4}$		143 5	∞	∞	∞ eth.
6963	col liq	0 9571$\frac{15}{4}$	.	143 1	∞	∞	∞ eth.
6964							
6965	need. f. w		137	subl.	v s.	5 44^{25}	v. sl. s. eth., bz., chl.
6966							
6967	red monocl f chl., 1.54, >1.95, 1 505		168–9	.	0 14^{22}	s	sl. s. eth.; s. bz, glac. ac. a., aniline
6968							
6969	yel rhomb. leaf. f. w.	1 763	121 8	exp >300	1 4^{20}, 6 8^{100}	4 91^{20}	1 43 c eth; s. bz.
6970							
6971	yel monocl. pr f. eth.	1 797	83	d	0 018^{15}	4 48^{17}	7 23^{17} eth.
6972							
6973	viscid oil, $[\alpha]+81.3°_D$		.		s	v s.	sl. s. eth.
6974	or yel leaf or dk. red pyr		88–9; anh. 187 d			i.	... ..
6975	wh. cr ...		137		50	s	.
6976	col oil or need, $[\alpha]+106°^{18}_D$ in w		34		v s.	v s	sl. s. eth.; v s. chl.; v. sl. s. bz; i. pet. eth.
6977	deliq pr or need, $[\alpha]+91\ 74°_D$		anh 196 7		333	37^{25}	i. eth; sl. s. chl.
6978	pr f al. or w, $[\alpha]+82.9°_D$		176–8 (173)		16^{20}	6 2^{60}	i. eth, chl.
6979	wh cr., $[\alpha]+62.5°_D$		120		s	s	......
6980	wh. cr f al. +eth., $[\alpha]+84\ 72°_D$		132 (120)	.	s	s	.....
6981	cr		212	282^{20}	i	s.	s eth
6982	monocl pr. f w	1 329^{15}	103	272^{100} subl.	2 52^{18}, 5^{20}	v s	v. s. eth.
6983	col liq	0 999$\frac{15}{15}$		252–5^{748}	i	s	s. eth.
6984							
6985							
6986	col need ..	0.9672^{15}	38 (41–3)	172 8	s c, v s h	v s	v. s. eth.; sl. s. CS_2
6987	col liq	0 811; 0 8208$\frac{0}{4}$	–52 5	106 2	2 51^{15}	s	s. eth.; v. s. acet.
6988	liq or silky need.	0 812^{25}	5 5	121–3	v sl s	s	∞ eth.
6989							
6990							
6991	col. liq, 1.4658	0.8582$\frac{20}{4}$	–55 (–50)	154 (158–61)	v sl s.	∞	∞ eth., chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
6992	**Pinole(*dl*)**	6,8-epoxy-1-*p*-menthene; 4,7,7-trimethyl-6-oxabicyclo-[3,2,1]oct-3-ene, *dl*-sobrerone	$C_{10}H_{16}O$	152 23
6993	——, hydrate	*i*-1-*p*-menthene-6,8-diol	$C_{10}H_{16}(OH)_2$	170 25
6994	**2-Pipecoline**	2-methylpiperidine; α-pipecoline	$CH_3C_5H_9NH$	99 17
6995	**3-Pipecoline**	3-methylpiperidine, β-pipecoline	$CH_3C_5H_9NH$	99 17
6996	**4-Pipecoline**	4-methylpiperidine; γ-pipecoline	$CH_3C_5H_9NH$	99 17
6997	**Piperazine**	hexahydropyrazine; diethylenediamine	$NHCH_2CH_2$-$NHCH_2CH_2$	86 14
6998	——, dihydrobromide		$C_4H_{10}N_2\,2HBr$	247 99
6999	——, dihydrochloride		$C_4H_{10}N_2\,2HCl$	159 07
7000	——, hexahydrate		$C_4H_{10}N_2\,6H_2O$	194 23
7001	——, salts of organic acids. See under the acids.			
7002	**——, 1,4-bis(hydrocinnamyl)-**		$(C_6H_5CH_2CH_2CO)_2C_4H_8N_2$	350 45
7003	**——, α,γ-diaci-.**	See *Glycine anhydride.*		
7004	**——1,4-dianisoyl-**		$(CH_3OC_6H_4CO)_2C_4H_8N_2$	354 39
7005	**——, 2,5-dimethyl-(*trans*)**		$(CH_3)_2C_4H_8N_2$	114 19
7006	**——, 1,4-dinitroso-**		$C_4H_8N_2(NO)_2$.	144 14
7007	**——, 1,4-di-α-toluyl-.**		$(C_6H_5CH_2CO)_2C_4H_8N_2$	322 39
7008	**——, 1-phenyl-**		$C_4H_9N_2C_6H_5$.	162 23
7009	**2,5-Piperazinedione.**	See *Glycine anhydride*		
7010	**Piperethylalkine.**	See *Piperidineethanol.*		
7011	**Piperic acid**	5-(3,4-methylenedioxyphenyl)-2,4-pentadienoic acid*, β-(3,4-methylenedioxystyryl)acrylic acid	$(CH_2O_2)C_6H_3CH\cdot CHCH{:}CHCOOH$	218 20
7012	**Piperidic acid.**	See *Butyric acid, γ-amino-.*		
7013	**Piperidine**	hexahydropyridine; pentamethylenimine	$(CH_2)_5NH$	85 15
7014	**——, 1-acetyl-**	acetic acid piperidide; *N*-acetylpiperidine	$CH_3CON(CH_2)_5$	127 18
7015	**——, 2-allyl-.**	See *β-Coniceine.*		
7015M	**——, 1-amyl-**	*N*-*n*-pentylpiperidine	$C_5H_{10}NC_5H_{11}$	155.28
7016	**——, 4-benzoxy-2,2,6-trimethyl-,** lactate. See *β-Eucaine, lactate*			
7017	**——, 1-benzoyl-**		$C_6H_5CONC_5H_{10}$	189 25
7017M	**——, 1-butyl-**		$C_5H_{10}NC_4H_9$	141 25
7018	**——, 1,2-dimethyl-**	*N*, α-dimethylpiperidine	$C_5H_9N(CH_3)_2$	113 20
7018M	**——, 1-dodecyl-**		$C_5H_{10}N(CH_2)_{11}CH_3$	253 46
7019	**——, ethoxyl-.**	See *Piperidineethanol.*		
7020	**——, 1-ethyl-**	*N*-ethylpiperidine	$C_2H_5NC_5H_{10}$	113 20
7021	**——, 2-ethyl-(*dl*)**	*dl*-α-ethylpiperidine	$NHCH(C_2H_5)$-$(CH_2)_4$	113 20
7022	**——, 3-ethyl-(*dl*)**	*dl*-β-ethylpiperidine	$NHCH_2CH$-$(C_2H_5)(CH_2)_3$	113.20
7023	**——, 1-formyl-**	*N*-formylpiperidine	$HCONC_5H_{10}$	113 16
7023H	**——, 1-heptyl-**		$C_5H_{10}N(CH_2)_6CH_3$	183.33

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6992	1.4715 .	0 9420$\frac{20}{4}$	.. ...	184		s.	s eth.
6993	col	...	150	270-1	3 3[15]	v s.	v. s. eth.
6994	liq., 1 44627[24.3]	0 844[24]	9	119	s.	..	i. dil. KOH
6995	liq., 1 43779[21.6]	0 845[24]		126	v. s.	.	. ....
6996	liq.	0 867[0]		129	s	...	. ..
6997	col. rhomb. f. al, 1 446[118]		104	145	s	v. v. s	.
6998	wh. need..		d.		v s.	i. c.	i. eth.
6999	wh. need ..	..	d.		v s.	i. c.	i. eth.
7000	wh. cr . .		44		v s.	s.	v. sl. s. eth.
7001							
7002	wh. cr.......	. .	122 5-3 0		i.	s. h.	sl. s. eth.
7003							
7004	wh. cr	.	192 5-3 5		i.	s h.	i. eth.
7005	monocl pr		(*cis*) 114 (*trans*) 118	162	v s.	v. s.	sl. s. eth.
7006	wh. pl .		157-8		s. h.	i. c.	i. eth.
7007	wh. cr .		150-1		v sl. s.	s. h.	sl. s. eth.
7008	pa. yel. oil.	1 0621$\frac{20}{4}$	..	156-7[10]	i.	∞	∞ eth.
7009							
7010							
7011	yel. need. f. al	...	217	220 d. subl.	v sl. s.	2 84 c.	s. eth.
7012							
7013	col liq, 1.4534[20]	0 8622[20]	-9 (-17)	106 3	∞	∞	∞ eth
7014	lt. liq	1 0111	107-9	227-8 (224)	∞	s.	...
7015							
7015M	1.4498[20]	0 8282[20]	.	198 2[160]			..
7016							
7017	col need		48 (29-33)	184[17]	i.	s.	s eth
7017M	1.4467[20]	0 8245[20]		175 8			.
7018	liq		.	127 9			.
7018M	1.4569[25]	0 8348[25]		139-40[2]			.
7019							
7020	liq, 1 4440[20].	0 8249[20]		130 8			.
7021		0 867[0]		143	5		
7022	liq	0 8658[0]		152 6 (155)	v. sl. s.		....
7023	wh.-yel. liq. .	1 0205$\frac{25}{4}$		218-22	∞	∞	∞ eth
7023H	1.4531[20]......	0 8316[20]		239 5			.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
7023R	**Piperidine, 1-hexyl-**	.	$C_5H_{10}N(CH_2)_5CH_3$	169 30
7024	**——, β-hydroxyethyl-.**	See *Piperidineethanol.*		
7025	**——, 1-methyl-.....**	...	$C_5H_{10}NCH_3$	99 17
7026	**——, 2-methyl-.**	See 2-*Pipecoline.*		
7027	**——, 3-methyl-.**	See 3-*Pipecoline.*		
7028	**——, 4-methyl-.**	See 4-*Pipecoline.*		
7028H	**——, 1-nonyl-.**	. . . .	$C_5H_{10}N(CH_2)_8CH_3$	211 38
7028M	**——, 1-octyl-.**		$C_5H_{10}N(CH_2)_7CH_3$	197 36
7028R	**——, *N-n*-pentyl-.**	See *Piperidine, 1-amyl-.*		
7029	**——, 1-piperyl-.**	See *Piperine*		
7030	**——, 1-propyl-......** .	*N-n*-propylpiperidine	$CH_3CH_2CH_2NC_5H_{10}$	127 23
7031	**——, 2-propyl-.**	See *Coniine.*		
7032	**——, 2-(3-pyridyl)-.**	See *Anabasine*		
7033	**1-Piperidinecarbodithioic acid,** piperidinium salt	piperidinium cyclopentamethylenedithiocarbamate	$C_5H_{10}NCSSNH_2C_5H_{10}$	246 42
7034	——, zinc salt.... .	...	$(C_5H_{10}NCSS)_2Zn$	385 92
7035	**Piperidineëthanol** . .	β-hydroxyethylpiperidine; ethoxylpiperidine; piperethylalkine	$C_5H_{10}NCH_2CH_2OH$	129 20
7036	**4-Piperidone, 2,2,6,6-te**	**tramethyl-.** See *Triacetona*	*mine*	
7037	**Piperine**...	1-piperylpiperidine..	$C_{17}H_{19}NO_3$ . . .	285 33
7038	——, hydriodide diiodide	... .	$(C_{17}H_{19}NO_3)_2$ HI I_2	952 43
7039	**Piperolidine** ...	octahydropyrrocoline; δ-coniceine	$C_8H_{15}N$.	125 21
7040	**Piperonal**	3,4-methylenedioxybenzaldehyde; protocatechualdehyde methylene ether; heliotropin	$CH_2(O_2)C_6H_3CHO$	150 13
7041	**Piperonyl alcohol.** .	3,4-methylenedioxybenzyl alcohol	$CH_2(O_2)C_6H_3CH_2OH$	152 14
7042	**Piperonylic acid** ..	3,4-methylenedioxybenzoic acid; protocatechuic acid methylene ether	$CH_2(O_2)C_6H_3COOH$	166 13
7043	**Piperylene.**	See 1,3-*Pentadiene**.		
7044	**Pivalaldehyde**	2,2-dimethylpropanal*; trimethylacetaldehyde	$(CH_3)_3CCHO$	86 13
7045	——, oxime .	trimethylacetaldoxime	$(CH_3)_3CCH{:}NOH$	101 15
7046	**Pivalic acid**...	2,2-dimethylpropanoic acid*, α,α-dimethylpropionic acid; trimethylacetic acid	$(CH_3)_3CCOOH$	102 13
7047	——, methyl ester	methyl pivalate	$(CH_3)_3CCOOCH_3$	116 16
7048	**Plumbane, tetramethy**	**l-.** See *Lead, tetramethyl-*.*		
7049	**——, tetraphenyl-.**	See *Lead, tetraphenyl-*.*		
7050	**Polyoxymethylene.** ..	trioxymethylene, paraformaldehyde; metaformaldehyde See also *sym-Trioxane.*	$(CH_2O)_x$.... .	$(30.03)_x$
7051	**Populin**.........	benzoylsalicin .	$C_{20}H_{22}O_8{\cdot}2H_2O$.	426 41
7052	——, (anhydrous synthetic)	benzoylsalicin	$C_{20}H_{22}O_8$.	390 38
7052M	**P. P. factor.**	See *Nicotinamide; Nicotinic ac*	*id.*	
7053	**Prehnitene**..........	1,2,3,4-tetramethylbenzene; prehnitole	$(CH_3)_4C_6H_2$.	134 21

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
7023R	1.4517^{20}.	0 830^{20}	..	219 2	....		.. . .
7024							
7025	liq., 1.4378^{20}...	0 8207^{20}	. . .	105 9	14.8^{49}; 5 5^{77}	∞	∞ eth.
7026							
7027							
7028							
7028H	1.4538^{25}...	0 8313^{25}	....	135.7^{11}	.		. ...
7028M	.. . .	0 834^{20}	.	142^{25}			. . . .
7028R							
7029							
7030	col liq, 1.4446^{20}	0 8231^{20}		152 1	$2.774^{0.5}$; 0 606^{32}	v s.	v s eth.
7031							
7032							
7033	pa. yel. pl.		171–2		v. s.	v s	v. sl s. eth.
7034	wh. powd..		223–5		i	i.	i. eth ; sl s. chl.
7035	liq.........	.		199	s	s.	. . ..
7036							
7037	col monocl. need f al	1 193	128–9 5		v sl s. c.	6 7, 23^{60}	2 8 eth ; s. chl.
7038	steel bl. need	....	145		s.		v. s. chl.
7039	liq	0 $904\frac{15}{4}$		(*dl*) 161; (*l*) 158	.		....
7040	wh-yel cr. f w.	.	37	263	0 2 c, ∞ ^{78}	s. c, ∞ h	∞ eth.
7041	cr		51	d	sl s.	∞	∞ eth.
7042	need. f w. or al.		228	subl.	sl. s. h	s h.	sl. s. eth.; s. alk.
7043							
7044	liq . .	0 793^{17}	3	75		s.	s eth.
7045	cr	....	41	65^{20}		s	..
7046	col need, $1.3931^{36.5}$	0 905^{50}	35.5	163 8	2 2	v. s.	v. s. eth.
7047	col liq . .	1 044^{0}	.	102	sl. s.	∞	∞ eth.
7048							
7049							
7050	wh need.. .	...	64 (60)	subl.	17.2^{18}, 21 1^{25}	s.	s. eth.
7051	col. need .		anh. 180	. .	0 04^{15}, 2.4^{100}	s.	s. eth., dil. a., alk.
7052	pr....		178–9	... ..	–....	......	.. . .
7052M							
7053	col., $1.52031^{16.0}$	0 $901\frac{20}{4}$, 1 $801\frac{20}{4}$	–4	204	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
7054	**Prehnitic acid** .	1,2,3,5-benzenetetracarboxylic acid*	$C_6H_2(COOH)_4$	254.15
7055	**Prehnitylic acid**	2,3,4-trimethylbenzoic acid	$(CH_3)_3C_6H_2COOH$	164.20
7056	**Procaine,** hydrochloride	β-diethylaminoethyl *p*-aminobenzoate hydrochloride, novocain, ethocain	$NH_2C_6H_4COOC_2H_4N(C_2H_5)_2 \cdot HCl$	272.77
7057	**Proline, hydroxy-**(*l*)		$C_4H_7N(OH)COOH$	131.13
7058	**——, 4-hydroxy-**(*d*)	4-hydroxy-2-pyrrolidinecarboxylic acid	$C_4H_7N(OH)COOH$	131.13
7059	***dl*-Proline**	*dl*-2-pyrrolidinecarboxylic acid	$C_4H_8N \cdot COOH$	115.13
7060	***d*-Proline**	*d*-2-pyrrolidinecarboxylic acid	C_4H_8NCOOH	115.13
7061	***l*-Proline**	*l*-2-pyrrolidinecarboxylic acid	$C_4H_8N \cdot COOH$	115.13
7061M	**Prontosil album.**	See *Sulfanilamide*		
7062	**Propadiene**†	allene, dimethylenemethane	$CH_2:C:CH_2$	40.06
7063	**——, dioxo-.**	See *Carbon suboxide*		
7064	**——, tetraphenyl-**	tetraphenylallene	$(C_6H_5)_2C:C:C(C_6H_5)_2$	344.43
7065	**Propanal**†**.**	See *Propionaldehyde*		
7066	**——, 2,2-dimethyl-**†**.**	See *Pivaldehyde*		
7067	**——, 2-methyl-**†**.**	See *Isobutyraldehyde*		
7068	**——, 2-oxo-***, 1-oxime	See *Pyruvaldehyde, aldoxime*		
7069	**——, 3-phenyl-.**	See *Hydrocinnamaldehyde*		
7070	**Propanamide*.**	See *Propionamide.*		
7071	**——, 2-hydroxy-*.**	See *Lactamide*		
7072	**——, 2-methyl-*.**	See *Isobutyramide*		
7073	**Propane**†	dimethylmethane	$CH_3CH_2CH_3$	44.09
7074	**——, 1-amino-2,2-dimethyl-.**	See *Propylamine, β β-dimethyl-**.		
7075	**——, 1-amino-2-methyl-.**	See *Isobutylamine*		
7076	**——, 2,2-bis(ethylsulfonyl)-***	acetone diethylsulfone, sulfonmethane, sulfonal	$(CH_3)_2C(SO_2C_2H_5)_2$	228.32
7077	**——, 1-bromo-**†**.**	See *Propyl bromide*		
7078	**——, 2-bromo-**†**.**	See *Isopropyl bromide*		
7079	**——, 1-bromo-2-chloro-**†		$CH_3CHClCH_2Br$	157.45
7080	**——, 2-bromo-1-chloro-***		$CH_3CHBrCH_2Cl$	157.45
7081	**——, 1-bromo-2,2-dimethyl-***	*tert*-butylmethyl bromide	$(CH_3)_3CCH_2Br$	151.06
7082	**——, 1-bromo-2-methyl-*.**	See *Isobutyl bromide*		
7083	**——, 2-bromo-2-methyl-*.**	See *tert-Butyl bromide*		
7084	**——, 1-chloro-**†**.**	See *Propyl chloride*		
7085	**——, 2-chloro-*.**	See *Isopropyl chloride*		
7086	**——, 1-chloro-2-(β-chloroisopropoxy)-**†**.**	See *Ether, bis-β-chloroisopropyl*		
7087	**——, 1-chloro-2,2,-dimethyl-***		$(CH_3)_3CCH_2Cl$	106.60
7088	**——, 1-chloro-2,3-epoxy-*.**	See *Epichlorohydrin*		
7089	**——, 1-chloro-2-methyl-*.**	See *Isobutyl chloride*		
7090	**——, 2-chloro-2-methyl-*.**	See *tert-Butyl chloride*		
7091	**——, 1,1-dibromo-***	propylidene bromide	$CH_3CH_2CHBr_2$	201.91
7092	**——, 1,2-dibromo-***	propylene bromide, propylene dibromide	$CH_2BrCHBrCH_3$	201.91

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7054	pr. (+$2H_2O$) f. w	.	237 d.	d	s.		s eth
7055	pr f. al		167 5		s.	s	s eth.
7056	col. need. f. al	$0\ 707^{17}$	156	..	$0\ 6^{25}$	30^{25}	v. sl s. eth.; sl. s chl
7057	rhomb. pl. or fine need	.	274; (238–41) d		25^{0}	v. sl. s.	i eth
7058	.		(a) 274; (b) 238–41 d	.			
7059			205 d.		s.	s	i eth; sl. s. chl, acet, bz.
7060	pr .	.	215–20 d.				..
7061	flat need f. al., pr f. w.	...	220–2 d.	. ...	v s.	$1\ 55^{19}$	i eth, butyl al, propyl al.
7061M							
7062	gas	1 787 g/1	–146	–32			
7063							
7064	need. or pr. f. dil al. or acet	. ..	166	. .	i.	sl s c	s. eth.
7065							
7066							
7067							
7068							
7069							
7070							
7071							
7072							
7073	col. gas ...	liq. $0\ 5853\frac{-44\ 5}{4}$, $2\ 014^{0}$ g/1	–189 9; frz –187 1	–42 17	$6\ 5^{18}$ cm^3	790^{17} cm^3	026^{17} cm^3 eth.
7074							
7075							
7076	col monocl. pr f al.	$1\ 260\frac{25}{4}$	128	300 d.	2^{15}, $6\ 7^{100}$	1 2 c, 39 h.	0 54 c. eth.
7077							
7078							
7079	liq., 1.47449	$1\ 531\frac{20}{4}$		118 0			.
7080	liq, 1.47763	$1\ 537\frac{20}{4}$		$117\ 0^{756}$		.	.
7081	col. liq.	$1\ 2604\frac{20}{0}$		$89–91^{749}$	i	s	s eth
7082							
7083							
7084							
7085							
7086							
7087	....		..	84 4			.
7088							
7089							
7090							
7091	liq ..	. . . . .	....	*ca.* 130			. ...
7092	col liq, 1.5203	$1\ 9333\frac{20}{4}$	–55 5	141.6 (140)	0.25^{20}	s.	v. s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
7093	**Propane, 1,3-dibromo-***	trimethylene bromide; trimethylene dibromide	$BrCH_2CH_2CH_2Br$	201.91
7094	**——, 2,2-dibromo-***	bromacetol	$CH_3CBr_2CH_3$	201.91
7095	**——, 1,2-dibromo-2-methyl-***	isobutylene bromide	$(CH_3)_2CBrCH_2Br$	215.94
7096	**——, 1,1-dichloro-***	propylidene chloride	$CH_3CH_2CHCl_2$	112.99
7097	**——, 1,2-dichloro-***	propylene chloride; propylene dichloride	$CH_2ClCHClCH_3$	112.99
7098	**——, 1,3-dichloro-***	trimethylene chloride; trimethylene dichloride	$ClCH_2CH_2CH_2Cl$	112.99
7099	**——, 2,2-dichloro-***	acetone dichloride; isopropylidene chloride	$CH_3CCl_2CH_3$	112.99
7099M	**——, 2,2-difluoro-***	isopropylidene fluoride; acetone fluoride; fluoroacetol, difluorodimethylmethane	$CH_3CF_2CH_3$	80.08
7100	**——, 1,2-diiodo-***	propylene diiodide; propylene iodide	CH_3CHICH_2I	295.92
7101	**——, 2,2-dimethyl-***	tetramethylmethane; neopentane	$(CH_3)_4C$	72.15
7102	**——, 1,3-diphenoxy-***	trimethylene glycol diphenyl ether	$C_6H_5OCH_2CH_2CH_2OC_6H_5$	228.28
7103	**——, 1,2-epoxy-**	See *Propene oxide.*		
7104	**——, 1,2-epoxy-3-iodo-**	See *Epiiodohydrin.*		
7105	**——, 1,2-epoxy-2-methyl-**	See *Ethylene oxide, α, α-dimethyl-.*		
7106	**——, 1-ethoxy-***	See *Ether, ethyl propyl.*		
7107	**——, 2-ethoxy-***	See *Ether, ethyl isopropyl.*		
7108	**——, 1-ethoxy-2-methyl-***	See *Ether, ethyl isobutyl.*		
7109	**——, 2-ethoxy-2-methyl-***	See *Ether, tert-butyl ethyl.*		
7110	**——, 1-fluoro-***	See *Propyl fluoride.*		
7111	**——, 2-fluoro-***	See *Isopropyl fluoride.*		
7112	**——, 1-fluoro-2-methyl-***	See *Isobutyl fluoride.*		
7113	**——, 1-iodo-***	See *Propyl iodide*		
7114	**——, 2-iodo-***	See *Isopropyl iodide.*		
7115	**——, 1-iodo-2,2-dimethyl-***	*tert*-butylmethyl iodide	$(CH_3)_3CCH_2I$	198.06
7116	**——, 1-iodo-2-methyl-***	See *Isobutyl iodide.*		
7117	**——, 2-iodo-2-methyl-***	See *tert-Butyl iodide.*		
7118	**——, 2-(isopropylthio)-***	See *Isopropyl sulfide.*		
7119	**——, 2-isopropoxy-***	See *Isopropyl ether.*		
7120	**——, 1-methoxy-***	See *Ether, methyl propyl.*		
7121	**——, 2-methoxy-***	See *Ether, isopropyl methyl.*		
7122	**——, 1-methoxy-2-methyl-***	See *Ether, isobutyl methyl.*		
7123	**——, 2-methyl-***	See *Isobutane.*		
7124	**——, 1-methyl-1-(methylpropylthio)-***	See *sec-Butyl sulfide.*		
7125	**——, 2-methyl-1-(β-methylpropoxy)-***	See *Isobutyl ether.*		
7126	**——, 2-methyl-1-(β-methylpropylthio)-***	See *Isobutyl sulfide.*		
7127	**——, 2-methyl-1-nitro-***	nitroisobutane	$(CH_3)_2CHCH_2NO_2$	103.12
7128	**——, 2-methyl-1-phenoxy-**	See *Ether, isobutyl phenyl.*		
7129	**——, 2-methyl-1-phenyl-**	See *Benzene, isobutyl-.*		
7130	**——, 2-methyl-2-phenyl-**	See *Benzene, tert-butyl-.*		
7131	**——, 1-nitro-***		$CH_3CH_2CH_2NO_2$	89.09
7131F	**——, 2-nitro-***	*sec*-nitropropane	$(CH_3)_2CHNO_2$	89.09

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7093	col. liq., 1.523	$1.979\frac{20}{4}$; $1.987\frac{17}{4}$	-34.4	167	0.168^{30}	s.	s. eth.
7094	.. ....	1.7825^{20}		$114\text{-}5^{740}$	.. ...	...	.
7095	liq., 1.509	1.759	-70.3	149.0	. ...	.	.
7096	liq., 1.4467	1.143^{10}	...	87	...	.	
7097	col. liq., 1.4388	$1.1593\frac{20}{20}$; 1.1656^{14}		96.8	0.27^{20}	v. s.	v. s. eth
7098	col. liq., 1.4469	1.201^{15}; $1.1896\frac{18}{4}$		125; 119^{740}	0.287^{30}	v. s.	v. s. eth.
7099	liq., 1.4471...	$1.093\frac{20}{20}$	-34.6	69.7	i.	s.	∞ eth., CS_2
7099M	col. gas......	0.92^{0}		-0.6 (-0.2)	... .	...	. . .
7100	liq	2.490		d.	..	......	.
7101	gas	$0.613\frac{0}{0}$	-20	9.5	i.	s.	s. eth.
7102	shiny leaf. f. al.	.....	61	338–40	i.	s.	s. eth.
7103							
7104							
7105							
7106							
7107							
7108							
7109							
7110							
7111							
7112							
7113							
7114							
7115	col. oil	1.5317^{13}		127–9 d.	i	s.	s. eth.
7116							
7117							
7118							
7119							
7120							
7121							
7122							
7123							
7124							
7125							
7126							
7127	col. liq	$0.9625\frac{25}{25}$		140.8 (158–9)	v. sl. s.	∞	∞ eth.
7128							
7129							
7130							
7131	col. liq., $1.40027^{24.3}$; 1.4015	$1.003\frac{20}{20}$	frz. -108	132	1.4 cc	∞	∞ eth.
7131F	w. wh. liq., 1.3941^{20}	$0.992\frac{20}{20}$	frz. -93	120	1.7 cc	......	...

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
7132	**Propane, 2-phenoxy-.**	See *Ether, isopropyl phenyl.*		
7133	**——, 1-phenyl-.**	See *Benzene, propyl-.*		
7134	**——, 2-phenyl-.**	See *Cumene.*		
7135	**——, 1-propoxy-*.**	See *Propyl ether.*		
7135M	**——, 1-(propylsulfinyl)**	**-*.** See *Propyl sulfoxide.*		
7136	**——, 1-propylsulfonyl-**	***.** See *Propyl sulfone.*		
7137	**——, 1-propylthio-*.**	See *Propylsulfide*		
7138	**——, 1,2,3-tribromo-*.**	glycerol tribromohydrin; tribromohydrin, allyl tribromide	$CH_2BrCHBrCH_2Br$	280 82
7139	**——, 1,2,3-trichloro-***	glycerol trichlorohydrin; allyl trichloride, trichlorohydrin	$CH_2ClCHClCH_2Cl$	147 44
7140	**——, 1,1,1-triphenyl-.**	α-ethyltritan	$(C_6H_5)_3CCH_2CH_3$	272 37
7140M	**1-Propaneboronic acid**	. See *Boric acid, propyl-.*		
7141	**Propanediamide*.**	See *Malonamide*		
7142	***dl*-1,2-Propanediamine***	*dl*-propylenediamine	$CH_3CH(NH_2)CH_2NH_2$	74 13
7143	**1,3-Propanediamine*.**	trimethylenediamine	$NH_2(CH_2)_3NH_2$	74 13
7144	**Propanedinitrile*.**	See *Malononitrile*		
7145	**Propanedioic acid*.**	See *Malonic acid*		
7146	**——, 2-propenyl-*.**	See *Malonic acid, allyl-*		
7147	**1,2-Propanediol*.**	propylene glycol	$CH_2OHCHOHCH_3$	76 09
7148	**——, 3-chloro-***	α-chlorohydrin, glycerol α-chlorohydrin	$CH_2ClCHOHCH_2OH$	110 54
7149	**——, 3-mercapto-*.**	See *Glycerol, 1-thio-.*		
7150	**——, 2-methyl-***	isobutylene glycol *as*-dimethylethylene glycol	$(CH_3)_2C(OH)CH_2OH$	90 12
7151	**——, 3-octadecyloxy-***	glycerol 1-octadecyl ether	$CH_3(CH_2)_{17}OCH_2CHOHCH_2OH$	344 57
7152	**1,3-Propanediol*.**	trimethylene glycol	$HOCH_2CH_2CH_2OH$	76 09
7152H	**——, 2-amino-2-ethyl-**		$HOCH_2C(NH_2)(C_2H_5)CH_2OH$	119 16
7152M	**——, 2-amino-2-hydroxymethyl-**	tris(hydroxymethyl)aminomethane	$H_2NC(CH_2OH)_3$	121 14
7152R	**——, 2-amino-2-methyl-**	.... .	$HOCH_2C(NH_2)(CH_3)CH_2OH$	105 14
7153	**——, 2,3-bishydroxym**	**ethyl-.** See *Pentaerythritol.*		
7154	**——, 2,2-dimethyl-*.**	dimethyltrimethylene glycol	$(CH_3)_2C(CH_2OH)_2$	104 15
7154M	**——, 2-ethyl-2-nitro-***	2-nitro-2-methylol-1-butanol	$HOCH_2C(C_2H_5)(NO_2)CH_2OH$	149 15
7155	**——, 2-hydroxymethyl-2-methyl-***	pentaglycerol; pentaglycerin	$CH_3C(CH_2OH)_3$.	120 15
7155H	**——, 2-hydroxymethyl-2-nitro-***	tris(hydroxymethyl)nitromethane	$NO_2C(CH_2OH)_3$.	151 12
7155R	**——, 2-methyl-2-nitro-***		$HOCH_2C(CH_3)(NO_2)CH_2OH$	135 12
7156	**1,3-Propanedione, 1,3-**	**diphenyl-.** See *Methane, dib*	*enzoyl-.*	
7157	**Propanenitrile*.**	See *Propionitrile*		
7158	**——, 2-hydroxy-*.**	See *Lactonitrile*		
7159	**——, 2-methyl-*.**	See *Isobutyronitrile*		
7160	**——, 2-oxo-*.**	See *Pyruvonitrile.*		
7161	**——, 3-oxo-3-phenyl-.**	See *Acetonitrile, benzoyl-.*		
7162	**1-Propanethiol***	*n*-propyl mercaptan	$CH_3CH_2CH_2SH$	76 15
7163	**——, 2-methyl-***	isobutyl mercaptan	$(CH_3)_2CHCH_2SH$	90 18
7164	**2-Propanethiol*.**	isopropyl mercaptan	$CH_3CHSHCH_3$...	76 15

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
7132							
7133							
7134							
7135							
7135M							
7136							
7137							
7138	pr., 1 584	2 436^{23}	16	220	i.	v. s.	v s eth.
7139	col. liq..	1 417$^{15}_{4}$	-14 7	156-8	i.	s.	s eth
7140	col. cr f me. al.		51-1 5	....	i.	s	v s. eth.
7140M							
7141							
7142	col liq. .	0 878^{15}		119			.
7143	col. liq.	0 884$^{25}_{4}$	....	135 5	s.	∞	∞ eth
7144							
7145							
7146							
7147	col. liq.	1 040	...	189	∞	∞	s. eth.
7148	ylsh liq ..	1 326$^{18}_{15}$	..	213 d (115-20^{18})	s.	s.	s eth.
7149							
7150	liq .	1 003		177	s.		.
7151	col cr		70-1	..	i.	s. h.	s. eth.
7152	visc. liq, 1 4398	1 0526$^{18}_{4}$	....	214 d.	∞	∞	v s eth.
7152H	1 490^{20}	1 099	37 5-38 5	152-3^{10}	∞		.
7152M			170 5-171 5	219-220^{10}	80		. .
7152R			109-111	151-2^{10}	250		.
7153							
7154	need f bz		127	203^{738}	i	v. s	v s eth
7154M			56-57	d.	400^{20}		.
7155	need f al		199	subl.	s.	v s.	i. eth
7155H			165-70	d.	220^{20}		
7155R			147-9	d.	80^{20}		
7156							
7157							
7158							
7159							
7160							
7161							
7162	liq .	0 8357$^{25}_{4}$	-111 5	68	v. sl. s.	s.	s. eth.
7163	liq, 1.43859	0 8357$^{20}_{4}$	<-79	88	sl. s..	v. s.	v. s eth
7164	col. liq	0 8055$^{25}_{4}$	-130.7	60	sl. s.	∞	∞ eth

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
7165	**1,2,3-Propanetricarbox**	**ylic acid*.** See *Tricarballylic*	*acid.*	
7166	**1,2,3-Propanetriol*.**	See *Glycerol.*		
7167	**Propanetrione, diphenyl-***	diphenyl triketone	$C_6H_5(CO)_3C_6H_5$	238 23
7168	**Propanoic acid*.**	See *Propionic acid.*		
7169	**——, 2-amino-3-merca**	**pto-.** See *Cysteine.*		
7170	**——, 3,3'-dithiobis(2-a**	**mino-.** See *Cystine.*		
7171	**——, 2-hydroxy-.**	See *Lactic acid.*		
7172	**——, 2-methyl-*.**	See *Isobutyric acid.*		
7173	**1-Propanol*.**	See *Propyl alcohol.*		
7173M	**——, 2-amino-2-methyl-**	...	$(CH_3)_2C(NH_2)$-CH_2OH	89 14
7174	**——, 3-bromo-*......**	trimethylene bromohydrin	$BrCH_2CH_2CH_2OH$	139 00
7175	**——, 2-chloro-*,** acetate	β-chloropropyl acetate; 2-chloropropyl ethanoate*	CH_3COOCH_2CH-$ClCH_3$	136 58
7176	**——, 3-chloro-*** ..	trimethylene chlorohydrin.	$ClCH_2CH_2CH_2OH$	94 54
7177	**——, 2,3-dibromo-***	β, γ-dibromopropyl alcohol, β-dibromohydrin; allyl alcohol dibromide	$CH_2BrCHBrCH_2$-OH	217 91
7178	**——, 2,3-dichloro-*** .	β-dichlorohydrin, *asym*-glycerol dichlorohydrin; β, γ-dichloropropyl alcohol, allyl alcohol dichloride	$CH_2ClCHClCH_2$-OH	128 99
7178H	——, ——, nitrate	β, γ-dichloropropyl nitrate	$ClCH_2CHClCH_2$-NO_3	173 99
7179	**——, 2,2-dimethyl-*..**	*tert*-butylcarbinol; neopentyl alcohol	$(CH_3)_3CCH_2OH$	88 15
7180	**——, 2,2-dimethyl-1-phenyl-**	*tert*-butylphenylcarbinol	C_6H_5CHOHC-$(CH_3)_3$	164 24
7181	**——, 2,3-epoxy-*.**	See *Glycidol.*		
7182	**——, 2-methyl-*.**	See *Isobutyl alcohol.*		
7183	**——, 2-methylamino-1**	**-phenyl-.** See *Pseudoephedri*	*ne.*	
7183M	**——, 2-methyl-2-nitro-***	β-nitroisobutyl alcohol	$(CH_3)_2C(NO_2)$-CH_2OH	119 12
7184	**——, 1-phenyl-**	ethylphenylcarbinol .	$C_2H_5CHOHC_6H_5$	136 19
7185	**——, 3-phenyl-......**	hydrocinnamyl alcohol	$C_6H_5CH_2CH_2CH_2$ OH	136 19
7186	**2-Propanol*.**	See *Isopropyl alcohol*		
7187	——, nitrate.	See *Isopropyl nitrate*		
7188	——, nitrite.	See *Isopropyl nitrite.*		
7189	**——, 1-chloro-***	propylene chlorohydrin	$CH_2ClCHOHCH_3$	94 54
7190	——, ——, acetate.. ..	β-chloroisopropyl ethanoate*	CH_3COOCH-$(CH_3)CH_2Cl$	136 58
7191	**——, 1,3-dichloro-*.**	α-dichlorohydrin; *sym*-glycerol dichlorohydrin; *sym*-dichloroisopropyl alcohol	$CH_2ClCHOH$-CH_2Cl	128 99
7192	——, ——, nitrate...	β, β'-dichloroisopropyl nitrate; dichloronitrohydrin	$CH_2ClCH(NO_3)$-CH_2Cl	173 99
7193	**——, 2-methyl-*.**	See *tert-Butyl alcohol.*		
7193M	**——, 1,1'-oxydi-**	dipropylene glycol; β, β'-dihydroxydi-*n*-propyl ether	$(CH_3CHOHCH_2)_2O$	134 17
7194	**——, 2-phenyl-.......**	α, α-dimethylbenzyl alcohol; dimethylphenylcarbinol	$C_6H_5(CH_3)_2COH$	136 19
7195	**——, 1,1,1-trichloro-2-**	**methyl-*.** See *Chloretone.*		
7196	**1-Propanone, 1-phenyl**	**-.** See *Propiophenone.*		
7197	**2-Propanone*.**	See *Acetone.*		
7198	**——, 1-amino-*.......**	aminoacetone; acetonylamine	$CH_3COCH_2NH_2$.	73 09

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7165							
7166							
7167	yel need.		68-70		i.	sl s	s eth
7168							
7169							
7170							
7171							
7172							
7173							
7173M	1 449^{20}..	0 934	25-26	165; 67 4^{10}	∞		. .....
7174	liq . ..	1 5710$^{20}_{4}$		98-112^{185}	16 6 c.	∞	∞ eth.
7175	col. liq.	1 098		152-3^{750}	i	s	s eth.
7176	liq .	1 1309$^{20}_{4}$		160-2	50 c.	s	s eth.
7177	col liq.	2 1682^{0}; 2 1259^{25}		219 sl. d ; 118^{17}	sl s	s	s. eth , acet., bz
7178	col. liq......	1 3681^{11}, 1 355$^{17.5}$		182; 81-81 5$^{13\ 5}$	s	s	s eth.
7178H	liq.......	1 3^{7}		180			. ....
7179	col. cr	0 812	53	114, 111 5^{738}	sl s	v s.	v s eth.
7180	need		45	114-6^{16}	i	s.	....
7181							
7182							
7183							
7183M			90-95 5	94 5-95 5	350^{20}		.. ..
7184	liq	0 9962$^{17}_{4}$		219 (212)	i	s	s. eth.
7185	liq , 1 53565	1 008	<-18	235 6 (237 4)	s	∞	∞ eth.
7186							
7187							
7188							
7189	col. liq....	1 103^{20}		127 0	∞	∞	∞ eth.
7190	liq . .			149-50		....	.. . .
7191	col liq., 1 480245^{17}	1 367$^{20}_{4}$; 1 3506$^{17}_{4}$		174	11^{19}	∞	∞ eth.
7192	col. liq......	1 459		180	i.	s.	s. eth.
7193							
7193M	col. liq.....	1 0224$^{20}_{20}$		229 2	∞	s	.
7194	pr., 1.5314^{19} .	0 9724$^{19}_{4}$	35-7	202 (215-20 d)	i	s.	s eth.
7195							
7196							
7197							
7198	need f al		189 d		v s.	s	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
7199	**2-Propanone, 1-bromo-***	bromoacetone	$CH_2BrCOCH_3$	136 99
7200	**——, 1-chloro-*.......**	chloroacetone	CH_3COCH_2Cl	92 53
7201	**——, 1,1-dichloro-*. . .**	*uns*-dichloroacetone, dichloromethyl methyl ketone	$CH_3COCHCl_2$	126 98
7202	**——, 1,3-dichloro-*....**	*sym*-dichloroacetone; bis-chloromethyl ketone	$CH_2ClCOCH_2Cl$	126 98
7202M	**——, 1,3-dihydroxy-***	dihydroxyacetone	$CO(CH_2OH)_2$	90 08
7203	**——, 1,3-diphenyl-* .**	dibenzyl ketone; diphenyl-acetone	$(C_6H_5CH_2)_2CO$	210 26
7204	**——, 1-hydroxy-*.**	See *Acetol.*		
7205	**——, 1-phenyl- . . .**	benzyl methyl ketone	$CH_3COCH_2C_6H_5$	134 17
7206	**——, 1,1,3,3-tetra-chloro-***	*sym*-tetrachloroacetone	$CHCl_2COCHCl_2$ $2H_2O$	231 91
7207	**——, 1-ureido-.**	See *Urea, acetonyl-.*		
	Propanoyl*.	See *Propionyl.*		
7208	**Propargyl acetate.**	See *2-Propyn-1-ol, acetate.*		
7209	**Propargyl alcohol.**	See *2-Propyn-1-ol*.*		
7210	**Propargylaldehyde.**	See *Propiolaldehyde*		
7211	**Propargyl bromide.**	See *Propyne, 3-bromo-**		
7212	**Propargyl chloride.**	See *Propyne, 3-chloro-**		
7213	**Propargylic acid.**	See *Propiolic acid.*		
7214	**Propargyl iodide.**	See *Propyne, 3-iodo-*.*		
7215	**Propenal*.**	See *Acrolein.*		
7215M	**——, 2-methyl-*.**	See *Acrolein, α-methyl-.*		
7216	**——, 3-phenyl-.**	See *Cinnamaldehyde.*		
7216M	**Propenamide.**	See *Acrylamide.*		
7217	**Propene*...........**	methylethylene, propylene	$CH_2{:}CHCH_3$	42 08
7218	**——, 1-bromo-* ...**	propenyl bromide	$CH_3CH{:}CHBr$	120 99
7219	**——, 2-bromo-* ..**	isopropenyl bromide	$CH_3CBr{:}CH_2$	120 99
7220	**——, 3-bromo-*.**	See *Allyl bromide.*		
7221	**——, 1-chloro-* ..**	propenyl chloride, α-chloropropylene	$CH_3CH{:}CHCl$	76 53
7222	**——, 2-chloro-* ....**	isopropenyl chloride, β-chloropropylene	$CH_3CCl{:}CH_2$	76 53
7223	**——, 3-chloro-*.**	See *Allyl chloride.*		
7224	**——, 3-chloro-1-phenyl-***	(γ-chloropropenyl)benzene, cinnamyl chloride	$C_6H_5CH{:}CHCH_2$-Cl	152 62
7225	**——, 2,3-dibromo-* .**	α-bromoallyl bromide; α-epidibromohydrin	$CH_2BrCBr{:}CH_2$	199 89
7226	**——, 1,2-dichloro-* .**	allylene dichloride	$CHCl{:}CClCH_3$	110 98
7227	**——, 2,3-dichloro-* .**	α-epidichlorohydrin; α-chloroallyl chloride	$CH_2{:}CClCH_2Cl$	110.98
7228	**——, 1,1-diphenyl- ...**		$(C_6H_5)_2C{:}CHCH_3$	194 26
7229	**——, 1,2-epoxy-*.....**	allylene oxide; methyl-oxirene	$CH_3C{:}CH\ O$	56 06
7230	**——, 3-ethoxy-*.**	See *Ether, allyl ethyl.*		
7231	**——, 3-fluoro-*.**	See *Allyl fluoride.*		
7232	**——, 3-iodo-*.**	See *Allyl iodide.*		
7233	**——, 3-methoxy-*.**	See *Ether, allyl methyl.*		
7234	**——, 2-methyl-* .**	*uns*-dimethylethylene; iso-butylene; γ-butylene	$CH_2{:}C(CH_3)CH_3$	56.10

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7199	pois. liq.	1 634[23]	-54	136 5[725]	sl. s.	sl. s.	s. acet.
7200	col. liq	1 15[20]	-44 5	119	s	s.	s eth , chl.
7201	col liq	1 234[15]		120	sl. s.	s.	∞ eth.
7202	pl. or need., 1.47144[46]	1 383[46]	45	173 4	s.	v. s	v. s. eth.
7202M	crystallizes as dimeride $(C_3H_6O_3)_2$		80		s h.	s h.	s h. eth., acet.; i. lgr.
7203	cr. f. dil. al		34-5	330 5	i	v s	v. s. eth.
7204							
7205	col cr	1 019[0]; 1 003[20]	-15 4	216 7	i.	v s.	v s. eth.
7206	tricl		48				
7207							
7208							
7209							
7210							
7211							
7212							
7213							
7214							
7215							
7215M							
7216							
7216M							
7217	col gas	liq. 0 6095 $\frac{-47}{4}$; 1 937[0] g/l	-185 2	-47 0	44 6 cm³	1250 cm³	524 5 cm³ ac. a
7218	liq., 1 4554	1 428[19.5]	-116 6	60 2			
7219	liq ...	1 362	-124 8	48 4			
7220							
7221	liq			35-6			
7222	liq	0 918[9]	.	23[738]	.		.
7223							
7224	col liq			213-5	i.	∞	∞ eth.
7225	liq .	1 934 $\frac{20}{4}$		140			
7226	liq			75 (84-6)		.	.
7227	col liq.	1 205 $\frac{25}{4}$, 1 236 $\frac{0}{4}$		94	i.	∞	∞ eth
7228	leaf f. al	0 984[60]	51 5-52	284 5	i.	v. s.	v. s. eth.; s. bz.
7229	liq .. .		. .	63	sl s.	∞	∞ eth.
7230							
7231							
7232							
7233							
7234	col. gas .	..	. ..	-6	i.	v. s.	v. s. eth.; s. H_2SO_4

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
7235	**Propene, 1-phenyl-.**	See *Benzene, propenyl-*.		
7236	**——, 2-phenyl-.**	See *Benzene, isopropenyl-*.		
7237	**——, 3-(2-propenoxy)-*.**	See *Allyl ether*.		
7238	**——, 3-(2-propenylthio)-*.**	See *Allyl sulfide*		
7239	**Propenenitrile*.**	See *Acrylonitrile*.		
7240	**Propene oxide.........**	1,2-epoxypropane; propylene oxide, methyloxirane	OCH_2CHCH_3	58 08
7241	**2-Propene-1-thiol***	allyl mercaptan .	$CH_2.CHCH_2SH$	74 14
7242	**1,2,3-Propenetricarboxylic acid*.**	See *Aconitic acid*.		
7243	**Propenoic acid*.**	See *Acrylic acid*.		
7244	**2-Propen-1-ol*.**	See *Allyl alcohol*		
7245	**——, 2-bromo-***	β-bromoallyl alcohol	$CH_2{:}CBr\,CH_2OH$	136 99
7246	**——, 2-chloro-***..... ..	β-chloroallyl alcohol	$CH_2{\cdot}CClCH_2OH$	92 53
7246C	**——, 3-chloro-*** ..	γ-chloroallyl alcohol	$CHCl{:}CHCH_2OH$	92 53
7248	**——, 3-(4-hydroxy-3-methoxyphenyl)-.**	See *Coniferyl alcohol*.		
7249	**——, 3-phenyl-.**	See *Cinnamic alcohol*		
7251	**2-Propen-1-one, 1,3-diphenyl-.**	See *Chalcone*.		
7251M	**Propenoyl chloride*.**	See *Acrylyl chloride*.		
7252	**2-Propenylamine*.**	See *Allylamine*		
7253	**Propenyl bromide.**	See *Propene, 1-bromo-**.		
7254	**Propenyl chloride.**	See *Propene, 1-chloro-**.		
7254H	**Propenyl cyanide.**	See *Crotononitrile*.		
7255	**2-Propenyl sulfide*.**	See *Allyl sulfide*.		
7256	**Propine.**	See *Propyne**.		
7256M	**Propioin.............**	4-hydroxy-3-hexanone; diethylketol	$C_2H_5COCHOH\text{-}C_2H_5$	116 16
7257	**Propiolaldehyde** ...	propynal*; propargylaldehyde	$CH{\vdots}CCHO$	54 05
7258	**Propiolic acid**	propynoic acid*; propargylic acid	$CH{\vdots}CCOOH$	70 05
7259	——, ethyl ester .. .		$CH{\vdots}CCOOC_2H_5$	98 10
7260	**——, ethyl-.**	See *2-Pentynoic acid**.		
7261	**——, methyl-.**	See *Tetrolic acid*.		
7262	**——, o-nitrophenyl-.** .	....	$NO_2C_6H_4C{\vdots}C\text{-}COOH$	191 14
7263	**——, p-nitrophenyl-.**	....	$NO_2C_6H_4C{\vdots}C\text{-}COOH$	191 14
7264	**——, phenyl-..** . .	phenylpropynoic acid .	$C_6H_5C{\vdots}CCOOH$	146 14
7264M	——, ——, ethyl ester	. .. .. .	$C_6H_5C{\vdots}CCOOC_2\text{-}H_5$	174 19
7265	**Propiolic alcohol.**	See *2-Propyn-1-ol**.		
7266	**Propionaldehyde**	propanal*, methylacetaldehyde	CH_3CH_2CHO	58 08
7267	——, oxime	propanal oxime*; propionaldoxime	$CH_3CH_2CH{:}NOH$	73 09
7269	**——, α,β-dihydroxy-.**	See *Glyceraldehyde*		
7270	**Propionaldoxime.**	See *Propionaldehyde, oxime*		
7271	**Propionamide**.	propanamide*; propionic acid amide	$CH_3CH_2CONH_2$.	73 09
7272	**——, N-phenyl-.**	See *Propionanilide*		
7273	**Propionanilide........**	N-phenylpropionamide .	$CH_3CH_2CONH\text{-}C_6H_5$	149 19
7274	**2-Propionaphthone, 4-bromo-1-hydroxy-**	4-bromo-2-propionyl-1-naphthol	$CH_3CH_2COC_{10}H_5\text{-}BrOH$	279 14
7275	**——, 1-hydroxy-......**	ethyl 1-hydroxy-2-naphthyl ketone	$CH_3CH_2COC_{10}H_6\text{-}OH$	200 23
7276	**Propione.**	See *3-Pentanone**.		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
7235							
7236							
7237							
7238							
7239							
7240	col. liq	$0.859\frac{0}{4}$, $0.8313\frac{20}{20}$		35	65^{30}	∞	∞ eth.
7241	liq			90	i	∞	∞ eth.
7242							
7243							
7244							
7245	liq	1.6^{15}		152			
7246	liq			136–40			
7246C	liq			153			
7248							
7249							
7251							
7251M							
7252							
7253							
7254							
7254H							
7255							
7256							
7256M	1.4340^{21}	$0.956\frac{21}{4}$		$57–78^{10}$			
7257	oil			61	v s		
7258	col liq	$1.139\frac{15}{15}$	9	144 d	s.	s	s eth.
7259	col liq	$0.968\frac{15}{15}$		119.5	i	v. s.	v s. eth, chl.
7260							
7261							
7262	need f h w		155.5 d	exp 155–6	v s h	s	s. eth, alk.; sl. s chl; i CS_2
7263	need f al		181 d	d	sl s	s h	s eth, i. pet. eth
7264	col trim need f. w.		137	subl.	v sl s	v s	v s eth; 3.32 CCl_4
7264M	oil	$1.063\frac{13}{4}$		260–70 sl d.			
7265							
7266	col liq, 1.36356	$0.807\frac{20}{4}$	-81	48.8	20^{20}	∞	∞ eth
7267	liq	$0.926\frac{20}{4}$	21.5	131–5			
7269							
7270							
7271	col rhomb leaf f chl, $1.4161^{107.8}$	1.042	79	213	s.	s.	s. eth.
7272							
7273	col. leaf. f al	1.175	104	222.2	0.42^{24}	v. s.	v s. eth.
7274	yel need		98		i.	s.	s eth.
7275	yel-grn leaf.		81		i.	s.	s eth.
7276							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
7277	**Propionic acid**........	propanoic acid*; methylacetic acid	CH_3CH_2COOH..	74 08
7278	——, amide.	See *Propionamide.*		
7279	——, amyl ester....	amyl propionate, pentyl propanoate*	CH_3CH_2COO-$(CH_2)_4CH_3$	144 21
7280	——, butyl ester.	butyl propionate; butyl propanoate*	$CH_3CH_2COOC_4H_9$	130 18
7281	——, ethylene ester.	See *Glycol, dipropionate.*		
7282	——, ethyl ester..... ..	..	$CH_3CH_2COOC_2H_5$	102 13
7283	——, furfuryl ester.	See *Furfuryl alcohol, propionate.*		
7284	——, isoamyl ester...	isoamyl propionate, γ-methylbutyl propanoate*	$CH_3CH_2COOC_5$-H_{11}	144 21
7285	——, isobutyl ester... ..	β-methylpropyl propanoate*	$CH_3CH_2COOCH_2$-$CH(CH_3)_2$	130 18
7286	——, isopropyl ester..	.....	CH_3CH_2COOCH-$(CH_3)_2$	116 16
7287	——, methyl ester . .	methyl propanoate*; methyl propionate	$CH_3CH_2COOCH_3$	88 10
7288	——, *p*-phenylphenacyl ester	....	$CH_3CH_2COOCH_2$-$COC_6H_4C_6H_5$	268 30
7289	——, piperazinium salt	....	$C_4H_{10}N_2\ 2C_2H_5$-$COOH$	234 29
7290	——, propyl ester .	propyl propanoate*, *n*-propyl propionate	$CH_3CH_2COOC_3H_7$	116 16
7290M	——, **α-amino-.**	See *Alanine.*		
7291	——, **β-amino-.**	See *β-Alanine.*		
7292	——, **α-amino-β-hydroxy-.**	See *Serine.*		
7293	——, **α-benzal-.**	See *Cinnamic acid, α-methyl-*		
7294	——, **β-benzal-.**	See *3-Butenoic acid, 4-phenyl-*		
7295	——, **α-benzamido-.**	See *Alanine, N-benzoyl-*		
7296	——, **β-benzoyl-.** ..	γ-keto-γ-phenylbutyric acid, 4-oxo-4-phenylbutanoic acid	$C_6H_5COCH_2CH_2$-$COOH$	178 18
7296H	——, **α-benzylidene-.**	See *Cinnamic acid, α-methyl-*		
7296R	——, **β-benzylidene-.**	See *3-Butenoic acid, 4-phenyl*		
7297	——, **α-bromo-(*dl*)** .	*dl*-2-bromopropanoic acid*	$CH_3CHBrCOOH$	152 99
7298	——, **α-bromo-,** ethyl ester	ethyl 2-bromopropanoate*	$CH_3CHBrCOOC_2$-H_5	181 04
7299	——, **β-bromo-** . .	3-bromopropanoic acid*	CH_2BrCH_2COOH	152 99
7300	——, **β-carbamyl-.**	See *Succinamic acid.*		
7301	——, **α-chloro-**	2-chloropropanoic acid*	$CH_3CHClCOOH$	108 53
7302	——, ——, ethyl ester....	ethyl 2-chloropropanoate*.	$CH_3CHClCOOC_2$-H_5	136 58
7303	——, **β-chloro-**..	3-chloropropanoic acid*.	CH_2ClCH_2COOH	108 53
7304	——, ——, ethyl ester. .	ethyl 3-chloropropanoate*	CH_2ClCH_2-$COOC_2H_5$	136 58
7305	——, **α-cyano-**........	2-cyanopropanoic acid*; methylmalonic mononitrile; methylcyanoacetic acid	$CH_3CH(CN)$-$COOH$	99 09
7306	——, **α,β-dibromo-**....	2,3-dibromopropanoic acid*	$CH_2BrCHBr$-$COOH$	231 89
7307	——, **β,β-diethyl-.**	See *Valeric acid, β-ethyl-.*		
7308	——, **α,β-dihydroxy-.**	See *Glyceric acid.*		
7309	——, **α,α-dimethyl-.**	See *Pivalic acid.*		
7310	——, **α-hydroxy-.**	See *Lactic acid.*		
7311	——, **β-hydroxy-.**	See *Hydracrylic acid.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7277	col liq, $1.38736^{19.9}$	0 992	-22	141 1	∞	∞	∞ eth., chl.
7278							
7279	....	$0\ 8761\frac{15}{4}$	-73.1	164-6	i	∞	∞ eth.
7280	col liq....	$0\ 8828^{15}$	-89 55	145 4	v sl s	∞	∞ eth.
7281							
7282	col liq, $1\ 38385^{20.2}$	$0\ 89574^{15}$, $0\ 8846^{25}$	-73 9 (-72 6)	99 10	$2\ 4^{20}$	∞	∞ eth.
7283							
7284	col liq, 1 4065	0 870	.....	160 2	$0\ 09^{25}$	s	s. eth.
7285	col liq. . .	$0\ 8876^{0}$	-71 4	136 8	v sl s	s	s. eth.
7286	col liq. .	$0\ 893^{0}$		111 3	$0\ 6^{25}$	∞	∞ eth.
7287	col liq, $1\ 37767^{18.5}$	$0\ 9148^{20}_{4}$	-87 5	79 9	$6\ 5^{20}$	∞	∞ eth.
7288	. .		102				....
7289	wh cr	...	124-5	....	s	s	i. eth.; s. h. dioxane
7290	col liq, 1 3935	0 883	-75 9	123 4, 122-5	0 5	∞	∞ eth.
7290M							
7291							
7292							
7293							
7294							
7295							
7296	leaf f al		116	d.	s h	s	s. eth., chl., CS_2, bz.; i. lgr.
7296H							
7296R							
7297	col pr., 1 4753	1 700	25 7	203 5	v s	v s.	s. eth.
7298	col. liq...	$1\ 394\frac{20}{4}$	.	159-61 d (160-5)	i	∞	∞ eth.
7299	col leaf. .	1 48	62.5	.....	s	s.	s. eth.
7300							
7301	col liq, [α] -2.30^{17}_{D}	$1\ 28^{0}$		186	∞	∞	∞ eth.
7302	col liq., 1 41850	1 087	...	146	v sl. s.	∞	∞ eth.
7303	col leaf. f w	hyg.	41 (61)	204	s	s.	∞ eth.
7304	col. liq. ..	$1\ 1086\frac{20}{4}$		$162\text{-}3^{765}$	v. sl. s	∞	∞ eth.
7305	oil ..	$1\ 14\frac{20}{4}$		$142\text{-}5^{11}$	s.	s	....
7306	monocl. need. or pl.		51; 64	220-40 d.; 160^{30}	1945^{11}	160^{20}	304^{10} eth.; s. bz., CS_2
7307							
7308							
7309							
7310							
7311							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
7312	**Propionic acid, α-iodo-**	2-iodopropanoic acid*	$CH_3CHICOOH$	199 99
7313	——, **β-iodo-**. . . .	3-iodopropanoic acid*	CH_2ICH_2COOH.	199 99
7314	——, **α-keto-**.	See *Pyruvic acid.*		
7315	——, **α-methyl-**.	See *Isobutyric acid.*		
7316	——, **α-phenyl-**.	See *Hydratropic acid.*		
7317	——, **β-phenyl-**.	See *Hydrocinnamic acid.*		
7318	**Propionic anhydride.**	propanoic anhydride*	$(CH_3CH_2CO)_2O$	130 14
7319	**Propionitrile** . . .	propanenitrile*, ethyl cyanide	CH_3CH_2CN	55 08
7320	——, **α,α-dimethyl-**	2,2-dimethylpropanenitrile*, *tert*-butyl cyanide, trimethylacetonitrile	$(CH_3)_3CCN$.	83 13
7321	——, **β-hydroxy-**.	See *Hydracrylonitrile.*		
7322	**Propionyl bromide** .	propanoyl bromide*	CH_3CH_2COBr .	136 99
7323	——, **α-methyl-**.	See *Isobutyryl bromide*		
7324	**Propionyl chloride**	propanoyl chloride*	CH_3CH_2COCl	92 53
7325	——, **α-methyl-**.	See *Isobutyryl chloride*		
7325M	**Propionyl fluoride**	propanoyl fluoride*	CH_3CH_2COF	76 07
7326	**Propionyl iodide**. .	propanoyl iodide*	CH_3CH_2COI	183 99
7327	**Propiophenone** .	ethyl phenyl ketone, 1-phenyl-1-propanone	$C_2H_5COC_6H_5$	134 17
7328	——, **β-acetyl-**.	See *Valerophenone, γ-oxo-*		
7329	——, **2,4-dihydroxy-**	4-propionylresorcinol	$CH_3CH_2COC_6H_3(OH)_2$	166 17
7330	**Proponal.**	See *Barbituric acid, 5,5-dipropyl-.*		
	Propyl. For propyl derivatives see the parent compounds (e g., for propylbenzene see			
7331	**Propyl alcohol** (*n*) .	1-propanol*; ethylcarbinol	$CH_3CH_2CH_2OH$.	60 09
7332	——, derivatives.	See under 1-*Propanol**.		
7333	**Propylamine***(*n*) .		$CH_3(CH_2)_2NH_2$	59 11
7334	——, **α,α-dimethyl-**.	See *tert-Amylamine.*		
7335	——, **α,β-dimethyl-**	3-amino-2-methyl-*n*-butane; methylisopropylcarbinylamine	$(CH_3)_2CHCH(CH_3)NH_2$	87 16
7336	——, **β,β-dimethyl-**	*tert*-butylmethylamine; 1-amino-2,2-dimethylpropane	$(CH_3)_3CCH_2NH_2$	87 16
7337	——, **α-ethyl-** . .	diethylcarbinylamine; *sec-n*-amylamine; 3-aminopentane	$CH_3CH_2CH(C_2H_5)NH_2$	87 16
7338	——, **α-methyl-**.	See *sec-Butylamine.*		
7339	——, **β-methyl-**.	See *Isobutylamine.*		
7340	——, **N-methyl-**. . .	. . .	$CH_3NHC_3H_7$	73 14
7341	——, **N-nitro-** .	*n*-propylnitramine	$C_3H_7NHNO_2$	104 11
7341M	——, **α,α,β-trimethyl-**	2-amino-2,3-dimethyl-*n*-butane	$(CH_3)_2CHC(CH_3)_2NH_2$	101 19
7341P	——, **α,β,β-trimethyl-**	. . .	$(CH_3)_3CCH(CH_3)NH_2$	101 19
7342	**Propyl borate**.	tripropyl borate, tripropoxyboron	$B(OC_3H_7)_3$ ..	188.08
7343	**Propyl bromide** (*n*).	1-bromopropane*	$CH_3CH_2CH_2Br$..	123 00
7344	**Propyl chloride** (*n*)....	1-chloropropane*....	$CH_3CH_2CH_2Cl$...	78 54

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7312	pr. or need		45.5	$105^{0.3}$	sl. s.	v. s	v. s. eth.
7313	leaf.......		82	8^{25}	•v. s.		v. s. eth.
7314							
7315							
7316							
7317							
7318	col. liq., 1.4038	$1.0336\frac{0}{4}$, $1.010\frac{20}{4}$	-45	169.3 (166)	d.	d	∞ eth.
7319	col. liq., $1.36888^{14.6}$	0.783^{21}_{4}	-91.9 (-104)	97.1 (96-7)	11.9^{40}, 28^{100}	∞	s. eth.
7320	cr........		15-6	105-6			
7321							
7322	liq	1.521^{16}		103.5	d	d	s. eth.
7323							
7324	col. liq., 1.40507	1.065	94	80	d	d	s. eth.
7325							
7325M	col. liq.	0.972^{15}		44			. .
7326	liq	.		127	d	d	. . .
7327	col. leaf or liq. $1.52900^{15.9}$	$1.012\frac{20}{4}$	21	218	i.	s	s. eth.
7328							
7329	. ..		97.5		sl s	s	s eth.
7330	*Benzene, propyl-*). For propyl esters of organic acids see the acids.						
7331	col. liq., 1.38543	$0.8044\frac{20}{4}$; $0.7998\frac{20}{4}$	-127	97.19 (97.8)	∞	∞	∞ eth.
7332							
7333	col liq., $1.39006^{16.6}$	0.719	83	48.7	s.	∞	∞ eth.
7334							
7335	liq., $1.40959^{17.9}$	0.7574^{19}		84.87	v s	s	
7336	liq .			82.3			
7337	oil .	$0.7487\frac{20}{4}$		91		s	
7338							
7339							
7340	col. liq .	0.720^{17}		62-4	s.	s	.
7341	col. liq.....	1.103^{15}	21	128^{40}	sl s	v s	v. s. eth
7341M	1.4096^{17}.... .	$0.7683\frac{0}{0}$		104-5			. . .
7341P	.	.....	-20	103	v. s. c.	.	. . .
7342	col liq. ...	0.867^{16}	. .	175	d.	∞	∞ eth
7343	liq., 1.43414...	$1.353\frac{20}{4}$	-110	70.9	0.25^{20}	∞	∞ eth.
7344	col. liq., 1.38856	$0.890\frac{20}{4}$	-122.8	47.2 (45-7)	0.27^{20}	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
7345	***n*-Propyl cyanide.**	See *Butyronitrile.*		
7346	**Propylene.**	See *Propene*.*		
7347	**Propylene aldehyde.**	See *Crotonaldehyde.*		
7348	**Propylene bromide.**	See *Propane, 1,2-dibromo-*.*		
7349	**Propylene chloride.**	See *Propane, 1,2-dichloro-*.*		
7350	**Propylene chlorohydrin.**	See *2-Propanol, 1-chloro-*.*		
7351	**Propylenediamine.**	See *1,2-Propanediamine*.*		
7352	**Propylene glycol.**	See *1,2-Propanediol*.*		
7353	**Propylene iodide.**	See *Propane, 1,2-diiodo-*.*		
7354	**Propylene oxide.**	See *Propene oxide*		
7355	**——, γ-chloro-.**	See *Epichlorohydrin.*		
7356	**——, γ-cyano-.**	See *Epicyanohydrin.*		
7357	**——, γ-iodo-.**	See *Epiiodohydrin.*		
7358	**Propyl ether.** . . .	di-*n*-propyl ether; 1-propoxypropane*	$(CH_3CH_2CH_2)_2O$	102 17
7359	**Propyl fluoride** (*n*) .	1-fluoropropane*	$CH_3CH_2CH_2F$	62 09
7360	**Propylidene bromide.**	See *Propane, 1,1-dibromo-**		
7361	**Propylidene chloride.**	See *Propane, 1,1-dichloro-**		
7362	**Propyl iodide** (*n*). . . .	1-iodopropane*	$CH_3CH_2CH_2I$	170 01
7363	**Propyl isocyanide** (*n*)	propylcarbylamine	$CH_3(CH_2)_2NC$	69 10
7364	***n*-Propyl mercaptan.**	See *1-Propanethiol*.*		
7365	***n*-Propyl mustard oil.**	See *Isothiocyanic acid, propyl ester.*		
7366	**Propyl nitrate** (*n*) .	. . . .	$CH_3CH_2CH_2NO_3$	105 09
7367	**Propyl nitrite** (*n*)	. . .	$CH_3CH_2CH_2ONO$	89 09
7368	**Propyl sulfate**. .	*di-n*-propyl sulfate	$(CH_3CH_2CH_2)_2SO_4$	182 23
7369	**Propyl sulfide**. .	1-propylthiopropane*; di-*n*-propyl sulfide	$(C_3H_7)_2S$.	118 23
7370	**Propyl sulfone** . .	1-propylsulfonylpropane*; dipropyl sulfone	$(CH_3CH_2CH_2)_2SO_2$	150 23
7370M	**Propyl sulfoxide**. .	1-(propylsulfinyl)propane*; di-*n*-propyl sulfoxide	$(CH_3CH_2CH_2)_2SO$	134 23
7371	**Propynal*.**	See *Propiolaldehyde*		
7372	**Propyne***.	propine, methylacetylene	$CH_3C:CH$	40 06
7373	**——, 3-bromo-*** .	propargyl bromide; γ-bromoallylene	$CH:CCH_2Br$	118 97
7374	**——, 3-chloro-*** . .	propargyl chloride	$CH:CCH_2Cl$	74 51
7374M	**——, 1,3-dibromo-*** .		$BrC:CCH_2Br$	197 88
7375	**——, 3-ethoxy-***	ethyl propargyl ether	$CH:CCH_2OC_2H_5$	84 11
7375T	**——, 1-iodo-*** .		$CI:CCH_3$.	165 97
7376	**——, 3-iodo-*.** .	propargyl iodide	$CH:CCH_2I$	165 97
7377	**——, 3-methoxy-***	methyl propargyl ether	$CH:CCH_2OCH_3$.	70 09
7378	**——, 1-phenyl-**.	methylphenylacetylene; 1-propynylbenzene, phenylallylene	$C_6H_5C:CCH_3$	116 15
7379	**Propynoic acid*.**	See *Propiolic acid.*		
7380	**2-Propyn-1-ol***.	propargyl alcohol, ethynylcarbinol, acetylenylcarbinol; propiolic alcohol	$CH:CCH_2OH$ . .	56 06
7381	——, acetate . . .	propargyl acetate	$CH_3COOCH_2C:CH$	98 10
7382	**Propytal.**	See *Barbituric acid, 5,5-dipropyl-*		
7383	**Protocatechualdehyde**	3,4-dihydroxybenzaldehyde, 3,4-dihydroxybenzenecarbonal*	$(HO)_2C_6H_3CHO$	138 12
7384	——, dimethyl ether.	See *Veratraldehyde.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7345							
7346							
7347							
7348							
7349							
7350							
7351							
7352							
7353							
7354							
7355							
7356							
7357							
7358	col liq., 1.3807	0.7360^{20}_{4}	122	91	0.25^{25}	∞	∞ eth.
7359	col gas, 1.3326^{-20}	$0.7788^{-3.2}$	-159	-3.2	sl. s	v. s	∞ eth.
7360							
7361							
7362	col. liq, 1.50508	1.747	101.1	102.4	0867^{20}	∞	∞ eth
7363	liq.			99.5	i.	∞	∞ eth.
7364							
7365							
7366	liq, 1.3972	1.058^{20}_{4}		100.5	v sl s	s	s eth
7367	liq, 1.3613	0.935		57		s	s. eth.
7368	col oil, 1.4139^{20}ϕ	$1.11^{22.5}$	d 140 70	120^{20};	i, sl d		
7369	liq	0.814^{17}	frz -101.9	141-2	i	s	s eth.
7370	sc		29-30		sl s.	s	s. eth.
7370M			15	not dist	sl. s.	s	s
7371							
7372	gas	liq 0.6785^{-27}_{4}, 1.787^{0} g/l	-104.7; frz -110	-23.3	v sl s	v s	2142^{16} cm^3 eth.
7373	liq	1.520		88-90			
7374	liq	1.0454^{7}		65	i	∞	∞ eth
7374M	liq	2.137^{0}		$73\text{-}4^{30}$			
7375	liq, 1.40390	0.8326		80	i	s	s eth
7375T	need. f w	1.857^{112}	93.4	d	sl s.	v s	v. s.
7376	liq	2.018^{0}		115			s eth.
7377	col. liq	0.83^{13}		62	sl. s.	∞	∞ eth.
7378	arom. oil			185	i.		s eth.
7379							
7380	col liq, 1.43064	0.9715^{20}_{4}	-17	114 115	s	∞	∞ eth.
7381	col liq., 1.42047	1.005		125	sl s	s	s. eth.
7382							
7383	col. tab. f. w.		154	d.	5	78.9 h.	v. s. eth.
7384							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt
7385	**Protocatechualdehyde,**	4-ethyl 3-methyl ether. See *Benzaldehyde, 4-ethoxy-3-meth*		
7386	——, methylene ether.	See *Piperonal.*		
7387	——, 3-methyl ether.	See *Vanillin.*		
7388	——, 4-methyl ether.	See *Isovanillin.*		
7389	**Protocatechuic acid** ..	3,4-dihydroxybenzoic acid; 3,4-dihydroxybenzenecarboxylic acid*	$(OH)_2C_6H_3COOH$	154 12
7390	——, dimethyl ether.	See *Veratric acid*		
7391	——, methylene ether.	See *Piperonylic acid.*		
7392	**Protopine**	....	$C_{20}H_{19}NO_5$	353 36
7393	**Protoveratrine**........	. ..	$C_{32}H_{51}NO_{11}$	625 74
7373M	**Provitamin A.**	See *β-Carotene*		
7394	**Prussic acid.**	See *Hydrocyanic acid.*		
7395	**Prussite.**	See *Cyanogen.*		
7396	**Pseudaconine, acetylbenzoyl-.**	See *Indaconitine*		
7397	**——, acetylveratryl-.**	See *Pseudaconitine*		
7398	**Pseudaconitine**	acetylveratrylpseudaconine	$C_{36}H_{49}NO_{12}$	687 76
7399	**Pseudobutylene.**	See 2-*Butene**.		
7400	**Pseudobutylene glycol.**	See 2,3-*Butanediol**.		
7401	**Pseudocinchonine.**	See *Cincholine.*		
7402	**Pseudocodeine**........		$C_{18}H_{21}NO_3$	299 36
7403	**Pseudoconhydrine**.. .	ψ-conhydrine . .	$C_8H_{17}NO$	143 23
7404	**Pseudoconiceine**..		$C_8H_{15}N$ . .	125 21
7405	**Pseudocumene**	1,2,4-trimethylbenzene, *as*-trimethylbenzene	$(CH_3)_3C_6H_3$	120 19
7406	——, **5-nitro-**. .	.. ..	$NO_2C_6H_2(CH_3)_3$.	165 19
7407	——, **6-nitro-**....	1,2,4-trimethyl-6-nitrobenzene	$NO_2C_6H_2(CH_3)_3$	165 19
7408	——, **3,5,6-trinitro-**		$(NO_2)_3C_6(CH_3)_3$	255 19
7409	**Pseudocumenol**	2,4,5-trimethylphenol	$(CH_3)_3C_6H_2OH$.	136 19
7410	**Pseudocumidine** . .	2,4,5-trimethylaniline	$(CH_3)_3C_6H_2NH_2$.	135 20
7411	**Pseudoephedrine** (*d*)	2-methylamino-1-phenyl-1-propanol (one form); *d*-isoephedrine	$C_6H_5CHOHCH(NHCH_3)CH_3$	165 23
7412	——, hydrochloride		$C_{10}H_{15}NO\ HCl$.	201 69
7413	**Pseudohexyl alcohol.**	See 1-*Butanol, 2-ethyl-**.		
7414	**Pseudohyoscyamine**		$C_{17}H_{23}NO_3$. . .	289 36
7415	**3-Pseudoindolone, 2-chloro-.**	See *Isatin chloride*		
7416	**Pseudoisatin, 1-acetyl-**	acetylisatin.... .	$C_6H_4N(COCH_3)$-COCO	189 16
7417	**Pseudoleucaniline.**	See *mp₂-Leucaniline.*		
7418	**Pseudomorphine.** .	.	$C_{34}H_{36}N_2O_6$......	568 65
7419	——, hydrochloride (*l*)		$C_{34}H_{36}N_2O_6 \cdot 2HCl$ $2H_2O$	677 61
7420	**Pseudopelletierine**....	methylgranatonine; ψ-pelletierine	$C_9H_{15}NO$... .	153 22
7421	**Pseudotropeine, benzoyl-.**	See *Tropacocaine.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7385	*oxy-*.						
7386							
7387							
7388							
7389	monocl. need	1.542^{4}	199 d		1.82^{14}, 27^{80}	v. s.	s. eth.
7390							
7391							
7392	monocl. cr		207		i.	v. sl. s.	v. sl. s. eth.; s. acet.; sl. s. NH_4OH, bz.
7393	rect. tab		245.50			sl. s.	sl. s. eth., chl.
7393M							
7394							
7395							
7396							
7397							
7398	rhomb. f. chl. + eth.		211–2 d		v. sl. s.	s.	s. eth., chl.
7399							
7400							
7401							
7402	col. need., 1.574, 1.602, 1.647	1.315, 1.290^{180}	181		sl. s.	s	
7403	slend. col. need., $[\alpha]_D^{15}$ +11°		105–6	236.5	s.	s	s. eth., bz.
7404	oily liq	0.8776^{15}		171–2			
7405	col. liq., 1.50672$^{15.8}$	0.876	−57.4 (−61)	169.8 (162–5)	i.	s.	s. eth
7406	lng. col. or grn.-yel need		65, 45–6 (71)	265	....	s	s. pet. eth.
7407	grn. pr		20	...	. . . .	s	
7408	pr		185	..	i.	v. sl. s. h.	s. h. bz.
7409	need. f. w		72	235	v. v. sl. s	v. s	v. s. eth
7410	col. need. f. al	0.957	66–8	234–5	0.12^{19}	s.	s. eth., chl.
7411	col. rhomb tab. f. eth		116.7	.	sl. s. c.	s	s. eth., chl.
7412	ylsh. need		176		s.	s	.
7413							
7414	ylsh. need		133–4		sl. s.	v. s.	s. eth., chl.
7415							
7416	yel. need. f. bz		141		sl. s.	s	s. bz.; d. h. HCl
7417							
7418	crusts or need		327 d		i	i	i. eth., chl.; s. alk., NH_4OH
7419	cr. powd				70^{10}		. .....
7420	pl. f. pet. eth., 1.47596$^{99.5}$	1.001^{100}	48–9	246	s.	v. s.	v. s. eth.; s. chl., bz.; sl. s. pet. eth.
7421							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
7422	**Pseudotropine**	.	$C_8H_{15}NO$	141 21
7423	**Pukateine** (*l*)		$C_{17}H_{17}NO_3$	283 32
7424	**Pulegone**	4(8)-*p*-menthen-3-one	$C_{10}H_{16}O$	152 23
7425	**Punicine.**	See *Pelletierine*		
7426	**Purine**	imidazo[4,5-*d*]pyrimidine	$C_5H_4N_4$	120 11
7427	**——, 6-amino-.**	See *Adenine.*		
7428	**——, 2,6-dioxy-.**	See *Xanthine.*		
7429	**——, 2,6,8-trioxy-.**	See *Uric acid*		
7430	**2,6(1,3)Purinedione.**	See *Xanthine.*		
7431	**2,6,8(1,3,9)-Purinetrione.** See *Uric acid.*			
7432	**6(1)-Purinone.**	See *Hypoxanthine*		
7433	**Purpuric acid,** ammonium salt See *Murexide.*			
7434	**Purpurin**	1,2,4-trihydroxyanthraquinone	$C_6H_4(CO)_2C_6H(OH)_3$	256 20
7435	**Purpuroxanthin**	1,3-dihydroxyanthraquinone	$C_6H_4(CO)_2C_6H_2(OH)_2$	240 20
7436	**Putrescine**	1,4-butanediamine*, tetramethylenediamine	$NH_2(CH_2)_4NH_2$	88 15
7437	**Pyraconitine**		$C_{32}H_{43}NO_9$	585 68
7438	**Pyran, tetrahydro-**	pentamethylene oxide	$O(CH_2)_4CH_2$	86 13
7439	**1,4-Pyran, 4-oxo-.**	See 1,4-*Pyrone*		
7440	**1,2-Pyran-5-carboxylic acid, 2-oxo-.** See *Coumalic acid.*			
7441	**1,4-Pyran-2,5-dicarboxylic acid, tetrahydro-2,6,6-trimethyl-*.** See *Cinacid*			
7442	**1,4-Pyran-2,6-dicarboxylic acid, 3-hydroxy-4-keto-.** See *Meconic acid*			
7443	**2,4-Pyrandione, 3-acetyl-6-methyl-.** See *Dehydroacetic acid*			
7444	**Pyrantin.**	See *Succinamide, N-p-phenetyl-*		
7445	**Pyrazine**	1,4-diazine, paradiazine, piazine	N·CHCH NCH.CH	80 09
7446	**——, 2,5-dimethyl-.**	See *Ketine.*		
7447	**——, hexahydro-.**	See *Piperazine.*		
7448	**——, tetraphenyl-.**	See *Amaron.*		
7449	**Pyrazole**	1,2-diazole, α-pyrromonazole	NHN·CHCH·CH	68 08
7450	**——, 4,5-dihydro-.**	See 2-*Pyrazoline*		
7451	**——, 4,5-dihydro-5-oxo-.** See 5-*Pyrazolone*			
7452	**2-Pyrazoline**	Δ²-pyrazoline, 4,5-dihydropyrazole, pyrazoline	$NHN{:}CHCH_2CH_2$	70 09
7453	**——, 1-phenyl-**		$C_6H_5NN.CHCH_2CH_2$	146 19
7454	**3-Pyrazolone, 1,5-dimethyl-2-phenyl-.** See *Antipyrine.*			
7455	**——, 1,5-dimethyl-2-phenyl-3-thio-.** See *Thiopyrine.*			
7456	**5-Pyrazolone**	4,5-dihydro-5-oxopyrazole	$NHN{:}CHCH_2CO$	84 08
7457	**——, 3-methyl-1-phenyl-**		$N(C_6H_5)N{\cdot}C(CH_3)CH_2CO$	174 20
7458	**Pyrene**	benzo[*def*]phenanthrene	$C_{16}H_{10}$	202 24
7459	**Pyridazine**	1,2-diazine, orthodiazine	N:NCH:CHCH:CH	80 09
7460	**Pyridine**		N CHCH:CH-CH·CH	79 10

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7422	rhbdr tab or pr. f eth.		108	243	v s	v s	sl. s. eth.; s. chl
7423	cr. f. al					s	0.6 eth.; s chl, pyr., alk.
7424	col liq, $1.48705^{18.3}$	0.9323^{20}		224	i.	∞	∞ eth.
7425							
7426	need f al		217	d	v s	s	v. sl. s. eth.; s. tol.
7427							
7428							
7429							
7430							
7431							
7432							
7433							
7434	red. need f al		256	d subl	s	s	s eth
7435	yel need f ac a		262–3	subl	i	sl s	s. h ac a., acet.
7436	leaf		27	158	v s	v s	v. s eth.
7437	need		167.8		sl s	v s	v. s. eth.
7438		0.8540		81.2	s	∞	∞ eth.
7439							
7440							
7441	*colic acid*						
7442							
7443							
7444							
7445	col. pr f w., $1.49526^{60.9}$	1.031^{61}_{4}	53	118	∞	v s.	v. s. eth.; s. chl., HCl, H_2SO_4
7446							
7447							
7448							
7449	need f. al, $1.47027^{99.8}_{He}$		70	188	v s	v s	v. s eth.; s. bz.
7450							
7451							
7452	col liq			144	∞	∞	sl s eth
7453	cr		52	273	i	s	
7454							
7455							
7456	need f tol		165	subl d.	s	s	sl. s. eth.
7457	pr, β 1.637		127	287^{205}	s h	s h	v. sl. s. eth.; sl. s. bz.
7458	lt yel monocl tab		150	>360	i	1.4	v s. eth.
7459	col liq, $1.52311^{23.5}$	1.107	8	208	∞	v. s.	v. s. eth.; s. HCl, bz., H_2SO_4, i. lgr.
7460	col liq, 1.50919^{21}	0.982	-42	115.3	∞	∞	∞ eth.; s. bz.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
7461	**Pyridine, 2-allyl-**		$C_3H_5C_5H_4N$	119.16
7462	**——, 2-amino-**	α-pyridylamine	$NH_2C_5H_4N$	94.11
7463	**——, 3-amino-**	β-pyridylamine	$NH_2C_5H_4N$	94.11
7464	**——, 4-amino-**	γ-pyridylamine	$NH_2C_5H_4N$	94.11
7465	**——, 2-benzyl-**	....	$C_6H_5CH_2C_5H_4N$	169.22
7466	**——, 3-benzyl-**	....	$C_6H_5CH_2C_5H_4N$	169.22
7467	**——, 3-bromo-***	....	BrC_5H_4N	158.01
7468	**——, 2-chloro-***	α-chloropyridine	ClC_5H_4N	113.55
7469	**——, 3-chloro-***	β-chloropyridine	ClC_5H_4N	113.55
7470	**——, 4-chloro-***	γ-chloropyridine	ClC_5H_4N	113.55
7471	**——, 3,5-dibromo-***		$C_5H_3Br_2N$	236.91
7472	**——, dihydroxy-.**	See *Pyridinediol.*		
7473	**——, dimethyl-.**	See *Lutidine.*		
7474	**——, 2-ethyl-**	α-ethylpyridine	$C_2H_5 \cdot C_5H_4N$	107.15
7475	**——, 3-ethyl-**	β-ethylpyridine	$C_2H_5 \cdot C_5H_4N$	107.15
7476	**——, 4-ethyl-**	γ-ethylpyridine	$C_2H_5 \cdot C_5H_4N$	107.15
7477	**——, 2-ethyl-3,5-dimethyl-.**	See *α-Parvoline*		
7478	**——, 3-ethyl-4-methyl-.**	See *β-Collidine.*		
7479	**——, 4-ethyl-2-methyl-.**	See *α-Collidine*		
7480	**——, 5-ethyl-2-methyl-.**	See *Aldehydine.*		
7481	**——, hexahydro-*.**	See *Piperidine.*		
7482	**——, hydroxy-.**	See *Pyridol.*		
7483	**——, 2-isopropyl-**		$(CH_3)_2CHC_5H_4N$	121.18
7484	**——, 4-isopropyl-**	...	$(CH_3)_2CHC_5H_4N$	121.18
7485	**——, 4-methoxy-***		N.CHCH C-(OCH₃)CH·CH	109.12
7486	**——, methyl-.**	See *Picoline.*		
7487	**——, 3-(1-methyl-2-pyrryl)-.**	See *Nicotyrine.*		
7488	**——, 2-phenyl-**	..	$C_6H_5C_5H_4N$	155.19
7489	**——, 3-phenyl-**	..	$C_6H_5C_5H_4N$	155.19
7490	**——, 4-phenyl-**	.	$C_6H_5C_5H_4N$	155.19
7491	**——, 2-propyl-.**	See *Conyrine.*		
7491M	**——, 2-sulfanilamido-.**	See *Sulfapyridine.*		
7491T	**——, 2-(sulfanilylamino)-.**	See *Sulfapyridine.*		
7492	**——, 1,2,3,4-tetrahydro-6-propyl-.**	See *γ-Coniceine.*		
7493	**——, tetramethyl-.**	See *β-Parvoline.*		
7494	**——, 2,4,6-trihydroxy-.**	See *2,4,6-Pyridinetriol.*		
7495	**——, 2,4,6-trimethyl-.**	See *γ-Collidine.*		
7495M	**3-Pyridinecarboxamide.**	See *Nicotinamide.*		
7496	**2-Pyridinecarboxylic acid*.**	See *Picolinic acid*		
7497	**3-Pyridinecarboxylic acid*.**	See *Nicotinic acid.*		
7498	**4-Pyridinecarboxylic acid*.**	See *Isonicotinic acid.*		
7498M	**3,4-Pyridinedicarbinol, 6-methyl-.**	See *Vitamin B_6.*		
7499	**2,3-Pyridinedicarboxylic acid*.**	See *Quinolinic acid.*		
7500	**2,4-Pyridinedicarboxylic acid*.**	See *Lutidinic acid*		
7501	**2,5-Pyridinedicarboxylic acid*.**	See *Isocinchomeronic acid.*		
7502	**2,6-Pyridinedicarboxylic acid*.**	See *Dipicolinic acid.*		
7503	**3,4-Pyridinedicarboxylic acid*.**	See *Cinchomeronic acid.*		
7504	**3,5-Pyridinedicarboxylic acid*.**	See *Dinicotinic acid.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7461	liq	0 959^{0}		190	sl s	∞	∞ eth.
7462	leaf. f. lgr		56	204	s.	v. s	s. eth.; sl. s. lgr.
7463	leaf. f. bz		64	252	v. s.	v. s.	v. s. eth.; i. lgr.
7464	col. need f. bz	..	158	.	s	s	s. eth., alk , bz.; sl s lgr.
7465	need	1 067$\frac{0}{0}$	139	276^{742}	i.	s	s eth.
7466	need.... .	1 061	34	286^{740}	i.	s	s eth.
7467	oil	1.632^{10}, 1 645$\frac{0}{4}$		169–70 (173)	v sl s	v s	v. s. eth.
7468	oily liq	1 205^{15}		170 (166^{714})	v sl s		s eth.
7469	liq			148^{744}	s		...
7470	liq			147 -8	s		
7471	col. need. f al		112 (110-1)	222, subl 100	sl s h	s h	v. s. eth.; s. H_2SO_4
7472							
7473							
7474	liq., 1.50214$^{22.5}$	0 950^{0}		148 8	sl s.	∞	v. s eth.
7475	col. liq.	0 945^{15}		165 3	v sl s	s	s. eth
7476	col liq.	0 935		166			s dil a
7477							
7478							
7479							
7480							
7481							
7482							
7483	liq .	0 934^{0}		159	sl s	∞	∞ eth
7484	liq	0 944^{0}		178	sl s	∞	∞ eth
7485	liq			191	s.		
7486							
7487							
7488	liq .	>1		270	i	v s	v. s eth
7489	oil	>1		270 4	i	v s	v. s eth.
7490	leaf f. w		78	275	v sl s h	s	s eth.
7491							
7491M							
7491T							
7492							
7493							
7494							
7495							
7495M							
7496							
7497							
7498							
7498M							
7499							
7500							
7501							
7502							
7503							
7504							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
7505	**2,4-Pyridinediol**. . . .	2,4-dihydroxypyridine	$C_5H_3N(OH)_2$	111.10
7506	**2,6-Pyridinediol**	2,6-dihydroxypyridine	$C_5H_3N(OH)_2 \cdot H_2O$	129.11
7507	**Pyridinepentacarboxylic acid***		$C_5N(COOH)_5 \cdot 2H_2O$	335.18
7508	**3-Pyridinesulfonic acid***		$C_5H_4NSO_3H$.	159.16
7508M	**2,3,4,5-Pyridinetetracarboxylic acid***(anh.)		$C_5HN(COOH)_4$.	255.14
7508P	**2,3,4,6-Pyridinetetracarboxylic acid***(anh.)		$C_5HN(COOH)_4$	255.14
7508R	**2,3,5,6-Pyridinetetracarboxylic acid***(anh.)	. .	$C_5HN(COOH)_4$.	255.14
7509	**2,3,4-Pyridinetricarboxylic acid***. See *Carbocinchomeronic acid*			
7509H	**2,3,5-Pyridinetricarboxylic acid***(anh.)	carbodinicotinic acid	$C_5H_2N(COOH)_3$	211.13
7509K	**2,3,6-Pyridinetricarboxylic acid***(anh.)	. . .	$C_5H_2N(COOH)_3$	211.13
7510	**2,4,5-Pyridinetricarboxylic acid***. See *Berberonic acid.*			
7511	**2,4,6-Pyridinetricarboxylic acid***. See *Trimesitic acid.*			
7512	**3,4,5-Pyridinetricarboxylic acid***	β-carbocinchomeronic acid	$C_5H_2N(COOH)_3$	211.13
7513	**2,4,6-Pyridinetriol**	2,4,6-trihydroxypyridine	$C_5H_2N(OH)_3$	127.10
7514	**2-Pyridol**.	2(1)-pyridone, α-pyridone	HOC_5H_4N	95.10
7515	**3-Pyridol**.	3-hydroxypyridine	HOC_5H_4N	95.10
7516	**4-Pyridol**.	4(1)-pyridone; γ-pyridone. .	HOC_5H_4N .	95.10
7517	**α-Pyridone.**	See 2-*Pyridol.*		
7518	**γ-Pyridone.**	See 4-*Pyridol.*		
7519	**2(1)-Pyridone.**	See 2-*Pyridol.*		
7520	**4(1)-Pyridone.**	See 4-*Pyridol.*		
7520M	**Pyridoxin.**	See *Vitamin B₆*		
7521	**α-Pyridylamine.**	See *Pyridine, 2-amino-.*		
7522	**β-Pyridylamine.**	See *Pyridine, 3-amino-.*		
7523	**γ-Pyridylamine.**	See *Pyridine, 4-amino-.*		
7524	**Pyrimidine**.	1,3-diazine; *m*-diazine; miazine	N·CHN:CHCH:CH	80.09
7525	**2,4(1,3)-Pyrimidinedione.** See *Uracil.*			
7526	**Pyrimidinetetrone.**	See *Alloxan.*		
7527	**Pyrimidinetrione.**	See *Barbituric acid.*		
7528	**Pyrocatechol**.	1,2-benzenediol*; catechol; pyrocatechin	$C_6H_4(OH)_2$	110.11
7529	——, dibutyl ether.	See *Benzene, 1,2-dibutoxy-**.		
7530	——, diethyl ether.	See *Benzene, 1,2-diethoxy-**.		
7531	——, dimethyl ether.	See *Veratrole*		
7532	——, dipropyl ether.	See *Benzene, 1,2-dipropoxy-**		
7533	——, monoamyl ether.	See *Phenol, o-amoxy-.*		
7534	——, monobutyl ether.	See *Phenol, o-butoxy-.*		
7535	——, monoethyl ether.	See *Phenol, o-ethoxy-.*		
7536	——, monomethyl ether.	See *Guaiacol.*		
7537	——, monopropyl ether.	See *Phenol, o-propoxy-.*		
7538	——, **3-methoxy-**.	pyrogallol 1-methyl ether. .	$CH_3OC_6H_3(OH)_2$	140.13

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7505	yel rhomb. cr. f. w or al.		265	.	sl. s	sl. s.	v. sl. s. eth.
7506	yel need f. w		195		sl s	sl. s.	v. sl. s. eth.
7507	cr f eth., $2H_2O$; f w. $3H_2O$		220 d. $-H_2O$, 100	d	v. s	.	v. sl. s. eth.
7508	need. or leaf		d		v s.	v sl s	i. eth.
7508M	cr. with 2 or $3H_2O$		$-H_2O$, 115, d 160	.	s.	.	.
7508P	need with $2H_2O$		dried at 115: 227 d (235) dried at 100: 187 d (192)		v. s.	v. sl s	v sl s eth.; s. ac. a.
7508R	cr with $2H_2O$ f. w.		d 150		v s		.
7509							
7509 H	cr. with 1.5 or $2H_2O$		sl. d. 150		s. h.	s.	.
7509 K	cr. with $2H_2O$ f. dil. al.		*ca.* 130 d.	.	v. s.	i	i eth., acetic anhydride
7510							
7511							
7512	leaf or pl		$-H_2O$, 115; anh 261	.	s h.		.....
7513	need or powd		230 d.		sl s	s	s eth
7514	col need f bz		107	281	v s.	v. s.	s eth.; sl. s lgr.
7515	need		129		v s	v. s	sl s. eth.
7516	col monocl		$+H_2O$, 92, anh. 148 5	>350	100^{15}	v. s.	v. sl. s. eth., chl., i. bz.
7517							
7518							
7519							
7520							
7520M							
7521							
7522							
7523							
7524	cr		22	124	s	s	...
7525							
7526							
7527							
7528	col monocl. leaf. f. bz., 1 604, 1.615, 1 650	$1\ 371^{15}$	105	240 (240-5)	$45\ 1^{20}$	v s	s eth., bz., chl, alk.
7529							
7530							
7531							
7532							
7533							
7534	.						
7535							
7536							
7537							
7538	need . .	. . .	38-41	$146\text{-}7^{15-16}$	. .		

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
7539	**Pyrocatechol, 3-methyl-**	3-methyl-1,2-benzenediol*; isohomopyrocatechol; 2, 3-dihydroxytoluene	$CH_3C_6H_3(OH)_2$.	124 13
7540	——, **4-methyl-.**	See 4-*Homopyrocatechol.*		
7541	**Pyrocatechol-o-acid.**	See *Benzoic acid, 2,3-dihydroxy-.*		
7542	**o-Pyrocatechuic acid.**	See *Benzoic acid, 2,3-dihydroxy-.*		
7543	**Pyrocoll**..............	5,10-dipyrrolo[1,2-*a*,1,2-*d*]-pyrazinedione	$C_4H_3N(CO)_2NC_4H_3$	186 16
7544	**Pyrodin.**	See *Hydrazine, 1-acetyl-2-phenyl-.*		
7545	**Pyrogallol**............	1,2,3-benzenetriol*; *v*-trihydroxybenzene	$C_6H_3(OH)_3$.. ...	126 11
7546	——, 1,2-dimethyl ether	See *Phenol, 2,3-dimethoxy-.*		
7547	——, 1,3-dimethyl ether.	See *Phenol, 2,6-dimethoxy-*		
7548	——, 1-methyl ether.	See *Pyrocatechol, 3-methoxy-.*		
7549	——, 2-methyl ether.	See *Resorcinol, 2-methoxy-.*		
7550	——, triacetate...........	.. ..	$C_6H_3(OOCCH_3)_3$	252 22
7551	——, trimethyl ether.	See *Benzene, 1,2,3-trimethoxy-**.		
7552	——, **4-acetyl-.**	See *Gallacetophenone*		
7553	——, **4-benzoyl-.**	See *Benzophenone, 2,3,4-trihydroxy-.*		
7554	——, **5-methyl-.**	3,4,5-trihydroxytoluene	$CH_3C_6H_2(OH)_3$.	140 13
7555	**4-Pyrogallolcarboxylic acid.**	See *Benzoic acid, 2,3,4-trihydroxy-.*		
7556	**Pyrogallolphthalein.**	See *Gallein.*		
7557	**Pyromellitic acid**.....	1,2,4,5-benzenetetracarboxylic acid*	$C_6H_2(COOH)_4$.	254 15
7558	**Pyromucic acid.**	See 2-*Furoic acid.*		
7559	——, amyl ester .	*n*-amyl furoate, pentyl 2-furancarboxylate	$C_4H_3O{\cdot}COOC_5H_{11}$	182 21
7560	——, butyl ester	*n*-butyl furoate	$C_4H_3O\ COOC_4H_9$	168 19
7561	——, *sec*-butyl ester	*sec*-butyl furoate	$C_4H_3OCOOC_4H_9$.	168 19
7562	——, ethyl ester	ethyl pyromucate, ethyl furoate	$C_4H_3O\ COOC_2H_5$	140 13
7563	——, furfuryl ester	See *Furfuryl alcohol, 2-furoate*		
7564	——, heptyl ester	*n*-heptyl furoate	$C_4H_3OCOOC_7H_{15}$.	210 27
7565	——, hexyl ester	*n*-hexyl furoate	$C_4H_3OCOOC_6H_{13}$	196 24
7566	——, isoamyl ester	isoamyl furoate	$C_4H_3O\ COOC_5H_{11}$	182 21
7567	——, methyl ester	methyl furoate	$C_4H_3OCO_2CH_3$	126 11
7568	——, octyl ester		$C_4H_3OCOOC_8H_{17}$	224 29
7569	——, propyl ester	*n*-propyl furoate	$C_4H_3OCOOC_3H_7$	154 16
7570	——, **3-bromo-**	3-bromofuroic acid	$C_4H_2BrO{\cdot}COOH$.	190.99
7571	——, **5-bromo-**	.	$BrC_4H_2O\ COOH$	190 99
7572	——, ——, ethyl ester	.	$BrC_4H_2O{\cdot}COOC_2H_5$	219.01
7573	——, **3-chloro-**.... ..	3-chloro-2-furancarboxylic acid*; 3-chlorofuroic acid	$C_4H_2ClO\ COOH$.	146 53
7574	——, **5-chloro-**..	5-chloro-2-furancarboxylic acid*; 5-chlorofuroic acid	$C_4H_2ClO\ COOH$.	146 53
7575	——, **5-methyl-** .. .		$CH_3C_4H_2O{\cdot}COOH$	126 11
7576	——, ——, methyl ester		$CH_3C_4H_2O\ COOCH_3$	140 13
7577	——, **5-nitro-** . ..		$NO_2C_4H_2O{\cdot}COOH$	157 08
7578	——, **tetrahydro-** .	tetrahydrofuroic acid	$C_4H_7O{\cdot}COOH$....	116.11

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7539	leaf f bz		68 (47)	241	s.	s.	s. eth., chl., bz.
7540							
7541							
7542							
7543	yel. monocl. leaf.		269	subl.	i	v. sl. s.	v. sl. s. eth.; s. ac. a.
7544							
7545	need or leaf	1 453$\frac{4}{4}$	133-4	309 (293 d.)	62 5^{25}	100^{25}	83 3^{25} eth.; sl. s. bz., chl., CS_2
7546							
7547							
7548							
7549							
7550	wh. cr powd		165	. .	v v sl s.		s dil. alk.
7551							
7552							
7553							
7554	need f bz		129				.
7555							
7556							
7557	tricl. tab ($+2H_2O$) f w		264 (269-71)		1 42^{16}	v s	sl s eth
7558							
7559	col. liq	1 0335		95-7^{1}	i.	∞	
7560	col liq.. ..	1 0555		118-20^{25}; 83-4^{1}	i.	∞	∞ eth.
7561	col liq ...	1 0465		67-9^{1}	i.	∞	∞ eth.
7562	wh cr. leaf., 1 4699^{40}	1 0974$\frac{40}{4}$, 1 1774$\frac{21}{4}$	34 (30-3)	195^{706}	i.	∞	s. eth.
7563							
7564	col liq. ..	1 0005$\frac{20}{4}$		116-7^{1}	i.	s	.
7565	col. liq.	1 0170$\frac{20}{4}$		105-7^{1}	i.	s	..
7566	col. liq.	.....		135-7^{25}	i	∞	.
7567	liq	1 178		181 3	i (sl. s.)	∞	∞ eth.
7568	col liq.	0 9885		126-7^{1}	i	s	. .. ..
7569	col. liq.	1 075		211	i. (sl s.)	s	∞ eth.
7570	wh. need. f. w		127 9		1 3^{20}	s.	s. eth.; v. sl. s. lgr., CS_2
7571	wh. leaf. f. w		186		v. sl. s c.	s.	v. s. eth.
7572	pr.	1 528^{20}	17	235^{767} ..	i.	s.	s. eth.
7573	wh. cr		148 5 9 5	...	i.	s.	..
7574	wh. leaf. . .		179 80	.	0.3^{20}	s	. . .
7575	pl. or need. f. w.		108 9		v. s. h	v. s.	v s eth.
7576	col. liq.....			98^{15}	. ..		s eth.
7577	wh. cr. f. w.	.	185 0-5 5	subl.	s. h.	s.	s eth.
7578	wh. cr	1 1933	21	131-2^{14}	. ..		

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
7579	**Pyromucyl chloride.**	See *Furoyl chloride.*		
7580	**1,4-Pyrone**............	4-oxo-1,4-pyran, α-pyrone	OCH:CH- COCH·CH	96.08
7581	**——, 5-hydroxy-2-hydroxymethyl-.**	See *Kojic acid.*		
7582	**Pyroracemic acid.**	See *Pyruvic acid.*		
7583	**Pyrotartaric acid**......	methylbutanedioic acid*; methylsuccinic acid	$COOHCH_2CH$- $(CH_3)COOH$	132 11
7584	**——, α-hydroxy-.**	See *Citramalic acid.*		
7585	**Pyrotritaric acid**......	2,5-dimethyl-3-furancarboxylic acid; uvic acid; uvinic acid	$(CH_3)_2C_4HO$· COOH	140 13
7587	**Pyrrocoline, octahydro-.**	See *Piperolidine.*		
7588	**Pyrro[ab1]diazole.**	See 1,2,4-*Triazole.*		
7589	**Pyrrole**...............	azole	NHCH:CH- CH:CH	67.09
7590	**——, 1-acetyl-**.......	*N*-acetylpyrrole	$CH_3CONC_4H_4$	109 12
7591	**——, dihydro-*.**	See *Pyrroline*.*		
7592	**——, 2,4-dimethyl-**...	..	$NHC(CH_3)$:CHC- (CH_3)·CH	95 14
7593	**——, 2,5-dimethyl-**	....	$NHC(CH_3)$:CH- CH $C(CH_3)$	95 14
7594	**——, 1-ethyl-**	*N*-ethylpyrrole ..	$C_2H_5NC_4H_4$.	95 14
7595	**——, 1-methyl-**	*N*-methylpyrrole .	$N(CH_3)CH$:CH- CH:CH	81 11
7596	**——, 2-methyl-**	α-methylpyrrole	$NCH(CH_3)$.CH- CH:CH	81 11
7597	**——, 3-methyl-**. .	β-methylpyrrole	NCH:$CH(CH_3)$- CH:CH	81 11
7598	**——, 1-propyl-**	*N*-*n*-propylpyrrole	$CH_3CH_2CH_2NC_4$- H_4	109.17
7599	**——, tetrahydro-*.**	See *Pyrrolidine*.*		
7600	**——, tetrahydro-2-oxo-.**	See 2-*Pyrrolidone.*		
7601	**——, 2,3,4,5-tetra-iodo-***	iodol	C_4I_4NH........	570 74
7602	**2-Pyrrolecarboxylic acid***	. ...	C_4H_4N·COOH...	111 10
7603	**Pyrrolidine***.........	tetrahydropyrrole; tetramethyleneimine	$NHCH_2CH_2CH_2C$- H_2	71 12
7604	**——, 2-keto-.**	See 2-*Pyrrolidone.*		
7605	**——, 1-methyl-**.......	*N*-methylpyrrolidine... .	$CH_3NC_4H_8$.......	85 15
7605M	**——, 2-oxo-.**	See 2-*Pyrrolidone.*		
7606	**2-Pyrrolidinecarboxylic acid*.**	See *Proline.*		
7607	**2,5-Pyrrolidinedione.**	See *Succinimide.*		
7608	**2-Pyrrolidone**.	2-oxopyrrolidine; α-pyrrolidone	$NHCOCH_2CH_2C$- H_2	85 10

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7579							
7580	pr., $1.5238^{40.1}$..	$1\ 190^{40.3}$	32 5	217 7	v. sl s.	s.	v. s. eth.
7581							
7582							
7583	tricl., $1.43025^{15.3}$	1 410	111	d.	$66\ 7^{20}$	71	s. eth ; 110^{19} me. al.
7584							
7585	col. need. f. w.	....	135 (136–7)	subl.	0.25^{100}	v. s.	v. s. eth.
7587							
7588							
7589	col liq., 1.5035	$0\ 948\frac{20}{4}$, ($0\ 9669\frac{21}{4}$)	. ....	131	i.	v. s.	v. s. eth.; s. bz., dil. a.; i. dil. alk.
7590	liq		. .	181–2	sl s.	....	d. HCl
7591							
7592	pa. bl. fluores liq.	$0\ 927\frac{14}{4}$	.	165^{743} (171)	sl. s.	v. s.	v. s. eth.; s. bz.
7593	oil, 1.50357.	0 935		165 (169)	v. sl. s.	s.	s. eth.
7594		$0\ 888^{16}$		130–1	i.	∞	∞ eth.
7595	col liq, $1\ 4888^{16}$	$0\ 9203^{10}$		$114–5^{748}$	i.	∞	∞ eth.
7596	liq	0 945	.	148	i.	∞	∞ eth.
7597	liq.	. .	...	143	..... .	....	sl. s. dil. a.
7598	liq	....	. . .	145.5–6.5	.	. ....	....
7599							
7600							
7601	yel need f. dil. al	....	d 150	......	0 02	$5\ 8^{15}$ 90%	50 eth.; s. bz, chl.
7602	monocl pr....	....	191 5 d.	d 208 5	s.	s.	s. eth.
7603	col. liq	$0\ 871^{19}$; $0\ 8520^{23}$	....	88 5	∞	∞	∞ eth.
7604							
7605	liq..........	....	....	81–3	s.	....	....
7605M							
7606							
7607							
7608	cr	1.116^{25}	24 6	245 (250.8)	v. s.	v. s.	v. s. eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
7609	**Pyrroline***............	dihydropyrrole*..........	C_4H_7N .	69.10
7610	**Pyrrolylene.**	See 1,3-*Butadiene**.		
7611	**α-Pyrromonazole.**	See *Pyrazole.*		
7612	**Pyruvaldehyde,** aldoxime	2-oxopropanal 1-oxime*; isonitrosoacetone	$CH_3COCH{:}NOH$.	87 08
7613	**Pyruvic acid**.........	2-oxopropanoic acid*; α-ketopropionic acid; pyroracemic acid; acetylformic acid	$CH_3COCOOH$.	88 06
7614	——, ethyl ester.....	ethyl pyruvate..... .	$CH_3COCOOC_2H_5$.	116 11
7615	——, methyl ester..	methyl 2-oxopropanoate*; methyl pyruvate	$CH_3COCOOCH_3$	102 09
7616	**Pyruvonitrile**.........	2-oxopropanenitrile*; acetyl cyanide	CH_3COCN. .	69 06
7617	**Quercetin**...... .	3,3′,4′,5,7-pentahydroxyflavone, meletin; sophoretin	$C_{15}H_{10}O_7$. ..	302.23
7618	***d*-Quercitol**.....	cyclohexanepentol* (one form), *d*-quercite	$C_6H_7(OH)_5$.	164.16
7619	**Quercitrin**.....	.	$C_{21}H_{20}O_{11}$...	448.37
7620	**Quinacetophenone.**	See *Acetophenone, 2,5-dihydroxy-*.		
7620M	**Quinaldic acid** (anh)	2-quinolinecarboxylic acid*	C_9H_6NCOOH	173.16
7621	——, **4-hydroxy-.**	See *Kynurenic acid.*		
7622	**Quinaldine** .	2-methylquinoline . ..	$CH_3C_9H_6N$	143 18
7623	——, **hydroxy-.**	See *Quinolinol, 2-methyl-*.		
7624	——, **methyl-.**	See *Quinoline, dimethyl-*.		
7625	**Quinalgen.**	See *Analgen.*		
7626	**Quinalizarin**	1,2,5,8-tetrahydroxyanthraquinone, alizarin bordeaux	$(HO)_2C_6H_2(CO)_2$-$C_6H_2(OH)_2$	272 20
7627	**Quinamine**...	..	$C_{19}H_{24}N_2O_2$ ..	312.40
7628	***p*-Quinanisole.**	See *Quinoline, 6-methoxy-*.		
7629	**Quinazine.**	See *Quinoxaline*		
7630	**Quinazoline** .. .	benzo[*a*]pyrimidine; 1,3-benzodiazine, phenmiazine	$C_6H_4N{:}CHN{:}CH$	130 14
7631	——, **3,4-dihydro-3-phenyl-**	orexin, phenzoline; cedrarine .	$C_6H_4N{:}CHN$-$(C_6H_5)CH_2$	208.25
7632	**Quinhydrone.** ..	benzoquinhydrone...	$C_6H_4O_2\ C_6H_4(OH)_2$	218 20
7633	**Quinic acid**..........	1,2,4,5-tetrahydroxycyclohexanecarboxylic acid*	$(HO)_4C_6H_7COOH$	192 17
7634	**Quinicine**	.	$C_{20}H_{24}N_2O_2$	324 41
7635	——, oxalate (*d*)......	. .	$(C_{20}H_{24}N_2O_2)_2\ H_2$-$C_2O_4{\cdot}9H_2O$	901 00
7636	**Quinidine**...........	conquinine .	$C_{20}H_{24}N_2O_2\ 2\frac{1}{2}H_2O$	369 45
7637	——, bisulfate.....	. . . .	$C_{20}H_{24}N_2O_2{\cdot}H_2$-$SO_4\ 4H_2O$	494 55

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
7609	liq	0.910^{20}_{4}		90	v. s.	∞	∞ eth.
7610							
7611							
7612	leaf. f. eth	$1.074^{66.5}$	69	subl	v. s		v. s. eth.; v. sl. s. pet. eth.
7613	col. liq.	1.267	13.6	165 sl. d	∞	∞	∞ eth.
7614	col. liq.	1.060^{16}_{4}		$144, 55^{17}$	sl. s.	∞	∞ eth.
7615	col. liq	1.154^{0}		137	sl. s.	∞	∞ eth.
7616	rhomb			93	d.		s. eth.
7617	yel. need		anh. 310 d	subl.	0.35	0.48	v. sl. s. eth.; s. alk.
7618	col. monocl	1.585^{17}	234	d	10 c	sl. s	i. eth.
7619	yel. need. or leaf		250-2, 185, (168 d.)		0.04^{20}, 0.69^{100}	25.6^{78}	0.8 eth., s. alk. sol., amyl al., ac. a
7620							
7620M	need. with $2H_2O$ f. w., anh., cr. f. bz		156 anh		sl. s. c., s. h.		v. s. h. bz.
7621							
7622	col. liq	1.103		246-7	v. sl. s	s.	s. eth., chl.
7623							
7624							
7625							
7626	red rhomb. need.		> 275	subl	i	v. sl. s	v. sl. s. eth.
7627	need.		172		i	v. s. h.	s. h. eth.
7628							
7629							
7630	pl. f. pet. eth		48	243	v. s	s	s. eth.
7631	hex. pl.	1.290^{4}	95			s	s. eth.
7632	dk. grn. rhomb. pr	1.401^{20}_{4}	171	subl	s. h.	v. s	v. s. eth.; s. NH_4OH, d. chl
7633	col. monocl. f. w	1.637	163	d	40^{9}	s	v. sl. s. eth., s. ac. a
7634	yel. oil		60		sl. s.	s	s. eth., chl
7635	pr. f. chl. or need. f. al		149		s. h.	s.	s. chl.
7636	pr. f. al., [α] $274.7°^{17}_{D}$ in al. + chl		171.5 d		0.05^{15}	4^{20} 80%	4.5^{20} eth.; s. chl
7637	hair-like need., bl. fluores. in sol., [α] $184.17°_D$ 3% sol. in chl.				1^{15}	12	v. sl. s. eth.

For explanations and abbreviations see beginning of table

No.	Name	Synonyms	Formula	Mol. Wt
7638	**Quinidine**, hydrochloride (*d*)	. . . .	$C_{20}H_{24}N_2O_2 \cdot HCl$ H_2O	378 89
7639	——, sulfate (*d*) . .	. . . .	$(C_{20}H_{24}N_2O_2)_2$ H_2-SO_4 $2H_2O$	782 93
7640	**Quinine** (anhydrous)	. . . . . .	$C_{20}H_{24}N_2O_2$	324 41
7641	**Quinine** (hydrate)	. . . .	$C_{20}H_{24}N_2O_2$ $3H_2O$.	378 46
7642	——, arsenate	. .	$(C_{20}H_{24}N_2O_2)_2 \cdot$ H_3AsO_4 $8H_2O$	934 88
7643	——, bisulfate	. . . . .	$C_{20}H_{24}N_2O_2$ H_2-SO_4 $7H_2O$	548 60
7644	——, dihydrochloride		$C_{20}H_{24}N_2O_2$ 2HCl	397 34
7645	——, formate	.	$C_{20}H_{24}N_2O_2$ HCOOH	370 44
7646	——, hydrobromide	.	$C_{20}H_{24}N_2O_2$ HBr H_2O	423 35
7647	——, (mono)hydrochloride	. . .	$C_{20}H_{24}O_2N_2$ HCl	360 88
7648	——, (mono)hydrochloride (hydrate)	. . . .	$C_{20}H_{24}O_2N_2$ HCl $2H_2O$	396 91
7649	——, iodosulfate	herapathite . .	$4C_{20}H_{24}N_2O_2$ $3H_2$-SO_4 2HI I_4 $6H_2O$	2463 50
7650	——, salicylate	. .	$C_{20}H_{24}N_2O_2$ C_7H_6-O_3 H_2O	480 55
7651	——, sulfate	.	$(C_{20}H_{24}N_2O_2)_2 \cdot$ H_2SO_4	746 90
7652	——, sulfate (hydrate)	.	$(C_{20}H_{24}N_2O_2)_2$ H_2-SO_4 $2H_2O$	782 93
7653	——, urea-hydrochloride		$C_{20}H_{24}O_2N_2$ HCl $CO(NH_2)_2$ HCl $5H_2O$	547 48
7654	——, valerate		$C_{20}H_{24}N_2O_2$ C_5H_{10}-O_2 H_2O	444 56
7655	**Quinizarin**	1,4-dihydroxyanthraquinone	$C_6H_4(CO)_2C_6H_2$-$(OH)_2$	240 20
7656	**Quinol.**	See *Hydroquinone*		
7657	**Quinoline**.	benzo[*b*]pyridine; 1-benzazine	C_6H_4N:CHCH:CH	129 15

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7638	asbestos-like pr, [α] 2 212-2 562°$_D$ 97% al		anh 258-9 d		1 6^{10}	v s	v. sl. s. eth, v. s. chl.
7639	pr or need; sol fluores bl, [α]+184 17°$_D$ 3% sol. in chl				1^{15}	12	v sl s eth, s chl.
7640	amor powd		174 9		0 0571	166	22 2 eth.
7641	flaky or micro cr. powd efflor, 1 620, 1 625, 1 630, [α] -145 2$^{\circ 15}_{D}$		57		0 064	154	73 8 eth; s. chl, bz, CS_2, oils, glyc.
7642	wh cr				s h		. .
7643	sm. ortho-rhomb need efflor.		160 d.		11 1	5 36	0 056 eth.; s. chl.
7644	wh powd or need				166 6	10 3	v sl s. eth.; sl. s chl
7645	cr powd .		109		3	s	v sl s. eth; s. chl
7646	silky efflor need		152-200		2 5	149 2	6 25 eth.; s. chl
7647	silky efflor need, [α] -144.98$^{\circ 15}_{D}$		158-60	259 d	5 6^{25}	166^{25}	0 42^{25} eth; s. CS_2, bz, oils, glyc, NH_4OH, KOH sol., a
7648	silky efflor need. [α] -144 98$^{\circ 15}_{D}$		156-90		5 55	166	0 415 eth; s. chl., glyc
7649	red-grn dichroic cr or olive grn powd				d	0 12 c., s h	. .
7650	col need		185 d.		1.3	8 8	0 88 eth; s. chl., glyc.
7651	silky efflor. need.		anh. 235		0 14^{25}	1 16^{25}	sl s eth; s. CS_2, bz, oils, glyc, KOH sol, NH_4OH, a; sl. s chl.
7652	silky cr. or need, efflor		205		0 139	1 16	sl s eth., chl.; s. glyc.
7653	wh pr. or powd.		70-5		111 1	51 4	... .
7654	cr. powd .	.	90		0 8	50	7 eth.
7655	red need. f. al		194-5	subl. sl. d		s	s eth., bz., KOH, H_2SO_4
7656							
7657	col liq, 1 62450$^{24.9}$	1 095$^{20}_{4}$	-19 5	237 7	6	∞	∞ eth., CS_2

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
7658	**Quinoline, 2-amino-**	α-quinolylamine	$NH_2C_9H_6N$	144.17
7659	**——, 4-amino-**	γ-quinolylamine	$NH_2C_9H_6N$	144.17
7660	**——, 5-benzamido-8-ethoxy-.** See *Analgen.*			
7661	**——, 2-chloro-***	α-chloroquinoline	ClC_9H_6N	163.60
7662	**——, 3-chloro-***	β-chloroquinoline	ClC_9H_6N	163.60
7663	**——, 4-chloro-*.**	γ-chloroquinoline	ClC_9H_6N	163.60
7664	**——, decahydro-*.**		$C_9H_{17}N$	139.24
7665	**——, 2,3-dichloro-***		$C_9H_5Cl_2N$	198.05
7666	**——, 5,8-dichloro-*.**		$C_9H_5Cl_2N$	198.05
7667	**——, 6,8-dichloro-***		$C_9H_5Cl_2N$	198.05
7668	**——, 7,8-dichloro-*.**		$C_9H_5Cl_2N$	198.05
7670	**——, 2,3-dimethyl-**	3-methylquinaldine	$(CH_3)_2C_9H_5N$	157.21
7671	**——, 2,4-dimethyl-**	4-methylquinaldine	$(CH_3)_2C_9H_5N$	157.21
7672	**——, 2,6-dimethyl**	p-toluquinaldine; 6-methylquinaldine	$(CH_3)_2C_9H_5N$	157.21
7673	**——, 3,4-dimethyl-**	....	$(CH_3)_2C_9H_5N$	157.21
7674	**——, 5,8-dimethyl-**		$(CH_3)_2C_9H_5N$	157.21
7675	**——, 6,8-dimethyl-**	β-cytisolidine	$(CH_3)_2C_9H_5N$	157.21
7676	**——, 2-homopiperonyl-4-methoxy-.** See *Cusparine.*			
7677	**——, 6-methoxy-**	p-quinanisole, methyl 6-quinolyl ether	$C_9H_6N\ OCH_3$	159.18
7678	**——, 2-methyl-.**	See *Quinaldine*		
7679	**——, 3-methyl-**	β-methylquinoline	$CH_3C_9H_6N$	143.18
7680	**——, 4-methyl-.**	See *Lepidine.*		
7681	**——, 6-methyl-**		$CH_3C_9H_6N$	143.18
7682	**——, 7-methyl-**		$CH_3C_9H_6N$	143.18
7683	**——, 8-methyl-**		$CH_3C_9H_6N$	143.18
7684	**——, 1-methyl-1,2,3,4-tetrahydro-.** See *Kairoline.*			
7685	**——, 5-nitro-***		$NO_2C_9H_6N$	174.15
7686	**——, 6-nitro-***		$NO_2C_9H_6N$	174.15
7687	**——, 7-nitro-***		$NO_2C_9H_6N$	174.15
7688	**——, 8-nitro-*.**		$NO_2C_9H_6N$	174.15
7689	**——, 2-phenyl-**		$C_6H_5C_9H_6N$	205.25
7690	**——, 6-phenyl-**		$C_6H_5C_9H_6N$	205.25
7691	**——, 8-phenyl-**		$C_6H_5C_9H_6N$	205.25
7692	**——, 1,2,3,4-tetrahydro-***		$C_9H_{11}N$	133.19
7693	**——, 1,2,3,4-tetrahydro-6-methoxy-.** See *Thalline.*			
7694	**——, 2,3,4-trimethyl-**		$C_9H_4N(CH_3)_3$	171.23

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7658	leaf f w	.	129		v sl s c, s h	v. s	v s. eth.; s chl; sl s bz, lgr
7659	need (+1H_2O) f w		anh 154; +1H_2O, 69–70	-H_2O, 100	s	s	v s. chl, sl s. lgr, CS_2
7660							
7661	need f. dil al	1 275[17]	37–8	266–7 (276)	i.	s.	s eth., bz, lgr
7662	hyg	.		255[743]			. . .
7663	cr	1 251	31	261[744]		v s	v. s. eth.; s. dil. HCl
7664	(*cis*) col liq.	0 9426$\frac{20}{4}$	-40	205–6 (83–3 5[16])	sl s	s	s eth.
	(*trans*) wh. cr	0 9021$\frac{55}{4}$	48	203[735]	s h	v. s	v. s. eth.
7665	cr f dil al		104–5		i	s	s eth., bz; sl. s lgr.
7666	sh. need f al		92–3			s	s eth
7667	need f. eth or al		104–5	volat >100		s.	s. eth.
7668	need		35 5			s.	s eth
7670	yel need or leaf	1 1013[16]	68–9	261 (247)	sl s	s	s eth., lgr.
7671	liq	1 061$\frac{15}{4}$	.	264	v sl s	v s	v s eth.
7672	trim f eth	.	60	266–7 (259–61)	sl s. h	s	s eth.
7673	cr		73–4 (65)	290[737]	i.	s.	s eth.
7674	liq	1 070$\frac{21}{4}$	4–5	265[736]	sl s.	s	s eth.
7675	liq .	1 0665[4]		269	sl s	s.	s eth.
7676							
7677	liq	1 165[0], 1 154[20]	<-18	186[35]		s.	. .
7678							
7679	col liq or cr, 1 60695[23 8]	1 074	14	250	i	s	s eth.
7680							
7681	1 6141[23]	1 066	10–4	255	v sl s (i)	s.	s. eth.
7682	yel oil.	1 072	<-20	252 5	v sl s (i)	s	s eth
7683	liq	1 073		247 3–8 3[751]	v sl s (i)	s.	s. eth.
7684							
7685	need f w		72	subl.	sl. s h	.	s. bz.
7686	need		150	subl	v sl s c, s h	v sl s	v. sl s. eth, v s bz., sl s lgr.
7687	need f al		133			v. sl s	v s eth
7688	monocl. need f al		89		v sl s c	s.	s eth, bz.
7689	need f al	. .	86	363	sl s	v s h	v s eth.
7690	trim f eth. or al.	1 195	111	260[77]	v sl s	s.	s. eth.
7691	thk fluores oil			283[187]		s	s eth., bz.
7692	col-yel cr, 1 59331[25 9]	1 055	20	251	v. sl s.	∞	∞ eth.
7693							
7694	cr		ca 65	285		. .	

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
7695	**Quinoline, 2,4,5-trimethyl-**		$C_9H_4N(CH_3)_3$	171 23
7696	**——, 2,5,7-trimethyl-**	tetracoline.	$C_9H_4N(CH_3)_3$	171 23
7697	**——, 2,6,7-trimethyl-**		$C_9H_4N(CH_3)_3$	171 23
7698	**——, 2,6,8-trimethyl-**		$C_9H_4N(CH_3)_3$	171 23
7698H	**2-Quinolinecarboxylic acid*.** See *Quinaldic acid.*			
7698K	**3-Quinolinecarboxylic acid***		C_9H_6NCOOH	173 16
7698M	**4-Quinolinecarboxylic acid*.** See *Cinchoninic acid*			
7698P	**5-Quinolinecarboxylic acid***		C_9H_6NCOOH	173 16
7698R	**6-Quinolinecarboxylic acid***		C_9H_6NCOOH	173 16
7698T	**7-Quinolinecarboxylic acid***		C_9H_6NCOOH	173 16
7698V	**8-Quinolinecarboxylic acid***		C_9H_6NCOOH	173 16
7699	**Quinolinic acid**	2,3-pyridinedicarboxylic acid*	$C_5H_3N(COOH)_2$	167 12
7700	**2-Quinolinol.**	See *Carbostyril.*		
7701	**4-Quinolinol**... ..	kynurine .	$HOC_9H_6N\ 3H_2O$	199 20
7702	**——, 2-methyl-**	4-hydroxyquinaldine	$C_{10}H_9NO$	159 18
7703	**5-Quinolinol**...		HOC_9H_6N	145 15
7704	**6-Quinolinol** .		HOC_9H_6N	145 15
7705	**——, 2-methyl-** .	6-hydroxyquinaldine	$C_{10}H_9NO$	159 18
7706	**7-Quinolinol** .		HOC_9H_6N	145 15
7707	**——, 2-methyl-**	7-hydroxyquinaldine	$C_{10}H_9NO$	159 18
7708	**8-Quinolinol.**		HOC_9H_6N	145 15
7709	**——, 2-methyl-**	8-hydroxyquinaldine .	$C_{10}H_9NO$	159 18
7710	**2(1)-Quinolone.**	See *Carbostyril*		
7711	**——, 3,4-dihydro-.**	See *Hydrocarbostyril.*		
7712	**α-Quinolylamine.**	See *Quinoline, 2-amino-.*		
7713	**γ-Quinolylamine.**	See *Quinoline, 4-amino-*		
7714	**Quinone** (para or ordinary)	*p*-benzoquinone, 1,4-cyclohexadienedione*	$O\ C_6H_4\ O$	108 09
7715	——, bischloroimide	*p*-benzoquinone bischloroimide	$C_6H_4(\cdot NCl)_2$	175 02
7716	——, chloroimide	*p*-benzoquinone monochloroimide	$O\ C_6H_4\ NCl$	141 56
7717	——, dioxime ...	*p*-benzoquinone dioxime	$C_6H_4(\ NOH)_2$	138 12
7718	——, monoxime	See *Phenol, p-nitroso-.*		
7719	**——, 2,6-dichloro-**...	2,6-dichloro-*p*-benzoquinone	$C_6H_2Cl_2O_2$	176 99
7720	**——, 2,5-dichloro-3,6-dihydroxy-.** See *Chloranilic acid*			
7721	**——, 2,5-dihydroxy-**	2,5-dihydroxy-*p*-benzoquinone	$C_6H_2O_2(OH)_2$	140 09
7722	**——, 2,5-dihydroxy-3,6-dinitro-.** See *Nitranilic acid*			
7723	**——, 2,3-dimethyl-.**	See *o-Xyloquinone.*		
7724	**——, 2,5-dimethyl-.**	See *Phlorone*		
7725	**——, 2,6-dimethyl-.**	See *m-Xyloquinone.*		
7726	**——, 2-methyl-.**	See *Toluquinone.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7695	need. f w		63–4		s.		
7696	pr.		43	285–7	v s	v s	v s eth.
7697	monocl						
7698	monocl pr f lgr		46	250^{719}	i	v s	v s lgr
7698H							
7698K	tab. f dil al		275 sl d		sl s c, s h	s.	
7698M							
7698P	cr by subl		338–40	subl	v sl s	v sl s.	i. eth., bz., CS_2; s min.a., alk.
7698R	pr by subl		290–1	subl	v sl s.	s. h.	s min a., alk.
7698T	need. f w or al		248 5–50	subl.	v sl. s c	s.	i eth.
7698V	need f w		186–7 5	subl	s h.	s. h.	s. min a, alk.
7699	monocl pr...		190 d (195)		$0\ 55^{6\ 5}$	sl. s.	v sl s. eth.
7700							
7701	col monocl need f w		$3H_2O$, 52, $-H_2O$, 110, anh. 201	>300 d	$0\ 47^{15}$	s.	sl s eth.
7702	pr. f w		231	d	1 c, 10 h.	s.	v sl s eth, bz.
7703	pr or leaf. f al		224	subl	sl s.	s.	sl s. eth; v s h Na_2CO_3, i lgr
7704	sm pr f al		193	360	v sl s	sl s.	v sl s eth; s. alk.
7705	cr		213	sl d	v sl s	s.	s eth.
7706	pr f al		235–8 d	subl.	sl s	v s.	s alk.
7707	leaf f al		232–4	sl d	i	s h	s eth
7708	pr f dil al		76 (73–4)	266 9	v sl s	v s.	sl s eth.; s. dil alk.
7709	tricl pr. f al		74	267			.....
7710							
7711							
7712							
7713							
7714	yel monocl pr f w	$1\ 318^{20}_{4}$	115 7	subl.	sl s.	s	s eth, h lgr, alk.
7715	need f w		124 d.	.	sl s h	s h.	s eth., v. s. bz.
7716	yel cr f lgr		84 7–5 0	exp.	s h	v s h.	v s eth, chl, s a.
7717	col or yel need.		240 d.	. .	s h	.	s. NH_4OH
7718							
7719	yel rhomb. pr f lgr. or bz.		121	subl.<120	sl. s.	s. h.	s chl.
7720							
7721	dk yel need f et al.			subl. 215–220 d	v sl s	s.	v sl s eth; s. ac a.
7722							
7723							
7724							
7725							
7726							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
7727	**Quinone, nitro-**		$NO_2C_6H_3O_2$	153.09
7728	**——, tetrachloro-.**	See *Chloranil*		
7729	**——, tetrahydro-.**	See 1,4-*Cyclohexanedione**		
7730	**——, tetrahydroxy-**		$(HO)_4C_6O_2$	172.09
7731	**——, trichloro-.**		$Cl_3C_6HO_2$	211.44
7732	**Quinovic acid**		$C_{32}H_{48}O_6$	528.71
7733	**Quinoxaline**	benzopyrazine, 1,4-benzodiazine, quinazine	$C_6H_4N\cdot CHCH\,N$	130.14
7734	**Racemic acid.**	See *dl-Tartaric acid*		
7735	**R acid.**	See 2-*Naphthol-3,6-disulfonic acid*		
7736	**Raffinose**		$C_{18}H_{32}O_{16}\,5H_2O$	594.52
7737	**Resacetophenone**	2,4-dihydroxyacetophenone.	$CH_3COC_6H_3(OH)_2$	152.14
7738	——, 4-methyl ether.	See *Peonol*		
7739	**Resodiacetophenone**	4,6-diacetylresorcinol	$(CH_3CO)_2C_6H_2(OH)_2$	194.18
7740	**Resorcinol**	1,3-benzenediol*; resorcin	$C_6H_4(OH)_2$	110.11
7741	——, diethyl ether	See *Benzene, 1,3-diethoxy-**		
7742	——, diisoamyl ether	See *Benzene, 1,3-diisoamoxy-*		
7743	——, dimethyl ether.	See *Benzene, 1,3-dimethoxy-**		
7744	——, dipropyl ether	See *Benzene, 1,3-dipropoxy-**		
7745	——, monoamyl ether	See *Phenol, m-amoxy-*		
7746	——, monobutyl ether.	See *Phenol, m-butoxy-.*		
7747	——, monoethyl ether	See *Phenol, m-ethoxy-.*		
7748	——, monomethyl ether	See *Phenol, m-methoxy-.*		
7749	——, monopropyl ether	See *Phenol, m-propoxy-.*		
7750	**——, 4-amyl-**	1-*n*-amyl-2,4-dihydroxybenzene	$CH_3(CH_2)_4C_6H_3(OH)_2$	180.24
7751	**——, 4-benzoyl-.**	See *Benzophenone, 2,4-dihydroxy-*		
7752	**——, 4-butyl-**	1-*n*-butyl-2,4-dihydroxybenzene	$CH_3(CH_2)_3C_6H_3(OH)_2$	166.21
7753	**——, 4-caproyl-.**	See *Caprophenone, 2,4-dihydroxy-*		
7754	**——, 4,6-diacetyl-.**	See *Resodiacetophenone*		
7755	**——, dihydro-.**	See 1,3-*Cyclohexanedione**		
7756	**——, 2,4-dimethyl-**	2,4-dimethyl-1,3-benzenediol*, 2,4-dihydroxy-*m*-xylene	$(CH_3)_2C_6H_2(OH)_2$	138.16
7757	**——, 2,5-dimethyl-**	2,5-dimethyl-1,3-benzenediol*, *p*-xylorcinol, β-orcinol, 2,6-dihydroxy-*p*-xylene, betorcinol	$(CH_3)_2C_6H_2(OH)_2$	138.16
7758	**——, 4,5-dimethyl-**	4,5-dimethyl-1,3-benzenediol*, 3,5-dihydroxy-*o*-xylene	$(CH_3)_2C_6H_2(OH)_2$	138.16
7759	**——, 4,6-dimethyl-**	4,6-dimethyl-1,3-benzenediol*, *m*-xylorcinol, 4,6-dihydroxy-*m*-xylene	$(CH_3)_2C_6H_2(OH)_2$	138.16
7760	**——, 2,4-dinitro-**	2,4-dinitro-1,3-benzenediol*, *n*-dinitroresorcin	$(NO_2)_2C_6H_2(OH)_2$	200.11
7761	**——, dithio-**	1,3-benzenedithiol*, *m*-phenylene dimercaptan	$C_6H_4(SH)_2$	142.23
7762	**——, 4-ethyl-**	1,3-dihydroxy-4-ethylbenzene	$C_2H_5C_6H_3(OH)_2$	138.16
7763	**——, 4-hexyl-.**	1-*n*-hexyl-2,4-dihydroxybenzene, caprokol	$CH_3(CH_2)_5C_6H_3(OH)_2$	194.27
7764	**——, 4-isoamyl-.**	2,4-dihydroxy-1-isoamylbenzene	$(CH_3)_2CH(CH_2)_2C_6H_3(OH)_2$	180.24

* Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7727	yel		d *ca.* 206	.	v s. h	s.	sl s. eth.
7728							
7729							
7730	bl. cr .		d.		s. h.	v. s.	sl. s. eth.
7731	yel. leaf. f. w		168–9	subl.	i.	sl. s.	v. s. eth.
7732	wh. cr. powd		. .	. .	i.	sl s h	i. eth.; s. chl., NH_4OH
7733	wh. cr., $1.62311^{48.9}$	1.133^{48}	30 5	226	s	s.	s. eth.; ∞ bz.
7734							
7735							
7736	need. f. w	1.465^{0}	anh 118 9	130 d	14^{20}, ∞ h	v sl s	i eth.; s. me. al
7737	need.		147		i	s.	s eth.
7738							
7739	wh. need.		180		i.	sl s	s eth.
7740	col rhomb. tab f w. or bz	1.285^{15}	110	276 5 (281 4)	229^{73}	243^{25}	v s eth.; s. glyc., bz., amyl al.
7741							
7742							
7743							
7744							
7745							
7746							
7747							
7748							
7749							
7750	col		71 5 3 0	$168\text{–}70^{6}$	v sl s	s	s eth.
7751							
7752	col		47–8	$196\text{–}200^{24}$	v sl s	s	s. eth.
7753							
7754							
7755							
7756	need. by subl		149–50		s	v s.	v. s. eth.
7757	tetr. f. w. or bz.		163	277–80	s	s	s eth.
7758	need f bz , pr (+$1H_2O$) f w.		+$1H_2O$, 115–7, anh 136–7	subl.	s.	v. s.	v. s. eth.; s. ac. a.; sl. s. chl., bz.; v. sl. s. CS_2
7759	monocl cr. f w., chl or bz		124 5–5	276–9 subl.	s	s	s. eth.
7760	yel leaf		147–8	subl ; exp.	sl s	v s	v. s. eth.; s chl
7761	col. shiny cr		27 (25)	243–5	i	s	s eth., alk.
7762	col pr .		98–9	131^{15}	s.	s.	s. eth.
7763	col need . .		68–70	$178\text{–}80^{7}$	0 05	v s	v s eth., acet.; s bz ; sl. s. pet. eth.
7764	col		61 2 5	$177\ 8^{6}$	v sl s	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
7765	**Resorcinol, 4-isobutyl-**	2,4-dihydroxy-1-isobutylbenzene	$(CH_3)_2CHCH_2C_6H_3(OH)_2$	166 21
7766	**——, 4-isohexyl-**	2,4-dihydroxy-1-isohexylbenzene	$(CH_3)_2CH(CH_2)_3C_6H_3(OH)_2$	194.27
7767	**——, 4-isopropyl-**	2,4-dihydroxy-1-isopropylbenzene	$(CH_3)_2CHC_6H_3(OH)_2$	152 19
7768	**——, 2-methoxy-**	pyrogallol 2-methyl ether . ..	$CH_3OC_6H_3(OH)_2$	140 13
7769	**——, 5-methoxy-**	phloroglucinol monomethyl ether	$CH_3OC_6H_3(OH)_2$	140.13
7770	**——, 2-methyl-**	2-methyl-1,3-benzenediol*; 2,6-dihydroxytoluene	$CH_3C_6H_3(OH)_2$..	124.13
7771	**——, 4-methyl-**	See *Cresorcinol.*		
7772	**——, 5-methyl-**	See *Orcinol.*		
7773	**——, 4-propionyl-.**	See *Propiophenone, 2,4-dihydroxy-.*		
7774	**——, 4-propyl-.** . .	2,4-dihydroxy-1-propylbenzene	$CH_3(CH_2)_2C_6H_3(OH)_2$	152.19
7775	**——, 2-salicylyl-.**	See *Benzophenone, 2,2′,6-trihydroxy-.*		
7776	**——, 2,4,6-tribromo-.**	. .	$Br_3C_6H(OH)_2$....	346 83
7777	**——, 2,4,6-trimethyl-.**	See *Mesorcinol*		
7778	**——, 2,4,6-trinitro-.**	See *Styphnic acid.*		
7779	**Resorcinolphthalein.**	See *Fluorescein.*		
7780	**β-Resorcylaldehyde**	2,4-dihydroxybenzaldehyde; 2,4-dihydroxybenzenecarbonal*	$(HO)_2C_6H_3CHO$..	138.12
7781	——, dimethyl ether.	See *Benzaldehyde, 2,4-dimethoxy-.*		
7782	**α-Resorcylic acid** .. .	3,5-dihydroxybenzoic acid; 3,5-dihydroxybenzenecarboxylic acid*	$(HO)_2C_6H_3COOH\ 1\frac{1}{2}H_2O$	181.14
7783	**β-Resorcylic acid**	2,4-dihydroxybenzoic acid; 2,4-dihydroxybenzenecarboxylic acid*	$(HO)_2C_6H_3COOH\ 3H_2O$	208 17
7784	**γ-Resorcylic acid** .	2,6-dihydroxybenzoic acid; 2,6-dihydroxybenzenecarboxylic acid*	$(HO)_2C_6H_3COOH\cdot 1\frac{1}{2}H_2O$	181.14
7785	**Retene**	7-isopropyl-1-methylphenanthrene	$C_{18}H_{18}$...	234.33
7786	**Rhamnitol**	1,2,3,4,5-hexanepentol* (one form), rhamnite	$CH_3(CHOH)_4CH_2OH$	166 17
7787	**β-Rhamnose**		$C_6H_{12}O_5\ H_2O$....	182 17
7788	**Rheadine**	rhoeadine.	$C_{21}H_{21}NO_6$.....	383 39
7789	**Rheum emodin.**	See *Emodin*		
7789M	**Rhodanates.**	See under *Thiocyanic acid.*		
7790	**Rhodinal.**	See *Citronellal.*		
7791	**Rhodinol**	3,7-dimethyl-6-octen-1-ol*(?)	$C_{10}H_{19}OH$......	156 26
7792	**Rhoeadine.**	See *Rheadine*		
7792M	**D-Riboflavin**	vitamin B_2; vitamin G, lactoflavin, ovoflavin, hepatoflavin; 6,7-dimethyl-9-(1-D-ribityl)isoalloxazine	$C_{17}H_{20}N_4O_6$.....	376 36
7792T	**D-Ribose**	....	$C_5H_{10}O_5$.........	150.13
7793	**Ricinine**	,.............	$C_8H_8N_2O_2$.......	164 16
7794	**Ricinoleic acid**	12-hydroxy-9-octadecenoic acid* (one form); ricinoleic acid	$CH_3(CH_2)_5CHOHCH_2CH{:}CH(CH_2)_7COOH$	298 46

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7765	col		63 5	166-8[6]	sl s.	s.	s eth.
7766	col . .		70-1 5	182-3[6]	v. sl. s.	s.	s. eth.
7767	col		105	265-81	sl. s.	s.	s. eth.
7768	cr f. bz.. .		85-7	154-5[24]		......	.... .
7769	tab. f. bz		78-81	213[16]	sl s.	v. s.	v. s. eth.
7770	col. need ..		116-21	264	s.	s.	s. eth., bz.
7771							
7772							
7773							
7774	col. pr. f. bz		107-8 (82-3)	172-4[14-5]	s.	s.	s. eth.
7775							
7776	col. need. f. w		111	....	sl. s.	v. s.	s. eth.
7777							
7778							
7779							
7780	yel need. f. w		135	220-8[22]	v. s.	v. s.	v. s. eth.; sl. s. c. bz.
7781							
7782	col. pr		232-3; anh 237	....	s.	v. s.	v. s. eth.
7783	col. need. f eth.		ca 213 (226-7 d.)	d.	0 26[17]	v. s.	v. s. eth.
7784	col. need. f w		anh. 167 d	. .	v s. h.	..	s. alk.
7785	leaf f al	1 13[16]	98 5	394	i	2 13 c, 69[78]	s. eth, bz., CS_2
7786	tricl. pr		121	.....	v. s.	v. s.	v. sl s. eth.; sl. s. acet., chl.
7787	col. monocl. f. w, 1.523, 1.531, 1.534	1 471	126	. .. .	57[18], 109[40]	sl s.	i. eth.
7788	sm. pr ..		245-7 d.	....	sl. s.	sl. s.	sl. s. eth., chl.; i. bz.
7789							
7789M							
7790							
7791	col. oily liq		. ..	113-4[15]	.. ..	...	... .
7792							
7792M	fine or.-yel. need.		275-80 d.	....	0 012[27.5] 0 019[40]	0 045[27.5]	i. eth., acet., chl., bz.
7792T	$[\alpha]_D$ H_2O, −21 5° (−19 5°)		95; dl -86-7	....	s.	sl. s.	.... .
7793	pr. or tab. f al. or w.	.	201 subl.	....	s. h.	s. h.	sl. s. eth., bz.
7794	col. liq., or cr. mass	0 945[15]	17	250[15]	i.	∞	∞ eth.; s. chl.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
7795	**Ricinoleic acid,** butyl ester	butyl ricinoleate; butyl 12-hydroxy-9-octadecenoate* (one form)	$C_{18}H_{33}O_3C_4H_9$....	354.56
7796	——, glycerol esters.	See under *Glycerol.*		
7797	——, isobutyl ester.......	isobutyl ricinoleate; β-methylpropyl 12-hydroxy-9-octadecenoate* (one form)	$C_{22}H_{42}O_3$........	354.56
7798	**Rodinal.**	See *Phenol, p-amino-.*		
7799	**Rosaniline**............	bis-p-aminophenyl-4-amino-m-tolylcarbinol	$H_2NC_7H_6(H_2NC_6H_4)_2COH$	319 39
7800	**Rosinduline**..........	5,8-dihydro-8-imino-5-phenylbenzo[b]phenazine	$HN{:}C_{10}H_5{:}NC_6H_4NC_6H_5$	321 37
7801	**Rosolic acid.**	See *Aurin.*		
7802	**Rotenone**	....	$C_{23}H_{22}O_6$.... .	394 41
7803	**Rufigallic acid**........	1,2,3,5,6,7-hexahydroxyanthraquinone, rufigallol	$C_{14}H_2O_2(OH)_6$.	304 20
7804	**Rufigallol.**	See *Rufigallic acid.*		
7805	**Rufiopin**..............	1,2,5,6-tetrahydroxyanthraquinone	$C_{14}H_4(OH)_4O_2$	272 20
7806	**Rufol**................	1,5-anthracenediol*; 1,5-anthradiol	$HOC_6H_3(CH)_2C_6H_3OH$	210 22
7807	**Rutaecarpine**........	. . . .	$C_{18}H_{13}N_3O$. .	287 31
7807M	**Rutylidene.**	See 1-*Hendecyne.**		
7808	**Sabadine**.............	.	$C_{29}H_{51}NO_8$	541 71
7809	**Sabinane, 6-keto-.**	See *α-Thujone.*		
7810	**Sabinene**............	1-isopropyl-4-methylenebicyclo[3,1,0]hexane	$C_{10}H_{16}$..... ..	136 23
7811	D-**Saccharic acid**....	2,3,4,5-tetrahydroxyhexanedioic acid* (one form)	$COOH(CHOH)_4COOH$	210.14
7812	**Saccharin**...........	o-sulfobenzoic imide; benzoic sulfimide, glucide	$C_6H_4SO_2NHCO$	183 18
7813	**Saccharose.**	See *Sucrose.*		
7814	**S acid.**	See 1-*Naphthol-5-sulfonic acid,*	*8-amino-.*	
7815	**Safrole**................	1-allyl-3,4-methylenedioxybenzene, shikimole	$CH_2(O_2)C_6H_3CH_2CH{:}CH_2$	162 18
7816	——, **2,5-dimethoxy-.**	See *Apiole.*		
7817	——, **5-methoxy-.**	See *Myristicin.*		
7818	**Salazolon.**	See *Salipyrine.*		
7819	**Salicin**...............	. ...	$C_6H_{11}O_5OC_6H_4CH_2OH$	286 28
7820	——, **benzoyl-.**	See *Populin.*		
7821	**Salicyl alcohol.**	See *Saligenin.*		
7822	**Salicylaldehyde**.......	o-hydroxybenzaldehyde; salicylic aldehyde	HOC_6H_4CHO	122 12
7823	——, glucoside.	See *l-Helicin*		
7824	——, methyl ether.	See *Benzaldehyde, o-methoxy-.*		
7825	**Salicylamide**..........	o-hydroxybenzamide; salicylic amide	$HOC_6H_4CONH_2$.	137.13
7826	——, ***N*-phenyl-.**	See *Salicylanilide.*		
7827	**Salicylanilide**.........	N-phenylsalicylamide.... .	$HOC_6H_4CONHC_6H_5$	213 23
7828	**Salicylic-*O*-acetic acid**	. See *Benzoic acid, o-(carboxym*	*ethoxy)-.*	

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7795	liq..........	0 906[22]	. .	275[18]	i.	. . .	s. eth.
7796							
7797	liq., 1.4538[22].	0 903[22]	....	262[9]	i.	......	s. eth.
7798							
7799	col. need. f. w		186 d.	d.	sl. s	s.	i. eth.; s. a., aniline
7800	br. leaf. f. al. or need. f. eth.		199	..	i.	v. s.	v. s. eth ; s. bz.
7801							
7802	hex. pl. f. al. or eth ; need. f. bz , chl , or CCl_4		163	..	i.	0 2[20]	0 4 eth.; 8 5 bz.; 0 6 CCl_4; 7 34 chl.
7803	or. red cr.		subl. sl. d.	....	i.		s. eth., alk., conc. H_2SO_4
7804							
7805	yel.-red need.		subl.	d.	sl. s. h	s.	sl. s. eth.; s. ac. a., H_2SO_4
7806	cr f. bz		280–5 d. (265)	...	v s	s (vlt. fluores.)	s. alk.
7807	yel. pl ; need f. et. ac.		257–8			sl. s.	
7807M							sl. s. eth.
7808	need. f. eth.		238–40 d.	.	sl. s.	v. s.	
7809							∞ eth.
7810	col. liq., 1.46738[17.5]	0 842	.. ...	165	i.	∞	i. eth.
7811	syrup		125–6 d.	.	v s	v s	sl. s. eth., chl.,
7812	col. monocl. f acet.	.	228 d (224–6)	subl.	0 43[15]	3 1	acet., glyc., s. alk., bz., amyl ac., et. ac , xylol
7813							
7814							v. s. eth.; ∞ chl.
7815	col liq. or monocl., 1.5420[12]	1 096	11	234 5	i.	v. s.	
7816							
7817							
7818							i. eth., chl.
7819	col rhomb. need or leaf	1 434[26]	198–202	240 d.	3 6[15]	1 13[25], 3 33[60]	
7820							
7821							∞ eth.; 64 6[12] bz.
7822	col. liq , 1.57358[19.7]	1 1669$\frac{20}{4}$	-7 (1 6)	196 5	1 72[86]	∞	
7823							
7824							sl. s. eth.; s. Na_2CO_3 sol.
7825	leaf. f. w	.	140 (137–8)	270 d.	sl. s.	s.	
7826							s. eth.; sl. s. CS_2
7827	pr. f. al . .	...	135	d.	sl. s h.	s.	
7828							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
7829	**Salicylic acid**........	*o*-hydroxybenzoic acid.	HOC_6H_4COOH	138 12
7830	——, acetate.	See *Aspirin*.		
7831	——, amyl ester...	amyl salicylate, pentyl *o*-hydroxybenzoate	$HOC_6H_4CO_2C_5H_{11}$	208 25
7832	——, ethyl ester .	.	$HOC_6H_4COOC_2H_5$	166 17
7833	——, ethyl ether.	See *Benzoic acid, o-ethoxy-*		
7834	——, isoamyl ester .	isoamyl salicylate, isoamyl *o*-hydroxybenzoate	$HOC_6H_4COOC_5H_{11}$	208 25
7835	——, isobutyl ester		$HOC_6H_4COOC_4H_9$	194 22
7836	——, methyl ester	methyl salicylate; artificial oil of wintergreen	$HOC_6H_4COOCH_3$	152 14
7837	——, methyl ether.	See *Benzoic acid, o-methoxy-*		
7838	——, 1-naphthyl ester	*α*-naphthyl salicylate	$HOC_6H_4COOC_{10}H_7$	264 27
7839	——, 2-naphthyl ester.	See *Betol*		
7840	——, nicotine salt.	See *Nicotine, salicylate.*		
7841	——, phenyl ester	salol	$HOC_6H_4COOC_6H_5$	214 21
7842	——, phenyl ether	See *Benzoic acid, o-phenoxy-*		
7843	——, propyl ester	*n*-propyl salicylate	$HOC_6H_4COOC_3H_7$	180 20
7844	——, **acetyl-.**	See *Aspirin*		
7845	——, **5-allyl-3-methoxy-.**	See *Eugenic acid.*		
7846	——, **3-amino-** .	3-amino-2-hydroxybenzoic acid	$NH_2C_6H_3(OH)COOH$	153 13
7847	——, **4-amino-.** .	4-amino-2-hydroxybenzoic acid	$NH_2C_6H_3(OH)COOH$	153 13
7848	——, **5-amino-**.....	5-amino-2-hydroxybenzoic acid	$NH_2C_6H_3(OH)COOH$	153 13
7849	——, **3,5-dinitro-** .	3,5-dinitro-2-hydroxybenzoic acid	$(NO_2)_2(HO)C_6H_2COOH$	228 12
7850	——, **hexahydro-.**	See *Cyclohexanecarboxylic acid, 2-hydroxy-.*		
7851	——, **3-nitro-**.... .	2-hydroxy-3-nitrobenzoic acid	$NO_2C_6H_3(OH)COOH \cdot H_2O$	201 13
7852	——, **5-nitro-**.... .	2-hydroxy-5-nitrobenzoic acid	$NO_2C_6H_3(OH)COOH$	183 12
7853	——, **6-nitro-**	2-hydroxy-6-nitrobenzoic acid	$NO_2C_6H_3(OH)COOH$	183 12
7854	——, ***O*-phenyl-.**	See *Benzoic acid, o-phenoxy-*		
7855	——, **thio-.**	See *Benzoic acid, o-mercapto-*		
7856	**Salicylic anhydride**	*o,o'*-dihydroxybenzoic anhydride	$(HOC_6H_4CO)_2O$	258 22
7857	**Saligenin**	*o*-hydroxybenzyl alcohol; salicyl alcohol; *α*,2-toluenediol	$HOC_6H_4CH_2OH$.	124 13
7858	——, 2-methyl ether.	See *Benzyl alcohol, o-methoxy-*		
7859	**Salipyrazolon.**	See *Salipyrine*		
7860	**Salipyrine**..........	antipyrine salicylate, salazolon; salipyrazolon, etc.	$C_{11}H_{12}N_2O \cdot C_7H_6O_3$	326 34
7861	**Salol.**	See *Salicylic acid, phenyl ester.*		
7862	**Salvarsan.**	See *Arsphenamine.*		
7863	**Sanguinarine**..... ...	. . .	$C_{20}H_{15}NO_4 \cdot H_2O$	351 35
7864	**Santalic acid**	.	$C_{15}H_{14}O_5$	274 26
7865	**Santonic lactone.**	See *Santonin*		
7866	**Santonin**	santonic lactone... ..	$C_{15}H_{18}O_3$	246 30

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
7829	monocl col need, f w., 1 565	1 443^{20}_{4}	159 (155-7)	subl 76	0 18^{20}; 1 76^{75}	39 2^{15}	50 5^{15} eth.; s. chl.
7830							
7831	col-ylsh. liq	1 065^{15}		265	i	∞	∞ eth ; s. chl.
7832	col. liq, $1.52511^{14.4}$	1 1362^{15}_{4}	1 3	234 0 (231 5)	i	∞	∞ eth.
7833							
7834	col-ylsh liq	1 042^{25}_{4}		273 (128-30^{12})	0 004^{22}	33 90%	∞ eth.; s. chl.
7835		1 075		259	i	s	s eth.
7836	col liq, 1 5369	1 $1840^{20.2}_{4}$	-8 6	223 3	0 074^{30}	∞	∞ eth.; s. glac. ac a, CS_2
7837							
7838	wh cr powd		83		i	s	s eth, fixed oils
7839							
7840							
7841	col rhomb f al	1 250	43	173^{12}	0 015^{25}	21 5^{25}	v. s eth, bz., chl, v. sl s. glyc.
7842							
7843	col liq	1 0091^{5}		240	v sl s	∞	∞ eth
7844							
7845							
7846	cr		235 d			v sl s	......
7847	redsh br cr powd		220 d		s	s	s eth.
7848	wh need		283 (280 d)		sl s h	i	s CS_2
7849	need or pl (+$1H_2O$) f w		anh 174 (170-2)	subl. d.	v s h	v s	v s eth.
7850							
7851	rhomb need f w		hyd 125, anh 144		0 13^{15}	v s	v s. eth
7852	need f w	1 650^{20}	228		0 18^{22}	v s	v s eth.
7853	yel need		130			sl s.	v s eth.; s. acet.
7854							
7855							
7856	yel amor		200 20	d.	i.	v s.	v s. eth.
7857	rhomb f w	1 161^{25}	86	subl	6 7^{12}	v s	v s eth
7858							
7859							
7860	cr. powd		92		0 5^{15}, 4 0^{100}		s eth., bz.; v. s. chl.
7861							
7862							
7863	bl. fluores. need		213		i	s.	s eth.
7864	red micr pr		226 (104)	195^{9}	i.	s.	s eth., alk.
7865							
7866	col rhomb. pr, 1 590, 1 630, 1 640	1 187	170	subl	0 02^{17}, 0 4^{100}	2 0^{22}, 37^{80}	sl s. eth.; s. chl, alk

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
7867	**Sarcine.**	See *Hypoxanthine.*		
7868	**Sarcolactic acid.**	See *d-Lactic acid*		
7869	**Sarcosine**	*N*-methylglycine ..	CH_3NHCH_2-COOH	89.09
7870	——, hydrochloride . .	...	$HCl\cdot NH(CH_3)$-CH_2COOH	125.56
7871	**Schäffer's acid.**	See *2-Naphthol-6-sulfonic acid.*		
7872	**Schöllkopf's acid.**	See *Naphthionic acid.*		
7873	***i*-Scopolamine**	atroscine . .	$C_{17}H_{21}NO_4$...	303.35
7874	***l*-Scopolamine.**	See *Hyoscine*		
7875	**Sebacic acid**	decanedioic acid*	$COOH(CH_2)_8$-COOH	202.25
7876	——, diethyl ester	ethyl sebacate ..	$[(CH_2)_4COOC_2H_5]_2$	258.35
7877	——, piperazinium salt .	....	$C_4H_{10}N_2\cdot C_{10}$-$H_{18}O_4$	288.38
7878	**Selenide, diethyl.**	See *Ethyl selenide.*		
7879	**——, dimethyl.**	See *Methyl selenide*		
7880	**Semicarbazide**	aminourea, carbamylhydrazine	$NH_2NHCONH_2$.	75.07
7881	——, hydrochloride	.	$NH_2NHCONH_2$ HCl	111.54
7882	**——, 1-phenyl-**... ...	1-carbamyl-2-phenylhydrazine	$C_6H_5NHNHCO$-NH_2	151.17
7884	**——, thio-**... . .	..	$NH_2NHCSNH_2$	91.13
7885	**Seminose.**	See *D-Mannose*		
7886	**Septentrionaline.** .	.	$C_{31}H_{46}N_2O_9$(?)	590.70
7887	***dl*-Serine**...	...	$CH_2OHCH(NH_2)$-COOH	105.09
7888	***d*-Serine**........... ...	*d-β*-hydroxyalanine .	$CH_2OHCH(NH_2)$-COOH	105.09
7889	***l*-Serine**	*l-α*-amino-*β*-hydroxypropionic acid, *l-β*-hydroxyalanine	$HOCH_2CH(NH_2)$-COOH	105.09
7890	**Shikimole.**	See *Safrole.*		
7891	**Silanol** (mono).	See *Silicol.*		
7892	**Silicane, dimethyl-**	dimethylmonosilane	$(CH_3)_2SiH_2$	60.14
7893	**——, ethoxytriethyl-** .	triethylsilicol ethyl ether	$(C_2H_5)_3SiOC_2H_5$	160.30
7894	**——, hydroxy-.**	See *Silicol.*		
7895	**——, methyl-**........	methylmonosilane.....	CH_3SiH_3 ...	46.12
7896	**——, tetraethyl-**......	silicon tetraethyl .	$(C_2H_5)_4Si$	144.30
7897	**——, tetramethyl-**...	silicon tetramethyl; tetramethylsilicon	$(CH_3)_4Si$.	88.20
7898	**——, trichlorophenyl-**	phenylsilicon trichloride	$C_6H_5SiCl_3$.	211.53
7899	**——, triethyl-**........	triethylsilicon hydride	$(C_2H_5)_3SiH$.	116.25
7900	**Silicoheptyl alcohol.**	See *Silicol, triethyl-.*		
7901	**Silicol, triethyl-**	silicoheptyl alcohol .. .	$(C_2H_5)_3SiOH$	132.25
7902	——, ——, ethyl ether.	See *Silicane, ethoxytriethyl-.*		
7903	**Silicon, tetramethyl-.**	See *Silicane, tetramethyl-.*		
7904	**Silicon hydride, triethyl-.**	See *Silicane, triethyl-.*		
7905	**Silicon oxide, triethyl-.**	See *Silicyl oxide, hexaethyl-.*		
7906	**Silicon tetraethyl-.**	See *Silicane, tetraethyl-.*		
7907	**Silicon trichloride, phenyl-.**	See *Silicane, trichlorophenyl-.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7867							
7868							
7869	deliq col rhomb f dil al.		210 d	d	v. s.	sl. s	i eth.
7870	need. f. al .		170–2	d	v s.	v sl s	v. sl. s. eth.
7871							
7872							
7873	cr., [α]-33 1°D		82-3 (50 9)		10 52^{15}	v. s	v. s. eth.; s. chl.; sl. s bz.
7874							
7875	thin col leaf, $1.422^{133.3}$		133	295^{100}	0 1^{17}, 2 0^{100}	v. s	v. s. eth.
7876	col liq....	0 $9646\frac{20}{4}$	1	308	0 008^{20}	s	s. eth.
7877	wh. cr . .		166–8		s. h	s h	i eth.
7878							
7879							
7880	pr f. al .		96		v. s.	s	i. eth., bz., chl
7881	pr f. dil. al		173 d		v. s.	i	i eth.
7882	leaf. f. dil. al		172	.	s. h., sl s c.	s	sl s. eth.; s chl., acet.
7884	need f. w		183		s	s	. . .
7885							
7886	wh powd		129	...	1 7	58	50 eth.
7887	monocl. pr f w.		246 d	...	5 02^{25}, 19 21^{75}	0 187 75% i. abs.	i. eth.
7888	hex tab, 1.515, 1.575, 1.586		228 d		ca. 25^{20}	i	i. eth.
7889	hex pl. or pr		228 d		25^{20}		.... . .
7890							
7891							
7892		0 68^{-80}	-150	-20 1			
7893	liq	0 8403^{0}		153	i	∞	∞ eth.; s. H_2SO_4
7894							
7895		0 62^{-57}	-156 5	-56 8	.	.	....
7896	col liq	0 7682		153	i.		....
7897	liq ign in air	$0.645\frac{20}{4}$	. . .	26–7^{761}	i.	v. s	v. s. eth.; i. H_2SO_4
7898	liq	....	. .	197	d.	d.	s. eth.
7899	liq	0 $751\frac{0}{4}$	.	107 (95–6)	i		i. H_2SO_4
7900							
7901	liq	0.8709^{0}		154	i	∞	∞ eth.
7902							
7903							
7904							
7905							
7906							
7907							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
7908	**Silicyl oxide, hexa-ethyl-**	triethylsilicon oxide	$[(C_2H_5)_3Si]_2O$	246 48
7909	**Silvan**	See *Furan, 2-methyl-*		
7911	**Sinapine**, bisulfate		$C_{16}H_{24}NO_6HSO_4 \cdot 3H_2O$	477 48
7912	——, thiocyanate		$C_{16}H_{24}NO_5SCN \cdot H_2O$	386 46
7913	**Sincaline.**	See *Choline.*		
7914	**Skatole**	3-methylindole	C_9H_9N	131 17
7915	**Sneezing gas.**	See *Arsine, chlorodiphenyl-.*		
7916	***dl*-Sobrerone.**	See *Pinole (dl).*		
7917	**Sodium glycerolate.**	See *Glycerol, 1-sodium derivative*		
7918	**Sodium mercaptide.**	See *Ethanethiol, sodium derivative.*		
7919	**Sodium thioethylate.**	See *Ethanethiol, sodium derivative.*		
7920	**Solanidine.**	. .	Mixt	
7921	**Solanine**	..	Mixt. (?)	
7922	**Sophoretin.**	See *Quercetin.*		
7923	**Sophorine.**	See *Cytisine.*		
7924	**Sorbic acid**	2,4-hexadienoic acid*	$CH_3CH:CH\text{-}CH{\cdot}CHCOOH$	112 12
7925	D-**Sorbitol**	1,2,3,4,5,6-hexanehexol* (one form); D-sorbite, D-sorbol	$C_6H_{14}O_6 \frac{1}{2}H_2O$	191 18
7926	D-**Sorbose**	1,3,4,5,6-pentahydroxy-2-hexanone* (one form); D-sorbinose	$C_6H_{12}O_6$	180 16
7927	**Sozolic acid.**	See 1-*Phenol-2-sulfonic acid.*		
7928	**Sparteine**	lupinidine	$C_{15}H_{26}N_2$	234 38
7929	——, bisulfate	.. .	$C_{15}H_{26}N_2 H_2SO_4 \cdot 5H_2O$	422 53
7930	**Spirit of wine.**	See *Ethyl alcohol.*		
7931	**Stachydrine**	. . . . .	$C_7H_{13}NO_2 H_2O$	161 20
7932	——, oxalate	.	$C_7H_{13}NO_2 H_2C_2O_4$	233 22
7933	**Stannane, diethyldimethyl-.**	See *Tin, diethyldimethyl-.*		
7934	**——, tetraethyl-.**	See *Tin, tetraethyl-*.*		
7935	**——, tetramethyl-.**	See *Tin, tetramethyl-*.*		
7936	**Stannone, diethyl-.**	See *Tin oxide, diethyl-*.*		
7937	**Stannonic acid, methyl-.**	See *Methanestannonic acid*		
7938	**Starch**	. . .	$(C_6H_{10}O_5)_x$ ..	(162-.14)$_x$
7938M	——, triacetate	acetyl starch, triacetyl starch	$[C_6H_7O_5(C_2H_3O)_3]_{18}$	5188 49
7939	**——, animal.**	See *Glycogen.*		
7940	**Starch gum.**	See *Dextrin.*		
7941	**Stearaldehyde**	octadecanal*	$C_{17}H_{35}CHO$	268 47
7942	**Stearamide**	octadecanamide*	$CH_3(CH_2)_{16}CO\text{-}NH_2$	283 49
7942H	**——, *N*-phenyl-.**	See *Stearanilide.*		
7942R	**Stearanilide**	*N*-phenylstearamide	$C_{17}H_{35}CONHC_6H_5$	359 58
7943	**Stearic acid**	octadecanoic acid*; *n*-octadecylic acid	$CH_3(CH_2)_{16}COOH$	284 47

*Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
7908	liq	0 859[0]		231	i.	s	s. eth , H_2SO_4
7909							
7911	leaf f al		127, 186 dry		s	s. h.	i eth.
7912	pa yel need f w		178		sl s	sl. s.	
7913							
7914	leaf. f. lgr		95	266 2	0 05 c.	v s.	s. eth , bz , chl , lgr.
7915							
7916							
7917							
7918							
7919							
7920	need. f. eth		191		v. sl s.	s h.	sl. s. eth.; s. chl.
7921	slend need. f. al.		244 50 (262)	d	v sl. s	s. h	i. eth., chl., bz.
7922							
7923							
7924	col. need. f. w		134 5	228 d	sl s.	v s	v. s. eth.
7925	col need		anh 110 (89–93)		s	v sl s.	i eth.
7926	col. rhomb	*d* 1 612, (*dl* 1 64)	165		55[17]	v sl s h, 0 26[17]	i eth.; sl. s. me. al.
7927							
7928	col oil, $[\alpha]$–14 6°D in al	1 023$^{20}_{4}$		325[751] in H_2, 180–1[20]	0 304[22]	v s	v s eth ; s. chl ; i. bz.
7929	col. hyg rhbdr cr or powd , 1 5289[19]		136, anh 150 2		91[25]	32[25]	i eth , chl.
7930							
7931	deliq cr		210 dry		s	s	i eth , chl.
7932	need		105–7			i c	
7933							
7934							
7935							
7936							
7937							
7938	wh amor., 1.53	1 50[21]	d		i	i.	i eth.
7938M	fine wh powd $[\alpha]^{28}_{D}$ 170.2 (chl), 160 4 (ac. a.), $[\alpha]^{14}_{D}$ 159.6 (pyr)		sinters 258; sl. d. >270		v. sl s	sl s	sl s eth , bz , $CHCl_3$, s. acet , toluene
7939							
7940							
7941	sc f eth		63 5	261[100]	i	s.	s. eth.
7942	col leaf		109	251[12]	i	sl. s.	sl. s. eth.
7942H							
7942R	col. cr		94	153 5[10]	i.	s.	s. eth.
7943	col. monocl. leaf., 1.4299[80 2]	0 847[69]	69 4	383	0 034[25], 0.1[37]	2 5 c.	v. s. eth.; s. chl., CCl_4, CS_2

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
7944	**Stearic acid**, amyl ester	.	$C_{17}H_{35}COO(CH_2)_4CH_3$	354 60
7945	——, benzyl ester....		$C_{17}H_{35}COOCH_2C_6H_5$	374 59
7946	——, butyl ester	butyl stearate, butyl octadecanoate*	$C_{17}H_{35}COOC_4H_9$	340 58
7947	——, diethylene glycol ester.	See *Diethylene glycol, distearate*.		
7948	——, ethylene ester.	See *Glycol distearate.*		
7949	——, ethyl ester	ethyl octadecanoate*	$C_{17}H_{35}COOC_2H_5$.	312 52
7950	——, glycerol ester....	See *Glycerol, tristearate.*		
7951	——, isoamyl ester.....	isoamyl stearate, γ-methylbutyl octadecanoate*	$CH_3(CH_2)_{16}COOC_5H_{11}$	354 60
7952	——, methyl ester ..	methyl octadecanoate*; methyl stearate	$C_{17}H_{35}COOCH_3$	298 50
7952M	——, phenyl ester	phenyl stearate ...	$C_{17}H_{35}COOC_6H_5$.	360 56
7953	——, *p*-phenylphenacyl ester	...	$C_{17}H_{35}COOCH_2COC_6H_4C_6H_5$	478 69
7954	——, **θ, ι-dibromo-.**	See *Elaidic acid, dibromide*		
7955	——, **α,β-dihydroxy-..**	2,3-dihydroxyoctadecanoic acid*	$C_{17}H_{33}(OH)_2COOH$	316 47
7956	——, **θ, ι-dihydroxy- .**	9,10-dihydroxyoctadecanoic acid*	$CH_3(CH_2)_7CH(OH)CH(OH)(CH_2)_7COOH$	316 47
7957	——, **θ, ι-dioxo-.**	See *Stearoxylic acid*		
7958	——, **θ, ι, λ, μ, ξ, o-hexabromo-**	9,10,12,13,15,16-hexabromooctadecanoic acid*; α-linolenic acid hexabromide	$C_{17}H_{29}Br_6COOH$	757 92
7959	——, ——, ethyl ester .	......	$C_{17}H_{29}Br_6COOC_2H_5$	785 97
7960	——, **α-hydroxy-.....**	2-hydroxyoctadecanoic acid*	$CH_3(CH_2)_{15}CHOHCOOH$	300 47
7961	——, **β-hydroxy-(*dl*).**	*dl*-3-hydroxyoctadecanoic acid*	$CH_3(CH_2)_{14}CHOHCH_2COOH$	300 47
7962	——, **ι-hydroxy-** .	10-hydroxyoctadecanoic acid*	$CH_3(CH_2)_7CHOH(CH_2)_8COOH$	300 47
7963	——, **κ-hydroxy- .**	11-hydroxyoctadecanoic acid*	$CH_3(CH_2)_6CHOH(CH_2)_9COOH$	300 47
7964	——, **λ-hydroxy- .**	12-hydroxyoctadecanoic acid*	$CH_3(CH_2)_5CHOH(CH_2)_{10}COOH$	300 47
7965	——, **θ, ι, λ, μ-tetrabromo-**	9,10,12,13-tetrabromooctadecanoic acid*, linoleic acid tetrabromide	$C_{17}H_{31}Br_4COOH$	600 10
7966	——, ——, ethyl ester	.	$C_{17}H_{31}Br_4COOC_2H_5$	628 16
7967	——, ——, methyl ester	....	$C_{17}H_{31}Br_4COOCH_3$	614 13
7968	**Stearic anhydride....**	octadecanoic anhydride*	$(C_{17}H_{35}CO)_2O$	550 93
7969	**Stearin.**	See *Glycerol, tristearate.*		
7970	**Stearolic acid........**	9-octadecynoic acid*	$CH_3(CH_2)_7C\equiv C(CH_2)_7COOH$	280 44
7971	**Stearone.**	See 18-*Pentatriacontanone**.		
7972	**Stearonitrile.......**	octadecanenitrile*	$C_{17}H_{35}CN$.	265 47
7972M	**Stearophenone ....**	heptadecyl phenyl ketone, 1-phenyl-1-octadecanone	$C_{17}H_{35}COC_6H_5$	344 56
7973	**Stearoxylic acid .. .**	9,10-dioxooctadecanoic acid*, θ, ι-diketostearic acid	$CH_3(CH_2)_7COCO(CH_2)_7COOH$	312 44
7974	**Stearoyl chloride** .	octadecanoyl chloride*; stearyl chloride	$C_{17}H_{35}COCl$..	302 92
7975	**Stibine, triethyl-** ..	antimony triethyl	$Sb(C_2H_5)_3$	208 94

***Name approved by the International Union of Chemistry.**

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
7944	pl . .	0.860	30	360	i.	s.	v. s. eth.
7945	cr	0.9075^{50}_{25}	45.8		i	s	v. s. eth.
7946	col. liq	$0.855-75^{25}$	19.5 (27.5)	$220-5^{25}$	0.29^{25}	s	s. eth.
7947							
7948							
7949	col. cr		33.7	$213-15^{15}$	i	s	s. eth.
7950							
7951	cr	0.855^{20}_{4}	23	$185-90^{1}$	i	sl. s	s. eth.
7952	col. cr. f. eth		38 (35-7)	215^{15}	i	s	s. eth.
7952M	col. cr		51.5-53	267^{15}	i	s	s. eth.
7953	....		91				....
7954							
7955	(a) leaf. f. al		132 (136.5)			0.47 c	sl. s. eth.
	(b) leaf. or pl. f. w.		99		s	2.8^{18}	s. eth.
7956	leaf ..		131.5 (136.5)		v. sl. s. c	2.84^{18}	sl. s. eth.
7957							
7958	need...		180-1		i		i. eth., chl., bz., s. h. xylene
7959	fine need		151.5-2.5		.	i.	i. eth.; sl. s. glac. ac. a.
7960	need. f. chl		93; 85			6.94 c	1.64 c eth.; v. s. h. bz
7961	pl. f. chl		89			s. h.	s. eth., chl.
7962	hex. pl.		81-1.5		i	8.78	2.3 eth.
7963	tab. f. al		84 (77-9)		i	0.58	1.71^{20} eth.
7964	cr. f. al		81-2		i	s.	s. eth., chl.
7965	wh. pl		114-5		i	v. s	v. s. chl.; sl. s. pet. eth.
7966	need ..		58-8.5		i	s.	s. pet. eth., glac. ac. a.
7967	leaf .	.	50-6		i	s.	s. pet. eth., glac. ac. a.
7968	col. cr	0.8368^{90}_{4}	71.5		i, d	d	s. eth.
7969							
7970	col. pr. f. al		48	260	i	sl. s. c	v. s. eth.
7971							
7972	col. cr	0.817^{41}_{4}	42.5-43	214^{13}	i	sl. s	sl. s. eth.
7972M	col. waxy cr		64-65	. .	i.	s.	s. eth.
7973	yel. leaf		86		i	v. s. h.	v. s. h. eth.; sl. s. lgr
7974	col. cr .		23	215^{15}	d	d.	v. s. eth.
7975	col. liq .	1.324^{16}	<-29	159.5	i.	s	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
7976	**Stibine, trimethyl-**...	antimony trimethyl	$Sb(CH_3)_3$ ...	166 86
7977	**Stilbene**.............	*trans*-1,2-diphenylethylene; *trans-sym*-diphenylethylene, toluylene	$C_6H_5CH{:}CHC_6H_5$	180 24
7978	——, **diamino-**........	See *Stilbenediamine.*		
7979	——, **2,2′-diamino-** (*cis*)		$NH_2C_6H_4CH{:}CH\text{-}C_6H_4NH_2$	210 27
7979M	——, **4,4′-dimethoxy-**..	bianisal; photoanethole	$[p\text{-}CH_3OC_6H_4CH{:}]_2$	240 29
7980	——, **α-phenyl-.**	See *Ethylene, triphenyl-*		
7981	**2,2′-Stilbenediamine**..	*o,o′*-diaminostilbene	$NH_2C_6H_4CH{:}CH\text{-}C_6H_4NH_2$	210 27
7982	**4,4′-Stilbenediamine**.	*p,p′*-diaminostilbene .	$NH_2C_6H_4CH{:}CH\text{-}C_6H_4NH_2$	210 27
7983	**Strychnine**.........	. .	$C_{21}H_{22}N_2O_2$.	334 40
7984	——, hydrochloride .	..	$C_{21}H_{22}N_2O_2\ HCl\ 2H_2O$	406 90
7985	——, nitrate.	..	$C_{21}H_{22}N_2O_2\ HNO_3$	397 42
7986	——, sulfate. . .	.	$(C_{21}H_{22}N_2O_2)_2\ H_2SO_4\ 5H_2O$	856 97
7987	**Styphnic acid**......	2,4,6-trinitroresorcinol	$(NO_2)_3C_6H(OH)_2$	245 11
7988	**Stypticin.**	See *Cotarnine, hydrochloride.*		
7989	**Styptol.**	See *Cotarnine, phthalate.*		
7990	**Styracin**............ .	γ-phenylallyl cinnamate, cinnamyl cinnamate	$C_{18}H_{16}O_2$	264 31
7991	**Styrene**...	vinylbenzene, phenylethylene, cinnamene	$C_6H_5CH{:}CH_2$.	104 14
7992	——, **α-bromo-**. . .	1-bromo-1-phenylethylene, α-bromostyrol, (α-bromovinyl)benzene	$C_6H_5CBr{:}CH_2$	183 05
7993	——, **β-bromo-**......	1-bromo-2-phenylethylene, (β-bromovinyl)benzene; ω-bromostyrene	$C_6H_5CH{:}CHBr$	183 05
7994	——, **α-chloro-**........	1-chloro-1-phenylethylene	$C_6H_5CCl{:}CH_2$.	138 59
7995	——, **β-chloro-**.......	1-chloro-2-phenylethylene, ω-chlorostyrene	$C_6H_5CH{:}CHCl$.	138 59
7996	——, **o, m or p-hydroxy-.** See *Phenol, vinyl-.*			
7997	——, **3-hydroxy-4-methoxy-.** See *Hesperetol.*			
7998	——, **o, m or p-methoxy-.** See *Anisole, vinyl-.*			
7999	——, **o-nitro-**...... ..	1-nitro-2-vinylbenzene...	$NO_2C_6H_4CH{:}CH_2$	149 14
8000	——, **m-nitro-**........	1-nitro-3-vinylbenzene .	$NO_2C_6H_4CH{:}CH_2$	149 14
8001	——, **p-nitro-**	1-nitro-4-vinylbenzene. .	$NO_2C_6H_4CH{:}CH_2$	149.14
8002	**o,β-Styrenedicarboxylic acid.** See *Cinnamic acid, o-carboxy-.*			
8003	**p,β-Styrenedicarboxylic acid.** See *Cinnamic acid, p-carboxy-.*			
8004	**Styrone.**	See *Cinnamic alcohol.*		
8005	**Styryl ketone**.........	1,5-diphenyl-1,4-pentadien-3-one*; dibenzalacetone; cinnamone; dicinnamyl ketone; distyryl ketone	$(C_6H_5CH{:}CH)_2CO$	234 28
8006	**Suberane.**	See *Cycloheptane*.*		
8007	**Suberene.**	See *Cycloheptene*.*		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7976	col. monocl liq f w	1.523^{15}	.	80.6	sl. s.	i.	s. eth.
7977	col. monocl. tab. f. al.	liq. $0.970\frac{12.5}{13}$; $1.164\frac{0}{4}$	124	307	i.	0.88^{17}	5.59^{18} eth.; s. bz.
7978							
7979	red need f w	.... .	123	......		...	. .... .
7979M	col. leaf	.. ..	214	......		s	s bz., ac. a.
7980							
7981	(*cis*) red need f w		123	......		s	s. eth., bz.
	(*trans*) gold-yel pr f al		176 (168)	......	...		....
7982	yel need. or leaf f al.		227–8	subl.	s h.	s	s. eth., me. al; sl. s. bz., chl., CS_2
7983	col rhomb f al	1.359^{18}	268	270^{5}	0.016^{25}	0.9	0.018 eth.; s. chl; sl s. bz.
7984	col trim. efflor.		....	......	2.9 c.	1.7	i. eth., HCl
7985	col need, [α]–46°D		d	.....	2.4^{25}	0.83^{25}	i. eth.; 0.64^{25} chl; s. glyc.
7986	col monocl. pr, 1.6137, 1.5988		anh 200	......	3.2^{25}	1.5^{25}	i eth; s chl, glyc.
7987	yel. hex. pr f. acet.	1.829	180 (176–7)	subl	0.6^{14}	s.	sl. s. eth.
7988							
7989							
7990	need or pr	1.085^{16}	14	....	i.	3.95 c	v s eth.; s. bz.
7991	col. liq., 1.54344^{17}	$0.9074\frac{20}{4}$	..	146	v. sl. s.	∞	∞ eth.
7992	oil, $1.5881^{19.5}$	1.4057	–43.5	160^{75} ($86–7^{14}$)	.....	.	. . ..
7993	(1) $1.6094^{20.5}$ (2) 1.5990^{22}	1.4269^{16} 1.4322^{16}	+7 –8 to –7	219 sl. d. 71^{6}	i. .	∞	∞ eth. . . ...
7994	liq., 1.5623^{17}.	$1.1016\frac{18}{4}$	–23	199	i.	s	s eth.
7995	liq.........	$1.112\frac{15}{4}$	....	199	i.	s.	s eth.
7996							
7997							
7998							
7999	col. liq......	...	13.5	....	....		s. conc. H_2SO_4
8000	yel. oil. . .		–5	....	... .	v. s	s eth., lgr., chl.
8001	pr. f. lgr...		29	d.	.....	v. s. h.	v. s. eth., bz., s. lgr.
8002							
8003							
8004							
8005	yel. monocl. leaf. f acet or eth.		112	d.	v. sl. s c.	sl. s.	sl. s. eth.; s. acet.
8006							
8007							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
8008	**Suberic acid**	octanedioic acid*	$COOH(CH_2)_6$-COOH	174 19
8009	——, diethyl ester	ethyl suberate	$(CH_2CH_2CH_2$-$COOC_2H_5)_2$	230 30
8010	**Suberol.**	See *Cycloheptanol**.		
8011	**Suberone.**	See *Cycloheptanone**.		
8012	**Suberyl alcohol.**	See *Cycloheptanol**.		
8013	**Suberylene.**	See *Cycloheptene**.		
8014	**Succinaldehyde**	butanedial*.	$CHO(CH_2)_2CHO$	86 09
8015	**Succinamic acid**	*β*-carbamylpropionic acid, succinic acid monoamide	$NH_2COCH_2CH_2$-COOH	117 10
8016	——, ***α*-amino-.**	See *Asparagine.*		
8016M	——, ***N*-phenyl-.**	See *Succinanilic acid.*		
8017	**Succinamide**	butanediamide*	$NH_2COCH_2CH_2$-$CONH_2$	116 12
8018	——, ***α*-hydroxy-.**	See *Malamide.*		
8019	——, ***N*-*p*-phenetyl-**	pyrantin; phenosuccin	$(CH_2CO)_2NC_6H_4$-OC_2H_5	219 23
8019H	**Succinanil**	*N*-phenylsuccinimide	$(CH_2CO)_2NC_6H_5$	175 18
8019R	**Succinanilic acid**	*N*-phenylsuccinamic acid	C_6H_5NHOOC-$(CH_2)_2COOH$	209 20
8020	**Succinic acid**	butanedioic acid*.	$COOH(CH_2)_2$-COOH	118 09
8021	——, dibenzyl ester		$(CH_2COOCH_2$-$C_6H_5)_2$	298 33
8022	——, diethyl ester	ethyl succinate	$(CH_2COOC_2H_5)_2$	174 19
8023	——, dimethyl ester	dimethyl butanedioate*; methyl succinate	$CH_3OOC(CH_2)_2$-$COOCH_3$	146 14
8024	——, monoamide	See *Succinamic acid.*		
8025	——, *p*-phenylphenacyl ester		$(CH_2COOCH_2CO$-$C_6H_4C_6H_5)_2$	506 53
8026	——, piperazinium salt		$C_4H_{10}N_2\ C_4H_6O_4$.	204 23
8027	——, **acetoxy-.**	See *Malic acid, acetate.*		
8028	——, **acetyl-**, diethyl ester	ethyl acetylsuccinate; diethyl acetylbutanedioate*	$CH_3COCH(COO$-$C_2H_5)CH_2COO$-C_2H_5	216 23
8029	——, ***α*-amino-**	See *Aspartic acid.*		
8030	——, **bromo-(*dl*)**	*dl*-2-bromobutanedioic acid*.	CH_2CHBr-$(COOH)_2$	197 00
8031	——, ***α,β*-dibromo-**	2,3-dibromobutanedioic acid*	$C_2H_2Br_2(COOH)_2$	275 90
8032	——, ***α,β*-dihydroxy-.**	See *Tartaric acid.*		
8033	——, **ethyl-**	2-ethylbutanedioic acid*; 1, 2-butanedicarboxylic acid	$(COOH)CH(C_2H_5)$-CH_2COOH	146.14
8034	——, ——, methyl ester		$C_2H_5OOC(CH_2)_2$-$COOCH_3$	160 17
8035	——, **ethylene-.**	See 1,2-*Cyclobutanedicarboxylic acid**.		
8036	——, **formyl-**, lactone.	See *Aconic acid.*		
8037	——, **hydroxy-.**	See *Malic acid.*		
8038	——, ***α*-hydroxy-*α*-methyl-.**	See *Citramalic acid.*		
8039	——, **isopropylidene-.**	See *Teraconic acid.*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8008	col. need. f. w	.	140	279^{100}	0 14^{16}	s.	v. sl. s. eth.
8009	col. liq......	0 982_{4}^{20}	. .	282–6	i.	s.	s. eth.
8010							
8011							
8012							
8013							
8014	liq., 1.4254....	1 064_{4}^{20}		169–70 sl. d. (201–3)	s.	s.	s. eth.
8015	col. need. or tab.		157	....	s.	v. sl. s.	i. bz.
8016							
8016M							
8017	col. need. f. w		243	....	0 45^{15}, 11^{100}	i.	i. eth.
8018							
8019	pr. f al ..		155	....	0 75^{17}, 1 2^{100}	v. s. h.	i. eth.
8019H	col need..		156	*ca.* 400	sl s. h.	s h.	s. eth
8019R	col. need		144 5–45 5	..	s. h.	s.	s eth
8020	col monocl, 1 450, 1.534, 1.610	1 564_{4}^{15}	185 (189–90)	235 d.	6 8^{20}, 121^{100}	7 $5^{21.5}$	0 3 eth ; i bz, chl.
8021	leaf. f. al.....		44–6	238^{14}	i.	v s	v s. eth.
8022	col. liq., 1.42007	1 0402_{4}^{20}	-21	217.7	i.	∞	∞ eth.
8023	col., $1.41976^{18.3}$	1 1202_{4}^{18}	19 5	192 8	2 8	s	
8024							
8025	....		208	. ...	..	..	.. . . .
8026	wh. cr.......		205–6, d	......	s.	s. h.	i. eth.
8027							
8028	col., liq. 1.438^{16}	1 081_{4}^{20}	. ..	256 d	i.	s.	s. eth., bz., CS_2
8029							
8030	col. cr.....	2 073	159	....	19^{15}	v. s.	i. eth.
8031	(*d*) [α] $+126.3_{D}^{\circ 24}$ in et. ac.	. .	151–3	....	......	....	....
	(*l*) need. f. bz, [α] $-148_{D}^{\circ 18}$ in et ac.		157–8 d. (152–4)	....	s.	s.	s. me. al., acet., et. ac.; sl. s. chl., CCl_4, pet. eth.
	(*dl*).......		166–7; 255–6 d.	....	s. h.	s.	s. eth.
8032							
8033	col. pr.. ..	.	98	....	v. s.	v. s.	v. s eth ; 1 06 chl.
8034	col. liq....	1 093^{0}	<-20	208 2	i.	v s	v s. eth.
8035							
8036							
8037							
8038							
8039							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
8040	**Succinic acid, methyl-**	See *Pyrotartaric acid.*		
8041	**——, methylene-.**	See *Itaconic acid.*		
8042	**——, tetrahydroxy-.**	tetrahydroxybutanedioic acid*, dihydroxytartaric acid	$(COOH)C(OH)_2$-$C(OH)_2COOH$	182 09
8043	**——, tetramethyl-...**	tetramethylbutanedioic acid*, 2,3-dimethyl-2,3-butanedicarboxylic acid	$HOOCC(CH_3)_2C$-$(CH_3)_2COOH$	174 19
8044	**Succinic anhydride.**	butanedioic anhydride*	$(CH_2CO)_2O$	100 07
8045	**Succinimide... ...**	butanimide*, 2,5-pyrrolidinedione	$(CH_2CO)_2NH$	99 09
8045M	**——, *N*-phenyl-.**	See *Succinanil.*		
8046	**Succinonitrile..**	butanedinitrile*; ethylene cyanide	$CNCH_2CH_2CN$	80 09
8047	**Succinyl chloride...**	butanedioyl chloride*	$(CH_2COCl)_2$	154 99
8048	**Sucrose............**	cane sugar; saccharose	$C_{12}H_{22}O_{11}$.....	342 30
8048M	——, octaacetate	octaacetylsucrose	$C_{28}H_{38}O_{19}$	678 59
8049	**Sulfanilamide...**	*p*-aminobenzenesulfonamide, *p*-anilinesulfonamide, prontosil album	$H_2NC_6H_4SO_2NH_2$-(*p*)	172 20
8049M	**——, *N*[1]-2-pyridyl-.**	See *Sulfapyridine.*		
8050	**Sulfanilic acid..**	*p*-aminobenzenesulfonic acid; *p*-anilinesulfonic acid	$NH_2C_6H_4SO_3H\cdot$ H_2O	191 20
8050M	**Sulfapyridine........**	*N*[1]-2-pyridylsulfanilamide; *p*-amino-*N*-2-pyridylbenzenesulfonamide, 2-sulfanilamidopyridine	$H_2NC_6H_4SO_2$-NHC_5H_4N	249 28
8051	**Sulfide, 2-benzothiazyl 2,4-dinitrophenyl.**	See *Benzothiazole, 2-(2,4-dinitro-*		
8052	**——, bis-β-chloroethyl.**	See *Sulfide, β, β'-dichloroethyl.*		
8053	**——, bis(dimethylthiocarbamyl)**	tetramethylthiuram (mono)-sulfide	$[(CH_3)_2NCS]_2S$.	208 35
8054	**——, bis-β-hydroxyethyl.**	See *Ethanol, 2,2'-thiodi-*		
8055	**——, bis(β-methylbutyl)**	di-*act*-amyl sulfide; 2-methyl-1-(β-methylbutylthio)-butane*	$[CH_3CH_2CH$-$(CH_3)CH_2]_2S$	174 34
8056	**——, bis(1-piperidylthiocarbonyl)**	dicyclopentamethylenethiuram monosulfide	$(C_5H_{10}NCS)_2S$	288 48
8057	**——, 4,4'-diaminodiphenyl.**	See *Aniline, p,p'-thiodi-*		
8058	**——, di-*act*-amyl.**	See *Sulfide, bis(β-methylbutyl)*		
8059	**——, dibenzyl.**	See *Benzyl sulfide*		
8060	**——, dibutyl.**	See *Butyl sulfide*		
8061	**——, β,β'-dichloroethyl**	1-chloro-2-(β-chloroethylthio)ethane*, bis-β-chloroethyl sulfide, 2,2'-dichlorodiethyl sulfide; mustard gas, yperite; yellow cross liquid	$(ClCH_2CH_2)_2S$.	159 08
8062	**——, diethyl.**	See *Ethyl sulfide.*		
8063	**——, diisoamyl.**	See *Isoamyl sulfide.*		
8064	**——, diisobutyl.**	See *Isobutyl sulfide.*		
8065	**——, diisopropyl.**	See *Isopropyl sulfide.*		
8066	**——, dimethyl.**	See *Methyl sulfide.*		
8067	**——, diphenyl.**	See *Phenyl sulfide.*		
8068	**——, dipropyl.**	See *Propyl sulfide*		

*Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8040							
8041							
8042	wh cr .		114-5		v s, d h		. ...
8043	cr .		190-2	subl.	0 48$^{18.5}$	v s	s. eth.; i. lgr.
8044	col need f al	1 104	119 6	261	v. sl. s.	s.	v. sl. s. eth.
8045	octahdr col need f acet	1 412^{16}	124-6	288	23^{20}, 152^{70}	4 1^{20}, 16^{50}	v. sl. s. eth.
8045M							
8046	col, 1 41645$^{63.1}$	0 985$\frac{63}{4}$, 1 023^{45}	54 5	267	v. s.	v s.	s. eth.
8047	col fum liq. or cr, 1 47348$^{15\ 2}$	1 395$\frac{20}{4}$	17	192	d	d	v s. eth.; s. bz.; i. pet. eth.
8048	col monocl, 1.5376, 1.5651, 1 5705	1 588^{15}	186 d.	d	179^{0}, 487^{100}	0 9	i eth, chl.; sl. s. me. al.
8048M	wh need. f al	1 27^{16}	72 3		v. sl. s.	s.	s. eth., common org solv.
8049	col leaf or need.		163; 164 5-6 5		0 4^{15}	3	s c acet.; i. bz.
8049M							
8050	col rhomb pl or monocl cr. (+2H_2O)		288 d.	.	1 08^{20}, 6 67^{100}	v. sl s	v. sl. s. eth.
8050M	wh cr		190-3		0 03	0 2	....
8051	*phenylthio)-.*						
8052							
8053	yel cr	1 40	107		i	s. h	sl s eth.; s. chl
8054							
8055	$[\alpha]+24\ 5^{\circ 20}_{D}$	0 8362$\frac{20}{0}$	95-813				. ..
8056	yel. cr .		121		i	sl s. c, s h.	sl. s. eth., s. chl
8057							
8058							
8059							
8060							
8061	col. oily liq or col. pr	sld 1 338^{13}; 1.2741^{20}	13 14	215-7; 98^{16}	0 048	s	s eth, ord. org solv.
8062							
8063							
8064							
8065							
8066							
8067							
8068							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt.
8069	**Sulfide, divinyl.**	See *Vinyl sulfide*		
8070	**——, ethyl methyl. .**	methylthioethane*	$CH_3SC_2H_5$	76.15
8071	**Sulfobenzide.**	See *Phenyl sulfone*		
8072	**Sulfocyanic acid.**	See *Thiocyanic acid*		
8073	**Sulfonal.**	See *Propane, 2,2-bis(ethylsulfonyl)-**		
8074	**Sulfone, dibenzyl.**	See *Benzyl sulfone.*		
8074M	**——, di-*n*-butyl.**	See *Butyl sulfone.*		
8075	**——, diethyl.**	See *Ethyl sulfone*		
8075M	**——, dimethyl.**	See *Methyl sulfone*		
8076	**——, diphenyl.**	See *Phenyl sulfone*		
8077	**——, dipropyl.**	See *Propyl sulfone*		
8078	**——, ethylenebisphenyl.**	See *Ethane, 1,2-bisphenylsulfonyl-**		
8079	**——, ethyl phenyl .**	ethylsulfonylbenzene*	$C_2H_5SO_2C_6H_5$	170.22
8080	**——, pentane-γ,γ-diethyl.**	See *Tetronal*		
8081	**Sulfonmethane.**	See *Propane, 2,2-bis(ethylsulfonyl)-**		
8082	**Sulfoxide, dibenzyl.**	See *Benzyl sulfoxide*		
8082M	**——, di-*n*-butyl.**	See *Butyl sulfoxide*		
8083	**——, diethyl.**	See *Ethyl sulfoxide*		
8083H	**——, dimethyl.**	See *Methyl sulfoxide*		
8083M	**——, di-*n*-propyl.**	See *Propyl sulfoxide*		
8084	**Sulfur chloride, trichloromethyl-.**	See *Methyl mercaptan, perchloro-*		
8085	**Sulfuric ether.**	See *Ethyl ether.*		
8086	**Sumatra camphor.**	See *d-Borneol*		
8087	**Superpalite.**	See *Diphosgene*		
8088	**Suprarenine.**	See *Adrenaline*		
8089	**Sylvan.**	See *Furan 2-methyl-*		
8090	***d*-Sylvestrene .**	*d*-1,8(9)-*m*-menthadiene	$C_{10}H_{16}$	136.23
8091	**Sylvic acid.**	See *Abietic acid*		
8091M	**D-Talose .**		$C_6H_{12}O_6$	180.16
8092	**Tannin.**	See *m-Digallic acid*		
8093	**Tartaric acid, dihydroxy-.**	See *Succinic acid, tetrahydroxy-.*		
8094	***dl*-Tartaric acid**	racemic acid	$HOOC(CHOH)_2COOH \cdot H_2O$	168.10
8094M	——, diethyl ester	diethyl tartrate (*dl*-), diethyl racemate	$C_8H_{14}O_6$	206.19
8095	——, dimethyl ester	dimethyl *dl*-2,3-dihydroxy-butanedioate*, methyl racemate	$(COOCH_3)(CHOH)_2COOCH_3$	178.14
8096	***d*-Tartaric acid. .**	*d*-2,3-dihydroxybutanedioic acid*, *d*-*α*, *β*-dihydroxy-succinic acid	$HOOC(CHOH)_2COOH$	150.09
8097	——, dibutyl ester	dibutyl *d*-2,3-dihydroxy-butanedioate*	$(CHOHCOOC_4H_9)_2$	262.30
8098	——, diethyl ester.	diethyl *d*-2,3-dihydroxy-butanedioate*, ethyl *d*-tartrate	$(CHOH\ CO_2C_2H_5)_2$	206.19
8099	——, diethyl ester diacetate	ethyl diacetyl-*d*-tartrate, ethyl *d*-diacetoxysuccinate	$[CH(OOCCH_3)COOC_2H_5]_2$	290.27
8100	——, dimethyl ester	methyl *d*-tartrate	$(COOCH_3)(CHOH)_2COOCH_3$	178.14
8101	——, dinitrate . .	dinitrotartaric acid	$COOH(CHNO_3)_2COOH$	240.09

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8069							
8070	liq .	0.837	-104.8	66	i	∞	∞ eth.
8071							
8072							
8073							
8074							
8074M							
8075							
8075M							
8076							
8077							
8078							
8079	monocl. pl f eth.	1.010^{22}	42	>300	sl s c	s	s eth.
8080							
8081							
8082							
8082M							
8083							
8083H							
8083M							
8084							
8085							
8086							
8087							
8088							
8089							
8090	liq, $1.47717^{17.2}$	0.863^{20}_{4}		177	i	∞	∞ eth.
8091							
8091M	cr		128-30				....
8092							
8093							
8094	col tricl. ..	1.697	$-H_2O$, 100; anh 204-6		20.6^{20} 9.23^{0} 185^{100}	1.66 c.	0.87 c. eth.
8094M	1.4454^{25}, $[\alpha]^{20}_{D}$ +7.45°	1.2036^{20}_{4}	17	280	sl s	∞	∞ eth.; s. ord. org solv.
8095	monocl f al	.	stable 90; metastable 84, meso 111	282		s	....
8096	col monocl, 1.4955, 1.5352, 1.6045	1.7598^{20}_{4}	170	....	139^{20}, 343^{100}	19.85^{15}	0.44 c. eth.; s. acet.; i. bz., chl.
8097	pr	1.087^{21}	22.5	203^{18}	..		....
8098	col hyg. liq, 1.4454^{25}, $[\alpha]^{20}_{D}$+7.45°	1.2036^{20}_{4}	17	280	s	s	∞ eth.; s. ord. org solv.
8099	monocl. cr..	1.109^{71}	67	$291-2^{727}$	sl s.	s.	v s. eth.
8100	col., $[\alpha]^{20}_{D}$ +9.32° in me al	1.3046^{50}_{4}	(1)48; (2) 50, (3)61	280	s	v s	s chl., bz.
8101	need		d		d	s	s. eth ; i. bz.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8102	***d*-Tartaric acid**, dipropyl ester	dipropyl *d*-2,3-dihydroxybutanedioate*; propyl tartrate	$(CHOHCOOC_3H_7)_2$	234.25
8103	——, monoethyl ester ..	ethyl hydrogen *d*-tartrate ..	$COOH(CHOH)_2COOC_2H_5$	178.14
8104	——, nicotine salt	See *Nicotine, tartrate.*		
8105	**——, dinitro-.**	See *d-Tartaric acid, dinitrate.*		
8105M	***l*-Tartaric acid**, diethyl ester	ethyl *l*-tartrate..........	$C_8H_{14}O_6$	206.19
8106	***i*-Tartaric acid**........	mesotartaric acid.......	$HOOC(CHOH)_2COOH$	150 09
8106M	——, diethyl ester........	diethyl tartrate (meso)	$C_8H_{14}O_6$	206 19
8107	**Tartronic acid**........	2-hydroxypropanedioic acid*; hydroxymalonic acid	$HOCH(COOH)_2$.	120 06
8108	**——, benzyl-**..........	1-hydroxy-2-phenyl-1,1-ethanedicarboxylic acid	$C_6H_5CH_2C(OH)(COOH)_2$	210 18
8109	**Taurine**.............	2-aminoethanesulfonic acid	$H_2NCH_2CH_2SO_3H$	125 14
8110	**Taurocholic acid** ..	.	$C_{26}H_{45}NO_7S\ H_2O$	533 71
8111	**Telluride, diethyl.**	See *Ethyl telluride.*		
8112	**——, dimethyl.**	See *Methyl telluride.*		
8113	**Tellurium ethyl.**	See *Ethyl telluride.*		
8114	**Teraconic acid**........	2-isopropylidenebutanedioic acid*, isopropylidenesuccinic acid, γ, γ-dimethylitaconic acid	$(CH_3)_2C\ C(COOH)CH_2COOH$	158 15
8116	**Terebic acid**	2,2-dimethylparaconic acid	$C_7H_{10}O_4$ . .	158 15
8117	**Terephthalaldehyde**	1,4-benzenedicarbonal*	$C_6H_4(CHO)_2$	134 13
8118	**Terephthalaldehydic acid**	*p*-formylbenzoic acid..	$CHOC_6H_4COOH$	150 13
8119	**——, 3-hydroxy-**....	4-formyl-3-hydroxybenzoic acid	$CHOC_6H_3(OH)COOH$	166 13
8120	**Terephthalic acid**....	1,4-benzenedicarboxylic acid*, *p*-phthalic acid	$C_6H_4(COOH)_2$	166 13
8121	——, diethyl ester	ethyl *p*-phthalate .	$C_6H_4(COOC_2H_5)_2$	222 23
8122	——, dimethyl ester.....	dimethyl 1,4-benzenedicarboxylate*	$C_6H_4(COOCH_3)_2$	194 18
8123	——, mononitrile.	See *Benzoic acid, p-cyano-.*		
8124	**——, benzoyl-**.......	2,5-benzophenonedicarboxylic acid	$C_6H_5COC_6H_3(COOH)_2$	270 23
8125	**——, 2,3-dihydro-.**	See 1,3-*Cyclohexadiene*-1,4-*dicarboxylic acid.*		
8126	**——, 2,5-dihydroxy-**..	2,5-dihydroxy-1,4-benzenedicarboxylic acid*, 2,5-hydroquinone dicarboxylic acid	$(HO)_2C_6H_2(COOH)_2$	198 13
8127	**——, hexahydro-.**	See 1,4-*Cyclohexanedicarboxylic acid*.*		
8128	**——, 2-nitro-**.......		$NO_2C_6H_3(COOH)_2$	211 13
8129	**Terephthalonitrile**....	1,4-benzenedicarbonitrile*; *p*-phenylene cyanide	$C_6H_4(CN)_2$.	128 13
8130	**Terephthalyl chloride**	1,4-benzenedicarbonyl chloride*, *p*-phthalyl dichloride	$C_6H_4(COCl)_2$....	203 03
8131	**Terpane.**	See *p-Menthane.*		
8132	**Terphenyl**..........	1,4-diphenylbenzene; *p*-phenylbiphenyl; triphenyl; diphenylphenylene	$(C_6H_5)_2C_6H_4$....	230.29
8133	***m*-Terphenyl.**	See *Benzene*, 1,3-*diphenyl-.*		
8134	**α-Terpinene**..........	1,3-*p*-menthadiene....... .	$C_{10}H_{16}$	136 23
8135	***dl*-α-Terpineol**........	*dl*-1-*p*-menthen-8-ol . ..	$C_{10}H_{17}OH$	154 25
8136	**Terpin hydrate.**	See *Terpinol, hydrate*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8102	liq........	1 139	. .	303	i.	v. s.	v. s. eth.
8103	col. rhomb...		90	....	s.	s.	s. eth.
8104							
8105							
8105M	$[\alpha]-7.55^{\circ 19.7}_{D}$	$1\ 2054\frac{19.7}{4}$	......	162^{19}	.. ..	—....	....
8106	col. tab., 1 495, 1.536, 1.605	1 666	anh. 140	... ..	125^{15}	s.	sl. s. eth.
8106M			55				....
8107	col. pr. f. eth		158 d.	d , subl 110–20	v. s.	v. s.	sl. s. eth.
8108	pr. ...		153 (147 d)	..... .	s.	s.	s. eth.
8109	tetr. need		328–9 d	d.	$6\ 5^{12}$	$0\ 0032^{17}$	i. eth.
8110	deliq. need		180 d	.	v s.	v s.	sl. s. eth.
8111							
8112							
8113							
8114	tricl. f. eth.		161 d.		v. s.	v. s.	v. s. eth.; v. sl. s. bz.
8116	monocl. f al	$0\ 8155\frac{24}{4}$	174	d.	sl s	s	1 21 c eth.
8117	need f. w .		116	248	$1\ 5^{100}$	v s	v. sl. s. eth.
8118	need. f. w		256 (248–50)	subl.	s h	v. s	sl. s. eth , chl.
8119	need...		234	..	sl s h	s.	s. eth.
8120	need. or amor	1 510	subl.	subl *ca* 300	0 0016	v. sl. s	v. sl. s. eth., chl ; s. alk.
8121	col	.	44				
8122	rhomb. f. al		140	subl. >30[illegible]	0 33 h	s h.	s. eth.
8123							
8124	need		285	..... .	i.	s.	s. eth.; i. tol.
8125							
8126	yel cr. f. al. or eth.		d.		s (grn fluor-es)	s (bl fluor-es)	s. eth.
8127							
8128	..		270 (263)	.....	v. s. h.	s h	..... .
8129	col. need. f bz		222	......	i.	sl. s.	sl. s. eth.; s. h. ac. a.
8130	need....		78	259	d.	d.	s. eth.
8131							
8132	col. leaf. f. al	$1\ 234\frac{0}{4}$	213	subl. 427	.	v. sl. s.	sl. s. eth., ac. a., CS_2; s. h. bz. (bl. fluor-es.)
8133							
8134	col. liq., 1.4846	(α)0 846 (β)0 838		180 173	i.	∞	∞ eth.
8135	col. liq., 1 4827	$0\ 9357\frac{20}{4}$	35, d 40	219 8	i.	v. s.	v. s. eth.; s. chl.
8136							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8138	***cis*-Terpinol,** hydrate ..	*cis*-1,8-*p*-menthanediol hydrate; *cis*-terpin hydrate	$C_{10}H_{18}(OH)_2 \cdot H_2O$.	190 28
8139	**Terpinolene**..........	1,4(8)-*p*-menthadiene	$C_{10}H_{16}$...... ..	136.23
8140	**Tetracoline.**	See *Quinoline, 2,5,7-trimethyl-*		
8141	**Tetracosane*(*n*)**......	....	$CH_3(CH_2)_{22}CH_3$	338.65
8142	**Tetradecanal***, oxime.	See *Myristaldehyde, oxime.*		
8143	**Tetradecanamide*.**	See *Myristamide.*		
8144	**Tetradecane***.........	*n*-tetradecane	$CH_3(CH_2)_{12}CH_3$.	198.38
8145	**——, 1-amino-.**	See *Tetradecylamine*.*		
8146	**Tetradecanenitrile*.**	See *Myristonitrile.*		
8147	**Tetradecanoic acid*.**	See *Myristic acid.*		
8148	**Tetradecanoic anhydride*.**	See *Myristic anhydride*		
8149	**1-Tetradecanol*** . ..	*n*-tetradecyl alcohol, myristic alcohol	$CH_3(CH_2)_{12}CH_2$-OH	214.38
8150	**Tetradecanoyl chloride*.**	See *Myristoyl chloride.*		
8151	**1-Tetradecene***.......	*α*-tetradecylene	$CH_2.CH(CH_2)_{11}$-CH_3	196.37
8152	***n*-Tetradecyl alcohol.**	See 1-*Tetradecanol*.*		
8153	**Tetradecylamine*(*n*)**..	1-aminotetradecane; *prim*-*n*-tetradecylamine	$CH_3(CH_2)_{13}NH_2$.	213 40
8154	**Tetradecyl sulfate**.....	di-*n*-tetradecyl sulfate	$[CH_3(CH_2)_{13}]_2SO_4$	490 81
8154M	**2-Tetradecyne***	......	$CH_3C\vdots C(CH_2)_{10}$-CH_3	194 35
8154T	**Tetraethylene glycol,** dimethyl ether	2,5,8,11,14-pentoxapentadecane*	$(CH_3OC_2H_4OC_2$-$H_4)_2O$	222 28
	Tetrahydro-. See the parent compounds (e.g., for tetrahydronaphthalene see *Naphthalene*...)			
8155	**Tetralin.**	See *Naphthalene, 1,2,3,4-tetrahydro-*.*		
8156	**Tetramethylene.**	See *Cyclobutane**		
8157	**Tetramethylenediamine.**	See *Putrescine.*		
8158	**Tetramethylene glycol.**	See 1,4-*Butanediol*.*		
8159	**Tetramethylene oxide.**	See *Furan, tetrahydro-.*		
8160	**Tetramethylenimine.**	See *Pyrrolidine.*		
8160M	**1-Tetratriacontanol*.**		*n*-$C_{34}H_{69}OH$	494 91
8161	**s-Tetrazine**	1,2,4,5-tetrazine	N NCH:NN:CH	82 07
8162	**s-Tetrazinedione, tetrahydro-.**	See *p-Urazine*		
8163	**2,1,3,5-Tetrazole**. . .	1,2,3,5-tetrazole	NHN:NCH:N	70 06
8164	**Tetrolic acid** ...	2-butynoic acid*, methylpropiolic acid	$CH_3C\vdots CCOOH$	84 07
8165	**Tetronal**	3,3-bisethylsulfonylpentane*, pentane γ,γ-diethyl sulfone	$(C_2H_5)_2C$-$(SO_2C_2H_5)_2$	256 37
8166	**Tetryl**...........	*N*-methyl-*N*-2,4,6-tetranitroaniline, methylpicrylnitramine	$(NO_2)_3C_6H_2N$-$(NO_2)CH_3$	287 15
8167	**Thalline**.......... .	1,2,3,4-tetrahydro-6-methoxyquinoline	$C_{10}H_{13}NO$	163 21
8168	**Thebaine**........ . .	paramorphine	$C_{19}H_{21}NO_3$	311 37
8169	——, hydrochloride	.. . ..	$C_{19}H_{21}NO_3 \cdot HCl$ H_2O	365 85
8170	**Theine.**	See *Caffeine.*		
8171	***α*-Thenyl alcohol.**	See 2-*Thiophenecarbinol*		
8172	**Theobromine**	3,7-dimethylxanthine	$C_7H_8N_4O_2$	180 17

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8138	col. rhomb., 1 505, 1 512, 1.524		anh. 117 1	subl. 100	0 36[20]	7 94[15]	0 714[15] eth.; 0 745[15] chl.
8139	col. liq., 1.4823	0 855		185	i	∞	∞ eth.
8140							
8141	cr	$0\ 7786\frac{51}{4}$	51 1	324 1; 243[15]	i	v s	v s. eth.
8142							
8143							
8144	col. liq., 1.4459	0 765	5 5	252 5	i.	v s.	v. s. eth.
8145							
8146							
8147							
8148							
8149	opaque leaf f. al.	0 8355; liq. $0\ 8236\frac{35}{4}$	37.62	263 2; 167[15]	0[20]	sl s	s. eth.
8150							
8151	col. liq .	0 775	-12	246	i	v s	v. s. eth.
8152							
8153	col cr		37	291 2; 162[15]	v sl s	s.	s eth.
8154			57 8-8 0				....
8154M	col liq	$0\ 765\frac{20}{4}$	5 5	252 5	i	v s	v. s. eth.
8154T	col. liq	$1\ 0132^{20}_{20}$		275 8	∞	s	
	alene, tetrahydro	)					
8155							
8156							
8157							
8158							
8159							
8160							
8160M			91 9-92 2				
8161	red		99	subl	s		
8162							
8163	leaf f al		155	subl	s	s	i eth ; s. ac. a ; sl s bz.
8164	col tab f eth or CS_2		76 5	203	v s	v s	v. s. eth.; 8 33 CS_2
8165	glit. leaf f w	..	85	.	0 22 c	4 3[15]	7 1[15] eth.
8166	yel monocl. f al.	1 57[19]	130	exp. 187	i	0 422[18]	v. s. eth.; s. bz., ac. a.
8167	rhomb	....	43	283 8	s. h.	v. s.	v. s eth , bz.
8168	glit. pr. f al., $[\alpha]$-218 64°$^{15}_{D}$ in al	1 305	193	.	v. sl s	10 c.	0 71[18] eth.; v. s. chl ; s. bz.
8169	rhomb , $[\alpha]$-168.32°D				s h.	6 3[10]	s eth.
8170							
8171							
8172	wh rhomb. f w		337	subl 290-5	0 03[18] 0 67[100]	0 023[17]	sl. s. eth , amyl al.; v. sl s bz

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8173	**Theophylline**	1,3-dimethylxanthine	$C_7H_8N_4O_2$	180.17
8174	**Thetin, dimethyl-**	2,2-dihydro-2,2-dimethyl-1,2-oxathietan-4-one	$OS(CH_3)_2CH_2CO$	120 16
8175	**Thialdine**	5,6-dihydro-2,4,6-trimethyl-1,3,5-dithiazine	$SCH(CH_3)SCH(CH_3)NHCHCH_3$	163 29
8175M	**Thiamin,** chloride; **Thiamine,** hydrochloride. See *Vitamin B_1.*			
8176	**Thianthrene**	dibenzo-*p*-dithiin; diphenylene disulfide	$C_6H_4SC_6H_4S$	216 30
8177	**Thiazole**	thio[*b*]monazole; metathiazole	$SCH{:}NCH{:}CH$	85 12
8178	——, **2-amino-**	2-thiazolylamine	$C_3H_2NS{\cdot}NH_2$	100 14
8179	**2-Thiazolylamine.**	See *Thiazole, 2-amino-.*		
8180	**2-Thienyl ketone**	2,2'-dithienyl ketone; thienone	$(C_4H_3S)_2CO$	194 26
8180M	**Thiirane.**	See *Ethylene sulfide.*		
8181	**Thioacetic acid**	See *Acetic acid, thiol-.*		
8182	**Thioaniline.**	See *Aniline, p,p'-thiodi-.*		
8183	**Thiocarbonyl chloride.**	See *Phosgene, thio-.*		
8184	**Thiocarbonyl tetrachloride.** See *Methyl mercaptan, perchloro-.*			
8185	**Thiocyanic acid**	sulfocyanic acid	CNSH	59 09
8186	——, allyl ester	2-propenyl thiocyanate*; allyl sulfocyanide	$CH_2{:}CHCH_2CNS$	99 15
8188	——, butyl ester	*n*-butyl sulfocyanate; *n*-butyl rhodanate	$CH_3(CH_2)_3SCN$	115 19
8190	——, *tert*-butyl ester.	*tert*-butyl sulfocyanate; *tert*-butyl rhodanate	$(CH_3)_3CSCN$	115 19
8191	——, cyanogen ester	cyanogen sulfide, cyanogen thiocyanate	$N{:}CSC{:}N$	84 10
8192	——, ethylene ester.	See *Glycol, dithiocyanate.*		
8193	——, ethyl ester		C_2H_5SCN	87 14
8194	——, isoamyl ester	isoamyl sulfocyanate; isoamyl rhodanate	$(CH_3)_2CH(CH_2)_2$-SCN	129 22
8195	——, isobutyl ester	isobutyl sulfocyanate; isobutyl rhodanate	$(CH_3)_2CHCH_2$-SCN	115 19
8196	——, isopropyl ester	isopropyl sulfocyanate; isopropyl rhodanate	$(CH_3)_2CHSCN$	101 16
8197	——, methyl ester	methyl thiocyanate; methyl sulfocyanate	CH_3SCN	73 11
8198	——, phenyl ester	phenyl sulfocyanate; phenyl rhodanate	C_6H_5SCN	135 18
8199	——, propyl ester	*n*-propyl sulfocyanate; *n*-propyl rhodanate	$CH_3CH_2CH_2SCN$.	101 16
8200	**Thiocyanuric acid**	trithiocyanuric acid	$C_3H_3N_3S_3$	177 26
8201	**Thiodiglycol.**	See *Ethanol, 2,2'-thiodi-.*		
8202	**Thiodiphenylamine.**	See *Phenothiazine.*		
8203	**Thiofuran.**	See *Thiophene*		
8204	**Thioglycolic acid.**	See *Acetic acid, mercapto-.*		
8205	**Thiohydantoin.**	See *Hydantoin, 2-thio-.*		
8206	**Thioisatin.**	See *Thionaphthenequinone.*		
8207	**Thio[*b*]monazole.**	See *Thiazole*		
8208	**Thionaphthene**	benzothiophene; benzothiofuran	$C_6H_4SCH{:}CH$	134 19
8209	**Thionaphthenequinone**	1,2-thionaphthenedione; thioisatin	C_6H_4SCOCO	164 17
8210	**Thionine**	Lauth's violet	$C_{12}H_9N_3S$	227 27
8211	**Thiophene**	thiofuran	$SCH{:}CHCH{:}CH$	84 13

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8173	monocl. need f w		269–72·		0 44^{15} 1 3^{37}	1 25	sl. s. eth.; s. alk., NH_4OH
8174	deliq. cr .		d ,-H_2O		s.	s.	. . . .
8175	monocl. .	1 191	43	d.	sl. s.	s.	v s eth.
8175M							
8176	monocl. pr f al		158–60	353–4 d ; 204^{11}	i.	0 25 c	s. h. eth., CS_2, H_2SO_4, bz.
8177	col liq. .	1 198	.....	116 8		s.	s. eth.
8178	yel cr. f al		90	d.	sl s	sl s	sl. s. eth.
8179							
8180	col need f al		87–8	326	i	s. h.	s. ord. org. solv.
8180M							
8181							
8182							
8183							
8184							
8185	col liq.		5	d	∞, d	v s	v s. eth.
8186	oil .	1 056^{15}, (1 071^{0})		161	v sl s	∞	∞ eth.
8188	col liq., 1 4636$^{21.5}$	0 9563^{25}		184 5–5 5^{743}	i.	s.	s. eth.
8190	oil		.	d			....
8191	rhomb pl or leaf.		65 (60)	d , subl 30–40	s	s.	s. eth.
8192							
8193	col liq., 1 4666	0 996$\frac{25}{4}$	85 5	144 4	i	∞	∞ eth.
8194	col liq			197; 193 5-5^{740}	v sl s	s	s eth.
8195	col liq.			174–6	∞		....
8196	.	0 963^{20}		149–51 (152–3)	i.	∞	∞ eth.
8197	col liq , 1.46801$^{23.8}$	1 068	-51	133	i (v sl s)	∞	∞ eth.
8198	liq	1 1228$^{23.6}$		232	i	s	s. eth.
8199	col liq.			163			....
8200	yel need		d 200		v s. h	v sl s	v. sl. s. eth.
8201							
8202							
8203							
8204							
8205							
8206							
8207							
8208	leaf , 1 63324$^{36.2}$	1 165$\frac{20}{4}$	32	221 volat	i.	v. s.	v. s. eth.
8209	yel. pr		121	247	i.	s.	....
8210	grn powd or br -blk. leaf.				v. v. sl s c.	sl. s.	s. eth.
8211	liq., 1 5285	1 0884$\frac{0}{4}$	-40	84	i.	s.	s. bz., H_2SO_4

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
8212	**Thiophene, 2-acetyl-.**	See *Ketone, methyl 2-thienyl.*		
8213	**——, 2-acetyl-5-bromo-.**	See *Ketone, 5-bromo-2-thienyl methyl*		
8214	**——, 2-acetyl-5-chloro-.**	See *Ketone, 5-chloro-2-thienyl methyl.*		
8215	**——, 2-amino-.**	See *Thiophenine.*		
8216	**——, 2-bromo-**		SCBr.CHCH:CH	163 04
8217	**——, 2-chloro-**		SCCl:CHCH·CH	118 58
8218	**——, 2,5-dibromo-**		SCBr·CHCH:CBr	241 95
8219	**——, 2,5-dibromo-3,4-dinitro-**		$(NO_2)_2C_4Br_2S$	331 95
8220	**——, 2,5-dichloro-**		SCCl.CHCH·CCl	153 03
8221	**——, 2,3-dihydro-2-imino-.**	See *Thiophenine.*		
8222	**——, 2,5-diiodo-**		SCI:CHCH:CI.	335 96
8223	**——, 2,3-dimethyl-**	2,3-thioxene	$(CH_3)_2C_4H_2S$	112 18
8224	**——, 2,4-dimethyl-**	2,4-thioxene	$(CH_3)_2C_4H_2S$	112 18
8225	**——, 2,5-dimethyl-**	2,5-thioxene	$(CH_3)_2C_4H_2S$	112 18
8226	**——, 2,5-dinitro-**		$(NO_2)_2C_4H_2S$	174 13
8227	**——, 2-ethyl-**		$C_2H_5C_4H_3S$	112 18
8228	**——, 3-ethyl-**		$C_2H_5C_4H_3S$	112 18
8229	**——, 2-formyl-.**	See 2-*Thiophenecarbonal.*		
8230	**——, 2-iodo-**		C_4H_3IS	210 04
8231	**——, 2-iodo-5-nitro-.**		$NO_2C_4H_2IS$	255 04
8232	**——, 2-methyl-**	α-thiotolene	$CH_3C_4H_3S$	98 16
8233	**——, 3-methyl-**	β-thiotolene	$CH_3C_4H_3S$	98 16
8234	**——, 2-methyl-5-phenyl-**		$CH_3C_4H_2SC_6H_5$	174 25
8235	**——, 2-nitro-**		$NO_2C_4H_3S$	129 13
8236	**——, tetrabromo-**		C_4Br_4S	399 76
8237	**——, tetrachloro-**		C_4Cl_4S	221 93
8238	**——, 2,3,5-tribromo-**		C_4HBr_3S	320 86
8239	**——, 2,3,5-tribromo-4-nitro-**		$NO_2C_4Br_3S$	365 86
8240	**——, 2,3,5-trichloro-**		C_4HCl_3S	187 48
8241	**——, 2,3,5-trichloro-4-nitro-**		$NO_2C_4Cl_3S$	232 48
8242	**——, 2,3,5-trimethyl-**		$(CH_3)_3C_4HS$	126 21
8243	**2-Thiopheneacetic acid**	2-thienylacetic acid	$C_4H_3S\,CH_2COOH$	142 17
8244	**——, α-oxo-**	2-thienylglyoxylic acid; 2-thenoylformic acid	$C_4H_3SCOCOOH.$	156 15
8245	**Thiophene aldehyde.**	See *Thiophenecarbonal*.*		
8246	**2-Thiophenecarbinol**	α-thienylcarbinol, α-thenyl alcohol	$C_4H_3S\,CH_2OH$	114 16
8247	**2-Thiophenecarbonal***	2-thiophenealdehyde; α-thienylformaldehyde; 2-formylthiophene	$C_4H_3S\,CHO$	112 14
8248	——, oxime	2-thiophenealdoxime	$C_4H_3S\,CH{:}NOH.$	127 16
8249	——, phenylhydrazone	2-thienylformaldehyde phenylhydrazone	$C_4H_3S\,CH{:}NNH\text{-}C_6H_5$	202 27

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
8212							
8213							
8214							
8215							
8216	col....	$1.652\frac{23}{23}$		149.5-50.5	i.	v s	v. s eth.
8217	col			130		...	....
8218	col	$2.147\frac{23}{23}$		210.5-1.0	i.	v. s.	v. s. eth.
8219	pa. yel.		139-40			v. s. h.	....
8220	col			170		..	....
8221							
8222	col. fluores		40.5	.	i	v. s.	....
8223	col. liq. .	$0.9938\frac{20}{20}$		136-7	i	v. s.	v. s. eth.
8224	liq .. .	0.9956^{20}		138	i.	s.	s. eth.
8225	liq., 1.51418	$0.9859\frac{19}{4}$		137.5	i.	s.	s. eth.
8226	yel pl		52	290	sl s.	s.	v. s. eth.
8227	col	$0.990\frac{24}{24}$		132-4	i.	v s	v. s. eth.
8228	col	$1.0012\frac{16}{16}$		135-6	i	v. s.	v s. eth.
8229							
8230	col .			182; 73^{15}			v s. eth.
8231	lem. yel., shiny		74			s.	...
8232	col			113	i	v s	v. s. eth.
8233	col. oil	$1.0217\frac{15.8}{4}$	.	114^{738}	i.	v. s	v. s. eth.
8234	col need		49-51	.		v s	v s eth.
8235	monocl. f. al		46.5	225	i	v. s.	v s. eth.; i. alk.
8236	wh. need		116	326	i	s h.	v s. eth.
8237	spears		36			v. s	.....
8238	shiny spears		29	259-60	i	sl s h	v s. eth.
8239	red-yel need		106				v. s. eth.
8240	col. oil			206-7			......
8241	red-yel need		86			s	v. s. eth., bz.
8242	col....		.	160-3			.. ..
8243	col ...		76	.....	s h	s	s eth.
8244	cr.+H_2O.		+1H_2O 58-59; anh 91.5	.	v s		v s. eth.
8245							
8246	col. liq ..	..	.	207	i	v s	v. s. eth.
8247	yel oil .	$1.215\frac{21}{21}$		198	i.	v s	s. eth.
8248	wh. need.		128				v. s. eth.
8249	yel need..		134.5		i.	s.	. ...

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8250	**2-Thiophenecarboxylic acid***	α-thiophenic acid	$C_4H_3S\ COOH$.	128 14
8251	**——, 3-methyl-**......		$CH_3C_4H_2S\ COOH$	142 17
8252	**——, 5-methyl-**.......	*o,o*-thiotolenic acid .	$CH_3C_4H_2S\ COOH$	142 17
8253	**3-Thiophenecarboxylic acid***	β-thiophenic acid	$C_4H_3S\ COOH$. .	128 14
8254	**2,3-Thiophenedicarboxylic acid***	. . .	$C_4H_2S(COOH)_2$..	172 15
8255	**2,4-Thiophenedicarboxylic acid***	.	$C_4H_2S(COOH)_2$..	172 15
8256	**2,5-Thiophenedicarboxylic acid***	.	$C_4H_2S(COOH)_2$..	172 15
8257	——, diethyl ester		$C_4H_2S(COOC_2H_5)_2$	228 26
8258	**2-Thiophene-ol, 5-methyl-**	2,5-thiotenol .	$CH_3C_4H_2S\ OH$	114 16
8259	**2-Thiophenesulfonamide**	.	$C_4H_3S\ SO_2NH_2$	163 21
8260	**3-Thiophenesulfonamide**	.	$C_4H_3S\ SO_2NH_2$.	163 21
8261	**α-Thiophenic acid.**	See 2-*Thiophenecarboxylic acid*.		
8262	**β-Thiophenic acid.**	See 3-*Thiophenecarboxylic acid*.		
8263	**Thiophenine**..........	2-aminothiophene or 2,3-dihydro-2-iminothiophene	$C_4H_3S\ NH_2$ or $C_4H_4S(.NH)$	99 15
8264	**——, *N*-acetyl-.**	See *Acetamide, N-2-thienyl-*.		
8265	**——, *N*-methyl-**.......	.	$CH_3NHC_4H_3S$ ..	113 17
8266	**Thiophenol.**	See *Phenol, thio-*		
8267	**Thiopyrine**...........	1,5-dimethyl-2-phenyl-3-thio-3-pyrazolone.. ...	$CH_3NN(C_6H_5)$- $CSCH\ CCH_3$	204 28
8268	**Thiosalicylic acid.**	See *Benzoic acid, o-mercapto-*		
8269	**Thiosinamine.**	See *Urea, allylthio-*.		
8270	**2,5-Thiotenol.**	See 2-*Thiophene-ol, 5-methyl-*.		
8271	**α-Thiotolene.**	See *Thiophene*, 2-*methyl-*.		
8272	**β-Thiotolene.**	See *Thiophene*, 3-*methyl-*.		
8273	**o,o-Thiotolenic acid.**	See 2-*Thiophenecarboxylic acid*, *5-methyl-*.		
8274	**Thiourea.**	See *Urea, thio-*.		
8275	**Thioxene.**	See *Thiophene, dimethyl-*.		
8276	**Thiuram disulfide, dicyclopentamethylene-.**	See *Disulfide, bis(1-piperidyl-*		
8277	**——, diethyldimethyl-.**	See *Disulfide, bis(ethylmethylthiocarbamyl)*.		
8278	**——, tetrabenzyl-.**	See *Disulfide, bis(tetrabenzylthiocarbamyl)*.		
8279	**——, tetrabutyl-.**	See *Disulfide, bis(dibutylthiocarbamyl)*		
8280	**——, tetraethyl-.**	See *Disulfide, bis(diethylthiocarbamyl)*.		
8281	**——, tetramethyl-.**	See *Disulfide, bis(dimethylthiocarbamyl)*.		
8282	**——, dicyclopentamethylene-.**	See *Sulfide, bis(1-piperidylthiocarbonyl)*.		
8283	**Thiuram sulfide, tetramethyl-.**	See *Sulfide, bis(dimethylthiocarbamyl)*.		
8283M	**D-Threose**	*l*-threose, formerly.........	$C_4H_8O_4$....	120 10
8284	**α-Thujone**.........	6-ketosabinane (one form)	$C_{10}H_{16}O$	152 23
8286	**Thymine**.........	5-methyluracil	$NHCONHCOC$- $(CH_3)\ CH$	126.11

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8250	need. f. w		126.5	260 d.	0.75^{25}, v.s.h.	v. s.	v. s. eth.; sl. s. lgr.
8251	col need.		140; 144		sl. s c., v s.h	v. s.	v. s. eth.
8252	col. need.		137 subl.		sl s c, v. s h	v. s.	v. s. eth.
8253	need. f. w.		136	subl.	0.43^{25}		....
8254	need f. w		270 d.		sl s. h		v. s. eth.
8255	cr. .		280 subl. d		sl s. h.		....
8256	wh. cr. .		subl. >350		sl. s. h	s.	s. eth.
8257	need or pr		50			v. s.	....
8258	col oil		.....	85^{40} unst	sl s.	v. s.	v. s. eth.
8259	wh. ..		141–2		sl. s.		.
8260	shiny pl.		152–3		sl s		.
8261							
8262							
8263	yel. resin oil			$61\text{-}2^{1}$ d	v s	v s	i. eth.
8264							
8265	col. .			$88\text{–}92^{15}$			
8266							
8267	col. cr.		166		sl. s. c, s h	s.	s. eth.
8268							
8269							
8270							
8271							
8272							
8273							
8274							
8275							
8276	*thiocarbonyl*).						
8277							
8278							
8279							
8280							
8281							
8282							
8283							
8283M	micr. col need, v hygr.; $[\alpha]^{22}_{D}$ +29.09 to +19.59, $[\alpha]^{20}_{D}$ -12.5		126–32		v s	v sl s.	i. eth., pet. eth.
8284	col. liq., $1.4540^{18.6}$	0.913^{20}		200	v. sl. s.	∞	∞ eth.
8286	need. f. al....		d 270		0.74^{22}	sl. s.	v. sl. s. eth.; s. alk., H_2SO_4

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
8287	**Thymohydroquinone**	2,5-*p*-cymenediol	$CH_3(C_3H_7)C_6H_2(OH)_2$	166 21
8288	**Thymol**	3-*p*-cymenol	$CH_3(C_3H_7)C_6H_3OH$	150 21
8289	——, *l*-**hexahydro-**	See *l-Menthol.*		
8290	——, **6-nitroso-**	thymoquinone 2-oxime	$C_{10}H_{13}O(NOH)$	180 22
8291	**Thymolphthalein**		$OCOC_6H_4C(C_{10}H_{13}O)_2$	430.52
8292	**Thymoquinone**	3,6-*p*-menthadiene-2,5-dione, 2-isopropyl-5-methylhydroquinone	$(CH_3)_2CHC_6H_2(CH_3)O_2$	164 20
8293	——, 2-oxime.	See *Thymol, 6-nitroso-*.		
8294	**o-Thymotic acid**	3-hydroxy-2-*p*-cymenecarboxylic acid	$CH_3(C_3H_7)C_6H_2(OH)COOH$	194 22
8295	**Thymylamine**	3-*p*-cymylamine; 2-isopropyl-5-methylaniline	$C_3H_7(CH_3)C_6H_3NH_2$	149 23
8296	**Thyronine, tetraiodo-**	See *Thyroxine.*		
8297	***d*-Thyroxine**	*β*-[(3,5-diiodo-4-hydroxyphenoxy)-3,5-diiodophenyl]-*d*-alanine	$HOC_6H_2I_2OC_6H_2I_2CH_2CH(NH_2)COOH$	776.93
8298	***l*-Thyroxine**	*l*-tetraiodothyronine	$C_{15}H_{11}I_4NO_4$	776 93
8299	**Tiglaldehyde**	2-methyl-2-butenal*; *α, β*-dimethylacrolein; guaiole	$CH_3CH:C(CH_3)CHO$	84 11
8300	**Tiglic acid**	2-methyl-2-butenoic acid* (one form); *α, β*-dimethylacrylic acid	$CH_3CH:C(CH_3)COOH$	100.11
8301	**Tin, diethyl-***	tin diethyl	$Sn(C_2H_5)_2$	176 82
8302	——, **diethyldimethyl-***	diethyldimethylstannane	$(C_2H_5)_2Sn(CH_3)_2$	206 89
8303	——, **hexaethyldi-**	triethyltin	$(C_2H_5)_3SnSn(C_2H_5)_3$	411 76
8304	——, **tetraethyl-***	tetraethylstannane; tin tetraethyl	$Sn(C_2H_5)_4$	234 94
8305	——, **tetraisoamyl-**	tetraisoamylstannane.	$[(CH_3)_2CHCH_2CH_2]_4Sn$	403 26
8306	——, **tetramethyl-***	tin tetramethyl, tetramethylstannane	$Sn(CH_3)_4$	178 84
8307	——, **tetraphenyl-***	tetraphenylstannane	$(C_6H_5)_4Sn$	427.10
8308	——, **tetrapropyl-***	tetrapropylstannane	$(CH_3CH_2CH_2)_4Sn$	291 05
8309	——, **tetra-o-tolyl-**	tetra-*o*-tolylstannane	$(CH_3C_6H_4)_4Sn$	483 21
8310	——, **tetra-*p*-tolyl-**	tetra-*p*-tolylstannane	$(CH_3C_6H_4)_4Sn$	483 21
8311	——, **triethyl-**	See *Tin, hexaethyldi-*.		
8312	**Tin chloride, tribenzyl-***		$(C_6H_5CH_2)_3SnCl$	427 54
8313	——, **triethyl-***		$(C_2H_5)_3SnCl$	241 34
8314	——, **triisoamyl-**		$[(CH_3)_2CHCH_2CH_2]_3SnCl$	367 57
8315	——, **triphenyl-***		$(C_6H_5)_3SnCl$	385 46
8316	**Tin dichloride, diethyl-***		$(C_2H_5)_2SnCl_2$	247 74

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8287	pr.. ...	. .	143 (139)	290	s h.	s.	s. eth.
8288	col hex. pl 1.51893[24.4], 1.525, 1.609	0 969$\frac{20}{4}$; 0 978$\frac{15}{4}$	51.5	233 5	0 085[20], 0.132[37]	357[20] 91%	360[20] eth.; s. chl., CS_2, glac. ac. a.; sl. s. glyc.
8289							
8290	need.		160		i	v s.	v. s. eth.
8291	col. need...		245-6	.		s.	s. eth., acet. caustic alk., chl.
8292	yel. tricl. tab		45.5	232	v sl. s.	v. s.	v. s. eth.; s. chl.
8293							
8294	monocl. f w. or bz.		127	subl.	0 01 c.	s	s. eth., bz.
8295	oil.... .		. .. ..	230	v sl s	s	s. eth.
8296							
8297	need.... ..		237 d.		. ...	..	....
8298	wh. or sl. yel need	.	235-6 d	.	0 001	i	i. eth.
8299	liq, 1.4495 ..	0 865	......	116.5	40-50	∞	∞ eth.
8300	col. tricl pr., 1 4342[81]	0 872$\frac{20}{4}$; 0 964$\frac{76}{4}$	64	198.5	sl s. c., v. s. h.	s.	s. eth.
8301	yel oil...	1 558[15]	....	d.	i.	s	s. eth.
8302	col liq .	1 2319[19]	<-13	144-6	i.	i	s. org. solv.
8303	liq......	1 4115$\frac{0}{4}$	.... .	270 d.	i.	i	s eth., bz.
8304	col liq., 1.5143	1 187[23]	-112	181	i.	s.	s. eth.
8305	liq ...	1 035[19.5]		188[24]			....
8306	col liq, 1 5201	1 314$\frac{0}{4}$	...	78	i	s.	s. eth.
8307	col tetr f xylene	1 490$\frac{0}{4}$	226	>420	i	sl s.	s h. bz., pyr., CCl_4, chl, ac. a
8308	col. liq. ...	1 1065[20.2]	.... .	222-5	i.	.....	s org. solv.
8309	col liq.		158-9 (215)	.	i.	i.	s eth., bz.
8310	col need..		230-3		i	sl s.	sl. s. eth.; s. bz., chl., CS_2, pyr.
8311							
8312	wh. need..		142-4	d	i.	i	s. eth., ac. a., acet., bz., chl, pyr
8313	col. liq....	1 428[8]	10(15.5)	208-10	i c		s. org. solv.
8314	. ....	1 1290[34.2]	-30.2	114[13]	.		. .
8315	col. cr..		106	240[13.5]	i		s. org. solv.
8316	wh. need.		84-5	220	s.		s. HCl, org. solv.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
8317	**Tin difluoride, diethyl-***		$(C_2H_5)_2SnF_2$	214 82
8318	**Tin oxide, diethyl-***	diethylstannone	$(C_2H_5)_2SnO$	192 82
8319	**Tin trichloride, methyl-***		CH_3SnCl_3	240 11
8320	**T.N.A.**	See *Aniline, 2,4,6-trinitro-.*		
8321	**T.N.T.**	See *Toluene, 2,4,6-trinitro-**		
8322	**Tobias' acid.**	See 2-*Naphthylamine-1-sulfonic acid.*		
8322M	**α-Tocopherol**	one factor of vitamin E	$C_{29}H_{50}O_2$	430 70
8323	**Tolan.**	See *Acetylene, diphenyl-*		
8324	***o*-Tolidine**	4,4'-bi-*o*-toluidine ($NH_2=1$), 4,4'-diamino-3,3'-dimethylbiphenyl	$[NH_2(CH_3)C_6H_3]_2$.	212 29
8325	***m*-Tolidine**	4,4'-bi-*m*-toluidine ($NH_2=1$), 4,4'-diamino-2,2'-dimethylbiphenyl	$[NH_2(CH_3)C_6H_3]_2$	212 29
8326	***p*-Tolidine**		$[NH_2(CH_3)C_6H_3]_2$	212 29
8327	***o*-Tolualdehyde**	2-methylbenzenecarbonal*; *o*-methylbenzaldehyde	$CH_3C_6H_4CHO$	120 14
8328	***m*-Tolualdehyde**	*m*-methylbenzaldehyde	$CH_3C_6H_4CHO$	120 14
8329	***p*-Tolualdehyde**	*p*-methylbenzaldehyde	$CH_3C_6H_4CHO$	120 14
8330	**α-Tolualdehyde**	phenylacetaldehyde	$C_6H_5CH_2CHO$	120 14
8331	***o*-Toluamide**	*o*-methylbenzamide	$CH_3C_6H_4CONH_2$	135 16
8332	***m*-Toluamide**	*m*-methylbenzamide	$CH_3C_6H_4CONH_2$	135 16
8333	***p*-Toluamide**	*p*-methylbenzamide	$CH_3C_6H_4CONH_2$.	135 16
8334	**α-Toluanilide**	α-phenylacetanilide	$C_6H_5CH_2CONHC_6H_5$	211 25
8335	**Tolubenzyl alcohol.**	See *Carbinol, tolyl-*		
8336	**Toluene**	methylbenzene, phenylmethane	$C_6H_5CH_3$	92 13
8337	**——, α-amino-.**	See *Benzylamine.*		
8338	**——, ω-azido-.**	See *Toluene, α-triazo-.*		
8339	**——, benzyl-.**	See *Methane, phenyltolyl-*		
8340	**——, α-(benzyldithio)-.**	See *Benzyl disulfide.*		
8341	**——, *o*-bromo-**	*o*-tolyl bromide	$CH_3C_6H_4Br$	171.04
8342	**——, *m*-bromo-**	*m*-tolyl bromide	$BrC_6H_4CH_3$	171.04
8343	**——, *p*-bromo-**	*p*-tolyl bromide	$BrC_6H_4CH_3$	171.04
8344	**——, α-bromo-.**	See *Benzyl bromide*		
8345	**——, α-bromo-*o*-nitro-**	*o*-nitrobenzyl bromide	$NO_2C_6H_4CH_2Br$	216 04
8346	**——, α-bromo-*m*-nitro-**	*m*-nitrobenzyl bromide	$NO_2C_6H_4CH_2Br$	216 04
8347	**——, α-bromo-*p*-nitro-**	*p*-nitrobenzyl bromide	$NO_2C_6H_4CH_2Br$	216.04
8348	**——, butoxy-.**	See *Ether, butyl tolyl*		
8349	**——, *o*-butyl-**	1-butyl-2-methylbenzene	$CH_3C_6H_4(CH_2)_3CH_3$	148 24

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8317	sq pl. or lng rhomb tab f. me. al.		229			0 45[31]	2.64[31] me. al.; 0.047[31] bz.
8318	wh. powd.		infus.		i	.	s. HCl, dil. a., conc. alk.; i. org. solv.
8319	col. cr.		43		s c		s. org. solv.; hyd. by alk.
8320							
8321							
8322							
8322M	pa. yel oily liq			d 350	i.	s.	s eth.
8323							
8324	col. sc. f. h w		126.5–9		sl s.	v s.	v s. eth.
8325	pr. f. h. w.	.	107–8		s. h.	v. s.	v. s. eth.
8326	leaf. . .		103		s h.	v. s.	v. s eth.
8327	liq, 1 54852[19.6]	1 039	. . . .	195.5	sl. s.	s.	s. eth.
8328	liq, 1 54068[21.4]	1 019		199(195 5)	sl. s.	∞	∞ eth.
8329	liq., 1 54693[16.6]	1 020	. . .	204	sl. s.	∞	∞ eth.
8330	col liq., 1 52546[19.6]	1 027	<-10	194	v. sl s	∞	∞ eth.
8331	col need. f. w.	. . . . .	147 (139–40)	.	sl. s. c., v s. h	v. s.	v s. eth.
8332	need. f. eth	.	97 (94)		sl s.	s.	sl s eth.; v. sl. s. bz.
8333	col. need. f. w		165 (159–60)		sl s c., v s. h	v. s.	v. s. eth.
8334	wh. pr. f. al..		117		i	3.3	1 1 eth.; i. H_2SO_4, dil. KOH
8335							
8336	col liq., 1.49782[16.35]	$0.866\frac{20}{4}$; $0\ 86234\frac{25}{4}$	-95	110.8	0 047[16]	∞	∞ eth.; s. chl., glac. ac. a., acet., CS_2, bz.
8337							
8338							
8339							
8340							
8341	col. liq.. . . .	1 422	-27 (-26 to -29)	181 75	i.	v. s.	v. s. eth., bz.
8342	col. liq., 1.551	$1\ 4099\frac{20}{4}$	-39.8	183.7	i.	s.	∞ eth.
8343	rhomb. cr f al., 1.5490	$1\ 3898\frac{20}{4}$	28	184–5	i.	s.	s. eth., bz.
8344							
8345	cr. f. dil. al.		46–7	. . . .	i.	v. s.	s. bz.
8346	need.		58	. . . . .	v. sl. s.	s.	. . . .
8347	need. f. al.		100 (97–8)	. . .	sl s. (i)	2[19]; 37[75]	v. s. eth.
8348							
8349	oil.	$0\ 8702\frac{18}{4}$		200–1	i	sl s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8350	**Toluene, *m*-butyl-**	1-butyl-3-methylbenzene	$CH_3C_6H_4C_4H_9$	148 24
8351	**——, *p*-butyl-**	1-butyl-4-methylbenzene	$CH_3C_6H_4C_4H_9$	148 24
8352	**——, 3-*tert*-butyl-2,4,6-trinitro-**	artificial musk	$[(CH_3)_3C](CH_3)$-$C_6H(NO_2)_3$	283 24
8353	**——, *o*-chloro-**	2-chloro-1-methylbenzene	$ClC_6H_4CH_3$	126 58
8354	**——, *m*-chloro-**	3-chloro-1-methylbenzene	$ClC_6H_4CH_3$	126 58
8355	**——, *p*-chloro-**	4-chloro-1-methylbenzene	$ClC_6H_4CH_3$	126 58
8356	**——, α-chloro-.**	See *Benzyl chloride.*		
8357	**——, α-chloro-α,α-difluoro-**	benzodifluorochloride	$C_6H_5CF_2Cl$	162 57
8358	**——, chloromercuri-.**	See *Mercury chloride, tolyl-.*		
8359	**——, α-chloro-*o*-nitro-**	*o*-nitrobenzyl chloride	$NO_2C_6H_4CH_2Cl$	171 58
8360	**——, α-chloro-*m*-nitro-**	*m*-nitrobenzyl chloride	$NO_2C_6H_4CH_2Cl$	171 58
8361	**——, α-chloro-*p*-nitro-**	*p*-nitrobenzyl chloride	$NO_2C_6H_4CH_2Cl$	171 58
8362	**——, diamino-.**	See *Tolylenediamine.*		
8363	**——, α,α-dibromo-.**	See *Benzylidene bromide.*		
8364	**——, α,α-dibromo-*p*-nitro-**	p-nitrobenzal bromide	$NO_2C_6H_4CHBr_2$	294 95
8365	**——, α,α-dichloro-.**	See *Benzylidene chloride*		
8366	**——, α,4-dichloro-.**	See *Benzyl chloride, p-chloro-.*		
8366M	**——, α,α-dichloro-α-fluoro-**	benzofluoride dichloride	$C_6H_5CCl_2F$	179 02
8367	**——, α,α-dichloro-*m*-nitro-**	*m*-nitrobenzal chloride	$NO_2C_6H_4CHCl_2$	206 03
8368	**——, α,α-dichloro-*p*-nitro-**	*p*-nitrobenzal chloride	$NO_2C_6H_4CHCl_2$	206 03
8369	**——, 3,5-diethyl-**	1,3-diethyl-5-methylbenzene*	$(C_2H_5)_2C_6H_3CH_3$	148 24
8370	**——, *o*-diethylamino-.**	See *o-Toluidine,N,N-diethyl-.*		
8371	**——, *p*-diethylamino-.**	See *p-Toluidine,N,N-diethyl-.*		
8371M	**——, α,α-difluoro-.**	See *Benzal fluoride.*		
8372	**——, 1,2-dihydro-**		$C_6H_7CH_3$	94 15
8373	**——, 2,3-dihydroxy-.**	See *Pyrocatechol, 3-methyl-.*		
8374	**——, 2,4-dihydroxy-.**	See *Cresorcinol.*		
8375	**——, 2,5-dihydroxy-.**	See *Toluhydroquinone.*		
8376	**——, 2,6-dihydroxy-.**	See *Resorcinol, 2-methyl-.*		
8377	**——, 3,5-dihydroxy-.**	See *Orcinol.*		
8378	**——, 2,4-dinitro-**	1-methyl-2,4-dinitrobenzene	$(NO_2)_2C_6H_3CH_3$	182 13
8379	**——, 2,5-dinitro-**	2-methyl-1,4-dinitrobenzene	$(NO_2)_2C_6H_3CH_3$	182 13
8380	**——, 2,6-dinitro-**	2-methyl-1,3-dinitrobenzene	$(NO_2)_2C_6H_3CH_3$	182 13
8381	**——, 3,4-dinitro-**	4-methyl-1,2-dinitrobenzene	$(NO_2)_2C_6H_3CH_3$	182 13
8382	**——, 3,5-dinitro-**	1-methyl-3,5-dinitrobenzene.	$(NO_2)_2C_6H_3CH_3$	182 13
8383	**——, *o*, *m* or *p*-ethoxy-.**	See *Ether, ethyl tolyl.*		
8384	**——, α-ethoxy-.**	See *Ether, benzyl ethyl.*		
8385	**——, *o*-ethyl-**	1-ethyl-2-methylbenzene	$CH_3C_6H_4C_2H_5$	120.19

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
8350	oil	$0.8624\frac{18}{4}$	....	197–8	i.	sl. s.	s. eth.
8351	oil..........	$0.86132\frac{14}{4}$	....	198–9	i.	sl. s.	s. eth.
8352	wh. need. f. al.	....	85(97)	....	i.	s.	s. eth., bz.
8353	col. liq., 1.5238	$1.0817\frac{20}{4}$	-34(-36)	159	i.	s.	∞ eth.; s. bz., chl
8354	col. liq., 1.5214^{19}	$1.0722\frac{20}{4}$	-47.8	162	i.	s.	∞ eth.; s. bz., chl.
8355	col. liq., 1.5199^{19}	$1.0697\frac{20}{4}$	7.5	162	i	s.	∞ eth; s. bz., chl.
8356							
8357	col. liq.. ..	1.254^{13}	....	142.6^{770}	i	s.	s. eth.
8358							
8359	cr. f. lgr., $1.5557^{61.5}$	.	49		i.	s.	v. s. h. eth.
8360	yel. need f. lgr., $1.5577^{61.5}$	.....	44.5	183^{35}	i.	s.	s eth.
8361	leaf or need f. w $1.5647^{61.5}$	....	71	...	i.	7.10^{25}	s eth.; 8.87^{25} me. al.; 69.7^{25} bz.
8362							
8363							
8364	need. f. al	..	82.0–2.5	.....	i.	v. s.	v. s. eth.
8365							
8366							
8366M	col. liq., 1.5180^{11}	1.3138^{11}	.. ..	178–180	d.	s d.	.. .. .
8367	monocl. cr f. al.	.....	65		i.	v. s. h	v. s. h. eth.
8368	pr. f. al... .	.	46		i.	s.	s. eth.
8369	col. liq..	$0.879\frac{20}{4}$	..	198–200	i.	∞	∞ eth.
8370							
8371							
8371M							
8372	liq, 1.4763	$0.8354\frac{20}{4}$		110.1	i.	v. s.	s. eth.
8373							
8374							
8375							
8376							
8377							
8378	yel. need f. al. or CS_2, 1.442, 1.662, 1.756	1.521^{15}; 1.321^{71}	69.5–70.5	300 sl. d.	0.027^{22}	3.04^{15}	9.4^{22} eth.; s. bz., CS_2
8379	need. f. al.....	1.282^{111}	52.5(50.5)			v s	v. s. bz., CS_2
8380	rhomb need., 1.479, 1.669, 1.734	1.283^{111}	66(61)			s.	. . ..
8381	yel. need. f. CS_2	1.259^{111}	59.8 (59–61)	.	i.	s.	s. eth.; 2.2^{17} CS_2
8382	yel. monocl. need. f. w.	1.277^{111}	93	subl.	sl. s.	s.	v. s. eth.; s. CS_2, chl., bz.; sl. s. lgr.
8383							
8384							
8385	col. liq, $1.50569^{16.85}$	0.873	<-17	162	i.	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8386	**Toluene, *m*-ethyl-** . .	1-ethyl-3-methylbenzene .	$CH_3C_6H_4C_2H_5$ . .	120 19
8387	——, ***p*-ethyl-**	1-ethyl-4-methylbenzene	$CH_3C_6H_4C_2H_5$	120 19
8388	——, ***o*-fluoro-**. .		$CH_3C_6H_4F$	110 13
8389	——, ***m*-fluoro-**. . . .		$CH_3C_6H_4F$.	110 13
8390	——, ***p*-fluoro-**.		$CH_3C_6H_4F$.	110 13
8390M	——, ***α*-fluoro-**.	See *Benzyl fluoride.*		
8391	——, **hexahydro-**.	See *Cyclohexane, methyl-.*		
8392	——, ***o*, *m* or *p*-hydroxy**	**-**.See *Cresol*		
8393	——, ***α*-hydroxy-**.	See *Benzyl alcohol.*		
8394	——, ***o*-iodo-** . . .		$CH_3C_6H_4I$	218 05
8395	——, ***m*-iodo-** .		$CH_3C_6H_4I$	218 05
8396	——, ***p*-iodo-**.		$CH_3C_6H_4I$	218 05
8397	——, ***α*-iodo-**.	See *Benzyl iodide.*		
8398	——, **isopropyl-**.	See *Cymene*		
8399	——, ***o*, *m* or *p*-methox**	**y-**. See *Ether, methyl tolyl.*		
8400	——, ***α*-methoxy-**.	See *Ether, benzyl methyl*		
8402	——, ***o*-nitro-**. .		$NO_2C_6H_4CH_3$.	137 13
8403	——, ***m*-nitro-** .	. . .	$NO_2C_6H_4CH_3$	137 13
8404	——, ***p*-nitro-**.	.	$NO_2C_6H_4CH_3$	137 13
8405	——, ***o*-nitroso-**		$NOC_6H_4CH_3$	121 13
8406	——, ***m*-nitroso-**		$NOC_6H_4CH_3$	121 13
8407	——, ***p*-nitroso-**.		$NOC_6H_4CH_3$	121 13
8408	——, ***o*, *m* or *p*-phenyl-**	. See *Biphenyl, methyl-*		
8408M	——, ***α*-phenyl-**.	See *Methane, diphenyl-.*		
8409	——, **(2-propenoxy-)**.	See *Ether, allyl tolyl*		
8410	——, **propoxy-**.	See *Ether, propyl tolyl*		
8411	——, ***o*-propyl-**	1-methyl-2-propylbenzene	$CH_3C_6H_4(CH_2)_2$-CH_3	134 21
8412	——, ***m*-propyl-**	1-methyl-3-propylbenzene	$CH_3C_6H_4(CH_2)_2$-CH_3	134 21
8413	——, ***p*-propyl-**	1-methyl-4-propylbenzene	$CH_3C_6H_4(CH_2)_2$-CH_3	134 21
8414	——, **1,2,3,6-tetrahydr**	**o-**. See *Cyclohexene, 1-methyl-.*		
8415	——, ***α*-triazo-**	benzyl azide, *ω*-azidotoluene	$C_6H_5CH_2N_3$	133 15
8416	——, ***α*-trichloro-**.	benzotrichloride, phenylchloroform	$C_6H_5CCl_3$	195 48
8417	——, ***α*-trifluoro-** .	benzotrifluoride, phenyl fluoroform	$C_6H_5CF_3$	146 11
8417M	——, ***α*-trifluoro-*m*-nitro-**	*m*-nitrobenzotrifluoride	$CF_3C_6H_4NO_2$	191 11
8418	——, **3,4,5-trihydroxy-**.	See *Pyrogallol, 5-methyl-*		
8419	——, **2,3,4-trinitro-***.		$(NO_2)_3C_6H_2CH_3$	227 13
8420	——, **2,4,5-trinitro-***.	*γ*-trinitrotoluene	$(NO_2)_3C_6H_2CH_3$	227 13
8421	——, **2,4,6-trinitro-***. .	*sym*-trinitrotoluene, *α*-trinitrotoluene, "T.N T "	$(NO_2)_3C_6H_2CH_3$	227 13
8421H	**Tolueneboronic acid, *o***	**- and *m*-**. See *Boric acid, o(a*	*nd m)-tolyl-*	
8421K	***α*-Tolueneboronic acid**	. See *Boric acid, benzyl-*		
8422	**Toluenediamine.**	See *Tolylenediamine.*		
8423	***α*,*α*-Toluenediamine,**	***N*,*N*-dibenzylidene-**. See	*Hydrobenzamide.*	
8424	***α*,2,-Toluenedicarboxy**	**lic acid.** See *Homophthalic a*	*cid*	

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8386	col liq, $1.49966^{19.9}$	0.869^{20}		162.5 (158–9)	i.	s	s. eth.
8387	col liq., $1.49303^{22.8}$	0.862	<−20	162	i	s.	s. eth.
8388	col liq, 1.4704	1.0041^{18}	<−80	114	i.	v s	v. s. eth
8389	col liq., 1.4691	0.9972^{13}	−110.8	116	i	v s	v s eth.
8390	col liq., 1.470	1.001^{15}		117	i.	v s.	v s. eth.
8390M							
8391							
8392							
8393							
8394	liq, $1.61066^{15.9}$	1.697		211	i	∞	∞ eth.
8395	liq	1.698		204	i.	∞	∞ eth
8396	leaf		35	211.5	i.	v. s.	v. s. eth.
8397							
8398							
8399							
8400							
8402	yel liq, $1.54739^{20.4}$	$1.163\frac{20}{4}$	(α)−10.6; (β)−4.1	222.3	0.0652^{30}	∞	∞ eth, s bz, chl., pet eth.
8403	cr or liq., 1.5475	1.164^{15}, $1.157\frac{20}{4}$	15.5	231	0.0498^{30}	∞	∞ eth.; s. bz.
8404	col rhomb. need, $1.5346^{62.5}$	1.286^{20}, $1.139\frac{55}{55}$	51.3	238	0.0442^{30}	s	v s eth.; s. bz.
8405	need		72–2.5			v s	v s eth., chl
8406	need		53		i	sl s	s eth.
8407	col need f igr		48		v sl s (i)		v s. bz., h me. al.
8408							
8408M							
8409							
8410							
8411	liq, $1.50139^{15.75}$		.	181–2	i.	s.	. . . . .
8412	liq, $1.49640^{17.0}$	0.863^{16}		176–7	i	s	∞ eth.
8413	liq, $1.49655^{15.8}$	0.8682^{15}		183–4	i	s	s eth.
8414							
8415	oil, 1.53414^{25}	1.0655^{25}	exp	108^{23}	i	∞	∞ eth.
8416	col oil	1.38	−22	214	i	s	s. eth., bz.
8417	col. liq, 1.41707^{14}	1.196^{14}	−29.05	102.4	i	∞	∞ eth.
8417M	col liq., 1.47582^{15}	1.43571	<−20	201.5	i	s.	s. eth.
8418							
8419	tricl leaf f. al	1.620	112	302 d. exp	i	sl s. c.	v s. eth.
8420	yel. rhomb. pl f. acet	1.620	104	291 d	i	sl s. c.	v. s. eth.
8421	col monocl. (rhomb) f al	1.654	80.7(81–2)	240 exp.	0.02^{15}	1.99^{32} 18.6^{74}	$3.33^{20.3}$ eth.
8421H							
8421K							
8422							
8423							
8424							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8425	**α,2-Toluenediol.**	See *Saligenin.*		
8426	**α,3-Toluenediol.**	See *Benzyl alcohol, m-hydroxy-*		
8427	**α,4-Toluenediol.**	See *Benzyl alcohol, p-hydroxy-*		
8428	**o-Toluenesulfonamide**		$CH_3C_6H_4SO_2NH_2$	171 21
8429	**p-Toluenesulfonamide**		$CH_3C_6H_4SO_2NH_2$	171 21
8430	**——, N,N-dichloro-.**	See *Dichloramine(T).*		
8431	**o-Toluenesulfonic acid**	2-methylbenzenesulfonic acid	$CH_3C_6H_4SO_3H$	172 19
8432	**——, 5-amino-** ($SO_3H=1$)	p-toluidine-3-sulfonic acid ($NH_2=1$)	$NH_2C_6H_3(CH_3)$-(SO_3H)	187 21
8433	**m-Toluenesulfonic acid**		$CH_3C_6H_4SO_3H$	172 19
8434	**p-Toluenesulfonic acid**	4-methylbenzenesulfonic acid	$CH_3C_6H_4SO_3H$	172 19
8435	**——, 3-amino-** ($SO_3H=1$)	o-toluidine-5-sulfonic acid ($NH_2=1$)	$NH_2C_6H_3(CH_3)$-(SO_3H)	187 21
8436	**p-Toluenesulfonyl chloride**	p-toluenesulfone chloride	$CH_3C_6H_4SO_2Cl$	190 64
8437	**o, m or p-Toluenethiol**	See *Cresol, thio-.*		
8438	**α-Toluenethiol**	benzyl mercaptan; thiobenzyl alcohol, benzyl hydrosulfide	$C_6H_5CH_2SH$	124 19
8439	**Toluhydroquinone**	2-methyl-1,4-benzenediol*, 2-methylhydroquinone, homohydroquinone, 2,5-dihydroxytoluene, hydrotoluquinone	$CH_3C_6H_3(OH)_2$.	124 13
8440	**o-Toluic acid. .**	o-methylbenzoic acid	$CH_3C_6H_4COOH$	136 14
8441	——, ethyl ester		$CH_3C_6H_4COOC_2H_5$	164 20
8442	——, methyl ester ...		$CH_3C_6H_4COOCH_3$	150 17
8443	——, p-phenylphenacyl ester		$CH_3C_6H_4COOCH_2$-$COC_6H_4C_6H_5$	330 37
8444	**——, 4,6-dihydroxy-.**	See *o-Orsellinic acid.*		
8445	**——, α-hydroxy-....**	o-(hydroxymethyl)benzoic acid	$HOCH_2C_6H_4$-$COOH$	152 14
8446	——, ——, lactone.	See *Phthalide*		
8447	**——, 3-hydroxy-.**	See *3,2-Cresotic acid*		
8448	**——, 4-hydroxy-.**	See *4,2-Cresotic acid*		
8449	**——, 5-hydroxy-.**	See *3,6-Cresotic acid*		
8450	**——, 6-hydroxy-.**	See *2,6-Cresotic acid*		
8451	**m-Toluic acid.......**	m-methylbenzoic acid	$CH_3C_6H_4COOH$	136 14
8452	——, ethyl ester .		$CH_3C_6H_4COOC_2H_5$	164 20
8453	——, p-phenylphenacyl ester		$CH_3C_6H_4COOCH_2$-$COC_6H_4C_6H_5$	330 37
8454	**——, 2-hydroxy-.**	See *2,3-Cresotic acid*		
8455	**——, 4-hydroxy-.**	See *4,3-Cresotic acid*		
8456	**——, 5-hydroxy-.**	See *3,5-Cresotic acid*		
8457	**——, 6-hydroxy-.**	See *2,5-Cresotic acid*		
8458	**p-Toluic acid ...**	p-methylbenzoic acid	$CH_3C_6H_4COOH$	136 14
8459	——, ethyl ester....		$CH_3C_6H_4COOC_2H_5$	164 20
8460	——, methyl ester		$CH_3C_6H_4COOCH_3$	150 17
8461	——, p-phenylphenacyl ester		$CH_3C_6H_4COOCH_2$-$COC_6H_4C_6H_5$	330 37
8462	**——, 2-hydroxy-.**	See *2,4-Cresotic acid*		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8425							
8426							
8427							
8428	octahdr.	.	153–6	.	0.1^{9}	3.6^{5}	sl s. eth.
8429	monocl .	. . .	137.5	.	1.94^{9}	7.42^{5}	sl s eth
8430							
8431	deliq cr .		67.5	$128\ 8^{25}$	0 16	s.	i. eth.
8432	cr. $+H_2O$. .		d.		0 45	i.	.
8433	need .				0.78	s	i eth.
8434	monocl leaf. or pr		106–7	140^{20}	0 32	s	s eth.
8435	need				0 974	i	. .
8436	col tricl or rhomb		69	146^{15}	i.	s	s. eth.; v s. bz.
8437							
8438	liq	$1\ 058^{20}$		194–5	i	v s	v s. eth ; ∞ CS_2
8439	col rhomb leaf f bz.		124–25	163^{11} subl.	v. s.	v s	v. s eth ; sl. s. bz
8440	col need, $1.512^{114\ 6}$	$1\ 062\frac{115}{4}$	103 7 (104–5)	259.2	0.118c., 2.17^{100}	v s.	s. chl.
8441	col liq, $1\ 50699^{21.6}$	1 033; $1\ 038\frac{15}{4}$	<-10	221.3	i.	∞	∞ eth.
8442	liq. .	$1\ 073^{15}$	<-50	213	i.	∞	∞ eth.
8443	. .	. .	94 5	.			.
8444							
8445	need.	. .	120 (128) d.	. . . . .	0.4^{20}	v. s	v. s. eth.
8446							
8447							
8448							
8449							
8450							
8451	col. pr. f. w., 1 509	$1\ 054^{112}$	108.75 (109–12)	263	$0\ 085^{15}$ $1\ 7^{100}$	v s	v s. eth.
8452	col liq, $1\ 50502^{21.6}$	1 028		226 4	i	∞	∞ eth.
8453	. . . .	. . .	136 5				. . . .
8454							
8455							
8456							
8457							
8458	col. need. f. w.	. . . .	179.6	275	0.034c., 1.26^{100}	v. s.	v. s. eth.
8459	col liq., $1.50888^{18.2}$	1.026	. . . .	228 (235 5)	i.	∞	∞ eth.
8460	cr. f pet. eth.	. . . .	33	217	i.	v. s.	v. s. eth.
8461	. . . .	. . . .	165	. . . .	. . . .	. . . .	. . . .
8462							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt.
8463	***p*-Toluic acid, 3-hydroxy-.** See 3,4-*Cresotic acid*			
8464	***α*-Toluic acid....**	phenylacetic acid .	$C_6H_5CH_2COOH$.	136.14
8465	——, ethyl ester	ethyl phenylacetate. .	$C_6H_5CH_2COOC_2H_5$	164.20
8466	——, isobutyl ester	eglantine	$C_6H_5CH_2COOC_4H_9$	192.25
8467	——, methyl ester	methyl phenylacetate	$C_6H_5CH_2COOCH_3$	150.17
8468	——, piperazinium salt		$C_4H_{10}N_2 \cdot 2C_8H_8O_2$	358.43
8469	——, **o-amino-**, lactam.	See *Oxindole*		
8470	——, ***p*-amino-**	*p*-aminophenylacetic acid	$NH_2C_6H_4CH_2$-COOH	151.16
8471	——, ***α*-amino-**(*dl*)	*dl*-*α*-amino-*α*-phenylacetic acid	$C_6H_5CH(NH_2)$-COOH	151.16
8472	——, **2,4-dinitro-**	2,4-dinitrophenylacetic acid, 2,4-dinitrobenzeneethanoic acid	$(NO_2)_2C_6H_3CH_2$-COOH	226.14
8473	——, **o-hydroxy-**. ..	*o*-hydroxyphenylacetic acid	$HOC_6H_4CH_2$-COOH	152.14
8474	——, ***m*-hydroxy-**		$HOC_6H_4CH_2$-COOH	152.14
8475	——, ***p*-hydroxy-** .	..	$HOC_6H_4CH_2$-COOH	152.14
8476	——, ***α*-hydroxy-.**	See *Mandelic acid* *		
8477	——, **o-methyl-**	*o*-tolylacetic acid	$CH_3C_6H_4CH_2$-COOH	150.17
8478	——, ***m*-methyl-...**	*m*-tolylacetic acid	$CH_3C_6H_4CH_2$-COOH	150.17
8479	——, ***p*-methyl-**	*p*-tolylacetic acid .	$CH_3C_6H_4CH_2$-COOH	150.17
8480	——, ***α*-methyl-.**	See *Hydratropic acid*		
8481	——, ***α*-methylene-.**	See *Atropic acid*		
8482	——, ***p*-nitro-** .		$NO_2C_6H_4CH_2$-COOH	181.14
8483	**o-Toluic anhydride**		$(CH_3C_6H_4CO)_2O$	254.27
8484	**Toluidine, *N*-naphthyl-.** See *Naphthylamine, N-tolyl-*			
8485	**o-Toluidine**	*o*-methylaniline	$CH_3C_6H_4NH_2$	107.15
8486	——, ***N*-acetyl-.**	See *o-Acetotoluide*		
8487	——, ***N*-benzoyl-.**	See *o-Benzotoluide*		
8488	——, ***N,N*-diethyl-**	1-diethylamino-2-methylbenzene	$CH_3C_6H_4N(C_2H_5)_2$	163.26
8489	——, ***N,N*-dimethyl-**		$CH_3C_6H_4N(CH_3)_2$	135.20
8490	——, ***N*-methyl-**		$CH_3C_6H_4NHCH_3$.	121.18
8491	——, **3-nitro-**(NH_2=1)	2-methyl-3-nitroaniline	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8492	——, **4-nitro-.** ...	2-methyl-4-nitroaniline	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8493	——, **5-nitro-.......**	2-methyl-5-nitroaniline	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8494	——, **6-nitro-........**	2-methyl-6-nitroaniline	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8495	——, **4-o-tolylazo-** (NH_2=1)	4′-amino-2,3′-dimethylazobenzene	$CH_3C_6H_4N.NC_6$-$H_3(CH_3)NH_2$	225.29
8496	——, **4-*p*-tolylazo-** . .	4-amino-3,4′-dimethylazobenzene	$CH_3C_6H_4N.NC_6$-$H_3(CH_3)NH_2$	225.29
8497	***m*-Toluidine** ..	*m*-methylaniline .	$CH_3C_6H_4NH_2$	107.15
8497M	——, hydrochloride		$CH_3C_6H_4NH_3Cl$	143.62

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8463							
8464	col leaf .	1 228$\frac{20}{4}$, liq. 1.0778[83]	76.7	265.5	1.66[20]	186	v. s eth ; 151 chl.
8465	col. liq., 1.49921[18.5]	1 031	....	226 (120-1[20])	i.	∞	∞ eth.
8466	......	0 990	......	254; 128-31[20]	i.	s.	s. eth.
8467	col liq.....	1 044[16]	d. 360	220	i.	∞	∞ eth.
8468	wh need...		146 5-7 5		s h.	s h	i. eth.
8469							
8470	leaf......		199-200 d		i c, s h	s	.
8471	pr. f. w.+al.		237-8 d	subl 256	i	sl s	sl s most org solv.
8472	col need. f. w		179 d. (188-9)	d	sl s	s	s eth.
8473	need f. eth.		137 (145-7)	240-3 d	s		v s eth ; sl s. c chl.
8474	need f. bz.+lgr		129	190[11]	v. s.	v s	v. s. eth.
8475	pr or need. f w.		148	subl	v s h	v s	v s. eth.
8476							
8477	col. need. f. w		88-9	....	v s h		. . .
8478	need. . .		61	....	v. s h		
8479	col. need. f. w		91	266	sl s. c., v. s. h	v. s.	v s. eth ; s. bz.
8480							
8481							
8482	col. need. f w		152-3	d.	sl s	sl s	sl s. eth
8483	col f. eth.		39	325	d	d.	v. s. eth.
8484							
8485	col liq., 1 57276	1 004$\frac{20}{4}$	α,-24 4; β,-16.3	199 84	1 50[25]	∞	∞ eth.
8486							
8487							
8488	pr f. w....	....	72-3	206	v. sl. s.	s.	s. eth.
8489	1 5153......	0 9286$\frac{20}{4}$	-60.0	184.6	v. sl s.	∞	∞ eth.
8490	liq., 1.5649 .	0 973[15]	....	207	i.	∞	∞ eth.
8491	yel rhomb. leaf	1 378[15]	91 5	305 d.	1 3 h	v s.	v. s eth , bz
8492	yel monocl. f w.	1 366[15]	129(127.5)	. ...	v sl. s h.	v s.	s bz., glac. ac. a
8493	yel. monocl. f al	1 365[15]	105 (107)	....	v sl. s	s.	s eth.
8494	or pr. f al. .	......	96	.. ..	sl s.	v s	v s. eth.; s. bz., chl.
8495	yel. monocl. pl.	......	100	....	v. sl. s.	s.	s. eth., chl.
8496	yel. pl. f. al.	. ...	127-8	.	i.	sl. s	sl s. lgr.
8497	liq., 1.57106[22 4]	0 989$\frac{20}{4}$	-31.5	203 3	sl. s.	∞	∞ eth.
8497M	leaf.		228	249.8	96.3[12]	61.91[9] 94%	.. ..

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8498	**m-Toluidine, N-acetyl**-. See *m-Acetotoluide.*			
8499	——, **N-benzoyl-.**	See *m-Benzotoluide.*		
8500	——, **N,N-dimethyl-.**		$CH_3C_6H_4N(CH_3)_2$	135.20
8501	——, **N-methyl-**		$CH_3C_6H_4NHCH_3$	121.18
8502	——, **2-nitro-** (NH_2=1)	3-methyl-2-nitroaniline	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8503	——, **4-nitro-**	3-methyl-4-nitroaniline	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8504	——, **5-nitro-.**	3-methyl-5-nitroaniline	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8505	——, **6-nitro-**	3-methyl-6-nitroaniline	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8506	——, **4-m-tolylazo-** (NH_2=1)	4-amino-2,3′-dimethylazobenzene	$CH_3C_6H_4N$ NC_6-$H_3(CH_3)NH_2$	225.29
8506M	——, **α-trifluoro-**	*m*-trifluoromethylaniline; *m*-aminobenzotrifluoride	$CF_3C_6H_4NH_2$	161.13
8507	**p-Toluidine.**	*p*-methylaniline	$CH_3C_6H_4NH_2$	107.15
8507M	——, hydrochloride		$CH_3C_6H_4NH_3Cl$	143.62
8508	——, **N-acetyl-.**	See *p-Acetotoluide.*		
8509	——, **N-benzoyl-.**	See *p-Benzotoluide*		
8510	——, **2-bromo-**	2-bromo-4-methylaniline	$Br(CH_3)C_6H_3NH_2$	186.06
8511	——, **2-bromo-5-nitro-**	2-bromo-4-methyl-5-nitroaniline	$CH_3(NO_2)BrC_6H_2$-NH_2	231.06
8512	——, **N,N-diethyl-**	1-diethylamino-4-methylbenzene	$CH_3C_6H_4N(C_2H_5)_2$	163.26
8513	——, **N,N-dimethyl-**		$CH_3C_6H_4N(CH_3)_2$	135.20
8514	——, **N-methyl-**		$CH_3C_6H_4NHCH_3$	121.18
8515	——, **2-nitro-** (NH_2=1)	4-methyl-2-nitroaniline, *m*-nitro-*p*-toluidine	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8516	——, **3-nitro-.....**	4-methyl-3-nitroaniline	$NO_2(CH_3)C_6H_3$-NH_2	152.15
8517	**Toluidinesulfonic acid**. See *Toluenesulfonic acid, amino-*			
8518	**o-Tolunitrile.....**	2-methylbenzenecarbonitrile*, *o*-methylbenzonitrile	$CH_3C_6H_4CN$	117.14
8519	**m-Tolunitrile**	*m*-methylbenzonitrile	$CH_3C_6H_4CN$	117.14
8520	**p-Tolunitrile.....**	4-methylbenzenecarbonitrile*, *p*-methylbenzonitrile	$CH_3C_6H_4CN$	117.14
8521	——, **2-amino-**	homoanthranilonitrile	$CH_3C_6H_3(NH_2)CN$	132.16
8522	**α-Tolunitrile..**	benzyl cyanide, phenylacetonitrile	$C_6H_5CH_2CN$	117.14
8523	——, **α-keto-.**	See *Benzoyl cyanide.*		
8524	——, **o-nitro-......**	*o*-nitrobenzyl cyanide	$NO_2C_6H_4CH_2CN$	162.14
8525	——, **p-nitro-.....**		$NO_2C_6H_4CH_2CN$	162.14
8525M	——, **α-oxo-.**	See *Benzoyl cyanide*		
8526	**p-Toluquinaldine.**	See *Quinoline, 2,6-dimethyl-*.*		
8527	**Toluquinone**	2-methylquinone, *p*-toluquinone	$CH_3C_6H_3O_2$	122.12
8528	**α-Toluyl chloride**	phenylacetyl chloride.	$C_6H_5CH_2COCl$	154.59
8529	**Toluylene.**	See *Stilbene.*		
8530	**Toluylenediamine.**	See *Tolylenediamine.*		
	Tolyl-. For tolyl derivatives see the parent compounds (e g, for tolylhydrazine see *Hy-*			
8531	**Tolyl bromide.**	See *Toluene, bromo-.*		
8532	**Tolyl chloride.**	See *Toluene, o,m,* or *p-chloro-*; see also *Xylene, α-chloro-.*		

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8498							
8490							
8500	1.5492 ..	0 941	....	212.5	v sl s.	∞	∞ eth.
8501	liq.. .	. .	. ...	206	i.	∞	∞ eth.
8502	yel. need.	....	53	. .	sl s.	v s.	s. a.
8503	yel need f. w		138		s h.	s	s. eth., a.; sl. s. CS_2
8504	or. need. .		98.4		v sl s	v s	v s. eth.; s. bz.
8505	yel leaf. f. w	..	109	.	s h.	v s.	v. s. eth.; s. bz., chl.
8506	ylsh. br. need f. al		80		sl s	s.	.. ....
8506M	col. liq., 1.4847$^{12.5}$	1 30467$^{12.5}$		187.5	sl s.	s	s. eth.
8507	leaf f w, 1 55324$^{59.1}$	1 046$\frac{20}{4}$; 0 973$\frac{60}{60}$	45 (42–3)	200.3	0 74^{21}	156^{30}	s. eth.
8507M	monocl. need.	. ...	243	257.5 subl.	22.9^{11}	25^{17} 89%	i. eth., bz., CS_2
8508							
8509							
8510	leaf.	1.51^{20}	26 (12–3)	240	i.	s.	s. eth.
8511	yel. need f. al.	. .	121				....
8512	col liq. . .	0 9242$\frac{15}{4}$	229		v sl s	∞	∞ eth.
8513	liq., 1 53664 .	0 9287$\frac{20}{4}$		210–11	v sl s	∞	∞ eth.
8514	liq. ..	.		206–8	i	∞	∞ eth.
8515	red monocl. pr f al	1 312^{17}	117 (114)	....	v sl. s. h	v. s	s conc. H_2SO_4
8516	yel monocl. f w.	....	77.5 (81.5)	.....	s.	v s h.	s. eth.; sl. s. CS_2
8517							
8518	col liq., 1 52720$^{23.1}$	0 9941$\frac{25}{4}$	-13 to -14	204	i.	∞	∞ eth.
8519	col liq.	0 986$\frac{25}{4}$	-23	214	0.085 c, 1.67 h	∞	∞ eth.
8520	wh-yel. need. f. al	0 9805$\frac{30}{30}$	29 5	217	i	v. s.	v s. eth.
8521	need f al.....	..	136	.	i.	v s.	v s. eth.
8522	col. liq., 1 52105^{25}	1.015^{18}	-23.8	234; 107^{13}	i.	∞	∞ eth.
8523							
8524	need. f. w....		82.5–4.0	.	s h.	s.	s. eth.
8525	leaf. or pr. f. al.	. .	117	... .	i	s.	s eth.
8525M							
8526							
8527	yel. leaf. or need.		69 (65–7)	subl.	s. h.	v. s.	v. s. eth.
8528	col. fum. liq...	1 168$\frac{20}{4}$	....	170^{250}; 94–5^{13}	d.	d.	v. s. eth.
8529							
8530							
	drazine, tolyl-).						
8531							
8532							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
8533	**Tolylene.**	See also *Xylylene*		
8534	**3-*o*-Tolylenediamine** (NH_2=1,2)	2,3-toluenediamine, 2,3-diaminotoluene, 2,3-toluylenediamine	$CH_3C_6H_3(NH_2)_2$	122.17
8535	**4-*o*-Tolylenediamine** (NH_2=1,2)	3,4-toluenediamine, 3,4-diaminotoluene, 3,4-toluylenediamine	$CH_3C_6H_3(NH_2)_2$.	122.17
8536	**2-*m*-Tolylenediamine** (NH_2=1,3)	2,6-toluenediamine, 2,6-diaminotoluene, 2,6-toluylenediamine	$CH_3C_6H_3(NH_2)_2$	122.17
8537	**4-*m*-Tolylenediamine** (NH_2=1,3)	2,4-toluenediamine, 2,4-diaminotoluene, 2,4-toluylenediamine	$CH_3C_6H_3(NH_2)_2$.	122.17
8538	**5-*m*-Tolylenediamine** (NH_2=1,3)	3,5-toluenediamine, 3,5-diaminotoluene, 3,5-toluylenediamine	$CH_3C_6H_3(NH_2)_2$	122.17
8539	***p*-Tolylenediamine** (NH_2=1,4)	2,5-toluenediamine; 2,5-diaminotoluene, 2,5-toluylenediamine	$CH_3C_6H_3(NH_2)_2$	122.17
8540	**Tolylene glycol.**	See *Hydrobenzoin.*		
8541	**Tolyl mercaptan.**	See *Cresol, thio-*		
8542	**Tolyl mustard oil.**	See *Isothiocyanic acid, tolyl ester*		
8543	**o-Tolyl phosphate**	tri-*o*-cresyl phosphate	$(CH_3C_6H_4)_3PO_4$	368.36
8544	***p*-Tolyl phosphate**...	tri-*p*-cresyl phosphate	$(CH_3C_6H_4)_3PO_4$	368.36
8544M	**Torulin.**	See *Vitamin B_1.*		
8545	**Toxicarol**.		$C_{23}H_{22}O_7$	410.41
8546	**Tragacanthin.**	See *Bassorin*		
	Tri-. For tribromo, triethyl,	etc. derivatives see the parent	compounds (e g , *Acetic*	
8547	**Triacetamide**.......		$(CH_3CO)_3N$	143.14
8548	**Triacetin.**	See *Glycerol, triacetate.*		
8549	**Triacetonamine**	2,2,6,6-tetramethyl-4-piperidone	$C_9H_{17}NO \cdot H_2O$	17[illegible].25
8550	**Triacontane***. .	*n*-triacontane	$CH_3(CH_2)_{28}CH_3$	422.80
8550M	**1-Triacontanol***		n-$C_{30}H_{61}OH$	438.80
8551	**Triazene, 1,3-bis(*p*-nitrophenyl)-.** See *Diazoaminobenzene, 4,4'-dinitro-**			
8552	——, **1,3-di-1-naphthyl-***. See *1,1'-Diazoaminonaphthalene**			
8553	——, **1,3-di-2-naphthyl-***. See *2,2'-Diazoaminonaphthalene**			
8554	——, **1,3-diphenyl-***.	See *Diazoaminobenzene**		
8555	——, **1-phenyl-3-*p*-tolyl-**	4-methyldiazoaminobenzene	$C_6H_5N_2NHC_6H_4$-CH_3	211.26
8556	***sym*-Triazine, hexahydro-1,3,5-triphenyl-**	anhydroformaldehydeaniline, methyleneaniline, trimethylenetrianiline	$(C_6H_5N\,CH_2)_3$	315.40
8557	——, **2,4,6-triamino-.**	See *Melamine.*		
8558	——, **trichloro-.**	*See Cyanuric chloride*		
8559	***sym*-Triazine-2,4-diol, 6-amino-.** See *Ammelide*			
8560	***sym*-Triazinetriol.**	See *Cyanuric acid.*		
8561	***sym*-Triazin-2-ol, 4,6-diamino-.** See *Ammeline.*			
8562	**Triazobenzene.**	See *Benzene, triazo-.*		
8563	**1,2,4-Triazole** .	*sym*-triazole (one form), pyrro[*ab*] diazole	NHN CHN CH.	69.07
8564	——, **4,5-dihydro-1,4-diphenyl-3,5-phenylimino-.** See *Nitron.*			
8565	**Tribenzaldiamine.**	See *Hydrobenzamide.*		
8566	**Tribenzoin.**	See *Glycerol, tribenzoate.*		
8567	**Tribenzylamine** . .		$(C_6H_5CH_2)_3N$	287.39
8568	**Tribromohydrin.**	See *Propane, 1,2,3-tribromo-**		

*Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8533							
8534	cr.		61	255	s	s	s eth.
8535	col leaf. f lgr		38 5	265	s	.	–
8536	pr. f. w. ...		105	..	s	s.	–
8537	col. rhomb.; need f w., pr f. al.		39	280	s	v. s.	v. s. eth.
8538	liq			285		s.	s. eth.
8539	leaf f. bz.		64	274	v s.	v. s.	v. s. eth
8540							
8541							
8542							
8543	liq			410 sl. d, 263-5[20]	i.	v s.	v. s. eth., bz.
8544	need. f w.		77 3	.	i	v. s.	v. s. eth., bz.
8544M							
8545	bright yel-grn hex. pl or rods, 1 580, 1 618, 1 768		219			sl s	s. h. chl.
8546	*acid, tribromo-;*	*Benzene, trie*	*thyl-).*				
8547	need f. eth.		79				s. eth.
8548							
8549	tetr. need f w		anh. 40; $\frac{1}{2}H_2O$ 58		s.	s.	s. eth.
8550	cr	liq 0.7797	66 1 (69-70)	235[1]	i.	sl s	s. eth, bz.
8550M			86 3-86 5				
8551							
8552							
8553							
8554							
8555	ylsh. leaf		[illegible]0 1	d	i.		...
8556	wh silky need		[illegible]	185	v sl s	sl s.	s. eth, bz., chl, tol
8557							
8558							
8559							
8560							
8561							
8562							
8563	need, 1.48544[25.3]		121	[illegible]60	.	s.	sl. s. eth.
8564							
8565							
8566							
8567	monocl f al	$0.991^{9.5}_{4}$	92	380-90	v sl. s	s h.	s eth
8568							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
8569	**Tributylamine***.	tri-*n*-butylamine	$(CH_3CH_2CH_2CH_2)_3N$	185 35
8570	**Tricarballylic acid**	1,2,3-propanetricarboxylic acid*	$HOOCCH_2CH(COOH)CH_2COOH$	176 12
8571	——, α,β-**dihydroxy-**	1,2-dihydroxy-1,2,3,-propanetricarboxylic acid*, hydroxycitric acid	$COOHCH_2COH(COOH)CHOHCOOH$	208 12
8572	——, α-**hydroxy-.**	See *Isocitric acid*		
8573	——, β-**hydroxy-.**	See *Citric acid*		
8574	——, α,α,β-**trimethyl-.**	See *Camphoronic acid*		
8575	**Tricarbonamide.**	See *Fulminuric acid*		
8576	**Tricosane***.	*n*-tricosane	$CH_3(CH_2)_{21}CH_3$	324 62
8577	**12-Tricosanone***	dihendecyl ketone, diundecyl ketone, laurone	$[CH_3(CH_2)_{10}]_2CO$	338 60
8578	**Tricresyl phosphate.**	See *Tolyl phosphate*		
8579	**Tricyanic acid.**	See *Cyanuric acid*		
8580	**Tricyanogen chloride.**	See *Cyanuric chloride*		
8581	**Tridecanal***, oxime	*n*-tridecylaldoxime	$CH_3(CH_2)_{11}CH{:}NOH$	213 36
8582	**Tridecane*** .		$CH_3(CH_2)_{11}CH_3$	184 36
8583	——, **1-amino-.**	See *Tridecylamine**		
8584	**Tridecanoic acid***	*n*-tridecoic acid, *n*-tridecylic acid	$CH_3(CH_2)_{11}COOH$	214 34
8585	—— **13-(2-cyclopentenyl)-.**	See *Chaulmoogric acid*		
8586	**1-Tridecanol***	*prim-n*-tridecyl alcohol	$CH_3(CH_2)_{11}CH_2OH$	200 36
8587	**2-Tridecanone***	hendecyl methyl ketone	$CH_3CO(CH_2)_{10}CH_3$	198 34
8588	**7-Tridecanone***	dihexyl ketone, enanthone, oenanthone	$[CH_3(CH_2)_5]_2CO$	198 34
8589	***n*-Tridecoic acid.**	See *Tridecanoic acid**		
8590	***n*-Tridecyl alcohol.**	See 1-*Tridecanol**.		
8591	***n*-Tridecylaldoxime.**	See *Tridecanal, oxime**		
8592	**Tridecylamine*** (*n*) .	1-aminotridecane, *prim-n*-tridecylamine	$CH_3(CH_2)_{12}NH_2$	199 37
8593	**Tridecylene.** . . .		$C_{13}H_{26}$	182 34
8594	***n*-Tridecylic acid.**	See *Tridecanoic acid**		
8595	**Triethanolamine.**	triethanolamine	$N(CH_2CH_2OH)_3$	149 19
8596	**Triethylamine***		$(C_2H_5)_3N$	101 19
8597	——, hydrochloride	triethylammonium chloride*	$(C_2H_5)_3N\ HCl$	137 65
8598	——, β, β-**diethoxy-**	diethylaminoacetal	$(C_2H_5)_2NCH_2CH(OC_2H_5)_2$	189 29
8599	——, β, β'-**dihydroxy-.**	See *Ethanol,2,2'-ethyliminodi-*		
8600	——, β-**hydroxy-.**	See *Ethanol, 2-diethylamino-**		
8601	——, **2,2',2''-trihydroxy-.**	See *Triethanolamine*		
8602	**Triethyl arsenate.**	See *Ethyl arsenate*		
8603	**Triethyl arsenite.**	See *Ethyl arsenite*		
8604	**Triethyl borate.**	See *Ethyl borate*		
8606	**Triethylene glycol.** . . .	2,2'-ethylenedioxydiethanol, glycol bis(hydroxyethyl) ether	$(CH_2OCH_2CH_2OH)_2$	150 17
8607	**Triethylolamine.**	See *Triethanolamine.*		
8608	**Triethyl phosphate.**	See *Ethyl phosphate*		
8609	**Triethyl phosphite.**	See *Ethyl phosphite*		
8610	**Trifuraldiamine.**	See *Hydrofuramide*		

* Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C.	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8569	deliq col liq.	0 7782^{20}		214	sl s	v. s	v. s. eth
8570	col. rhomb pr. f. w	.	162-3	d	40 5	v. s	0 86^{15} eth.
8571	need	1 39^{35}	160	.	v s.	sl s	v. s. eth.
8572							
8573							
8574							
8575							
8576	glit leaf f al.	0 7799^{48}	47 7	234^{15}	i.	sl s	s eth.
8577	sc or pl, 1 4283$^{79\ 5}$	0 8086$\frac{69}{4}$	69	.....	i.	v sl s	s eth
8578							
8579							
8580							
8581	need f dil. al		80 5		i	sl s.	v s. eth., chl.; sl. s bz, pet eth
8582	col liq., 1 4419$^{16.8}$	0 757	-6 2	234	i.	v. s	v s. eth
8583							
8584	pl		51 (39 5-40.5)	236^{100}	i	v s	v s eth
8585							
8586	col cr	0 8223$\frac{31}{4}$	30 63	155-6^{15}	i	s	s eth
8587	cr	0 8229^{28}	28	263	i	v. s	v s eth
8588	leaf f al	0 825^{30}	33	255^{766}(264)		v s	v s eth., s. chl, lgr
8589							
8590							
8591							
8592	col cr		27	275 7; 108 0^{2}	sl s	s.	s eth
8593	col liq	0 7977$\frac{20}{4}$		232.7	i	v s	v. s. eth
8594							
8595	vis col liq, 1 4852	1 1242$\frac{20}{4}$	21 2	277-9^{150}	∞	∞	sl s. eth
8596	col. liq, 1 40032	0 7229$\frac{25}{4}$	-114 8	89 5	1 5^{20} 1 97^{65}	∞	∞ eth
8597	cr f. al	1 0688$\frac{21}{4}$	254	subl	150^{28}	s	i. eth.
8598	liq.	0 863^{16}		194-5	s	s	s. eth
8599							
8600							
8601							
8602							
8603							
8604							
8606	col. liq .	1 1254	-5	280-90	∞	∞	sl s eth
8607							
8608							
8609							
8610							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
8611	**Trifurfurylamine** .	α,α',α''-tri-2-furyltrimethylamine	$(C_4H_3OCH_2)_3N$.	257 28
8612	**Trigonelline**	nicotinic acid N-methylbetaine	$C_7H_7NO_2$..	137 13
8613	**Triisoamylamine**		$[(CH_3)_2CHCH_2CH_2]_3N$	227 43
8614	**Triisoamyl borate.**	See *Isoamyl borate.*		
8615	**Triisobutylamine**		$[(CH_3)_2CHCH_2]_3N$	185 35
8616	**Triisobutyl arsenite.**	See *Isobutyl arsenite.*		
8617	**Triisobutyl borate.**	See *Isobutyl borate*		
8618	**Triketone, diphenyl-.**	See *Propanetrione, diphenyl-**		
8619	**Trilaurin.**	See *Glycerol, trilaurate.*		
8620	**Trimellitic acid**... .	1,2,4-benzenetricarboxylic acid*	$C_6H_3(COOH)_3$	210 14
8621	**Trimesic acid**.......	1,3,5-benzenetricarboxylic acid*	$C_6H_3(COOH)_3$	210 14
8622	**——, hydroxy-**	phenol-2,4,6-tricarboxylic acid	$HOC_6H_2(COOH)_3$	226 14
8623	**Trimesitic acid**. .	2,4,6-pyridinetricarboxylic acid	$C_5H_2N(COOH)_3$	211 13
8624	**Trimethylamine**[t]		$(CH_3)_3N$	59 11
8625	——, hydrochloride	trimethylammonium chloride*	$(CH_3)_3N\ HCl$	95 58
8626	**——, α,α',α''-tri-2-furyl-.**	See *Trifurfurylamine*		
8627	**Trimethyl borate.**	See *Methyl borate*		
8628	**Trimethylene.**	See *Cyclopropane**		
8629	**Trimethylene bromide.**	See *Propane, 1,3-dibromo-**		
8630	**Trimethylene bromohydrin.**	See *1-Propanol, 3-bromo-**		
8631	**Trimethylene chloride.**	See *Propane 1,3-dichloro-**		
8632	**Trimethylene chlorohydrin.**	See *1-Propanol, 3-chloro-**.		
8633	**Trimethylene cyanide.**	See *Glutaronitrile*		
8634	**Trimethylenediamine.**	See *1,3-Propanediamine**		
8635	**Trimethylene dibromide.**	See *Propane, 1,3-dibromo-**		
8636	**Trimethylene dichloride.**	See *Propane, 1,3-dichloro-**		
8637	**Trimethylene dicyanide.**	See *Glutaronitrile*		
8638	**Trimethylene glycol.**	See *1,3-Propanediol**		
8639	——, diphenyl ether	See *Propane, 1,3-diphenoxy-**		
8640	——, methylene ether.	See *m-Dioxane*		
8641	**——, α-methyl-.**	See *1,3-Butanediol**		
8642	**——, α,α,α'-trimethyl-.**	See *2,4-Pentanediol, 2-methyl-**		
8643	**Trimethylene methylene dioxide.**	See *m-Dioxane*		
8644	**Trimethylenetrianiline.**	See *sym-Triazine, hexahydro-1,3,5-triphenyl-*		
8645	**Trimethylene trisulfide.**	See *Formaldehyde thio-(trimer)*		
8646	**Trimethylenimine**...	tetrahydroazete, azetidine	$CH_2CH_2CH_2NH$	57 09
8647	**Trimethyl phosphate.**	See *Methyl phosphate*		
8648	**Trinitrin.**	See *Nitroglycerin*		
	Trinitro-. See the parent compounds (e g , for trinitrotoluene see *Toluene, trinitro-*).			
8649	**Triolein.**	See *Glycerol, trioleate*		
8650	**Trional**...	2,2-bis(ethylsulfonyl)butane*	$CH_3C(SO_2C_2H_5)_2CH_2CH_3$	242 35
8651	*sym*-**Trioxane**	1,3,5-trioxane, α-trioxymethylene	$OCH_2OCH_2OCH_2$	90 08
8652	**——, 2,4,6-trimethyl-.**	See *Paraldehyde.*		
8653	*sym*-**Trioxanetriimine.**	See *Cyamelide*		
8654	**Trioxymethylene.**	See *Polyoxymethylene.*		
8655	**α-Trioxymethylene.**	See *s-Trioxane*		
8656	**Tripalmitin.**	See *Glycerol, tripalmitate.*		
8657	**Triphenyl.**	See *Terphenyl*		
	Triphenyl-. For triphenyl derivatives see the parent compounds (e.g., for triphenyl-			

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8611	col. liq.			133–8[1]	i		s eth.
8612	hyg pr. f. al		218 d	. . .	v s	s.	sl. s. eth., chl.; i. bz.
8613	col. liq...	0 7859[20]		237 (242–5)	i	v s	∞ eth
8614							
8615	col liq, 1 42519[17.3]	0.766^{25}_{25}	-21 3	191 5 *l*	i	v s	∞ eth.
8616							
8617							
8618							
8619							
8620	col need f w		216 d.		s h.	v. s.	s. eth.
8621	col pr. f. w.		350 (375–80)	subl <300	2 69[22]	v. s	s. eth.
8622	need. f. w		d 180		0 5[10]	v s h	sl. s. eth.; i. chl.
8623	pl f dil. H_2SO_4	.	227 d	subl. d.	s h.		sl s. eth
8624	col. gas	0.662^{-5}	-124	3 5	v s	v s	s eth
8625	col deliq cr f al		275 d		v s	s	i eth
8626							
8627							
8628							
8629							
8630							
8631							
8632							
8633							
8634							
8635							
8636							
8637							
8638							
8639							
8640							
8641							
8642							
8643							
8644							
8645							
8646	col liq, odor NH_3	0 843		63	∞		
8647							
8648							
8649							
8650	col tab f. al or eth.	1.251^{25}_{4}	74–6	d.	0.3	5.7	4.71[15] eth
8651	need. . .		54	subl. 46	s	s	s. eth
8652							
8653							
8654							
8655							
8656							
8657	methane see *Methane, triphenyl-*						

For explanations and abbreviations see beginning of table

No.	Name	Synonyms	Formula	Mol Wt
8658	**Triphenylamine***		$(C_6H_5)_3N$	245 31
8659	**Triphenylene**	benzo[*l*]phenanthrene, isochrysene	$C_{18}H_{12}$	228 28
8660	**Tripropylamine***(*n*).		$(CH_3CH_2CH_2)_3N$	143 27
8661	**Tripropyl borate.**	See *Propyl borate.*		
8662	**Triquinoyl hydrate.**	See *Cyclohexanehexone, hydrate*	*.	
8663	**Trisulfide, diallyl.**	See *Allyl trisulfide*		
8664	**Tritan.**	See *Methane, triphenyl-*		
8665	——, **α-benzyl-.**	See *Ethane,* 1,1,1,2-*tetraphenyl*	-	
8666	——, **4,4′-dimethyl-.**	See *Methane, phenyldi-p-tolyl-*		
8667	——, **α-ethyl-.**	See *Propane,* 1,1,1-*triphenyl-*		
8668	——, ***m*** **or *p*-methyl-.**	See *Methane, diphenyltolyl-*		
8669	——, **α-methyl-.**	See *Ethane,* 1,1,1-*triphenyl-*		
8670	**Tritanol.**	See *Carbinol, triphenyl-*		
8671	***sym*-Trithiane.**	See *Formaldehyde, thio-*		
8672	——, **2,4,6-trimethyl-** (α)	α-trithioacetaldehyde; α-trimolecular thioacetaldehyde	$SCH(CH_3)SCH-(CH_3)SCHCH_3$	180 34
8673	——, **2,4,6-trimethyl-** (β)	β-trithioacetaldehyde; β-trimolecular thioacetaldehyde	$SCH(CH_3)SCH-(CH_3)SCHCH_3$	180 34
8674	——, **triphenyl-** (higher-melting)	β-trithiobenzaldehyde	$[SCH(C_6H_5)]_3$	366 54
8675	——, **triphenyl-** (lower-melting)	α-trithiobenzaldehyde	$(SCHC_6H_5)_3$	366 54
8676	**Tritopine.**	See *Laudanidine.*		
8677	**Trityl.**	See *Methyl, triphenyl-*		
8678	**Tropacocaine**	benzoylpseudotropeine	$C_{15}H_{19}NO_2$	245 31
8679	——, hydrochloride		$C_{15}H_{19}NO_2 \cdot HCl$	281 78
8680	**Tropaic acid.**	See *Tropic acid*		
8681	**Tropic acid**	α-phenylhydracrylic acid, tropaic acid	$C_6H_5CH(COOH)-CH_2OH$	166 17
8682	——, tropine ester	See *Atropine*		
8683	**Tropine**	8-methyl-3-nortropanol, *N*-methyltropoline	$C_8H_{15}NO$	141 21
8684	——, chloroplatinate		$(C_8H_{15}NO \cdot HCl)_2-PtCl_4$	692 41
8685	**Tropinecarboxylic acid.**	See *l-Ecgonine*		
8686	**Tropoline, *N*-methyl-.**	See *Tropine*		
8687	***dl*-Tryptophan**	*dl*-β-(3-indyl)alanine, *dl*-α-amino-3-indolepropionic acid	$C_8H_6NCH_2CH-(NH_2)COOH$	204 22
8688	***d*-Tryptophan**	*d*-β-(3-indyl)alanine, *d*-α-amino-3-indolepropionic acid	$C_8H_6NCH_2CH-(NH_2)COOH$	204 22
8689	***l*-Tryptophan**	*l*-α-amino-3-indolepropionic acid, *l*-β-3-indylalanine	$C_6H_4NHCH\,C-CH_2CH(NH_2)-COOH$	204 22
8690	**Tyramine**	*p*-(β-aminoethyl)phenol, *p*-hydroxyphenethylamine	$HOC_6H_4CH_2CH_2-NH_2$	137 18
8691	**Tyrosine, 3,5-diiodo-.**	See *Iodogorgoic acid*		
8692	***dl*-Tyrosine**	*dl*-β-*p*-hydroxyphenylalanine	$HOC_6H_4CH_2CH-(NH_2)COOH$	181 19

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8658	monocl. pr f. eth, 1 353[16]	0 774$\frac{0}{0}$	126 5	365	i.	sl s	s. eth, acet.; v s. bz.
8659	wh. cr.		198 5		i.	s.	s. eth.
8660	col liq, 1 41756[19.4]	0 757$\frac{20}{4}$	-93 5	156	v sl s	∞	s. eth.
8661							
8662							
8663							
8664							
8665							
8666							
8667							
8668							
8669							
8670							
8671							
8672	pr		101	247			
8673			126				
8674	need		225			sl s.	s. ac. a., bz.
8675	wh amor. powd.		160	d	i	i	v. s. chl.; s. bz.
8676							
8677							
8678	glit. need f. eth, 1 50801[100 1]	1 013[100]	49	d	sl s	v s.	v. s eth, bz., chl, NH_4OH
8679	col need or pl. f w + al		271 (276-7d.)		s	sl s c	i. eth
8680							
8681	need or pl. f al.		117-8	d	2[15]	s	s eth, i CS_2
8682							
8683	hyg tab. f. eth, 1 48113[99 8]	1 039$\frac{76}{4}$	63	233	v s.	v s	v. s eth; s. chl, bz
8684	or -red monocl		198-200		s	i	
8685							
8686							
8687	col hex pl		283-5		sl. s. c., s. h	sl s.	
8688			281-2				
8689	col. hex. leaf.	..	293-5 (289 d)	.	1 14[25], 2 79[75]	sl s.	i. eth.
8690	need. or leaf. f. bz.		161	180	1.05 c	10	s. bz; sl s h. xylene
8691							
8692	sh. need .		316		0.041[20]	v. sl. s.	i. eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
8693	**d-Tyrosine** . .	d-β-p-hydroxyphenylalanine	$HOC_6H_4CH_2CH(NH_2)COOH$	181 19
8694	**l-Tyrosine**. . .	l-α-amino-p-hydroxyhydrocinnamic acid, l-β-(p-hydroxyphenyl)alanine	$HOC_6H_4CH_2CH(NH_2)COOH$	181 19
8695	**Ulexine.**	See *Cytisine*		
8696	**Umbellic acid**	2,4-dihydroxycinnamic acid	$(HO)_2C_6H_3CH:CHCOOH$	180 15
8697	**Umbelliferone**	7-hydroxycoumarin	$C_9H_6O_3$ . . .	162 14
	Undecan-.	See *Hendecan-*		
8698	**Undecene†.**	See *Hendecene**		
8699	**Undecenoic acid*.**	See *Hendecenoic acid**.		
8700	**pri-n-Undecyl alcohol.**	See 1-*Hendecanol**.		
8701	**n-Undecylaldehyde.**	See *Hendecanal**		
8702	**n-Undecylamine.**	See *Hendecylamine**.		
8703	**n-Undecyl cyanide.**	See *Lauronitrile*		
8704	**β-Undecylene.**	See 2-*Hendecene**.		
8705	**θ-Undecylenic acid.**	See 9-*Hendecenoic acid**		
8706	**n-Undecylic acid.**	See *Hendecanoic acid**		
8706M	**Undecyne.**	See *Hendecyne*		
8707	**Uracil**	2,4(1,3)-pyrimidinedione	NHCONHCO- CH CH	112 09
8708	——, **5-methyl-.**	See *Thymine*		
8708M	**Uradal.**	See *Adalin*		
8709	**Uramil**.	5-aminobarbituric acid, dialuramide murexan	NHCONHCO- $CH(NH_2)CO$	143 10
8710	**p-Urazine**.	tetrahydro-sym-tetrazinedione, diurea	NHNHCONH- NHCO	116 08
8711	**Urea**	carbamide	NH_2CONH_2	60 06
8712	——, chloride.	See *Carbamyl chloride*		
8712M	——, nitrate.		$CO(NH_2)_2 \cdot HNO_3$	123 07
8713	——, **acetonyl-**	1-ureido-2-propanone	$CH_3COCH_2NHCONH_2$	116 12
8714	——, **acetyl**		$CH_3CONHCONH_2$	102 09
8715	——, **N-acetyl-N′-methyl-**		$CH_3CONHCONHCH_3$	116 12
8716	——, **acetyl-thio-**	N-(thiocarbamyl)acetamide	$CH_3CONHCSNH_2$	118 15
8717	——, **allyl-**	2-propenylurea*	$C_3H_5NHCONH_2$	100 12
8718	——, **N-allyl-N′-phenyl-**	. . . .	$C_3H_5NHCONHC_6H_5$	176 21
8719	——, **allyl-thio-**	thiosinamine 2-propenylthiourea, allylsulfocarbamide	$CH_2:CHCH_2NHCSNH_2$	116 18
8720	——, **amino-.**	See *Semicarbazide*		
8721	——, **benzoyl-thio-**	benzoylthiocarbamide	$C_6H_5CONHCSNH_2$	180 22
8722	——, **benzyl-***	benzylcarbamide	$C_6H_5CH_2NHCONH_2$	150 18
8723	——, **benzyl-thio-** .	benzylthiocarbamide	$C_6H_5CH_2NHCSNH_2$	166 24

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
8693	. .	.....	310–4		.	. .	.....
8694	sm silky need f. w., 1.550, 1.600, 1 680	$1\ 456\frac{20}{4}$	295 d.		0.048^{25}, 0.238^{75}	0.01^{17} 95% i abs	i. eth., acet.; s. alk.
8695							
8696	yel powd		240 d.		sl. s.	s.	i. eth., bz., lgr.
8697	need.		225–7	subl	1^{100}	s.	sl s. eth ; s. H_2SO_4
8698							
8699							
8700							
8701							
8702							
8703							
8704							
8705							
8706							
8706M							
8707	need f w		338		v. sl. s. c, v. s. h.	i.	s. eth., NH_4OH
8708							
8708M							
8709	need				sl s h		s NH_4OH, c. H_2SO_4, NH_3
8710	monocl. pr. f w.		270		sl. s	sl s.	sl s h. ac. a.
8711	col tetr, 1 484, 1 602	1 335	132 7	d	78^5, 119.3^{25}	$15\ 8^{20}$	sl s eth.; s. conc HCl; i. chl.
8712							
8712M	monocl. pr..		152 d.		s. h.		sl. s. HNO_3; d. HCl, H_2SO_4
8713	pr	$0\ 8018^4$	-41	82	s.	s	s. eth.
8714	need f. w		218–9	d	1.2^{20}	1^{20}	sl s. eth
8715	col monocl f w		180	d.	s.	s	sl s eth
8716	pr f w		165–6		sl s.	s.	sl. s. eth.
8717	need f al		85		v. s.	v s.	sl s. eth, chl.; i pet. eth., tol, CS_2
8718	need. f. bz.		115.5		v sl s	s.	s bz.
8719	col monocl or rhomb., $\gamma 1\ 63454^{78}$ liq	$1\ 219\frac{20}{20}$	78 4		3	s	sl s eth ; i. bz.
8720							
8721	pr f. al..		171		sl s	s.	i. eth
8722	col. need. f. al		147–8		1.7^{45}	s.	$0\ 36^{22.5}$ eth.; $3\ 1^{23}$ acet.
8723	pr f w.		162–4		i c.	1.31 c.	

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8723F	**Urea, (α-bromo-α-ethylbutyryl)-.** See *Adalin.*			
8723M	——, **butyl-***	*n*-butylcarbamide	$C_4H_9NHCONH_2$	116.16
8723P	——, **sec-butyl-**	*sec*-butylcarbamide	$C_4H_9NHCONH_2$	116 16
8723S	——, ***tert*-butyl-**	*tert*-butylcarbamide	$(CH_3)_3CNH$-$CONH_2$	116 16
8724	——, **carbamyl-.**	See *Biuret.*		
8725	——, ***N,N'*-diacetyl-**	*sym*-diacetylurea	CH_3CONH-$CONHCOCH_3$	144 13
8726	——, ***N,N*-diethyl-***	*uns*-diethylurea; *N,N*-diethylcarbamide	$(C_2H_5)_2NCONH_2$	116 16
8727	——, ***N,N'*-diethyl-***	*sym*-diethylurea, *N,N'*-diethylcarbamide	$CO(NHC_2H_5)_2$	116 16
8728	——, ***N,N'*-diethyl-thio-**	*sym*-diethylthiourea, *N,N'*-diethylthiocarbamide	$(C_2H_5NH)_2CS$	132 22
8729	——, ***N,N*-dimethyl-***	*uns*-dimethylurea	$(CH_3)_2NCONH_2$	88 11
8730	——, ***N,N'*-dimethyl-***	*sym*-dimethylurea	$CH_3NHCONHCH_3$	88 11
8731	——, ***N,N*-diphenyl-**	*uns*-diphenylurea	$(C_6H_5)_2NCONH_2$	212 24
8732	——, ***N,N'*-diphenyl-.**	See *Carbanilide.*		
8733	——, ***sym*-diphenyl-.**	See *Carbanilide.*		
8734	——, ***N,N*-diphenyl-thio-**		$(C_6H_5)_2NCSNH_2$	228.30
8735	——, **ditolylthio-.**	See *Carbanilide, dimethyl-thio-*		
8736	——, ***sym*-di-*o*-tolylthio-.** See *Carbanilide, thio-o,o'-dimethyl-.*			
8737	——, ***p*-ethoxyphenyl-.**	See *Urea, p-phenetyl-*		
8738	——, **ethyl-***		$NH_2CONHC_2H_5$	88 11
8739	——, **ethylene-**	2-ketotetrahydroglyoxaline, dihydro-2(3)-imidazolone	$CH_2NHCONHCH_2$ (ring)	86 09
8740	——, **ethylidene-**	4-methyluretidone	$NHCONHCHCH_3$ (ring)	86 09
8741	——, ***N*-ethyl-*N'*-phenyl-**		$C_2H_5NHCONH$-C_6H_5	164 20
8742	——, **furfuralmalonylthio-.** See *Barbituric acid, 5-(2-furfurylidene)-2-thio-.*			
8743	——, **glycolyl-.**	See *Hydantoin*		
8744	——, **glycolyl-thio-.**	See *Hydantoin, 2-thio-.*		
8745	——, **glyoxalyl-.**	See *Allanturic acid*		
8746	——, **guanyl-**	dicyan(o)diamidine, 1-carbamylguanidine	$NH_2C(:NH)NH$-$CONH_2$	102 10
8747	——, **hydroxy-**	carbamide oxide	$NH_2CONHOH$	76 06
8748	——, **isoamyl-**	(γ-methylbutyl)urea*	$C_5H_{11}NHCONH_2$	130 19
8749	——, **isobutyl-**	(β-methylpropyl)urea*	$NH_2CONHCH_2$-$CH(CH_3)_2$	116 16
8750	——, **α-lactyl-.**	See *Hydantoin, 5-methyl-*		
8751	——, **malonyl-.**	See *Barbituric acid.*		
8752	——, **mesoxalyl-.**	See *Alloxan.*		
8753	——, **methyl-***		$NH_2CONHCH_3$	74 08
8754	——, **methyl-thio-**		$CH_3NHCSNH_2$	90 14
8755	——, **nitro-***		$NH_2CONHNO_2$	105 06
8755M	——, oxalate		$2CO(NH_2)_2{\cdot}H_2C_2$-O_4	210 15
8756	——, **oxalyl-.**	See *Parabanic acid.*		
8757	——, **oximidomesoxalyl-.** See *Violuric acid.*			
8758	——, ***p*-phenetyl-**	*p*-ethoxyphenylurea; dulcin	$C_2H_5OC_6H_4NH$-$CONH_2$	180 20
8759	——, **phenyl-***		$C_6H_5NHCONH_2$	136 15
8760	——, **phenylene-.**	See *2(3)-Benzimidazolone*		

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8723F							
8723M	wh need f bz		96		s.	...	
8723P	wh need.		166		.	s.	
8723S	wh. need.		172 d.		s.	s.	
8724							
8725	need f al.		152	subl.; d 179-80	v sl s.	sl. s	
8726	col deliq need. f. al		74 (70)		v s.	v. s.	1 86 c. eth.
8727	col deliq need f al, $1.4616^{48.6}$	1 042	112 (106-8)	263	v s.	v. s.	v. s. eth.
8728	col cr.		77	d.	s.	s.	v. s. eth.
8729	col monocl pr f. me al	1 255	182		v s	v sl s	v sl. s eth.
8730	col rhomb pr	1 112	106(102 5)	270	v s	s	i. eth.
8731	col. rhomb. need.	1 276	189	d.	v sl s	s.	s eth., chl.
8732							
8733							
8734	cr		189		i	s	
8735							
8736							
8737							
8738	col monocl pr f al + eth	$1\ 213^{18}$	92	d.	v s.	v. s.	i. eth.
8739	col. need.		131		v s h	v s h	sl. s. eth., s. chl
8740	col. need.		154	160 d.	v. sl s	sl. s.	v. sl s. eth.
8741	need f. al		99	. -		s.	
8742							
8743							
8744							
8745							
8746	col pr. f. al..		105	d. 160	s. h.	sl s c.	i eth, chl., bz., CS_2, s. pyr.
8747	col need f al		128-30 (139-40)	d.	v s	s.	
8748	col. cr.		89-91	..	sl s		..
8749	need. f. acet		141	.			v. sl. s. eth.; sl. s acet, bz.
8750							
8751							
8752							
8753	col rhomb pr f. w. or al.	1 204	101	d.	v s.	v s.	0 073 eth.
8754	pr .		118		s	s.	sl s. eth.
8755	wh. cr. f al or eth.		155-6	exp.	sl. s.	v s.	v. s. eth.
8755M	monocl. pr.		d.	..... .	4.4^{16} c.	1.6	i. eth.
8756							
8757							
8758	col. leaf. or need f. dil. a	.	173-4	d	0 125 c., 2 h	4, 90%	sl. s. eth.
8759	monocl., α 1 602, γ 1.627	1 302	147	238	sl s c., v s. h.	v. s.	v. s eth.
8760							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8761	**Urea, phenyl-thio-**		$C_6H_5NHCSNH_2$	152 21
8762	**——, 2-propenyl-*.**	See *Urea, allyl-*		
8763	**——, propyl-***		$C_3H_7NHCONH_2$	102.14
8764	**——, tartronyl-.**	See *Dialuric acid.*		
8765	**——, tetraethyl-***		$(C_2H_5)_2NCON-(C_2H_5)_2$	172 27
8766	**——, tetramethyl-***		$(CH_3)_2NCON-(CH_3)_2$	116 16
8767	**——, tetraphenyl-**	*N,N'*-diphenylcarbanilide	$(C_6H_5)_2NCON-(C_6H_5)_2$	364 43
8768	**——, thio-**	thiocarbamide	NH_2CSNH_2	76 12
8769	**——, thio-*m*-tolyl-**		$CH_3C_6H_5NHCS-NH_2$	167 25
8770	**——, *o*-tolyl-**		$CH_3C_6H_5NHCO-NH_2$	151 19
8771	**——, *m*-tolyl-**		$CH_3C_6H_5NHCO-NH_2$	151 19
8772	**——, *p*-tolyl-**		$CH_3C_6H_5NH-CONH_2$	151 19
8773	**——, trimethyl-***		$CH_3NHCON-(CH_3)_2$	102 14
8774	**Ureaacetic acid.**	See *Hydantoic acid*		
8775	**Urethan.**	See *Carbamic acid, ethyl ester*		
8776	**——, methyl-.**	See *Carbamic acid, methyl ester*	*, Carbamic acid, meth*	*yl-,*
8777	**——, phenyl-.**	See *Carbanilic acid, ethyl ester*		
8777M	**——, *n*-propylphenyl-.**	See *Carbanilic acid, propyl este*	*r*	
8778	**——, thio-.**	See *Carbamic acid, thiol-, ethyl*	*ester, Carbamic acid,*	
8779	**Uretidone, 4-methyl-.**	See *Urea, ethylidene-*		
8780	**Uric acid**	2,6,8(1,3,9)-purinetrione, 2,6,8-trioxypurine	$C_5H_4N_4O_3$.	168 11
8781	**——, 1-methyl-**		$C_6H_6N_4O_3$	182 14
8782	**——, 3-methyl-**		$C_6H_6N_4O_3$	182 14
8783	**——, 7-methyl-**		$C_6H_6N_4O_3$	182 14
8784	**Urotropine.**	See *Hexamethylenetetramine*		
8785	***dl*-Usnic acid**	*dl*-usninic acid	$C_{18}H_{16}O_7$	344 31
8786	***d*-Usnic acid**	*d*-usninic acid	$C_{18}H_{16}O_7$	344 31
8787	**Uvic acid, Uvinic acid.**	See *Pyrotritaric acid.*		
8788	**Uvitic acid**	5-methylisophthalic acid	$CH_3C_6H_3(COOH)_2$	180 15
8789	**Uvitonic acid**	6-methyllutidinic acid, 2-picoline-4,6-dicarboxylic acid	$CH_3C_5H_2N-(COOH)_2$	181 14
8790	**Valeraldehyde**	pentanal*, *n*-valeric aldehyde, *n*-amyl aldehyde	$CH_3(CH_2)_3CHO$	86 13
8791	——, oxime	pentanal oxime*	$CH_3(CH_2)_3-CH.NOH$	101 15
8792	**——, γ-oxo-.**	See *Levulinaldehyde.*		
8793	**Valeramide**	pentanamide*	$CH_3(CH_2)_3CONH_2$	101 15
8793H	**——, *N,N*-dimethyl-**		$CH_3(CH_2)_3CON-(CH_3)_2$	129 20
8793R	**Valeranilide**	*n*-valeranilide	$CH_3(CH_2)_3CON-HC_6H_5$	177.24
8794	**Valeric acid** (*active*).	See *Butyric acid, α-methyl-*		
8795	**Valeric acid** (*n*)	pentanoic acid*	$CH_3(CH_2)_3COOH$	102 13

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
8761	col. need. f. w. or trim. f. al.	1 3	154	....	0.26^{18}	5.66^{25}	....
8762							
8763	col. cr........	....	107	....	s.	......	. . ..
8764							
8765	liq..........	. ...	....	210–5	i.	......	s. a , i. alk.
8766	liq.	$0\ 972^{15}$	....	177	......	v. s.	v s. eth.
8767	col. rhomb....	1 222	183	....	i.	s.	... .
8768	rhomb. pr. f. al	$1\ 405\frac{20}{4}$	182 (174–6)	d.	$9\ 18^{13}$	s.	v. sl. s. eth.
8769	pr. f. al......	. ... ..	110–1	....	s. h.	v. s.	v. s eth.
8770	leaf. f. al. ...	....	190–1	....	0.25^{45}	s.	s. eth.
8771	leaf f. w.....	....	142–3	....	s.	v. s.	sl s. eth.
8772	need. f. w...	......	187	....	0.31^{45}	s.	$0.062^{22.5}$ eth.
8773	monocl. . .	1 19	75.5	232 5	v. s.	v. s.	s. eth.
8774							
8775							
8776	*ethyl ester.*						
8777							
8777M							
8778	*thiono-, ethyl ester*						
8779							
8780	sc.	1 893	d.	. .	$0\ 00645^{37}$, 0 06 h	i.	i eth , s. glyc., h conc. H_2SO_4
8781	col. need. .	... ...	400 d	. .	$0\ 05^{100}$	v. sl. s.	. . . . .
8782	col pr f. w.	.	>360 d.	..	$0\ 38^{100}$	v sl. s.	s alk.
8783	col leaf f w.	.... ..	370 d.	....	$1\ 25^{100}$	.	s alk.
8784							
8785	yel monocl pr	. ....	193	....	i.	v. sl. s	$0\ 3^{20}$ eth.
8786	yel pr f al, 1.463, 1.653, 1.780	. . .	203	d.	i.	v. sl. s.	sl s eth.
8787							
8788	col need f w	....	290	subl.	sl s. h.	v. s.	v. s. eth.
8789	col. cr. powd..	....	274 d.	....	v. sl. s.	.....	s a., aniline; v sl. s. h. bz.
8790	liq , 1 3882...	$0\ 8185^{11}$	-91.5	103.4	sl. s.	v. s.	v. s. eth.
8791	cr. .. .	.... ..	52	....	s.	s.	.. ..
8792							
8793	monocl. pl. ..	1 023	114–6 (105.8)	....	s.	s.	s. eth.
8793H	col. liq......	$1\ 4419^{25}$	-51	141^{100}	∞	∞	∞ eth.
8793R	col. monocl. pr.	... .	63	....	......	s.	s. eth.
8794							
8795	col. liq., 1.4086	$0.942\frac{20}{4}$; $0\ 9435\frac{15}{4}$	-59; -34.5	187	3.7^{16}	∞	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8796	**Valeric acid**, amyl ester	amyl valerate; pentyl pentanoate*	$C_4H_9COOC_5H_{11}$.	172.26
8797	——, butyl ester . . .	butyl valerate, butyl pentanoate*	$CH_3(CH_2)_3$-$COOC_4H_9$	158.24
8798	——, ethyl ester.....	ethyl valerate; ethyl pentanoate	$CH_3(CH_2)_3$-$COOC_2H_5$	130.18
8799	——, 2-furylmethyl ester	furfuryl valerate	$CH_3(CH_2)_3COO$-$CH_2C_4H_3O$	182.21
8800	——, isobutyl ester	isobutyl valerate, β-methylpropyl pentanoate*	$CH_3(CH_2)_3COO$-$CH_2CH(CH_3)_2$	158.24
8801	——, methyl ester	methyl pentanoate*, methyl valerate	$CH_3(CH_2)_3$-$COOCH_3$	116.16
8802	——, *p*-phenylphenacyl ester	. .	$CH_3(CH_2)_3COO$-$CH_2COC_6H_4\ C_6H_5$	296.35
8803	——, piperazinium salt	. . . .	$C_4H_{10}N_2\ 2C_4H_9$-$COOH$	290.40
8804	——, propyl ester	*n*-propyl *n*-valerate .	$CH_3(CH_2)_3$-$COOC_3H_7$	144.21
8806	——, **α-amino-** . .	2-aminopentanoic acid*	$CH_3CH_2CH_2CH$-$(NH_2)COOH$	117.15
8807	——, **γ-amino-**.	4-aminopentanoic acid*	$CH_3CH(NH_2)$-CH_2CH_2COOH	117.15
8808	——, **δ-amino-**	5-aminopentanoic acid*	$NH_2(CH_2)_4COOH$	117.15
8809	——, **α-amino-δ-guanido-**.	See *Arginine*.		
8810	——, **α-amino-β-methyl-**.	See *Isoleucine*		
8811	——, **α-bromo-**.	2-bromopentanoic acid*	$CH_3(CH_2)_2CHBr$-$COOH$	181.04
8812	——, ——, ethyl ester	ethyl 2-bromopentanoate*	$CH_3CH_2CH_2CH$-$BrCOOC_2H_5$	209.09
8813	——, **α,δ-diamino-**.	See *Ornithine*		
8814	——, **α-ethyl-**	2-ethylpentanoic acid*, 3-hexanecarboxylic acid; ethylpropylacetic acid	$CH_3CH_2CH_2CH$-$(C_2H_5)COOH$	130.18
8815	——, **β-ethyl-**	3-ethylpentanoic acid*, β,β-diethylpropionic acid	$(C_2H_5)_2CHCH_2$-$COOH$	130.18
8816	——, **α-hydroxy-**. . .	2-hydroxypentanoic acid*, valerolactic acid	$CH_3CH_2CH_2CH$-$OHCOOH$	118.13
8817	——, **γ-hydroxy-**, lactone	4-hydroxypentanoic acid lactone, γ-valerolactone	CH_3-$CHCH_2CH_2COO$	100.11
8818	——, **γ-keto-**.	See *Levulinic acid*		
8819	——, **α-methyl-** . .	2-methylpentanoic acid*, methylpropylacetic acid	$CH_3(CH_2)_2CH$-$(CH_3)COOH$	116.16
8820	——, **β-methyl-**. .	3-methylpentanoic acid*, *sec*-butylacetic acid	$C_2H_5CH(CH_3)$-CH_2COOH	116.16
8820M	——, **γ-oxo-**.	See *Levulinic acid*.		
8821	——, **α,β,γ,δ-tetrahydroxy-**.	See *Arabonic acid*.		
8822	**Valeric anhydride**	pentanoic anhydride* .	$[CH_3(CH_2)_3CO]_2O$	186.25
8823	**Valerolactic acid.**	See *Valeric acid, α-hydroxy-*.		
8824	**γ-Valerolactone.**	See *Valeric acid, γ-hydroxy-, lactone.*		
8825	**Valerone.**	See 4-*Heptanone, 2,6-dimethyl-**		
8826	**Valeronitrile**.	pentanenitrile*; *n*-butyl cyanide	$CH_3(CH_2)_3CN$.	83.13
8827	**Valerophenone**	butyl phenyl ketone	$CH_3(CH_2)_3COC_6H_5$	162.22
8828	——, **γ-oxo-** (or **γ-keto-**)	1-phenyl-1,4-pentanedione; phenacylacetone, β-acetylpropiophenone; α-acetonylacetophenone	$C_6H_5COCH_2CH_2$-$COCH_3$	176.21
8829	**Valeryl chloride**	pentanoyl chloride*	$CH_3(CH_2)_3COCl$	120.58
8830	**Valerylene.**	See 2-*Pentyne**.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8796	col liq., 1.4145	0 881^{0}	-78.8	203.7	sl. s.	∞	∞ eth.
8797	liq.	0 8700$\frac{15}{4}$	-92.8	185.6	v sl s	∞	∞ eth.
8798	col. liq., 1.40094^{20}	0 8739$\frac{20}{4}$	-91.2	146	0.237^{25}	∞	∞ eth.
8799	col. liq.......	1.0284$\frac{20}{4}$	....	228-9^{764}; 82-3^{1}	i.	s.	s. eth.
8800	col. liq....	0 854	..	167	i.	∞	∞ eth.
8801	col. liq. .	0 910^{0}	-91.0	127.3	v sl s	∞	∞ eth.
8802	.....	...	63 5	..			... .
8803	wh cr..		112 5-13	..	s	s.	i eth.; s. h. dioxane
8804	col. liq. .	0 889^{0}	..	167 5	i.	s.	∞ eth.; s. chl.
8806	leaf. f. w	.....	291 5 d.	subl.	10 7^{5}	sl. s.	i. eth.
8807	cr...	...	193	d.	v s	sl. s.	i. eth., bz , lgr.
8808	leaf	.	157	d	v s	sl. s.	i. eth.
8809							
8810							
8811	....			67^{10} (126-30^{27})	sl. s.	v s.	s. eth.
8812	liq... . .	1 226$\frac{18}{4}$	.	192(74-6^{11})	i.	∞	∞ eth.
8813							
8814	col. oil .	....	....	209 2	i.	s.	s. eth.
8815	oil	......	. .	212			.
8816	hyg. pl	....	34	subl.	v s.	v. s.	v s. eth
8817	liq.	1 072	-31	206-7	s	s.	
8818							
8819	col. liq	0 928$\frac{20}{4}$		193 5	0 57^{17}	s.	s. eth.
8820	liq . .	0 930^{15}		195-6		s.	s. eth.
8820M							
8821							
8822	col. liq . ..	0 929$\frac{20}{4}$	-56 1	215	d. h.	s. d	v. s. eth.
8823							
8824							
8825							
8826	col. liq., 1 3909	0 8014$\frac{20}{4}$	-96 0	141	i.	s.	s. eth.
8827	liq.		....	239 5	i.	v. s.	v s. eth.
8828	yel oil	>1	...	162^{12}d.	sl s c.	. ....	i. alk.
8829	col. liq., 1 41555	1.016^{15}	-110 0	128	d.	d.	∞ eth.
8830							

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
8831	***dl*-Valine**	*dl*-α-aminoisovaleric acid; *dl*-2-amino-3-methylbutanoic acid*	$(CH_3)_2CHCH(NH_2)COOH$	117 15
8832	***d*-Valine**	α-aminoisovaleric acid	$(CH_3)_2CHCH(NH_2)COOH$	117 15
8833	***l*-Valine**	*l*-α-aminoisovaleric acid *l*-2-amino-3-methylbutanoic acid*	$(CH_3)_2CHCH(NH_2)COOH$	117 15
8834	**Valylene**		Mixt (?)	
8835	**Vanillaldehyde.**	See *Vanillin*		
8836	**Vanillic acid**	4-hydroxy-3-methoxybenzoic acid	$CH_3O(HO)C_6H_3COOH$	168 14
8837	——, ethyl ester		$HO(CH_3O)C_6H_3COOC_2H_5$	196 20
8838	**Vanillin**	vanillaldehyde, 4-hydroxy-3-methoxybenzaldehyde, protocatechualdehyde 3-methyl ether	$CH_3O(OH)C_6H_3CHO$	152 14
8839	——, acetate	4-acetoxy-3-methoxybenzaldehyde, acetylvanillin	$CH_3O(CH_3COO)C_6H_3CHO$	194 18
8840	——, ethyl ether.	See *Benzaldehyde, 4-ethoxy-3-methoxy-.*		
8841	——, **acetyl-.**	See *Vanillin, acetate*		
8842	——, **5-bromo-**	5-bromo-4-hydroxy-3-methoxybenzaldehyde	$CH_3O(OH)BrC_6H_2CHO$	231 05
8843	——, **5-chloro-**	5-chloro-4-hydroxy-3-methoxybenzaldehyde	$CH_3O(OH)ClC_6H_2CHO$	186 59
8443H	——, **2,5-diiodo-**		$CH_3O(OH)C_6HI_2CHO$	403 97
8843M	——, **2-iodo-**		$CH_3O(OH)C_6H_2ICHO$	278 06
8843N	——, **5-iodo-**		$CH_3O(OH)C_6H_2ICHO$	278 06
8844	**Vanillyl alcohol**	4-hydroxy-3-methoxybenzyl alcohol, vanillic alcohol	$CH_3O(HO)C_6H_3CH_2OH$	154 16
8845	**Vasicine**		$C_{11}H_{12}N_2O$	188 22
8846	**Veratraldehyde**	3,4-dimethoxybenzaldehyde, protocatechualdehyde dimethyl ether, 3,4-dimethoxybenzenecarbonal*	$(CH_3O)_2C_6H_3CHO$	166 17
8847	**Veratric acid**	3,4-dimethoxybenzoic acid, protocatechuic acid dimethyl ether	$(CH_3O)_2C_6H_3COOH$	182 17
8848	**Veratrine** (crystalline)	cevadine	$C_{32}H_{49}NO_9$	591 72
8850	**Veratrole**	1,2-dimethoxybenzene*, pyrocatechol dimethyl ether	$C_6H_4(OCH_3)_2$	138 16
8851	——, **4-allyl-**	eugenol methyl ether, methyleugenol	$CH_2{:}CHCH_2C_6H_3(OCH_3)_2$	178 22
8852	——, **4-propenyl-**	isoeugenol methyl ether	$CH_3CH{:}CHC_6H_3(OCH_3)_2$	178 22
8853	**Veronal.**	See *Barbital*		
8854	***l*-Vicine**		$C_{10}H_{16}O_7N_4$	304 26
8856	**Vinaconic acid**	1,1-cyclopropanedicarboxylic acid*, ethylenemalonic acid	$CH_2CH_2C(COOH)_2$	130 10

*Name approved by the International Union of Chemistry

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8831	monocl. leaf f al.		298(292)d	subl.	7 44[25], 13 31[75]	0 571[25] 75%; 0 014[0] abs.	i. eth., acet.
8832	hex leaf. f al, pr f w.		315 d	subl. d.	9 1[16.5]	v sl. s	i. eth.
8833	leaf f al. ..		293 d		5 3[20]		. .. ...
8834	col. liq.		.....	50	i.	v s	∞ eth.
8835							
8836	col. need f w		207	subl	0.12[14], 2.5[100]	v s.	v. s. eth.
8837	col. need..		44	293	i.	v. s	v s eth.; s. alk
8838	col monocl. need f. w. or lgr.		81–2	285 (in CO_2); 140–5[6]	1 c; 5 h.	v s.	v s. eth.; s. chl, glyc.
8839	col. need		77		v sl s	v s.	v s. eth.
8840							
8841							
8842	col. leaf		164		i	s h.	sl. s. c. eth., c. bz.
8843	col pl		164–5		i	s h	....
8843H	nearly col [illegible]		200		i	s	sl. s eth.
8843M	nearly col need		155–156		i	s	sl. s. eth.
8843N	pa yel need		180		i	sl s	sl. s. eth.
8844	col need f w or bz		115	d	v s h	v s	v s eth.
8845	need		198 d		sl s	s	sl. s eth., bz.; s chl; i. pet. eth.
8846	col need f eth.		42–3 (44–5)	283	i, sl s h	v. s.	v s. eth.
8847	cr. f w		anh 181	subl.	0 05[14], 0.6[100]	v s	v s. eth.
8848	col cr f al, $[\alpha]+12\ 5^{\circ 17}_{D}$ in al		205 d.		0 11 c	s	s chl.
8850	col cr f pet. eth, 1 52870[21.2] α	1 0842$^{25}_{25}$	22 5 (19–20)	206–7	sl s.	s	s. eth.
8851	col liq., 1 5383[17]	1 055[15]	...	248–9	i.	∞	∞ eth.
8852	col liq, 1 5720[11.5]	1 0551[22]		262–4	i	s	s eth.
8853							
8854	need		242	..	s	i.	s. me. al.
8856	tricl need f eth		175	210[30]	v s	s.	s. eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt.
8857	**Vinetine.**	See *Oxyacanthine*		
8858	**Vinyl alcohol**	ethenol, vinol	CH_2 CHOH .	44 05
8859	**Vinylamine**...	ethenylamine* .	CH_2.$CHNH_2$.	43 07
8860	**Vinyl bromide**	bromoethene*; bromoethylene	CH_2·CHBr .	106 96
8861	**Vinyl chloride**	chloroethylene, chloroethene*	CH_2 CHCl .	62 50
8862	**Vinyl cyanide.**	See *Acrylonitrile.*		
8863	**Vinyl ether**.	ethenyloxyethene*; divinyl ether	$(CH_2·CH)_2O$	70 09
8863M	**Vinyl fluoride**	fluoroethylene	CH_2·CHF ..	46 04
8864	**Vinyl iodide**...	iodoethylene, iodoethene*	CH_2 CHI .	153 96
8865	**Vinyl sulfide**...	ethenylthioethene*; divinyl sulfide	$(CH_2.CH)_2S$...	86 15
8866	**Vinyl tribromide.**	See *Ethane, 1,1,2-tribromo-**		
8867	**Vinyl trichloride.**	See *Ethane, 1,1,2-trichloro-**.		
8868	**Violuric acid** . .	alloxan 5-oxime, 5-isonitrosobarbituric acid, oximidomesoxalylurea	CONHCO-NHCOC.NOH	157 09
8868D	**Vitamin A**.......... .	axerophthol	$C_{20}H_{29}OH$	286 44
8868H	**Vitamin B_1**.......	thiamine hydrochloride, thiamin chloride, aneurin, antineuritic vitamin, oryzanin, torulin	$C_{12}H_{18}ON_4SCl_2$	337 27
8868M	**Vitamin B_2.**	See *D-Riboflavin*		
8868S	**Vitamin B_6**.......	adermin, pyridoxin, 5-hydroxy-6-methyl-3,4-pyridinedicarbinol	$C_8H_{11}NO_3$. .	169 18
8868U	——, hydrochloride		$C_8H_{11}NO_3$ HCl	205 64
8869	**Vitamin C.**	See *l-Ascorbic acid.*		
8869C	**Vitamin D_2.**	See *Calciferol*		
8869G	**Vitamin E.**	See *α-Tocopherol*		
8869J	**Vitamin F.**	See *Linoleic acid*		
8869M	**Vitamin G.**	See *D-Riboflavin.*		
8869S	**Vitamin K.**	See *Phthiocol.*		
8870	**Wintergreen oil.**	See *Salicylic acid, methyl ester*		
8871	**Wood alcohol.**	See *Methanol**.		
8872	**Wood sugar.**	See *l-Xylose.*		
8873	**Xanthaline**...........		$C_{37}H_{36}N_2O_9$	652 68
8874	**Xanthene**	dibenzo-1,4-pyran; diphenylmethane oxide, *o,o'*-methylenediphenyl ether	$C_6H_4OC_6H_4CH_2$	182 21
8875	**9-Xanthene-o-benzoic**	**acid, 9-hydroxy-**, lactone.	See *Fluoran.*	
8876	——, **3,4,5,6-tetrahydr**	**oxy-.** See *Gallin*		
8877	**9-Xanthenone.**	See *Xanthone*		
8878	**Xanthic acid,** ethyl ester	ethyl ethoxymethanethionothiolate*; ethyl xanthogenate	$C_2H_5OCSSC_2H_5$.	150 25
8879	**Xanthine**	2,6(1,3)purinedione; 2,6-dioxypurine	$C_5H_4N_4O_2$	152 11
8880	——, **1,3-dimethyl-.**	See *Theophylline.*		
8881	——, **3,7-dimethyl-.**	See *Theobromine.*		
8882	——, **1,3,7-trimethyl-.**	See *Caffeine*		

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
8857							
8858	unstable	. ..					......
8859	liq	$0.832\frac{20}{4}$		56	∞	s.	∞ eth.
8860	liq, 1.4462	1.5167[14]	-137.8	15.8	i.	∞	∞ eth.
8861	gas	liq 0.9195$\frac{15}{4}$	-159.7	-13.9	sl s.	s	v. s. eth.
8862							
8863	col liq.	$0.774\frac{20}{20}$		39 (28 3)	i.	∞	∞ eth.
8863M	col. gas	....		-51	i.	400[20] cm³	550[20] cm³ eth.
8864	liq	2.08[0]		56	i.	∞	∞ eth; s. chl., bz, tol., CS_2
8865	oil	0.912	. .	101	sl. s.	∞	∞ eth.
8866							
8867							
8868	rhomb.	.. ....	$-H_2O$, 100, 224 d.	..	s. h.	s	
8868D	micr need; pa yel visc. liq, 1.627[40]	$0.948\frac{25}{4}$	8	120-30[0.001]	i	s	v. s. eth.
8868H	wh cr		245–8 d.		100[25]	0.3; 1 95%	i. eth., bz.
8868M							
8868S	clusters of wh. need. or wh. platelets	.....	160 d.	subl in vacuo	v. s.	s	sl. s. eth., chl.; s. acet.
8868U	wh platelets	..	206–8 d		22.2	1.1	sl s acet.
8869							
8869C							
8869G							
8869J							
8869M							
8869P							
8869S							
8870							
8871							
8872							
8873	cr powd.		208		i	v sl s h	
8874	leaf f al		100.5	315	v. sl. s.	sl. s.	s eth., bz., chl., CS_2, H_2SO_4
8875							
8876							
8877							
8878	cr., garlic odor	$1.085\frac{19}{4}$	. .	200 (91–3[18])			
8879	yel-wh. powd.; sm pl become anh at 125	....	>150 d.	subl. d.	0.26[17]	0.033[17]	v. s alk.
8880							
8881							
8882							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8883	**Xanthogenamide.**	See *Carbamic acid, thiono-, ethyl ester*		
8884	**Xanthogenic acid** ...	thiolthionocarbonic acid O-ethyl ester, ethylxanthogenic acid	C_2H_5OCSSH .	122 20
8885	——, **ethyl-.**	See *Xanthogenic acid.*		
8886	**Xanthone**	9-xanthenone, diphenylene ketone oxide	$CO:(C_6H_4)_2:O$	196 19
8887	——, **1,7-dihydroxy-.**	See *Euxanthone*		
8888	——, **1,7-dihydroxy-3-methoxy-.**	See *Gentisin.*		
8889	**Xenylamine** ..	p-biphenylamine, 4-aminobiphenyl, p-phenylaniline	$C_6H_5C_6H_4NH_2$	169 22
8890	**Xenyl isothiocyanate, Xenyl mustard oil.**	See *Isothiocyanic acid, xenyl ester.*		
8891	**Xylene, musk.**	See *Benzene, 1-tert-butyl-3,5-dimethyl-2,4,6-trinitro-*		
8892	**o-Xylene**	1,2-dimethylbenzene*	$C_6H_4(CH_3)_2$	106 16
8893	——, **α-bromo-.**	o-xylyl bromide, ω-bromo-o-xylene	$CH_3C_6H_4CH_2Br$	185 07
8894	——, **4-bromo-** .	as-bromo-o-xylene	$BrC_6H_3(CH_3)_2$	185 07
8895	——, **α-chloro-**	o-xylyl chloride, ω-chloro-o-xylene, o-tolyl chloride (incorrect)	$CH_3C_6H_4CH_2Cl$	140 61
8896	——, **α,α′-dibromo-.**	o-xylylene bromide, o-xylylene dibromide, ω,ω′-dibromo-o-xylene	$C_6H_4(CH_2Br)_2$	263 98
8897	——, **α,α′-dichloro-**	o-xylylene (di)chloride, ω,ω′-dichloro-o-xylene	$C_6H_4(CH_2Cl)_2$	175 06
8898	——, **dihydro-.**	See *Cantharene.*		
8899	——, **3,5-dihydroxy-.**	See *Resorcinol, 4,5-dimethyl-*		
8900	——, **3,6-dihydroxy-.**	See *Hydroquinone, 2,3-dimethyl-*		
8901	——, **3,4-dinitro-**	1,2-dimethyl-3,4-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196 16
8902	——, **3,5-dinitro-**	1,2-dimethyl-3,5-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196 16
8903	——, **3,6-dinitro-**	2,3-dimethyl-1,4-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196 16
8904	——, **4,5-dinitro-**	1,2-dimethyl-4,5-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196 16
8905	——, **4-ethyl-**	4-ethyl-1,2-dimethylbenzene*	$(CH_3)_2C_6H_3C_2H_5$	134 21
8906	——, **3-nitro-**		$NO_2C_6H_3(CH_3)_2$	151 16
8907	——, **4-nitro-**		$NO_2C_6H_3(CH_3)_2$	151 16
8908	***m*-Xylene**	1,3-dimethylbenzene*	$C_6H_4(CH_3)_2$	106 16
8909	——, **α-bromo-**	m-xylyl bromide, ω-bromo-m-xylene	$CH_3C_6H_4CH_2Br$	185 07
8910	——, **4-bromo-** . .	as-bromo-m-xylene	$BrC_6H_3(CH_3)_2$	185 07
8911	——, **α-chloro-** .	m-xylyl chloride, ω-chloro-m-xylene, m-tolyl chloride (incorrect)	$CH_3C_6H_4CH_2Cl$	140 61
8912	——, **4,6-dibromo-**	4,6-dibromo-1,3-dimethylbenzene	$C_6H_2Br_2(CH_3)_2$	263 98
8913	——, **α,α-dichloro-** ..	m-xylene (di)chloride, ω,ω′-dichloro-m-xylene	$C_6H_4(CH_2Cl)_2$	175 06
8914	——, **2,4-dihydroxy-.**	See *Resorcinol, 2,4-dimethyl-.*		
8915	——, **2,5-dihydroxy-.**	See *Hydroquinone, 2,6-dimethyl-*		
8916	——, **4,6-dihydroxy-.**	See *Resorcinol, 4,6-dimethyl-*		

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No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
8883							
8884	liq.	>1	-53	24 d.	v sl s (i)		
8885							
8886	wh. need f al		174	351	sl s h	0 55 c., 0.71 h	sl s eth, bz, lgr.
8887							
8888							
8889	col. leaf. f. dil al.	$1\ 160\frac{20}{20}$	53	302	sl. s. c	$44.18^{19.5}$	v.s. eth ;s. chl.; $58^{19.5}$ me al.
8890							
8891							
8892	col liq., $1\ 50777^{15.5}$	$0\ 8745\frac{20}{4}$	-29(-27 1)	144	i.	v. s.	v. s. eth.
8893	pr ..	$1\ 381\frac{23}{4}$	21	217 7	i.	s.	v. s. eth.
8894	liq	...	-2	214	i.	v s.	v. s. eth.
8895	liq	...	...	199	i.	∞	∞ eth.
8896	rhomb. cr. f chl	1 988	95	d.	i.	v. s.	20 eth.
8897	monocl f pet. eth.	$1\ 393\frac{0}{4}$	55	241	i.	v. s.	v s eth., chl.
8898							
8899							
8900							
8901	need. f al.	.	82	exp 413		sl s	v s eth.; s. chl, CS_2, bz.
8902	yel need f al		75-6	.		s.	v s bz., chl.; s acet.
8903	col cr f al		89-90(56)		v sl s	s.	s eth., chl., bz., acet.
8904	need. f al		115-6		v sl. s h.	v sl s	s. eth, chl, CS_2, acet, bz, sl s pet. eth
8905	liq. ..	$0\ 869\frac{20}{4}$	<-20	189(183-4)	i.	v. s	s. eth.
8906	liq or need f al.	$1\ 147^{15}$	7-9	245(250 8)	i.	s.	. ....
8907	yel. pr f al.	$1\ 139^{3}$	30	258	i.	∞	s eth
8908	col liq, $1\ 49962^{14.85}$	$0\ 8684^{15}$, $0\ 8641\frac{20}{4}$	-53.6 (-47 4)	138 8	i	v. s.	v s eth.
8909	liq.	$1\ 371^{23}$	.....	215 8 sl d	i.	v. s.	v. s. eth.
8910	liq.........	. . .	....	203	i.	v. s.	v s eth.
8911	liq	$1\ 064^{20}$	....	196	i.	∞	∞ eth.
8912	cr........ ..	.. ..	69-72	255-6	i.	sl. s c, s h.	
8913	col. cr.	$1\ 302\frac{20}{4}$	34 2	255	i.	v. s.	v. s eth.
8914							
8915							
8916							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8917	***m*-Xylene, 2,5-dinitro-**	1,3-dimethyl-2,5-dinitrobenzene*	$(NO_2)_2C_6H_2(CH_3)_2$	196 16
8918	**——, 4-ethyl-**	1-ethyl-2,4-dimethylbenzene*	$(CH_3)_2C_6H_3C_2H_5$	134 21
8919	**——, 5-ethyl-**	1-ethyl-3,5-dimethylbenzene*	$(CH_3)_2C_6H_3C_2H_5$	134 21
8920	**——, hexahydro-.**	See *Cyclohexane*, 1,3-*dimethyl-*		
8921	**——, 2-nitro-**		$NO_2C_6H_3(CH_3)_2$	151 16
8922	**——, 4-nitro-**		$NO_2C_6H_3(CH_3)_2$	151 16
8923	**——, 5-nitro-**		$NO_2C_6H_3(CH_3)_2$	151 16
8924	**——, 2,4,6-trinitro-**	...	$(NO_2)_3C_6H(CH_3)_2$	241 16
8925	***p*-Xylene**	1,4-dimethylbenzene*	$C_6H_4(CH_3)_2$	106 16
8926	**——, α-bromo-**	*p*-xylyl bromide, ω-bromo-*p*-xylene	$CH_3C_6H_4CH_2Br$	185 07
8927	**——, 2-bromo-**	*eso*-bromo-*p*-xylene	$BrC_6H_3(CH_3)_2$	185 07
8928	**——, α-chloro-**	*p*-xylyl chloride, ω-chloro-*p*-xylene, *p*-tolyl chloride (incorrect)	$CH_3C_6H_4CH_2Cl$	140 61
8929	**——, α,α′-dibromo-**	*p*-xylylene bromide; *p*-xylylene dibromide	$C_6H_4(CH_2Br)_2$.	263 98
8930	**——, α,α′-dichloro-**	*p*-xylylene (di)chloride, ω,ω′-dichloro-*p*-xylene	$C_6H_4(CH_2Cl)_2$	175 06
8931	**——, 2,5-dihydroxy-.**	See *Hydroquinone*, 2,5-*dimethyl-*.		
8932	**——, 2,6-dihydroxy-.**	See *Resorcinol*, 2,5-*dimethyl-*		
8933	**——, 2,3-dinitro-**	1,4-dimethyl-2,3-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196 16
8934	**——, 2,5-dinitro-**	1,4-dimethyl-2,5-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196 16
8935	**——, 2,6-dinitro-**	2,5-dimethyl-1,3-dinitrobenzene	$(NO_2)_2C_6H_2(CH_3)_2$	196 16
8936	**——, 2-ethyl-.**	2-ethyl-1,4-dimethylbenzene*	$(CH_3)_2C_6H_3C_2H_5$	134 21
8937	**——, hexahydro-.**	See *Cyclohexane*, 1,4-*dimethyl-*		
8938	**——, 2-nitro-**	.	$NO_2C_6H_3(CH_3)_2$	151 16
8939	**——, 2,3,5-trinitro-**		$(NO_2)_3C_6H(CH_3)_2$	241 16
8940	**α,α′-Xylenediol.**	See *Xylylene glycol.*		
8941	***o*-Xylene-4-sulfonic acid**	3,4-xylenesulfonic acid	$(CH_3)_2C_6H_3SO_3H$	186 22
8942	**2,3-Xylenol**	2,3-dimethylphenol, *vic-o*-xylenol	$(CH_3)_2C_6H_3OH$	122 16
8943	**2,4-Xylenol**	2,4-dimethylphenol; *as-m*-xylenol	$(CH_3)_2C_6H_3OH$	122 16
8944	**2,5-Xylenol**	2,5-dimethylphenol, *p*-xylenol	$(CH_3)_2C_6H_3OH$	122 16
8945	**2,6-Xylenol**	2,6-dimethylphenol; *vic-m*-xylenol	$(CH_3)_2C_6H_3OH$.	122 16
8946	**3,4-Xylenol**	3,4-dimethylphenol, *as-o*-xylenol	$(CH_3)_2C_6H_3OH$	122 16
8946M	**——, 2,5,6-tribromo-**		$(CH_3)_2C_6Br_3OH$	358 88
8947	**3,5-Xylenol**	3,5-dimethylphenol; *sym-m*-xylenol	$(CH_3)_2C_6H_3OH$	122 16
8947M	**——, 2,4,6-tribromo-**	.	$(CH_3)_2C_6Br_3OH$	358 88
8948	***vic-o*-Xylic acid.**	See *Hemellitic acid*		
8949	***sym-m*-Xylic acid.**	See *Mesitylenic acid.*		
8950	***p*-Xylic acid.**	See *Isoxylic acid*		
8951	**2,3-Xylic acid.**	See *Hemellitic acid.*		
8952	**2,4-Xylic acid**	2,4-dimethylbenzoic acid; *as-m*-xylic acid	$(CH_3)_2C_6H_3COOH$	150 17

*Name approved by the International Union of Chemistry

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8917	ylsh. cr. f. al.	......	101	..	.	s.	s. eth., CS_2, chl., bz.
8918	col. liq.....	0.8686^{20}_{4}	<-20	185-6	i.	v s	s eth.
8919	col. liq.......	0.861^{20}	<20	185	i.	s.	s. eth.
8920							
8921	liq..........	1.112^{15}	13	225	i	....	....
8922	liq	1.135^{15}	2	244	i.	s.	s. eth.
8923	col need f. al.	..	71	273.7	i	v. s.	v. s. eth.
8924	rhomb need f al + bz.	1.604^{19}	181.5	....	i.	0 039 c	sl s. eth.
8925	col monocl. or liq., $1.4942^{23.4}$	0.8611^{20}_{4}	13.2	138 5	i.	v. s.	v. s. eth.
8926	need. f al.	1.3237^{20}_{4}	38(34-5.5)	220.7	i.	v. s.	v. s. eth., chl.
8927	liq. ...		9	200	i	v. s.	v. s. eth.
8928	oil........ .	.	....	202	i.	∞	∞ eth.
8929	monocl. f. bz	2.012^{0}	143.5	245	i.	v. s.	2.65^{20} eth.; s. h. chl.
8930	monocl. pl. or leaf	1.417^{0}	100 5	240-50	i.	s.	v. s. eth.
8931							
8932							
8933	monocl. pr f. al		93		i.	s. h.	s. eth., chl, bz., acet.
8934	yel need. f al		147		i.	s. h.	s h. eth., bz., acet.
8935	need f al.		123-4		i.	sl. s.	s. eth.
8936	liq.	0.875^{22}	<-20	185	i.	sl. s.	s. eth.
8937							
8938	ylsh liq. .	1.132^{15}	....	239 9	i	s.	s. eth.
8939	col monocl need f. al	1.59^{19}	140	exp. 410	v. sl. s	s. h.	sl. s. eth.
8940							
8941	pl. f. dil H_2SO_4	. ....	d.	.....	s.		...
8942	lng. need f w	..	75	218	s.	s.	.
8943	col. need	1.036^{20}_{4}	26	211.5	v sl s	∞	∞ eth.
8944	col monocl f al + eth	1.169^{15}_{4}	74 5	211.5	s.	s.	v s. eth.
8945	col. leaf ...		49	212	s h	s	......
8946	need. f w.	1.023^{17}_{15}	65	225	s.	s	∞ eth.
8946M	col silky need		173-74	..	i	s	s eth
8947	need. f. w		68(64)	219 5	sl s	s.	s. NaOH
8947M	col need.		166		i.	v s.	s eth.
8948							
8949							
8950							
8951							
8952	col. monocl.		126	268	v. sl. s. h	v. s. h.	s. eth., bz., chl., acet., tol.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
8953	**2,5-Xylic acid.**	See *Isoxylic acid.*		
8954	**2,6-Xylic acid**	2,6-dimethylbenzoic acid; *vic-m*-xylic acid	$(CH_3)_2C_6H_3COOH$	150 17
8955	**3,4-Xylic acid**	3,4-dimethylbenzoic acid, *as-o*-xylic acid; paraxylic acid	$(CH_3)_2C_6H_3COOH$	150 17
8956	**3,5-Xylic acid.**	See *Mesitylenic acid.*		
8957	**2,3-Xylidine**	2,3-dimethylaniline; *vic-o*-xylidine	$(CH_3)_2C_6H_3NH_2$.	121 18
8958	**2,4-Xylidine**	2,4-dimethylaniline; *as-m*-xylidine	$(CH_3)_2C_6H_3NH_2$.	121 18
8959	**2,5-Xylidine**	2,5-dimethylaniline; *p*-xylidine	$(CH_3)_2C_6H_3NH_2$.	121 18
8960	**2,6-Xylidine**	2,6-dimethylaniline; *vic-m*-xylidine	$(CH_3)_2C_6H_3NH_2$.	121 18
8961	**3,4-Xylidine**	3,4-dimethylaniline, *as-o*-xylidine	$(CH_3)_2C_6H_3NH_2$.	121 18
8962	**3,5-Xylidine**	3,5-dimethylaniline, *sym-m*-xylidine	$(CH_3)_2C_6H_3NH_2$.	121 18
8963	***p*-Xylohydroquinone.**	See *Hydroquinone, 2,5-dimethyl-*.		
8964	***o*-Xyloquinone**	2,3-dimethylquinone	$(CH_3)_2C_6H_2O_2$.	136 14
8965	***m*-Xyloquinone**	2,6-dimethylquinone	$(CH_3)_2C_6H_2O_2$	136 14
8965M	**——, 3,5-dibromo-**		$(CH_3)_2C_6Br_2O_2$	293 96
8966	***p*-Xyloquinone.**	See *Phlorone*		
8967	***m*-Xylorcinol.**	See *Resorcinol, 4,6-dimethyl-*		
8968	***p*-Xylorcinol.**	See *Resorcinol, 2,5-dimethyl-*.		
8968M	D-**Xylose**, phenylosazone	D-xylosazone, D-lyxosazone	$C_{17}H_{20}N_4O_3$...	328 36
8969	D-**Xylose**	wood sugar	$C_5H_{10}O_5$	150 13
8970	**Xylyl bromide.**	See *Xylene α-bromo-*.		
8971	**Xylyl chloride.**	See *Xylene, α-chloro-*.		
8972	**Xylylene alcohol.**	See *Xylylene glycol*		
8973	**Xylylene bromide.**	See *Xylene, α,α'-dibromo-*.		
8974	**Xylylene chloride.**	See *Xylene, α,α'-dichloro-*.		
8975	**Xylylene cyanide.**	See *Benzenediacetonitrile*		
8976	***o*-Xylylene glycol**	α,α'-*o*-xylenediol; 1,2-benzenedicarbinol; *o*-xylylene alcohol; phthalyl alcohol	$C_6H_4(CH_2OH)_2$.	138 16
8977	***m*-Xylylene glycol**	α-α'-*m*-xylenediol, 1,3-benzenedicarbinol; *m*-xylylene alcohol	$C_6H_4(CH_2OH)_2$..	138 16
8978	***p*-Xylylene glycol**	α,α'-*p*-xylenediol, 1,4-benzenedicarbinol; *p*-xylylene alcohol	$C_6H_4(CH_2OH)_2$..	138 16
8979	**Yara-yara.**	See *Ether, methyl 2-naphthyl.*		
8980	**Yellow cross liquid**	See *Sulfide, β, β'-dichloroethyl.*		
8981	**Yohimbine**	corynine	$C_{21}H_{26}N_2O_3$	354 44
8982	——, hydrochloride(*d*)	corynine hydrochloride; aphrodine hydrochloride	$C_{21}H_{26}N_2O_3\ HCl$.	390 90
8983	——, nitrate		$C_{21}H_{26}N_2O_3{\cdot}HNO_3$	417 45
8985	**Yperite.**	See *Sulfide, β, β'-dichloroethyl*		
8986	**Zinc, diethyl-*.**	zinc ethyl, zinc diethyl; zinc ethide	$Zn(C_2H_5)_2$	123 50
8987	**——, dimethyl-***	zinc methyl; zinc methide	$Zn(CH_3)_2$	95 45
8987M	**Zinc ethide.**	See *Zinc, diethyl-**.		
8988	**Zinc methide.**	See *Zinc, dimethyl-**.		

*Name approved by the International Union of Chemistry.

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8953							
8954	col. need. f. lgr.	....	116	274 5	sl. s.	s.	v. s. eth.
8955	col. pr. f. al...	....	165–6	subl.	sl. s. h.	s.	s. eth., bz.
8956							
8957	liq , 1 570	0.991^{15}	<-15	223 8	v. sl. s.	v. s.	v. s. eth.
8958	liq., 1 559...	$0\ 974\frac{20}{4}$; $0.9761\frac{18}{4}$	....	216	v. sl. s.	s.	s. eth., bz.
8959	oil..........	0.980^{15}	15.5	217	v. sl. s.	0 980	s. eth.
8960	col. liq , 1 561	0 979	....	216.9	i.	s.	s. eth.
8961	monocl tab. f. lgr.	1 076	49	226	sl. s.	......	v. s. lgr.
8962	liq., 1 558	$0\ 972\frac{20}{4}$; $0\ 9935^{0}$	....	221	sl. s.	......	....
8963							
8964	yel need ..	. . ...	55	subl.	sl. s.	s.	s. eth.
8965	yel need.....	......	73	subl.	.	......	.. ..
8965M	yel pl . . .	. ...	174	.	i.	s.	s. eth.
8966							
8967							
8968							
8968M	bright yel. rhomb. need.; 1 725, 1 760, 1 805; $[\alpha]_D$:0 9 (al.)	0 85 (in al.)	160, d 167		sl s	s.	s eth , acet.
8969	wh. rhomb need., 1 517, 1 544, 1 546	$1\ 525\frac{20}{4}$; $1\ 535^{0}$	153(144)		117^{20}	$6\ 2^{20}$ 80%	v. sl s. eth.
8970							
8971							
8972							
8973							
8974							
8975							
8976	pl. f. eth	.. .	62 0–4 8	....	s.	s.	17.9 eth.
8977	col. cr. f. bz..	$1\ 161^{18}$	46–7	....	v. s.	... .	s. eth.
8978	need...........	....	112–3	....	v. s.	v. s.	v. s. eth.
8979							
8980							
8981	col. need f. w. +al	....	248(231)	....	v. sl. s.	v. s.	s. eth., chl., bz
8982	col. cr.......	....	295-300 d.	....	s.	......	... ...
8983	col. pr........	....	276	....	......	......	... .
8985							
8986	col. liq ign. in air	$1\ 182^{18}$	-28	118	d.	d.	s. eth.
8987	col liq ign. .	$1\ 386^{18}$	-40	46	d.	d	∞ eth
8987M							
8988							

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
64Z	**Acetanilide, *m*-ethoxy-.**	See *m-Acetophenetide.*		
71Z	**——, *m*-methoxy-.**	See *m-Acetaniside*		
83M	**——, *α*-trichloro-** . .	trichloroacetic anilide .	$CCl_3CONHC_6H_5$.	238 51
83T	***m*-Acetaniside** . .	*N*-acetyl-*m*-anisidine; *m*-methoxyacetanilide	$CH_3CONHC_6H_4$-OCH_3	165 19
87M	**Acetic acid,** acetonyl ester.	See *Acetol,* acetate		
107W	——, vinyl ester	vinyl acetate, ethenyl ethanoate*	CH_3COOCH CH_2	86 09
164F	**——, naphthyl-.**	See *Naphthaleneacetic acid*		
164T	**——, nitrilotri-**	trimethylamine-*α*, *α′*, *α″*-tricarboxylic acid, triglycolamidic acid; triglycollamic acid	$N(CH_2COOH)_3$ . . .	191 14
207C	**Acetol,** acetate . . .	acetonyl acetate, acetoxyacetone; acetylmethyl acetate	CH_3COOCH_2-$COCH_3$	116 11
222M	**Acetone, acetoxy-.**	See *Acetol,* acetate.		
238M	**——, hexamethyl-.**	See *3-Pentanone,* 2,2,4,4-*tetramethyl-**		
263W	***m*-Acetophenetide** .	*N*-acetyl-*m*-phenetidine; *m*-ethoxyacetanilide	$CH_3CONHC_6H_4$-OC_2H_5	179 21
285M	**Acetophenone, 3,4-dimethoxy-.**	See *Acetoveratrone.*		
285Q	**——, *m*-dimethyl-amino-**		$CH_3COC_6H_4N$-$(CH_3)_2$	163 21
285R	**——, *p*-dimethyl-amino-**	.	$CH_3COC_6H_4N$-$(CH_3)_2$	163 21
286W	**——, *o*-hydroxy-**	*o*-acetylphenol	$CH_3COC_6H_4OH$.	136 14
286X	**——, *m*-hydroxy-** .	*m*-acetylphenol .	$CH_3COC_6H_4OH$	136 14
288F	**——, 4-hydroxy-3-methoxy-.**	See *Acetovanillone.*		
293X	**——, *o*-methoxy-** . .	*o*-acetylanisole, *o*-anisyl methyl ketone	$CH_3COC_6H_4OCH_3$	150 17
293Y	**——, *m*-methoxy-** . .	*m*-acetylanisole, *m*-anisyl methyl ketone	$CH_3COC_6H_4OCH_3$	150 17
294X	**——, *o*-methyl-** .	methyl *o*-tolyl ketone	$CH_3COC_6H_4CH_3$	134 17
312M	**Acetovanillone** .	4-hydroxy-3-methoxyacetophenone, apocynin	$CH_3COC_6H_3(OH)$-OCH_3	166 16
312T	**Acetoveratrone**	3,4-dimethoxyacetophenone	$CH_3COC_6H_3$-$(OCH_3)_2$	180 20
372M	**Acridine, 6-chloro-9-(4-diethylamino-1-methylbutylamino)-2-**			
406E	**Acrylonitrile, *α*-methyl-.**	See *Methacrylonitrile*		
419S	**Alanine, *β*-(3,4-dihydroxyphenyl)-(*l*)**	*l*-2-amino-3-(3,4-dihydroxyphenyl)propanoic acid; *l*-dopa	$(HO)_2C_6H_3CH_2CH$-$(NH_2)COOH$	197 19
425F	**——, *β*, *β′*-methylenedithiodi-.**	See *Djenkolic acid*		
441M	**Aleuritic acid** . . .	9,10,16-trihydroxyhexadecanoic acid*; *θ*, *ι*, *o*, -trihydroxypalmitic acid	$C_{16}H_{32}O_5$	304 42
522M	**Amphetamine**.	*dl*-*α*-methylphenethylamine; *dl*-2-phenylisopropylamine; Benzedrine	$C_6H_5CH_2CH$-$(CH_3)NH_2$	135 20
555M	**Amyl phosphate (*n*)** . . .	tri-*n*-amyl phosphate	$(C_5H_{11})_3PO_4$	308 39
562F	**Androstane, 3(*α*)-hydroxy-17-keto-.**	See *Androsterone.*		
562L	**3-Androstenone, 17-hydroxy-.**	See *Testosterone.*		
562Q	**Androsterone** . .	3(*α*)-hydroxy-17-ketoandrostane	$C_{19}H_{30}O_2$	290 43

* Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
64Z							
71Z							
83M	sc		95-7		.	.	....
83T	nd or lf		80-1			v. s	. ...
87M							
107W	col liq, 1 3953	0 9317	-100 2	72 3[765]	2 5	∞	∞
164F							
164T	sm pr		258 9 d (246 d)		0 13[5]; 3 3[100]		....
207C	col liq, 1 415	1 075		174-5, 65[11]		s	s. eth.
222M							
238M							
263W	lf f w		96				. ...
285M							
285Q	col cr		42-3	148[13]			v s. eth.
285R	col cr		110 5	108 10[12]	v s h.	.	v s.eth, v.s.h. pet eth
286W	col liq, 1 558[21 3]	1 1307[20 8]		106-7[17]	sl s.	s.	s eth, ac. a.
286X	yel powd	.	99	.	v. s h	v s	v s eth, chl., ac a, bz; i. lgr.
288F							
293X	yel liq	.		245			....
293Y	col liq 1 543[1, 35]	1 0943[19]		239			. ...
294X	col liq 1 535[12]	$1\ 0201\frac{13}{4}$	.	92 3[17]			.
312M	pr f h w		115	295-300, 233-5[15 20]	s. h.	s	s. eth, bz, chl; sl s. lgr.
312T	pr f dil al		51	205 7[10-15]	s. h.	s.	s. eth, bz, chl.
372M	**methoxy-.** See *Quinacrine*						
406E							
419S	nd or pr f w		280		0 5	i.	i. eth., s. alk., a.
425F							
441M	lf or nd		101(102)				...
552M	liq			203 (205); 63-4[7]		.	
555M	col liq .	$0\ 9497\frac{26}{4}$		158-63[6]	i	s.	s. eth, tol., CS_2
562F							
562L							
562Q	lf or nd; $[\alpha]+94\ 6°$ (in al)		185 5.5 (184-5)	.	v. sl. s.	s.	s. eth.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
716V	**Anisole, acetyl-.**	See *Acetophenone, methoxy-*		
718M	**——, p-anisoyl-.**	See *Benzophenone, p,p'-dimethoxy-.*		
726M	**——, thio-.**	See *Sulfide, methyl phenyl*		
870M	**Apocynin.**	See *Acetovanillone*		
933M	**Atabrine, Atebrin.**	See *Quinacrine,* dihydrochloride.		
935M	**Atophan.**	See *Cinchoninic acid, 2-phenyl-.*		
950C	**Auxenetriolic acid.**	See *Auxin a*		
950E	**Auxenolonic acid.**	See *Auxin b*		
950H	**Auxin a**	auxenetriolic acid; 3-5-di-*sec*-butyl-α,β,δ-trihydroxy-1-cyclopentenevaleric acid	$C_{18}H_{32}O_5$	328 44
950J	**Auxin b.** . .	auxenolonic acid 3,5-di-*sec*-butyl-δ-hydroxy-β-oxo-2-cyclopentenevaleric acid	$C_{18}H_{30}O_4$	310 42
952M	**5-Azepotetrazole, 6,7,8,9-tetrahydro-.**	See *Metrazol*		
1032M	**Benz[j]aceanthrene.**	See *Cholanthrene*		
1062M	**Benzaldehyde, 4-hydroxy-3,5-dimethoxy-.**	See *Syringaldehyde.*		
1112M	**Benzedrine.**	See *Amphetamine*		
1255M	**Benzene, methylthio-.**	*See *Sulfide, methyl phenyl*		
1384M	**Benzenesulfonic acid, 3,4-dichloro-,** dihydrate	.	$Cl_2C_6H_3SO_3H\ 2H_2O$	263 10
1540B	**Benzoic acid, 3,5-dinitro-,** amyl ester		$(NO_2)_2C_6H_3COOC_5H_{11}$	282 25
1540D	——, ——, benzyl ester		$(NO_2)_2C_6H_3COOCH_2C_6H_5$	302 24
1540F	——, ——, butyl ester		$(NO_2)_2C_6H_3COOC_4H_9$	268 22
1540H	——, ——, ethyl ester		$(NO_2)_2C_6H_3COOC_2H_5$	240 17
1540Q	——, ——, isopropyl ester		$(NO_2)_2C_6H_3COOC_3H_7$	254 20
1540T	——, ——, methyl ester		$(NO_2)_2C_6H_3COOCH_3$	226 14
1540W	——, ——, phenyl ester		$(NO_2)_2C_6H_3COOC_6H_5$	288 21
1540Y	——, ——, propyl ester(*n*).	.	$(NO_2)_2C_6H_3COOC_3H_7$	254 20
1561M	**——, 4-hydroxy-3,5-dimethoxy-.**	See *Syringic acid.*		
1602J	**——, *m*-sulfo-,** dichloride	See *Benzoyl chloride, m-chlorosulfonyl-*		
1669M	**Benzophenone, *p,p'*-dimethoxy**	-*p*-anisoylanisole	$(CH_3OC_6H_4)_2CO$	242 26
1686M	**Benzopyran, dihydro-.**	See *Chroman.*		
1687M	**Benzo[*a*]pyrene, 1,2-Benzopyrene**	3,4-Benzpyrene .	$C_{20}H_{12}$	252 30
1719M	**2-Benzoxazolol**	2-hydroxybenzoxazole; 2(3)-benzoxazolone (tautomer); oxycarbanil	$C_6H_4OC(OH)N$	135 12
1725M	**Benzoyl chloride, *m*-chlorosulfonyl-**	*m*-sulfobenzoyl dichloride	$ClSO_2C_6H_4COCl$	239 08
1737M	**Benzpyrene.**	See *Benzopyrene.*		
1813M	**3,3'-Bicoumarinyl.**	See *Dicoumarin*		
1818M	**Bicyclohexyl**	Dicyclohexyl; dodecahydrobiphenyl	$C_6H_{11}C_6H_{11}$ ...	166 30
1841M	**Biotin** ...	hexahydro-2-oxo-1-thieno-[3,4]imidazole-4-valeric acid, vitamin H; coenzyme R	$C_{10}H_{16}N_2O_3S$	244 30

* Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
716V							
718M							
726M							
870M							
933M							
935M							
950C							
950E							
950H	hex. cr. [α] − 3.19° (alc)	. .	196	...	sl. s.	s.	sl. s eth, i pet. eth
950J	cr. [α] − 2.8°	. ...	183	...			.
952M							
1032M							
1062M							
1112M							
1255M							
1384M	need	. . .	69–70 (71-2)		v s	v s.	v. s eth; i c chl; sl s h chl
1540B			46			s h.	
1540D			112				
1540F	monocl. nd, 1 488, 1 621		63			s h.	.
1540H	monocl nd, 1.560, 1 576		93			s h.	
1540Q	monocl nd, (β)1.609		122			s h.	
1540T	monocl. pl., 1 382, 1 780	. .	108			s h.	
1540W	col rods, 1.505, 1 690, >1 740		145 8	.	i.	s h.	v. s eth
1540Y	monocl pl, 1 486, 1 603	.....	73	.. .		s h.	
1561M							
1602J							
1669M	wh nd	.	144	..		v s h	v. s. chl., bz
1686M							
1687M	lt. yel nd		(176-7)	310-12[10]	i.	. . .	
1719M	nd . .	. ...	141-2(137)	>360	sl s.	s.	s.
1725M	.. . . . .	. .. ...	20 4	153-4[7]		.	
1737M							
1813M							
1818M	col. liq. 1.4766	0.8644^{20}	3 65	234	<0 01	∞ (abs al. above 23.4)	∞
1841M	lng nd . ..	1 41	230-2	....	.. ...	.	. . .

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
1877M	**Biphenyl, dodecahydr**	**o-.** See *Bicyclohexyl*		
1983M	**Bromoprene.**	See 1,3-*Butadiene, 2-bromo-**.		
1991M	**1,3-Butadiene, 2-bromo-***	bromoprene	$CH_2:CBrCH:CH_2$	133 00
2008M	**Butane, 1-butoxy-3-methyl-*.**	See *Ether, butyl isoamyl*		
2036F	**——, 1-(2-methylprop**	**oxy)-*.** See *Ether, butyl iso*	*butyl*	
2036J	**——, 3-methyl-1-prop**	**oxy-*.** See *Ether, isoamyl pr*	*opyl*	
2039M	**——, 1-propoxy-*.**	See *Ether, butyl propyl*		
2177F	**2,3-Butylene glycol.**	See 2,3-*Butanediol* in the Mai	n Table	
2186Q	***tert*-Butyl ketone.**	See 3-*Pentanone, 2,2,4,4-tetra*	*methyl-**	
2193M	**Butyl phosphate (n).**	tri-*n*-butyl phosphate	$(C_4H_9)_3PO_4$	266 32
2239F	**Butyric acid, α-amino-**	**γ-(aminooxy)-.** See *Can*	*aline*	
2239M	**——, α-amino-γ-(guan**	**idooxy)-.** See *Canavanine*		
2239Q	**——, α-amino- α-hydr**	**oxy-.** See *Threonine*		
2328F	**Canaline**	α-amino-γ-(aminooxy)-butyric acid	$H_2NOCH_2CH_2CH(NH_2)COOH$	134 14
2328M	**Canavanine**	α-amino-γ-(guanidooxy)-butyric acid	$CH_4N_3OCH_2CH_2$-$CH(NH_2)COOH$	176 18
2329M	**Cannabidiol**		$C_{21}H_{30}O_2$	314 45
2329Q	**Cannabinol** . .	3-amyl-1-hydroxy-6,6,9-trimethyl-5-dibenzopyrone	$C_{21}H_{26}O_2$	310 42
2446J	**Carbazone, diphenylt**	**hio-.** See *Dithizone*		
2595M	**Cardiazol.**	See *Metrazol*		
2652M	**Cetyl mercaptan.**	See 1-*Hexadecanethiol**.		
2690M	**Cholanthrene** .	benz[*j*]aceanthrene	$C_{20}H_{14}$	254 31
2690T	**Cholanthrene, 3-methyl-.**	20-methylcholanthrene	$C_{21}H_{16}$	268 34
2698M	**Chroman** .	3,4-dihydro-1,2-benzopyran, 2,3-dihydro-1,4-benzopyran	$C_9H_{10}O$	134 17
2698T	**——, 6-hydroxy-2,5 (o**	**r 7), 8-trimethyl-2-(4,**	**8, 12-trimethyl**	
2731R	**Cinchoninic acid 2-phenyl-**	cincophen, atophan, quinophan	$C_6H_5C_9H_5NCOOH$	249 26
2731W	**Cincophen.**	See *Cinchoninic acid, 2-pheny*	*l-*	
2799M	**Citrulline**	α-amino-δ-ureidovaleric acid, N^δ-carbamylornithine, δ-ureidonorvaline	$H_2NCONH(CH_2)_3$-$CH(NH_2)COOH$	175 19
2810M	**Coenzyme R.**	See *Biotin*		
2827M	**Coniferin, methoxy-.**	See *Syringin*		
2837J	**Coronene** .		$C_{24}H_{12}$	300 34
2837M	**Corticosterone**	11,21-dihydroxyprogesterone	$C_{21}H_{30}O_4$	346 45
2975J	**1,3-Cyclobutanedicarb**	**oxylic acid, bis-(*o*-hydro**	**xyphenyl)-,** dila	ctone
3035M	**2-Cyclohexen-1-one, 3,**	**5,5-trimethyl-*.** See *Iso*	*phorone*	
3047M	**Cyclopentane, methyl-**		$C_5H_9CH_3$	84 16
3060M	**2-Cyclopentenevaleric**	**acid, 3,5-di-*sec*-butyl-δ**	**-hydroxy-β-oxo**	**-.**
3060P	**1-Cyclopentenevaleric**	**acid, 3,5-di-*sec*-butyl α,**	**β,δ-trihyrdoxy.-**	
3094F	**DDT.**	See *Ethane, 1-trichloro-2,2-bis*	*(p-chlorophenyl)-*	
3104M	**1-Decanethiol*** .	*n*-decyl mercaptan	$CH_3(CH_2)_9SH$	174 34
3117M	***cis*-5-Decene*** ..	*cis*-1,2-dibutylethylene	$[CH_3(CH_2)_3CH:]_2$	140 26
3117N	***trans*-5-Decene***	*trans*-1,2-dibutylethylene	$[CH_3(CH_2)_3CH:]_2$	140 26
3117T	**1-Decene-1,10-dicarbo**	**xylic acid.** See *Traumatic*	*acid*	
3130M	***n*-Decyl mercaptan.**	See 1-*Decanethiol**.		
3141J	**Desoxycorticosterone.**	deoxycorticosterone; 21-hydroxyprogesterone	$C_{21}H_{30}O_3$.	330 45

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
1877M							
1983M							
1991M	liq., 1.4988	1.397		$42\text{–}3^{165}$	i.	s.	s. eth.
2008M							
2036F							
2036J							
2039M							
2177F							
2186Q							
2193M	col. liq	0.9727^{25}_{4}		289; $160\text{–}2^{15}$	i.	s.	s. eth., tol., CS_2
2239F							
2239M							
2239Q							
2328F	nd f al; $[\alpha]^{21}$ −8.31°		214 d.				....
2328M	cr f al; $[\alpha]$ +7.9°		184				.
2329M	rods f. pet eth		66–7	$187\text{–}90^{2}$	i.	s.	s eth., bz., chl.
2329Q	pl or lf, $[\alpha]$ −148° (alc)		76–7	$185^{0.05}$	i.	s.	s. alk.
2446J							
2595M							
2652M							
2690M	pa yel lf		173(170–1)		i.		
2690T	pa yel nd		176.5–7.5		i.		
2698M	liq 1.544	1.064		$214\text{–}5^{749}$; 95^{12}	s. h.		∞ org. solv.
2698T	**tridecyl.**) See *Tocopherol*						
2731R	sm. wh nd		209(212–3)	...	i c., s h.	0.8	s eth; 0.25 chl; sl s. bz.
2731W							
2799M	pr; $[\alpha]$ +3.7°		222	....	s.	i.	....
2810M							
2827M							
2837J	yel nd		437–40	.			s. h. bz.
2837M	pl or nd, $[\alpha]_{D}$ +222° (in al)		181–2 (177–9)				
2475J	See *Dicoumarin*						
3035M							
3047M	col liq, 1.4098^{20}	0.7488	−142.4	71.8	i.	∞	∞ eth., bz.
3060M	See *Aurin b*						
3060P	See *Aurin a*						
3094F							
3104M	col liq, 1.4558			$132\text{–}4^{40}$	i.	s.	s eth.
3117M	col liq, 1.4252	0.7445	112	169.5^{739}	i.	∞	∞ eth.
3117N	col liq, 1.4235	0.7401	-73	170.2^{739}	i.	∞	∞ eth.
3117T							
3130M							
3141J	$[\alpha]^{22}$ 178° (in al)		141–2	...	sl. s.	s.	s. acet.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol Wt
3192M	**5-Dibenzopyrone, 3-amyl-1-hydroxy-6,6,9-trimethyl-.**	See *Cannabin*		
3208L	**Dicoumarin** (Ciamician, Silber)	3,4-bis(o-hydroxyphenyl)-1,2-cyclobutane dicarboxylic dilactone	$C_{18}H_{12}O_4$	292.28
3208M	**Dicoumarin** (Fittig, Dyson)	3,3′-bicoumarinyl	$C_{18}H_{10}O_4$	290.26
3208N	**Dicoumarin** (Strom) .	2,4-bis(*o*-hydroxyphenyl)-1,3-cyclobutanedicarboxylic dilactone	$C_{18}H_{12}O_4$	292.28
3210M	**Dicyclohexyl.**	See *Bicyclohexyl*		
3376M	**Dithizone** ..	phenylazothionoformic phenylhydrazide, formazyl mercaptan; diphenylthiocarbazone	$C_6H_5N.NCSNHNHC_6H_5$ or C_6H_5-N:NC(SH):NN-HC_6H_5	256.32
3382M	**Djenkolic acid** . . .	3,3′-methylenedithiobis-(2-aminopropanoic acid), β,β'-methylenedithiodialanine	$CH_2(SCH_2CHNH_2$-$COOH)_2$	254.32
3389M	**Dodecanamide*.**	See *Lauramide*		
3393M	**1-Dodecanethiol***	*n*-dodecyl mercaptan	$CH_3(CH_2)_{11}SH$	202.39
3398F	**2-Dodecenedioic acid*.**	See *Traumatic acid*		
3400C	**Dodecylamine,** hydrochloride	dodecylammonium chloride	$CH_3(CH_2)_{11}NH_3Cl$	221.81
3401M	***n*-Dodecyl mercaptan.**	See 1-*Dodecanethiol**		
3402W	**Dopa.**	See *Alanine, β-(3,4-dihydroxyphenyl)-*		
3445D	**Enanthonitrile**	heptanenitrile*, *n*-hexyl cyanide	$CH_3(CH_2)_5CN$	111.18
3478M	**Estradiol**	$\Delta^{1,3,5(10)}$-estratriene-3,17-diol; dihydroxyestrin, dihydrotheelin, dihydromenformone	$C_{18}H_{24}O_2$	272.37
3479F	**$\Delta^{1,3,5(10)}$-Estratriene-3,17-diol.**	See *Estradiol*		
3479J	**Estrin, dihydroxy-.**	See *Estradiol*		
3479M	**——, trihydroxy-.**	See *Estriol.*		
3479Q	**Estriol** . . .	oestriol, theelol, trihydroxyestrin	$C_{18}H_{24}O_3$	288.37
3479T	**Estrone**	oestrone; theelin; menformone	$C_{18}H_{22}O_2$	270.36
3502F	**Ethane, 1-chloro-1-nitro-***		$CH_3CH(Cl)NO_2$	109.52
3509M	**——, dichlorodiphenyltrichloro-.**	See *Ethane, 1,1,1-trichloro-2,2-bis-(p-chlorophenyl)-*		
3555J	**——, 1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)-**	dichlorodiphenyltrichloroethane; DDT	$CCl_3CH(C_6H_4Cl)_2$.	354.50
3578M	**Ethaneorthosiliconic acid,** triethyl ester	triethoxyethylsilicane	$C_2H_5Si(OC_2H_5)_3$.	192.30
3578Q	**——,** trimethyl ester	ethyltrimethoxysilicane	$C_2H_5Si(OCH_3)_3$.	150.22
3680J	**Ether, butyl isoamyl**	1-butoxy-3-methylbutane*	$C_4H_9OC_5H_{11}$	144.25
3680Q	**——, butyl isobutyl**	1-(2-methylpropoxy)-butane*	$CH_3(CH_2)_3OCH_2$-$CH(CH_3)_2$	130.22
3682M	**——, butyl propyl**	1-propoxybutane* ..	$CH_3(CH_2)_2O$-$(CH_2)_3CH_3$	116.20

* Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
3192M	ol.						
3208L	lf. f. glac. ac.a		262				.
3208M	nd. f. glac ac a		>330	.		i.	i. eth , bz.; v. sl. s. chl.
3208N	nd. or lf. f. glac ac a.		>275	.	. .		
3210M							
3376M	bl. blk. cr . .				i.	sl. s.	sl. s eth ; s chl., alk
3382M	nd ; $[\alpha]^{26}$ − 44 5°	.	300-50d			. .	. .
3389M							
3393M	col. liq., 1 4589		.	143	i.	s.	s. eth
3398F							
3400C	col cr		d > 150		0 4^{25}; 33 3^{30} 77^{60} 103^{100}	20 0^{20} 66^{40} 157^{60} (95%)	i. eth ; $i.^{0-40}$, 6 2^{50}, 46 5^{70} bz.
3401M							
3402W							
3445D	1 41037^{30}	0 80176^{30}_{4}	-65	186 1; 74 7^{16}	v. sl. s	∞ abs., 95%	∞ eth., bz., CCl_4, chl., acet , ac a , me. al meCN
3478M	(α)[α] + 81° (alc); (β)$[\alpha]^{18}$ + 56 7° (alc)		(α)170–8 (β)222	. .		. .	(α) s pet. eth.
3479F							
3479J							
3479M							
3479Q	[α] + 30°		281	. .		sl. s.	s. pyr ; sl. s. me al., pet eth
3479T	[α] − 167°	.	. . . .		0 002	v sl s.	s pet. eth , sl. s. acet.; v. sl s. bz
3502F	liq , 1 423	1 258^{20}_{20}		124–5^{758}	0 4^{20}	s	s. eth., glycols, esters, min. oil
3509M							
3555J	nd. f. al . .		107	d	i.	s.	s. eth., bz.
3578M	.	0 9281	.	158–60	.	. . . .	. . . . .
3578Q		0 9747^{0}		125–6		s.	.
3680J	liq	.		157^{756}	i	s.	∞ eth
3680Q	liq	0 763		131 5 32	i.	s.	∞ eth
3682M	liq .	0 7773		117	i.	s.	∞ eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
3690M	**Ether, 2-chloroethyl phenyl.**	See *Phenetole, β-chloro-*.		
3709M	**——, difurfuryl.**	See *Furfuryl ether.*		
3751J	**——, isoamyl propyl**	3-methyl-1-propoxybutane*	$C_3H_7OC_5H_{11}$....	130.22
3753J	**——, isobutyl propyl**.	2-methyl-1-propoxypropane*	$(CH_3)_2CHCH_2O(CH_2)_2CH_3$	116.20
3755F	**——, isopropyl propyl**	2-propoxypropane*	$(CH_3)_2CHOCH_2CH_2CH_3$	102.17
3815M	**Ethylene, 1-butyl-2-ethyl-.**	See *3-Octene**.		
3821M	**——, 1,2-dibutyl-.**	See *5-Decene*		
3833M	**——, 1,2-dipropyl-.**	See *4-Octene**.		
3881M	**Ethylenediamine, *N,N*-diethyl-**		$H_2NCH_2CH_2N(C_2H_5)_2$	116.20
4015M	**Formazyl mercaptan.**	See *Dithizone*		
4046F	**Formic acid, phenylazothiono-,** phenylhydrazide.		See *Dithizone*	
4070M	**Fumaryl chloride** ..	*trans*-butenedioyl chloride*	$(ClCOCH{:})_2$	152.97
4140M	**Furfuryl alcohol, tetrahydro-,** stearate	See *Stearic acid, tetrahydrofurfuryl ester.*		
4143J	**Furfuryl ether** .	difurfuryl ether; di-*α*-furfuryl ether	$(C_4H_3O{\cdot}CH_2)_2O$	178.18
4157M	**Gallaldehyde, 3,5-dimethyl ether.**	See *Syringaldehyde.*		
4160M	**Gallic acid,** 3,5-dimethyl ether.	See *Syringic acid*		
4204F	**Glucurone**	glucuronic acid lactone	$C_5H_8O_4COO$	176.12
4204K	***β*-D-Glucuronic acid**		$C_5H_9O_5COOH$	194.14
4400M	**Guanidine, 1-sulfanilyl-.**	See *Sulfaguanidine.*		
4475M	**Heptanenitrile*.**	See *Enanthonitrile*		
4522M	**Heteroauxin.**	See *3-Indoleacetic acid*		
4532M	**1-Hexadecanethiol*** .	cetyl mercaptan, *n*-hexadecyl mercaptan	$CH_3(CH_2)_{15}SH$	258.49
4538M	***n*-Hexadecyl mercaptan.**	See *1-Hexadecanethiol**.		
4569M	**Hexane, 1-hexylthio-*.**	See *Hexyl sulfide*		
4623A	***cis*-2-Hexene*** ...		$CH_3CH{:}CHCH_2CH_2CH_3$	84.16
4623B	***trans*-2-Hexene*** ...		$CH_3CH{:}CHCH_2CH_2CH_3$	84.16
4628A	***cis*-3-Hexene*** .		$CH_3CH_2CH{:}CHCH_2CH_3$	84.16
4628B	***trans*-3-Hexene*** .		$CH_3CH_2CH{:}CHCH_2CH_3$	84.16
4643M	***n*-Hexyl cyanide.**	See *Enanthonitrile*		
4649F	**Hexyl sulfide** .	di-*n*-hexyl sulfide, 1-hexylthiohexane*	$[CH_3(CH_2)_5]_2S$	202.39
4658J	***l*-Histidine,** bis-3,4-dichlorobenzenesulfonate		$C_6H_9N_3O_2(Cl_2C_6H_3SO_3H)_2$	609.29
4675J	**Hydantoin, 5,5-diphenyl-**		$C_{15}H_{12}N_2O_2$	252.26
4882M	**Indole, 1,3-dimethyl-**	*N*-methylskatole	$C_6H_4N(CH_3)CH{:}C(CH_3)$	145.20
4884M	**3-Indoleacetic acid** ...	heteroauxin; indole-*β*-acetic acid	$C_8H_6NCH_2COOH$	175.18
4950M	**Isobutenol.**	See *2-Propen-1-ol, 2-methyl-**		
4950T	**Isobutenyl chloride.**	See *Propene, 3-chloro-2-methyl-**.		
4996F	**Isobutyric acid, *α*-hydroxy-,** ethyl ester		$(CH_3)_2COHCOOC_2H_5$	132.16
5026M	**Isocrotyl chloride.**	See *Propene, 1-chloro-2-methyl-**		
5053M	**Isohemipinic acid** ..	4,5-dimethoxyisophthalic acid	$(CH_3O)_2C_6H_2(COOH)_2$	226.18

* Name approved by the International Union of Chemistry.

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
3690M							
3709M							
3751J	liq ..			130	i.	s.	∞ eth.
3753J	liq .			105-6	i.	s.	∞ eth.
3755F	liq			82-3	i.	s	∞ eth.
3815M							
3821M							
3833M							
3881M	liq	$0.827\frac{18.5}{18.5}$		145; 75^{20}	sl. s.	s	s. eth., tol.
4015M							
4046F							
4070M	1.500^{18}	1.410		160			
4140M							
4143J	col. liq., 1.5088	1.1405, $1.137\frac{20}{0}$		101^{2}; $88\text{-}9^{1}$	i.		.
4157M							
4160M							
4204F	monocl. pl., [α] + 19.21° (in w.)		175-8		s.	i.	
4204K	need., $[\alpha]^{24}$ + 11.73→36.26° (5.6% i. w.)		156		s.	s.	i. eth.
4400M							
4475M							
4522M							
4532M	col. liq., 1.4623		18	$167\text{-}70^{3}$	i.	sl. s.	s. eth.
4538M							
4569M							
4623A	col. liq., 1.3954	0.6845	-146	68.2^{749}	i.	∞	∞ eth.
4623B	col. liq., 1.3935	0.6780	-133	67.5^{750}	i.	∞	∞ eth.
4628A	col. liq., 1.3934	0.6796	-135	66.8^{741}	i	∞	∞ eth.
4628B	col. liq., 1.3938	0.6779	-113	67.5^{741}	i	∞	∞ eth
4643M							
4649F	1.459	0.841		230, 113.5^{4}			
4658J	rhomb. need		280-1 d		sl. s. c.; s. h	i	0.051^{8} 10% w. sol reagent
4675J	cr		286		i	s	s. acet., ac. a.; sl. s. chl., bz.
4882M	liq			225-32, $135\text{-}8^{18}$			.
4884M	lf. f. bz., pl. f. chl.; [α] − 3.8° (alc.)		165		v. sl. s.	v. s.	v. s. eth.
4950M							
4950T							
4996F	.	.		150	∞	∞	∞
5026M							
5053M	nd. f. w.		245-6	..	sl. s. h	s.	s. eth.

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol. Wt.
5078M	**3-Isophenoxazinone,** 10-oxide.	See *Resazurin*.		
5078T	**Isophorone**...........	3,5,5-trimethyl-2-cyclohexen-1-one*	$C_9H_{14}O$	138 20
5086M	**Isophthalic acid, 4,5-dimethoxy-.**	See *Isohemipinic acid*.		
5099M	**Isopropylamine,** *dl*-**2-phenyl-.**	See *Amphetamine*.		
5180T	**Ketone, anisyl methyl.**	See *Acetophenone, methoxy-*.		
5264W	——, **methyl** *o*-**tolyl.**	See *Acetone, o-methyl-*.		
5286M	**Lactic acid,** isopropyl ester	isopropyl 2-hydroxypropanoate*	$CH_3CHOHCOOCH(CH_3)_2$	132 16
5287M	——, phenyl ether.	See *Propionic acid, α-phenoxy-*.		
5300F	**Lactonitrile,** acetate ..	α-cyanoethyl acetate; α-acetoxypropionitrile	$CH_3CH(OOCCH_3)CN$	113 11
5308F	**Lauramide**	dodecanamide*	$CH_3(CH_2)_{10}CONH_2$	199 33
5308M	——, ***N*-phenyl-.**	See *Lauranilide*		
5308T	**Lauranilide** ...	N-phenyldodecanamide; N-phenyllauramide	$CH_3(CH_2)_{10}CONHC_6H_5$	275 42
5314H	**Lauric acid,** methyl ester	methyl laurate	$C_{11}H_{23}COOCH_3$	214 34
5504M	**α-Menaphthyl chloride.**	See *Naphthalene, 1-(chloromethyl)-*		
5504R	**Menformone.**	See *Estrone*		
5504U	——, **dihydro-.**	See *Estradiol*.		
5532M	**Mepacrine.**	See *Quinacrine*, dihydrochloride		
5580W	**Methacrylic anhydride**	.	$[CH_2:C(CH_3)CO]_2O$	154 16
5580X	**Methacrylonitrile** ...	α-methylacrylonitrile; 2-methylpropenenitrile*	$CH_2:C(CH_3)CN$	67 09
5580Y	**Methallyl alcohol.**	See *2-Propen-1-ol, 2-methyl-**.		
5580Z	**Methallyl chloride.**	See *Propene, 3-chloro-2-methyl-**.		
5707M	**Methaneorthosiliconic acid,** ethyl ester	triethoxymethylsilicane	$CH_3Si(OC_2H_5)_3$	178 27
5761M	**Methyl orthosilicate**..	methyl silicate tetramethoxysilicane	$(CH_3)_4SiO_4$	152 20
5771M	**Metrazol**	6,7,8,9-tetrahydro-5-azepotetrazole; pentamethylenetetrazole, Cardiazol	$C_6H_{10}N_4$	138 17
5771T	**Metycaine**	2-methyl-1-piperidine-propanol benzoate-hydrochloride	$C_{16}H_{24}ClNO_2$	297 82
5779M	**Monophenyl orthophosphate.**	See *Phenylphosphoric acid*		
5819M	**Myristic acid,** methyl ester	methyl myristate	$C_{13}H_{27}COOCH_3$	242 39
5844M	**Naphthalene, 1-(chloromethyl)-**	α-menaphthyl chloride	$C_{10}H_7CH_2Cl$ ..	176 64
5897M	**1-Naphthaleneacetic acid**	α-naphthylacetic acid ..	$C_{10}H_7CH_2COOH$.	186 20
5972M	**1-Naphthol, 4-*p*-nitrophenylazo-**	*p*-nitrobenzeneazo-α-naphthol	$O_2NC_6H_4N:NC_{10}H_6OH$	293 27
6038R	**1,-4-Naphthoquinone, 2-methyl-**	vitamin K (one form) .	$C_{11}H_8O_2$	172 17

* Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc
5078M							
5078T	.	0 9229$\frac{20}{20}$		252	.		.
5086M							
5099M							
5180T							
5264W							
5286M	col. liq			166 5	s	s.	s. eth., bz.
5287M							
5300F	liq	1 032^{14}		172-3; 60-2^{10}	4 0	s	v. s. alk., eth., glac. ac a
5308F	col cr		frz 102.4		i.	9 0^{30} (95%)	v sl. s. eth., bz., CCl_4, chl ; sl s. acet.; s. me. al.
5308M							
5308T	col. cr		frz 77.2		i.	17 6^{30} (95%)	s. eth., bz , CCl_4, chl., acet , me. al.
5314H	col oil		frz. 5.15	. . .	i.	∞ abs 95%	∞ eth , bz., CCl_4, chl , et. acetate, acet., ac. a., me. al.
5504M							
5504R							
5504U							
5532M							
5580W	col liq , 1 4525^{25}	1 0243		98^{25}; 84^{11}	d.	∞	∞
5580X	col. liq , 1 4002	0 805	-40	90		∞	∞
5580Y							
5580Z							
5707M		0 938		150-1		s.	. . .
5761M		1 028^{22}		121-2$^{7.9}$; 25-27^{12}		s.	.
5771M	sm cr		59(57-8)		v. s	..	v. s. org. solv.
5771T	sm cr		171-3		v. s	s.	i. eth ; s. chl
5779M							
5819M	col oil		frz 18 37	.	i.	∞ abs., 95%	∞ eth., bz., CCl_4, chl , et. acetate, acet., ac. a., me. al
5844M	pr		32(34)	291-2; 134^{3}			
5897M	need		134(131)	d.	0.042$^{20.5}$; s. hot	s.	s. eth., bz., glac. ac a.
5972M	br -red nd		277-9d		v. sl. s.		s. boiling $PhNO_2$
6038R	yel. nd		106(104)		sl. s.	s.	s. eth., bz , ac. a.; sl. s pet. eth.

For explanations and abbreviations see beginning of table

No.	Name	Synonyms	Formula	Mol. Wt.
6038U	**1,4-Naphthoquinone,2-methyl-3-phytyl-.** See *Vitamin K_1*.			
6127M	**Niacin.**	See *Nicotinic acid*, in the Main Table.		
6139M	**Niperyt.**	See *Pentaerythritol*, tetranitrate.		
6151M	**"Nitrogen mustard gas."** See *Triethylamine, 2,2',2''-trichloro-*			
6214M	***l*-Nornicotine**	*l*-3-(2-pyrrolidyl)pyridine	$C_9H_{12}N_2$	148 20
6215M	**Norvaline.**	See *Valeric acid, α-amino-*, in the Main Table.		
6215S	——, **δ-ureido-.**	See *Citrulline*		
6225M	**1-Octadecanethiol***	*n*-octadecyl mercaptan	$CH_3(CH_2)_{17}SH$	286 54
6234M	**Octadecylamine,** hydrochloride	octadecylammonium chloride	$C_{18}H_{37}NH_3Cl$	305 97
6235T	***n*-Octadecyl mercaptan.** See *1-Octadecanethiol**.			
6277J	***cis*-3-Octene***	1-butyl-2-ethylethylene	$CH_3CH_2CH{:}CH(CH_2)_3CH_3$	112 21
6277K	***trans*-3-Octene***	*trans*-1-butyl-2-ethylethylene	$CH_3CH_2CH{:}CH(CH_2)_3CH_3$	112 21
6277Q	***cis*-4-Octene***	*cis*-1,2-dipropylethylene	$[CH_3(CH_2)_2CH{:}]_2$	112 21
6277R	***trans*-4-Octene***	*trans*-1,2-dipropylethylene	$[CH_3(CH_2)_2CH{:}]_2$	112 21
6302M	**Oestr-.**	See *Estr-*		
6321M	**Ornithine, N^{δ}-carbamyl-.** See *Citrulline*.			
6394M	**Oxycarbanil.**	See *2-Benzoxazolol*		
6401F	**Palmitamide, *N*-phenyl-.** See *Palmitanilide*			
6401M	**Palmitanilide**	*N*-phenylhexadecanamide; *N*-phenylpalmitamide	$CH_3(CH_2)_{14}CONHC_6H_5$	331 52
6403M	**Palmitic acid,** butyl ester	butyl hexadecanoate*	$C_{15}H_{31}COOC_4H_9$	312 52
6409Q	——, **θ,ι,ο-trihydroxy-.**	See *Aleuritic acid.*		
6457V	**Pentadecanoic acid***	*n*-pentadecylic acid	$CH_3(CH_2)_{13}COOH$	242 39
6468J	**Pentaerythritol,** tetranitrate	penthrit(e); pentrit(e); PETN, niperyt	$C(CH_2NO_3)_4$	316 15
6560M	**3-Pentanone, 2,2,4,4-tetramethyl-***	Hexamethylacetone; *tert*-butyl ketone; pivalone	$(CH_3)_3CCOC(CH_3)_3$	142 23
6592T	**Penthrit(e), Pentrit(e), PETN.** See *Pentaerythritol*, tetranitrate.			
6615J	**Phenanthrene, 9-bromo-**		$C_{14}H_9Br$	257 13
6626T	——, quinhydrone		$C_{28}H_{18}O_4$	418 42
6648M	**Phenethylamine, *dl*-α-methyl-.** See *Amphetamine*			
6660C	**Phenetole, β-chloro-**	2-chloroethyl phenyl ether	$C_6H_5OCH_2CH_2Cl$	156 61
6670A	**Phenol, acetyl-.**	See *Acetophenone, hydroxy-.*		
6795M	——, ***p*-propionyl-.**	See *Propiophenone, p-hydroxy-.*		
6836M	**o-Phenylenediamine, 4-chloro-**		$ClC_6H_3(NH_2)_2$	142 59
6858M	**Phenyl phosphate**	triphenyl orthophosphate	$(C_6H_5)_3PO_4$	326 28
6858Q	**Phenylphosphoric acid.**	monophenyl orthophosphate; dihydrogen phenyl phosphate	$C_6H_5OPO(OH)_2$	174 10

* Name approved by the International Union of Chemistry

No	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
6038U							
6127M							
6139M							
6151M							
6214M	col liq 1.538^{18} $[\alpha]-88.8^{\circ 22}$	1.074		266–7; 131^{11}	s.	..	....
6215M							
6215S							
6225M	solid, 1.4648 ..		20–30	$169\text{–}71^{1}$	i	sl s.	s. eth.
6234M	col cr .		d > 180	.	i^{0-55}, 7.8^{60}; 12.7^{100}	2.3^{30}, 11.3^{50}, 80^{70} (95%)	i. eth., bz.
6235T							
6277J	col liq, 1.4125	0.7189	−126	122.3^{741}	i.	∞	∞ eth.
6277K	col liq, 1.4124	0.7163	−108	122.4^{741}	i	∞	∞ eth.
6277Q	col liq, 1.4136	0.7205	−118	121.7^{739}	i	∞	∞ eth
6277R	col liq, 1.4116	0.7147	−94	121.4^{739}	i	∞	∞ eth
6302M							
6321M							
6394M							
6401F							
6401M	col cr		frz 90.2		i	1.7^{30} (95%)	sl. s. bz., CCl_4, chl, acet, me. al
6403M	col oil		(α) frz 14.88, (β) m 18.3		i	∞ abs, 95%	∞ eth, bz, CCl_4, chl, et acetate, acet., ac. a., me. al.
6409Q							
6457V	1.4348^{55}, 1.4254^{80}	0.8423^{80}	frz 52.54	212.0^{16}, 157.8^{1}	0.0012^{20}, 0.0020^{60}	3.1^{0}, 15.6^{20}, 230^{40} (95%)	s. eth, CS_2; 31.8 bz., 35.4 CCl_4, 56.5 chl; 10.9 acet, 9.2 ac. a, 13.0 me. al
6468J	tetr cr	1.773	140–1 (138–40)		sl s.	sl. s	v sl s eth.; s acet
6560M	col liq 1.41702^{25}	0.81992^{25}_{4}		149–51		∞	v s eth, bz.
6592T							
6615J	col pr		63		i	v sl s.	s. eth, ac. a., CS_2
6626T	blk nd		167.9				
6648M							
6660C	pr		28	220, $100\text{–}2^{12}$	i	v. s	v s eth., bz., lgr
6670A							
6795M							
6836M	lf		76		sl s c w	s	s eth.
6858M	pr f al		49.5	245^{11}	i	s.	s. eth, bz., chl
6858Q	nd f w, sc f chl.		99.5		s		s. eth, bz., alk

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
7035M	**1-Piperidinepropanol, 2-methyl-**, hydrochloride	*See Metycaine.*		
7047M	**Pivalone**	See 3-*Pentanone*, 2,2,4,4-*tetramethyl-**.		
7052G	**Porphine**	.	$C_{20}H_{14}N_4$	310.34
7052T	**Δ⁴-Pregnene-3, 20-dione.**	See *Progesterone*		
7056J	**Progesterone**	Δ⁴-pregnene-3,20-dione; progestin	$C_{21}H_{30}O_2$	314.45
7056M	**——, 11,21-dihydroxy-.**	See *Corticosterone*		
7056Q	**——, 21-hydroxy-.**	See *Desoxycorticosterone.*		
7090F	**Propane, 1-chloro-1-nitro-***		$CH_3CH_2CH(Cl)$-NO_2	123.54
7090M	**——, 2-chloro-2-nitro-***		$CH_3CCl(NO_2)$-CH_3	123.54
7130M	**——, 2-methyl-1-propoxy-*.**	See *Ether, isobutyl propyl.*		
7135B	**——, 2-propoxy-*.**	See *Ether, isopropyl propyl.*		
7143F	**1,3-Propanediamine, 2-hydroxy-*.**	See 2-*Propanol, 1,3-diamino**-		
7190M	**2-Propanol, 1,3-diamino-***	2-hydroxy-1,3-propanediamine*	H_2NCH_2CHOH-CH_2NH_2	90.13
7223M	**Propene, 1-chloro-2-methyl-***	isocrotyl chloride	$(CH_3)_2C{:}CHCl$	90.55
7223Q	**——, 3-chloro-2-methyl-***	methallyl chloride; isobutenyl chloride	$CH_2{:}C(CH_3)CH_2Cl$	90.55
7234F	**——, 2-methyl-*,** tetramer	tetraisobutylene	$(C_4H_8)_4$	224.42
7234J	——, ——, trimer	triisobutylene	$(C_4H_8)_3$	168.31
7234Q	**——, 2-nitro-1-phenyl-.**	See *Styrene, β methyl-β-nitro-*		
7248M	**2-Propen-1-ol, 2-methyl-***	methallyl alcohol, isobutenol	$CH_2{:}C(CH_3)CH_2$-OH	72.10
7277M	**Propionic acid,** allyl ester		$CH_3CH_2COOC_3H_5$	114.14
7315M	**——, α-phenoxy-**	lactic acid phenyl ether	$CH_3CH(OC_6H_5)$-$COOH$	166.17
7319M	**Propionitrile, α-acetoxy-.**	See *Lactonitrile*, acetate		
7319T	**——, β-chloro-**	3-chloropropanenitrile*	$ClCH_2CH_2CN$	89.53
7329J	**Propiophenone, p-hydroxy-**	p-propionylphenol	$CH_3CH_2COC_6H_4$-OH	150.17
7367M	**Propyl phosphate** (*n*)	tri-*n*-propyl orthophosphate	$(C_3H_7)_3PO_4$	224.24
7382M	**Prostigmine bromide.**		$C_{12}H_{19}BrN_2O_2$	303.20
7447M	**Pyrazine, 2-sulfanilamido-.**	See *Sulfapyrazine.*		
7491G	**Pyridine, 3-(2-pyrrolidyl)-.**	See *Nornicotine*		
7495G	**——, 2-vinyl-**	α-vinylpyridine	$CH_2{:}CHC_5H_4N$	105.13
7524M	**Pyrimidine, 2-sulfanilamido-.**	See *Sulfadiazine*		
7620G	**Quinacrine,** dihydrochloride	6-chloro-9-(4-diethylamino-1-methyl-butylamino)-2-methoxyacridine dihydrochloride; Atabrine; atebrin, mepacrine.	$C_{23}H_{30}ClN_3O.2HCl$	472.88
7731M	**Quinophan.**	See *Cinchoninic acid, 2-phenyl-*		
7738M	**Resazurin**	3-isophenoxazinone 10-oxide, resazoin	$C_{12}H_7NO_4$	229.18
7824M	**Salicylaldehyde, 3-methoxy-.**	See *o-Vanillin.*		
7882M	**Semicarbazide, 1-phenyl-3-thio-.**		$C_6H_5NHNHCS$-NH_2	167.23

* Name approved by the International Union of Chemistry.

COMPOUNDS, SUPPLEMENTARY TABLE (Continued)

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of		
					Water	Alcohol	Ether, etc.
7035M							
7047M							
7052G	dk red pl., met. lust.		.	.	i.	v. sl. s.	sl.s.
7052T							
7056J	sm. cr. [α] 193.5° (alc.)	.	(α)128 5; (β)121	.	i.	s.	s. org. solv.
7056M							
7056Q							
7090F	liq., 1 430	1 209$\frac{20}{20}$	.	141–3[761]	0 8[20]	s.	s eth., glycols, esters, min oil
7090M	liq , 1 425 .	1 193$\frac{20}{20}$		13[illegible] 4[illegible]	0 5[20]	s.	s eth , glycols, esters, min. oil
7130M							
7135B							
7143F							
7190M			42	235		.	
7223M	col liq , 1 4221	0 9186		68 1		∞	∞
7223Q	col liq , 1 427	0 925		72 2		∞	∞
7234F	1 448	0 794		106[7] (109 5–11[illegible])	.		
7234J	1 431	0 759 (0 760)		179–81			
7234Q							
7248M	col liq 1 4255	0 8515		114 5	19 4	∞	∞
7277M				124–4 5[774]			
7315M	nd		115–6 (112-3)	265–6	v sl s c , s h	s	s eth.
7319M							
7319T	col liq	1 144[18 5]	.	175–6 (173-4 5)	. . .		
7329J	wh nd or pr		148–8 5	.	sl. s c.; s h.	v s.	v s eth.
7367M	col liq	1 0023$\frac{25}{4}$		252, 138[47], 133 5[22]	i.	s.	s eth , tol, CS_2
7382M	sm cr		*ca* 167 d		s.	......	.
7447M							
7491G							
7495G	liq	0 999[0]		158–9 d , 79–82[29]	sl s.	.	v. s. eth., chl., alk.
7524M							
7620G	cr. f. w	.	248–50	.	...	. .	
7731M							
7738M	pr., grnsh., lust	. .	d.	. .. . .	i.	sl. s	sl. s. glac. ac. a ; i. eth.
7824M							
7882M	monocl pr		201 d.	. . ..	sl. s.	s. h.	sl. s. eth., chl., bz.; s. conc. alk.

For explanations and abbreviations see beginning of table.

No	Name	Synonyms	Formula	Mol. Wt
7882Q	**Semicarbazide, 4-phenyl-3-thio-**	....	$H_2NNHCSNH$-C_6H_5	167.23
7886W	**Serine, β,β-dimethyl-.**	See *Valine, β-hydroxy-.*		
7893M	**Silicane, ethyltrimethoxy-.**	See *Ethaneorthosilicic acid,* trimethyl ester.		
7896M	**——, tetramethoxy-.**	See *Methyl orthosilicate.*		
7898M	**——, triethoxyethyl-.**	See *Ethaneorthosilicic acid,* triethyl ester.		
7898Q	**——, triethoxymethyl-.**	See *Methaneorthosilicic acid,* ethyl ester		
7914J	**Skatole, *N*-methyl-.**	See *Indole,* 1,3-*dimethyl-*		
7946M	**Stearic acid,** cyclohexyl ester	cyclohexyl octadecanoate*	$C_{17}H_{35}COOC_6H_{11}$	366.61
7953M	——, propyl ester	propyl octadecanoate* ...	$C_{17}H_{35}COOC_3H_7$	326.55
7953T	——, tetrahydrofurfuryl ester	tetrahydrofurfuryl octadecanoate	$C_{17}H_{35}COOCH_2$-C_4H_7O	368.58
7982J	***trans*-4,4′-Stilbenediol.**	See *Stilbestrol*		
7982M	**Stilbestrol** ..	*trans*-4,4′-stilbenediol; stilboestrol	$(HOC_6H_4CH)_2$.	212.24
7982Q	**——, α,α′-diethyl-** ...	stilbestrol	$[HOC_6H_4C$-$(C_2H_5):]_2$	268.34
7993T	**Styrene, *o*-chloro-** ...	1-chloro-2-vinylbenzene . ..	$ClC_6H_4CH{:}CH_2$.	138.59
7993U	**——, *m*-chloro-** ...	1-chloro-3-vinylbenzene	$ClC_6H_4CH{:}CH_2$	138.59
7993V	**——, *p*-chloro-** ..	1-chloro-4-vinylbenzene	$ClC_6H_4CH{:}CH_2$	138.59
7995M	**——, *o*-fluoro-** ...	1-fluoro-2-vinylbenzene	$FC_6H_4CH{:}CH_2$	122.14
7995N	**——, *m*-fluoro-** .	1-fluoro-3-vinylbenzene .	$FC_6H_4CH{:}CH_2$	122.14
7995P	**——, *p*-fluoro-** ..	1-fluoro-4-vinylbenzene	$FC_6H_4CH{:}CH_2$	122.14
7998M	**——, β-methyl-β-nitro-**	2-nitro-1-phenylpropene . .	$C_6H_5CH{:}C(NO_2)$-CH_3	163.17
8001C	**——, β-nitro-**	(2-nitrovinyl)benzene. ..	$C_6H_5CH{:}CHNO_2$.	149.14
8048T	**Sulfadiazine.**	N^1-2-pyrimidylsulfanilamide; 2-sulfanilamidopyrimidine	$H_2NC_6H_4SO_2$-$NHC_4H_3N_2$	250.27
8048V	**Sulfaguanidine** .	1-sulfanilylguanidine N^1-guanylsulfanilamide	$NH_2C_6H_4SO_2NHC$-$(NH)NH_2$	214.24
8049E	**Sulfanilamide, N^1-guanyl-.**	See *Sulfaguanidine.*		
8049J	**——, N^1-2-pyrazinyl-.**	See *Sulfapyrazine*		
8049Q	**——, N^1-2-pyrimidyl-.**	See *Sulfadiazine*		
8049T	**——, N^1-2-thiazolyl-.**	See *Sulfathiazole*		
8050J	**Sulfapyrazine**	2-sulfanilamidopyrazine, N^1-2-pyrazinylsulfanilamide	$C_{10}H_{10}N_4O_2S$.	250.27
8050T	**Sulfathiazole**	N^1-2-thiazolylsulfanilamide, 2-sulfanilamidothiazole; thiazomide	$H_2NC_6H_4SO_2$-NHC_3H_2NS	255.31
8062M	**Sulfide, dihexyl.**	See *Hexyl sulfide.*		
8070M	**——, methyl phenyl...**	methylthiobenzene*; thioanisole	$C_6H_5SCH_3$.	124.19
8091F	**Syringaldehyde.......**	4-hydroxy-3,5-dimethoxybenzaldehyde; gallaldehyde 3,5-dimethyl ether	$(CH_3O)_2(OH)C_6$-H_2CHO	182.17
8091H	**Syringic acid**	4-hydroxy-3,5-dimethoxybenzoic acid; gallic acid 3,5-dimethyl ether	$(CH_3O)_2(OH)C_6$-H_2COOH	198.17
8091K	**Syringin** ..	methoxyconiferin ..	$C_{17}H_{24}O_9$ ..	372.36

* Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of: Water	Alcohol	Ether, etc.
7882Q	lf. or pr		140–1 (140 d)		.	. ...	v sl s bz.; i. eth, lrg., alk
7886W							
7893M							
7896M							
7898M							
7898Q							
7914J							
7946M	semisolid	$0.890\frac{25}{25}$	28–9	.. ....	i.	i.	s. eth
7953M	col cr		frz 28.78	. ....	i.	$\infty^{28.8}$ abs., 95%; 9.2^{20} 95%	v s eth., bz., CCl_4, chl, et. acetate, acet., ac a.; s me. al
7953T	liq	$0.917\frac{25}{25}$	22		i	s	s. eth.
7982J							
7982M	nd. or tab		284			sl s.	s acet, h. ac a, sl s eth, v. sl s bz
7982Q	pl	.	171 (167–8)		i.	s.	
7993T	col liq, 1.5648	1.100		$60–1^{4}$	i	s.	s eth
7993U	col liq, 1.5619	1.090		$62–3^{6}$	i	s.	s. eth
7993V	col liq, 1.5658	1.090		$53–4^{3}$	i	s	s. eth.
7995M	col liq, 1.5197	1.030		$32–4^{3}$	i	s	s eth
7995N	col liq, 1.5173	1.025		$30–1^{4}$	i	s	s. eth
7995P	col liq, 1.5158	1.024		$29–30^{4}$	i.	s	s eth
7998M	yel nd	.	64		i.	sl. s	s pet eth, eth; i alk.
8001C	yel pr		58		i.	s.	s eth., pet. eth, bz, CCl_4, CS_2
8048T			255.6 (251–2)		0.12^{37}		. .
8048V	col cr		189–90	. . .	sl. s.	sl s	i.
8049E							
8049J							
8049Q							
8049T							
8050J	clusters tiny nd		253 (251–1.5)	.			sl. s h cyclohexanol
8050T	col cr		200–2	. . ..	0.06	0.5	s. acet, dil. HCl, alk
8062M							
8070M	col liq, 1.5847, 1.5832^{25}	1.053^{25}		$58–60^{6}$	i.	s.	s. eth
8091F	col cr f lgr		113	$192–3^{14}$	sl s	v. s.	v s eth, chl, ac a, h bz, v. sl s lgr.; i pet eth.
8091H	col nd f w or eth	.	204.5	.	v sl. s c.	s.	v. s. eth chl.
8091K	nd ($1H_2O$) f. w, [α] — 17.1°	.	191–2	......	v. sl. s. c.; s. h.	s. h.	i. eth, s c. HNO_3, H_2SO_4

For explanations and abbreviations see beginning of table.

No.	Name	Synonyms	Formula	Mol Wt
8139M	**Testosterone**	17-hydroxy-3-androstenone	$C_{19}H_{28}O_2$	288.41
8146M	**1-Tetradecanethiol*** .	*n*-tetradecyl mercaptan	$CH_3(CH_2)_{13}SH$	230.44
8153M	***n*-Tetradecyl mercaptan.**	See *1-Tetradecanethiol**.		
8154W	**Tetraethylene glycol** monostearate	3,6,9-trioxahendecane-1,11-diol monooctadecanoate*	$C_{17}H_{35}COOCH_2$-$CH_2(OC_2H_4)_3OH$	460.68
8154X	**Tetraisobutylene.**	See *Propene, 2-methyl-**, tetramer		
8162M	**Tetrazole, pentamethylene-.**	See *Metrazol.*		
8169M	**Theelin.**	See *Estrone*		
8169P	**——, dihydro-.**	See *Estradiol.*		
8169R	**Theelol.**	See *Estriol*		
8174Q	**8-Thiachromineëthanol, 2,7-dimethyl-.**	See *Thiochrome.*		
8178M	**Thiazole, 2-sulfanilamido-.**	See *Sulfathiazole*		
8179M	**Thiazomide.**	See *Sulfathiazole*		
8179T	**1-Thieno[3,4]imidazole-4-valeric acid, hexahydro-2-oxo-.**	See *Biotin.*		
8184M	**Thiochrome** .	2,7-dimethyl-8-thiachromineëthanol	$C_{12}H_{14}N_4OS$	262.32
8283G	***dl*-Threonine**	*dl*-α-amino-β-hydroxybutyric acid	$CH_3CHOHCH$-$(NH_2)COOH$	119.1
8322P	**β-Tocopherol**	Vitamin E (one form); 6-hydroxy-2,5,8-trimethyl-2-(4,8,12-trimethyltridecyl) chroman	$C_{28}H_{48}O_2$	416.66
8322R	**γ-Tocopherol**	vitamin E (one form); 6-hydroxy-2,7,8-trimethyl-2-(4,8,12-trimethyltridecyl) chroman	$C_{28}H_{48}O_2$	416.66
8434M	***p*-Toluenesulfonic acid,** methyl ester	methyl *p*-toluenesulfonate	$CH_3C_6H_4SO_3CH_3$	186.22
8546M	**Traumatic acid**	2-dodecenedioic acid*, 1-decene-1,10-dicarboxylic acid	$C_{10}H_{18}(COOH)_2$.	228.28
8550T	**Triamyl phosphate.**	See *Amyl phosphate*		
8569M	**Tributyl phosphate.**	See *Butyl phosphate*		
8600Q	**Triethylamine, 2,2′,2″-trichloro-**	"nitrogen mustard gas"	$(ClCH_2CH_2)_3N$	204.54
8611M	**Triglycolamidic acid.**	See *Acetic acid, nitrilotri-*		
8611P	**Triglycollamic acid.**	See *Acetic acid, nitrilotri-*		
8617J	**Triisobutylene.**	See *Propene, 2-methyl-**, trimer		
8626M	**Trimethylaminetricarboxylic acid.**	See *Acetic acid, nitrilotri-*		
8650M	**3,6,9-Trioxahendecane-1,11-diol*.**	See *Tetraethylene glycol*		
8659M	**Triphenyl orthophosphate.**	See *Phenyl phosphate*		
8686M	**Tripropyl orthophosphate.**	See *Propyl phosphate*		
8690T	***l*-Tyrosine, 3,5-dibromo-,** dihydrate	. . .	$HOC_6H_2Br_2CH_2$-$CH(NH_2)COOH\cdot 2H_2O$	375.03
8810J	**Valeric acid, α-amino-δ-ureido-.**	See *Citrulline*		
8831M	***dl*-Valine, β-hydroxy-**	α-amino-β-hydroxyisovaleric acid; β,β-dimethylserine	$(CH_3)_2COHCH$-$(NH_2)COOH$	133.15
8843T	***o*-Vanillin.**	2-hydroxy-3-methoxybenzaldehyde; 3-methoxysalicylaldehyde	$CH_3O(OH)C_6H_3$-CHO	152.14
8869P	**Vitamin H.**	See *Biotin.*		
8869T	**Vitamin K.**	See also *1,4-Naphthoquinone, 2-methyl-.*		
8869U	**Vitamin K₁**	2-methyl-3-phytyl-1,4-naphthoquinone	$C_{31}H_{46}O_2$	450.68

* Name approved by the International Union of Chemistry.

No.	Crystalline form, color and index of refraction	Density g/ml	Melting point, °C	Boiling point, °C	Solubility in grams per 100 ml of Water	Alcohol	Ether, etc.
8139M	sm cr ; [α] + 109° (alc.)		154-4 5	.	i.	s.	s. org solv.
8146M	col. liq , 1.4613			160-2[5]	i.	s.	s. eth
8153M							
8154W	solid .	0 971$\frac{25}{25}$	35-40		.		
8154X							
8162M							
8169M							
8169P							
8169R							
8174Q							
8178M							
8179M							
8179T							
8184M	yel pr f chl	.	277-8		.	sl s	s. me al ; sl s. eth., acet , chl.
8283G	orth cr ($\frac{1}{2}H_2O$)		229-30 d.		v. s	i	i eth , chl.
8322P	$[\alpha]_{5461}^{20}$ 2 9°(al.)	..		.			
8322R	liq $[\alpha]_{5461}^{20}$ − 2 4° (al)	..	.				
8434M	col liq or cr		28		i	s	∞ eth., bz.
8546M			165-6				
8550T							
8569M							
8600Q	col or yel liq		-4	143-4[15]	v sl s	∞	∞ eth , bz.; s HCl
8611M							
8611P							
8617J							
8626M							
8650M							
8659M							
8686M							
8690T	rhomb nd. or tab f w.; [α] + 1 3° in dil. HCl		ca 245 d.	.	sl s.	sl s	i. eth.; s. a., alk.
8810J							
8831M	pl. f. al	. .	218 d.		s.	i	i eth., bz , et. acetate
8843T	yel. nd. f. w., lgr.	.. ..	45 5	265-6; 128[10]	i.	s	s eth., chl., lgr., ac. a
8869P							
8869T							
8869U	yel. oil	0 97$\frac{25}{25}$		140-45	i.	sl s	v. s. pet. eth.; s acet , eth., bz., chl.

For explanations and abbreviations see beginning of table.

FORMULA INDEX OF ORGANIC COMPOUNDS

Numbers refer to compounds in the preceding table Physical Constants of Organic Compounds.

The arrangement of symbols in formulas is alphabetical except that C always comes first followed immediately by H if hydrogen is present. The arrangement of formulas is also alphabetical except that the number of atoms of any specific kind influences the order of compounds.

The numbers following any one formula are given in numerical order which is also their occurrence in the table of physical constants.

NOTE: the letter S preceding any compound number indicates that it is to be found in the **Supplement** to the table Physical Constants of Organic Compounds.

FORMULA INDEX OF ORGANIC COMPOUNDS
(Continued)

FORMULA INDEX OF ORGANIC COMPOUNDS
(Continued)

C_4

FORMULA INDEX OF ORGANIC COMPOUNDS
(Continued)

C_5

FORMULA INDEX OF ORGANIC COMPOUNDS
(Continued)

FORMULA INDEX OF ORGANIC COMPOUNDS
(Continued)

FORMULA INDEX OF ORGANIC COMPOUNDS (Continued)

FORMULA INDEX OF ORGANIC COMPOUNDS (Continued)

C_{10}

FORMULA INDEX OF ORGANIC COMPOUNDS
(Continued)

FORMULA INDEX OF ORGANIC COMPOUNDS
(Continued)

C_{15}

C_{16}

FORMULA INDEX OF ORGANIC COMPOUNDS (Continued)

C_{17}

C_{18}

C_{19}

MELTING POINT INDEX OF ORGANIC COMPOUNDS

The following table lists the melting points of organic compounds in ascending order of temperature in degrees Centigrade. The compounds are identified by the numbers as given in the table Physical Constants of Organic Compounds.

The letter **S** preceding any compound number indicates that it is to be found in the **Supplement** to the table.

Melting points will be quoted as they occur in this table. The order of compounds listed with the same melting point is not significant and will be arbitrarily given in the order of the compound numbers. Owing to lack of agreement in values reported by various observers more than one value is sometimes given or the melting point is indicated by a temperature range. In such cases the position in the list is determined by the lower temperature of the stated range or by the *first* of two stated values, the second value being given in parentheses. Where the values are separated by more than 5° C the melting points are listed separately.

Melting points are given in bold face followed by the numbers of the compounds.

Abbreviations: **a** = anhydrous; h = **hydrate.**

(**−213**), 2583
−207, 2583
−189.9, 7073
−185.2, 7217
−184, 2587M, 5584
−181, 5606M
−172, 3488
−169.4, 3809
−161.5, 1947
−160.5, 2028
−159.7, 8861
−159, 7359
−156.5, 7895
−151, 5175
−150, 4650, 7892
(**−147.3**), 3586
−146, 5604M, 7062, S4623A
−145, 4950, 5613
−142.5, 3862M
−142.4, S3047M
−141, 4541
−139, 6572
−138.7, 3806
−138.5, 5749
−138, 2590, 6564
−137.8, 8860
−136.4, 478
−135.1, 2019
−135, 1998, 2117, S4628A
−133, S4623B
−131.5(**−129.9**), 6481
−131.3, 2167
−131.2, 4958
−130.7, 7164
−130, 2110, 2198
−129, 468
−127, 7331
−126.6, 3062
−126.4, 3002
−126, S6277J
(**−125.6**), 6498
−125, 6493
−124.8, 7219
−124, 2120, 3678, 8624
−123.5, 10
−123.4, 6495
−123.3, 3902β
−123.1(**−121**), 5715
−123.1, 2166
−122.8, 7344
−122, 7358
−121, 3586
−120, 1990M, 5095
−119.4, 476, 4572
−119.1, 4571
−119, 3804
−118.5, 4957
−118, 6876, S6277Q
−117.3, 3785
−117.2, 4923
−117, 5101
−116.6, 7218
−116.3, 3902α
−115.9, 2072
−115.5, 3681
−114.8, 8596
−114.6, 3785
−114, 2589M
−113, S4628B
−112.6, 2266
−112.4, 2160
−112, 321, 8304, S3117M
(**−112**), 3917
−111.9, 4928
−111.5, 7162
−111.3(**−107**), 2585
−111.3, 3899
−110.8, 8389
−110, 7343, 8829
−108.6, 2565
−108.5(**−105** to **−111**), 3912
−108, 4951, S6277K
−107, 3557M
−105, 534
−104.8, 5628, 8070
−104.7, 7372
−104.5, 2157
−104, 2182
(**−104**), 6876, 7319
−103.7, 3029
−103.5, 2181, 3691
−102.1, 3930
−102, 3917
−101.6, 1276
−101.4, 7362
−101.2, 5099
−101, 6595
−100.6, 3530M
−100.2, S107W
<**−100**, 2083, 2347
−100, 5124
−99.3, 488, 5145
−99, 537, 2204, 4031
−98.9, 100
−98.5, 4618
−98.2, 2018
−98.1, 103
−98, 2982
−97.8, 5719
−97.6, 5738
−96.9, 2925, 5356
−96.7, 3507, 5744
−96.5, 319
−96, 3276, 8826
−95.3, 4028
−95.2(**−98**), 2178
−95.2, 2235
−95, 213, 6594, 8336
<**−95**, 2232
−94.5, 6498
−94.4, 5059
−94.3, 4556
−94, 7324, S6277R
−93.9(**−92.8**), 1210
−93.66, 5734
−93.5, 4966, 8660
−93.3, 2225, 3046, 3058
−93, 4597
−92.9, 4034
−92.8, 8797
−92.5, 107, 5729
−92, 2100, 3995
−91.9, 7319
−91.5, 2224, 8790
−91.3, 4543
−91.2, 8798
−91, 4566, 8801
−90.8, 5106
−90.5, 4458
−90, 4020, 5000
−89.55, 7280
−89.2 to **−89.8**, 2149
−89, 2150, 2272, 5100
−88.5 to **−89.5**, 5098
−88.2, 4981
−88, 535
−87.7, 378

MELTING POINT INDEX OF ORGANIC COMPOUNDS (Continued)

−25.6, 3454
<−25, 2365, 2658, 3069
−25, 2041, 2279, 4539
−24.8, 1175
−24.5, 3929
−24.4, 8485α
−24.1, 4214
−24, 5036
−23.8, 8522
−23.2, 6525
−23, 1215, 4503, 7994, 8519
−22.8, 2587
−22.5, 130, 131
−22.4, 1453
−22.35, 3862
−22, 132, 5877, 6186, 6552, 7277, 8416
−21.8, 8615
−21.2, 1134
−21.2 to **−20.5,** 3020
<−21, 5347, 6650
−21, 412, 2283, 5136, 5598, 7341, 8022
−20.9, 6274
<−20, 1181, 1182, 1212, 1213, 1261, 1856, 2248, 2534, 2884, 4689, 5822, 6539, 6842, 7682, 8034, 8387, 8417M, 8905, 8918, 8936
−20, 2162, 4264, 4302, 6544, 7101, 7341P
−19.96, 2336
−19.5, 7657
−19, 531, 4641, 4996, 5401, 5870
(−19), 6190
<−18, 500, 771, 1437, 2363, 5119, 5271, 5863, 6585, 6873, 7185, 7677
−18, 2337
−17.9, 2344
<−17.5, 6776
−17.5, 179, 1174
−17.4, 4290
<−17, 173, 8385
−17, 207, 2251, 4259, 5319M, 5759, 7380
(−17), 7013
−16.6, 3495
−16.5, 160
−16.3, 6265, 8485β
−16, 1774R, 2607, 2821, 3632
−15.4, 7205
−15.3, 1738
−15.25, 180M
−15.05, 3108
<−15, 2247, 4173, 4303, 4419, 5550, 6063, 8957
−14.7, 7139
−14.5, 2575
<−14, 5869
−14, 600α, 2088, 2245, 4783
−13.8, 3602
−13 to **−14,** 8518
<−13, 8302
−13, 1635
−13(−9), 5870K
−12.5, 1461
<−12, 713, 3379
−12, 2978, 3390, 6363, 8151
(−12), 4290
−11.9, 2090
−11, 5361
−10.7, 5313
−10.6, 8402α
−10.45(−6.5), 3231
−10.4, 601
<−10, 3760, 8330, 8441
−10, 3437, 4495, 5045, 5479
−9.5 to **−9.2,** 3020
(−9.5), 2350
−9.3, 1139
−9, 3115, 3402M, 4585, 7013
−8.6, 7836
−8.2, 6190
−8 to **−7,** 7993(2)
−8, 1577, 6191, 7459
−7.9, 2220
−7.6, 3329
−7.5, 2737
−7, 7822
−6.9, 1171
−6.6, 5532
−6.5, 5821
−6.2, 571, 8582
−6, 1223H, 2274, 2392, 2960, 3107, 4853
−5.9, 5131, 6192
−5, 634, 6183, 8000, 8606
−5^{713}, 1991
−4.5, 2284
−4.1, 8402β
−4, 1766, 2242, 4424, 6760, 7053, S8600Q
−3.5, 600β
−3, 1887
−2.5, 2830
−2, 2081M, 4866, 8894
(−1.68), 5313
−1.5 to **−2.0,** 2350
−1, 1724, 2388, 5825
−0.82, 637P
<0, 117, 2361, 5332, 6694
0, 501, 600α+β, 1723, 3546, 4151, 6716β
0.1, 3547
0.2–0.7, 5840
0.35, 138M
0.5, 2572
0.5(1–2), 2605
0.6, 4065
1, 2735, 7876
1.3, 7832
1.5, 2734
(1.6), 7822
1.8(5.6), 1170
2, 2836, 6912, 8922
2.1, 1138
2.1(5–6), 6661
2.4, 6652
2.5, 621, 701, 3113
2.55, 4003
2.9, 6152
3, 1735, 7044
3.6, 1223K
3.65, S1818M
4, 5319, 6540
4–5, 1773, 7674
4.1, 6716γ
4.5, 4432
5, 3935, 8185
5–6, 135, 5747
5–7, 1925
5.15, S5314H, frz.
5.2(3–4), 712
5.48–.49(5.51), 1113
5.5, 2864, 3732, 6988, 8144, 8154M
5.6(4–5), 6705
5.7, 1256
6, 3965, 5768M
6–7, 1981
6.2, 5840
6.5, 2744, 2988
7, 706, 3003, 6716α, 7993(1)
7–8, 2787
7–9, 8906
7.5, 8355
8, 3771, 8868D
8.2, 775
8.40, 4016
8.5, 2657, 3879, 5312
9, 2282, 3832, 5264, 6994, 7258, 8927
9.2, 1762
9.4(10), 723
9.5(6–7), 4563
9.97(10), 3871
10, 1983, 3880, 6457, 8313
10–4, 7681
10.3, 3948
10.5, 3598, 5130, 5416
10.5(11.93), 5817
11, 2270, 4429, 7815
11(8–9), 1048
11–2, 720, 2878, 6415
11.4, 4514
11.7(9–13), 3297
12, 4430, 4475, 6448
(12), 2744
(12–3), 8510
12–5, 667
12.3, 385
12.4, 1179
12.6(10.5), 6429
13, 774, 1284, 5440, 5675, 8921
13–4, 8061
13.2, 3555R, 6152, 8925

(41), 6847
41-1.5, 2098
41-2, 2424
41.5, 260
41.8, 3687
41.9-2.1, 6203
42, 229, 942, 1141, 1628, 1725, 3306, 4581, 4825, 6598, 8079, S7190M
42(27), 219
(42), 5018
42-3, 2893, S285Q
42-3(44-5), 8846
42-4, 6907
42-52, 2302*l*
42.5, 2249, 5529
42.5-43, 7972
43, 1153β, 1301, 2196H, 2948, 7696, 7841, 8167, 8175, 8319
43(39-40), 6718
43(40), 3451
43(40.4), 6768
43-4, 1376h
43-5, 1178
43.84(45-6), 6458
44, 1296, 2769, 2947, 4708, 4829, 5154, 5376, 5558, 6617, 7000, 7990, 8121, 8837
44(39), 909
44(48), 5311
44-5, 5432
(44-5), 3423
44-6, 1075, 8021
44-7, 2666
44.4, 3383
44.5, 5308, 8360
44.8, 5956
45, 564, 1899, 2914, 6733, 6783, 7180, 7202
45, *ca*., 5885
45(42-3), 8507
45-6, 7406
45-8, 1650γ
45.5, 7312, 8292, 8556, S8843T
45.8, 7945
46, 589, 671, 2130, 3272, 4260, 5572, 6690, 6761, 7698, 8368, S1540B
46, *ca*., 4828
46-7, 4376, 8345, 8977
46.4, 4255
46.5, 8235
47, 14, 1193, 1311, 1545, 1579, 2951, 4765, 5024, 6412
(47), 7539
47-8, 7752
47.5, 1050, 1280, 4014
47.7, 8576
48, 133, 707, 3428, 4989, 6767, 7017, 7206, 7630, 7664, 7970, 8100(1), 8407
48-9, 3429, 5854, 7420
48-50, 2250, 6398
48.4, 2586α
48.4-8.5, 3402
48.5, 5142
48.6, 4766
49, 1650α, 1780, 8359, 8678, 8945, 8961
49-50, 6693
49-51, 277, 8234
49.3, 2647
49.3(45.5), 1895
49.4, 1234
49.5, 4584, S6858M
50, 119, 123γ, 275, 276, 611, 787, 883, 2301, 2428, 6043, 6596, 6597, 6819, 8100(2), 8257
50(48), 2395
50-1, 1376, 2431M
50-2, 4300
50-6, 7967
(50-9), 7873
50.5, 613
51, 381, 1281, 1567, 2346, 6850, 7041, 7306, 8584, S312T
51(48), 2302*d*
51-1.5, 7140
51-7, 4868h
51.1, 8141
51.3, 8404
51.5, 3423, 4318, 8288
51.5-52, 7228
51.5-53, 7952M
51.7, 2668
52, 1298, 1698, 2398, 2430, 2959, 5197, 7453, 7701h, 8226, 8791
52-3, 3378, 4122, 4609, 6062
52.5, 1809, 4881
52.54, S6457V frz.
52.5(50.5), 8379
52.9, 6889
53, 1176, 1263, 3317, 6777, 6847, 7179, 7445, 8406, 8502, 8889
(53), 2400
53(50.5), 4446
53(51.5), 209M
53(57-60), 5407
53-4, 1637
53-4(54-6), 3667
53.31(54), 4445
53.4, 5821
53.4(51), 1153α
53.5, 1977
53.5-54(55-6), 3149
54, 725, 1854, 4048, 4242, 6350, 6368
(54), 2434
54(51-2), 592
54-4.5, 1029, 1030, 3560
54-5, 1000, 3234
54-5(52), 1312
54.5, 884, 4261, 5875, 8046
55, 597, 999, 2397, 2651, 4833, 8106M, 8897, 8964
(55), 2666
55(59), 1154
55-6, 123β, 4781, 5843, 6743
(55-6), 3149
55-7, 2144
(55-7), 2655
55.5, 3436, 6404
56, 308, 1142, 1196, 2373, 2883, 4736, 5665, 6791, 6898, 7462
(56), 8903
56-7, 3541, 6524, 6730, 6798, 7154M
56.5, 644, 4256
56.6, 4234
57, 961, 1158, 1582, 3538, 4520, 4821, 5569, 6732, 7641
(57), 15
57-8, 1763, 3281
(57-8), 4247
57.5, 177, 1031, 6000
(57.7), 714
57.8-8.0, 8154
58, 268, 1070, 1593, 4241, 5018, 5140, 5491, 5815, 6172, 6316h, 6422, 6734, 8346, 8549h, S8001C
58-8.5, 7966
58-9, 2376, 5047, 8244h
58-60, 2721, 5905h
58.5, 4319
58.5-61, 1889
58.8(56-7), 5883
59, 281, 714, 747, 2244(2), 2700, 2748, 4883, 5659, 6714
59d, 4823
59(56-7), 5841
59(57-8), S5771M
59(57.85), 6228
59-60, 1336, 1660, 5832
(59-60), 623
59-61, 4723
59.5, 2535, 4440
59.5-67, 6048
59.8(59-61), 8381
60, 5273, 6663, 6765, 7634, 7672
60(55-6), 3140
60-1, 622, 2400, 6787
(60-1), 310
60.5, 5831, 6312, 6548
60.66(58-9), 5487

MELTING POINT INDEX OF ORGANIC COMPOUNDS (Continued)

MELTING POINT INDEX OF ORGANIC COMPOUNDS (Continued)

MELTING POINT INDEX OF ORGANIC COMPOUNDS (Continued)

MELTING POINT INDEX OF ORGANIC COMPOUNDS (Continued)

MELTING POINT INDEX OF ORGANIC COMPOUNDS
(Continued)

281–2, 8688
283d, 434, 5724
283(280d), 7848
283–4, 2671
283–4d, 432, 5066
283–5, 8687
284, 1482, S7982M
285, 5676, 5782, 8124
285–6d, 4654
286, 794, 2732, 2773, 5502, S4675J
287, 4064
287–8, 4655
288, 5090
288d, 8050
289d, 445
290, 442, 806, 810, 2670, 8788
(290), 5341
290–1, 7698R
(291), 1431
291.5d, 8806
292, 809
292d, 5065
(292d), 8831
293, 1259
293d, 1792, 8833
(293–5), 4064
293–5(289d), 8689
295, 426, 2862, 5342
295d, 433, 8694
295–300d, 3972, 8982
296, 935
297, 2997
297d, 430
298d, 1479, 5801, 8831
300, 1835, 3009, 4166
>300, 1592, 6357
300–50d, S3382M
301d, 6212, 6213
301–2d, 6136β
301–3, 6628
302, 796, 829
303, 805
305, 448, 1432
306, 1224
307–8, 5161
308–10d, 949
310, 1914a, 2618
310d, 768, 7617
310(306), 5089
310–4, 8693
310–20d, 813
312–4, 5084
312–8d, 3988
(314–6), 1413
315d, 8832
316, 8692
317, 5075
318–20d, 429
319, 808
(320), 1005
>320, 812, 3133
323, 3291
327d, 6211, 7418
327–8, 1419
328–9d, 8109
330, 767, 4946, 5084
>330, 814, S3208M
330, *ca.*, 983
331, 1413
332d, 5341
333d, 4391R
337, 8172
338, 8707
338–40, 7698P
340, 982
345d, 1005
350, 8621
(>350), 1419
350d, 1229
354, 377
358d, 2756
360, 3968
>360, 764, 2965, 3978
360d, 4404
>360d, 8782
364, 6960
365, 407
369, 791
370d, 8783
(375–80), 8621
384–5, 826
392d, 4874
400d, 8781
419d, 6371
437–40, S2837J
450d, 1377
470–500d, 4865

BOILING POINT INDEX OF ORGANIC COMPOUNDS

The following table lists the boiling points of organic compounds in ascending order of temperature in degrees Centigrade. The compounds are identified by the numbers as given in the table Physical Constants of Organic Compounds.

The letter **S** preceding any compound number indicates that it is to be found in the **Supplement** to the table.

Boiling points will be quoted as they occur in this table. Only boiling points at or near atmospheric pressure will be listed. The order of compounds listed with the same boiling point is not significant and will be arbitrarily given in the order of the compound numbers. Owing to lack of agreement in values reported by various observers more than one value is sometimes given or the boiling point is indicated by a temperature range. In such cases the position in the list is determined by the lower temperature of the stated range or by the *first* of two stated values, the second value being given in parentheses. Where the values are separated by more than 5° C the boiling points are listed separately.

Boiling points are given in bold face followed by the numbers of the compounds.

−190(−192), 2583
−161.5, 5584
−128, 2587M
−103.9, 3809
−88.5, 328
−88.3, 3488
−83.6, 328
−83, 2589M
−82.2, 3993
−80, 5606M
−78.6, 5750
−78.5, 2563
−78.4, 3862M
−78.2, 3530M
<−70, 3826M
−56.8, 7895
−56, 5175
−51.6, 5746M
−51, 8863M
−50.2(−47.5), 2590
−47, 7217
−46.8, 3557M
−42.17, 7073
(−41), 5175
−40.8, 5604M
−38, 3502M
−37.7, 3903
−34.4, 3062
−32 to **−30**, 336
−32, 7062
−28, 5617
−24.7, 3512L
−23.7, 5738
−23.65, 5749
−23.3, 7372
−23, 5613
−21, 3995
−20.5, 2958
−20.1, 7892
−20, 1947
−14, 6886
−13.9, 8861
−12, 5759
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PHYSICAL CONSTANTS OF INDUSTRIAL ORGANIC COMPOUNDS

The following table is intended to provide information concerning the characteristics and properties of commercially available organic compounds. The material presented has been compiled from information furnished by the manufacturers whose courtesy is gratefully acknowledged. Where the same compound has been reported by two or more manufacturers separate entries have been made.

ABBREVIATIONS

a	acid	g	grams	ppnt	precipitant
absorb	absorbent	gen	general	prep	preparatory, preparation
accel	accelerator	gran	granules, granular	press	pressure
acet	acetone	grn	green	pung	pungent
agt	agent	h	hot, high	purif	purification
al	alcohol	hyg	hygroscopic	pyr	pyridene
alk	alkali	i	insoluble	quant	quantities
amm	ammoniacal	imm	immiscible	redsh	reddish
approx	approximately	indust	industrial	rub	rubbing
art	artificial	init	initial	s	soluble
astring	astringent	inter	intermediate	*sec*	secondary
boil	boiling	lab	laboratory	sl	slight, slightly
br	brown	lacq	lacquer	sld	solid
bz	benzene	liq	liquid	soft	softener, softening
c	cold	lt	light	solv	solvent
ca	about	lubr	lubricating	suff	suffocating
cellu	cellulose	lust	lustrous	syn	synthesis
char	characteristic	m	most	synth	synthetic
chem	chemical	mat	material	tech	technical
cl	clear	meth	methyl	*tert*	tertiary
col	colorless	mfg	manufacture	tetr	tetragonal
com	common	min	minimum	thick	thickening
comp	compound, compartment	misc	miscible	trans	transparent
conc	concentrated	mix	mixture	trig	trigonal
cr	crystals	moist	moistening	typ	typical
d	decomposes	monocl	monoclinic	v	very
deliq	deliquescent	need	needles	veget	vegetable
deriv	derivative	nitro	nitrocellulose	visc	viscous
disp	dispersible	n res	non residual	vol	volume
dist	distilled	n vol	non volatile	w	water
dk	dark	org	organic	wh	white
et	ethyl	pa	pale	wt	weight
eth	ether	pen	penetrating	yel	yellow
ethylcellu	ethylcellulose	per	permanent	>	above
extr	extractant, extracting, extraction	pet	petroleum	<	below
f	finger	pharm	pharmaceutical	∞	soluble in all proportions
fa	faint	photo	photographic		
fl	flakes	pk	pink		
flam	flammable	pl	plates		
		pleas	pleasant		
		powd	powder		

Sources of Information

An.	Ansul Chemical Co.	P P	Phillips Petroleum Co
At	Atlas Powder Co	Q O	Quaker Oats Company
C. & C.	Carbide & Carbon Chemicals Corp.	S.C.L.	Shawinigan Chemicals, Ltd.
C.S	Commercial Solvents Corp.	S.C.	Shell Chemical Co.
C P.	Corn Products Refining Co.	S.D	Shell Development Co.
D.	Dow Chemical Co	Sh	Sharples Chemicals, Inc.
G	Glyco Products Co , Inc.	S.P.	Solvay Process Company
N	Niacet Chemicals Corp	St.	Standard Oil Development Co.
Pa	Pennsylvania Coal Products Co.	U.S.I.	U.S. Industrial Chemicals Co., Inc.

No.	Trade name	Chemical name or synonyms	Formula	Mol wt.
1	Acet-*para*-toluide	*p*-acetotoluide	$CH_3CONHC_6H_4CH_3$	149 19
2	Acetaldol	hydroxybutyraldehyde	$CH_3CH(OH)CH_2CHO$	88 10
3	Acetamide, C.P.	acetamide	CH_3CONH_2	59 07
4	Acetamide, Tech	acetamide	CH_3CONH_2	59 07
5	Acetic acid, Glacial, C.P.	acetic acid	CH_3COOH	60 0
6	Acetic acid, Glacial, U.S.P. XI, and Standard	glacial acetic acid	CH_3COOH	60 05
7	Acetic anhydride	acetic anhydride	$(CH_3CO)_2O$	102 09
8	Acetoacetanilide	acetoacetanilide	$CH_3COCH_2CONHC_6H_5$	177 20
9	Acetoacetanilid	acetoacetanilid	$CH_3COCH_2CONHC_6H_5$	177 20
10	Acetoacet-*ortho*-chloranilid	acetoacet-*ortho*-chloranilid	$CH_3COCH_2CONHC_6H_4Cl$	211 65
11	Acetoacet-*ortho*-toluidid	acetoacet-*ortho*-toluidid	$CH_3COCH_2CONHC_6H_4CH_3$	191 22
12	α-Acetochloroglucose		$C_{14}H_{19}O_9Cl$	366 75
13	Acetone	dimethyl ketone	CH_3COCH_3	58 08
14	"	" "	CH_3COCH_3	58 08
15	"	" "	CH_3COCH_3	58 08
16	"	" "	CH_3COCH_3	58 08
17	Acetonitrile	methyl cyanide	CH_3CN	41 05
18	Acetonyl acetone	acetonyl acetone	$CH_3COCH_2CH_2COCH_3$	114 14
19	*cis*-Acetylene dichloride	*cis*-dichloroethylene	$CHCl:CHCl$	96 95
20	*trans*-Acetylene dichloride	*trans*-dichloroethylene	$CHCl:CHCl$	96 95
21	Adamsite, D.M	diphenylamine chlorarsine	$NH(C_6H_4)_2AsCl$	277 57
22	*dl*-Alanine	*dl*-α-aminopropionic acid	CH_3CHNH_2COOH	88 09
23	Alkazene 3	*x*-triethyl benzene	$C_6H_3(C_2H_5)_3$	162 27
24	" 6	hexaethylbenzene	$C_6(C_2H_5)_6$	246 42
25	" 8	*x*-diethyl-*x*-diisopropylbenzene	$(C_2H_5)_2C_6H_2[CH(CH_3)_2]_2$	218 37
26	" 12	*m*-diisopropylbenzene	$C_6H_4[CH(CH_3)_2]_2$	162 27
27	" 13	*x*-triisopropylbenzene	$C_6H_3[CH(CH_3)_2]_3$	204 34
28	" 14	*x*-tetraisopropylbenzene	$C_6H_2[CH(CH_3)_2]_4$	246 42

ORGANIC COMPOUNDS

No.	Physical form and color	Odor	Purity %	Sp. gr.
1	lt. gray cr	faint		
2	pa. yel. visc. liq	aromatic, pen	90-98	1 10-1 $11^{15.6}$
3	wh. sld	none	99 5-99 9	1 $15\frac{20}{4}$
4	wh. sld	mousey	99	1 $15\frac{20}{4}$
5	col liq	sharp, sour	99 8 min	1 05
6	w. wh. liq	vinegar	99 5	1 $049\frac{20}{4}$
7	col. liq	pungent	96 0	1 0830
8	wh. cr. sld			
9	wh. fine cr. sld	very mild	97	
10	wh. fine gran. powd	very mild	98	
11	wh. fine gran powd	very mild	96	
12	sld			
13	col. flam. liq	agreeable	99	0 7915- $7935\frac{20}{20}$
14	w wh liq	mild, n res	99 100	0 791 $793\frac{20}{20}$
15	col. liq	pleasant	99 by wt	0 791-.$793\frac{20}{20}$
16	w. wh. liq	mild	99	791- $799\frac{20}{20}$
17	col liq	ethereal	98 8 min	782- 785
18	col. liq	pleasant		0 9738
19	col. mobile liq	mildly sweet		1 $281\frac{25}{25}$
20	col. mobile liq	mildly sweet		1 $252\frac{25}{25}$
21	lt. yel.-grn. gran. sld	lacrimatory	90-95	1 $648\frac{20}{20}$
22	wh. cr	none		
23	cl. col. liq	mild char		0 $870\frac{25}{25}$
24	wh. cr	almost none		
25	col. liq			$867\frac{25}{25}$
26	cl. col liq	mild, pleas		$855\frac{25}{25}$
27	cl. col. liq	almost none		$854\frac{25}{25}$
28	wh. cr			

See two following pages for additional data on above compounds

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
1	Acet *para*-toluide	148-150	298-302	298-303.	..
2	Acetaldol	<0	83[20]	variable	181 4
3	Acetamide, C.P	81	220	215 221	
4	Acetamide, tech	77-79	219	210-220	
5	Acetic acid, glacial, C.P	16 24	118 1		111
6	Acetic acid, glacial, U.S.P. XI, and Standard	15 6	118 1		111
7	Acetic anhydride	−67 7	139 5		150
8	Acetoacetanilide	83 85			
9	Acetoacetanilid	<82 5			
10	Acetoacet-*ortho*-chloranilid	102 5			
11	Acetoacet-*ortho*-toluidide	104-105			
12	α-Acetochloroglucose	70-71			
13	Acetone	−95 1	56 1	56 1 57 1	15
14	"	−94 9	56 1	55 0-57 0	15
15	"	−95 0	56 1	<55 8 none; >56 6 none	<−4
16	"	−95	56 1	<55 6 none, >57 1 none	14
17	Acetonitrile	<−40	81 6	78 82	
18	Acetonyl acetone	−5 4	191 4	185-195	185
19	*cis*-Acetylene dichloride	<−80		58 3 5%; 60 1 95%	39 2
20	*trans*-Acetylene dichloride	<−20		47 9 5%, 49 0-95%	35 6
21	Adamsite, D.M	182 183		d 195	
22	*dl*-Alanine	270 8-275 8			
23	Alkazene 3	<−70		217 6 5%, 219 3 95%	181 4
24	" 6	126 5-128 3	296		>563
25	" 8	−50		253 9 5%; 257 4 95%	224 6
26	" 12	−65		205 5%, 208 6 95%	170 6
27	" 13	−15		235 9 5%; 237 4 95%	206 6
28	" 14	98 5-115 2.	260		244 4

See two preceding pages for additional data on above compounds

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
1	∞ al; s. eth; sl. s. w	dye inter	drums	Pa.
2	∞ w., al; s. eth	syn. rubber accel., dye inter., perfumes, pharm., denaturant	cans, drums	N.
3	v.s. eth.; s. al; 97.5^{20}w	solv., plasticizer, org. syn	lined drums	N.
4	v.s. eth; s. al; 97.5^{20}w	solv., soldering flux, plasticizer, org. syn.	lined drums	N.
5	s w., al., eth	lab. reagent, photo. syn	carboys, drums	N.
6	∞ w., al., eth	mfg. cellulose acetate; solv. oils, gums, resins, ppnt. albumen, casein & rubber	drums, tanks, cans	N.
7	s. al, $CHCl_3$, eth.; d.w	acetylating agt	tanks, cars, drums, carboys, jugs	C. & C.
8	sl. s. w	printing ink dyes	drums	C. & C.
9	sl. s.w., v.s. al., eth., $CHCl_3$, alk., a , h.bz.	dye inter	barrels	U.S.I.
10		dye inter	barrels	U.S.I.
11		dye inter	barrels	U.S.I.
12	d.h.w.; s. et. al , meth. al., acet., eth., CCl_4			C.P.
13	∞ w	solv. acetylene, process solv. rayon, art. leather, films, plastics, solv. lacq., dopes	tank cars, drums, cans	C. & C.
14	∞ w	solv	tank cars, drums, cans	C.S
15	∞ w., al., benzol, gasoline, kerosene, org. liq.	solv. lacq., gums; raw mat. for org. syn., plastics; extr. fats	tank cars, drums, tins	S.C.
16	∞ w	cellu. acetate solv., acetylene absorbent, dewaxing agt., mfg. acetic anhydride, $CHCl_3$, indigo, etc.	tank cars, drums, cans	U.S.I.
17	s w., al., i. paraffins	syn Vitamin B_1 and pyrimidines extr. agt.	carboys, drums	N
18	∞ w	solv. cellu acetate; syn. of cyclic comp.	drums	C. & C.
19	∞ acet., bz., CCl_4, eth., meth. al.; i w.			D.
20	∞ acet., bz., CCl_4, eth., meth. al.; i.w.			D.
21	d. w.; % by. wt: 15.9 acet., 2 bz., 8.4 eth., 6.3 meth. al.	sickening gas	drums	Pa.
22	17^{25} w., 32^{75} w., i. acet., bz., CCl_4, eth., meth. al			D.
23	∞ eth., acet., bz., CCl_4, g. per 100 g: 120 meth. al ; i.w.			D.
24	sl s. meth. al., acet., eth., CCl_4, bz; i.w.			D
25	∞ eth., CCl, bz., acet.; g per 100 g.: 44 meth. al.; i.w.			D.
26	∞ meth. al., eth., CCl_4, bz., acet.; i.w.			D.
27	∞ eth., CCl_4, bz., acet.; g. per 100 g.: 43 meth. al.; i.w.			D.
28	g. per 100 g: 97 bz., 85 eth., 62 CCl_4, 18 acet.; i.w.			D

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
29	Alkazene 16	*x*-triisopropyltoluene	$CH_3C_6H_2[CH(CH_3)_2]_3$	218 37
30	" 20	*m*-chloroethylbenzene	$ClC_6H_4C_2H_5$	140 61
31	" 21	*p*-chloroethylbenzene	$ClC_6H_4C_2H_5$	140 61
32	" 24	1-2-dichloro-*x*-ethylbenzene	$Cl_2C_6H_3C_2H_5$	175 06
33	" 25	*x*-dichloro-*x*-ethylbenzene	$Cl_2C_6H_3C_2H_5$	175 06
34	" 28	*x*-chloro-*x*-diethylbenzene	$ClC_6H_3(C_2H_5)_2$	168 66
35	" 32	ethyl pentachlorobenzene	$Cl_5C_6C_2H_5$	278 41
36	" 34	*x*-dichloro-*x*-diethylbenzene	$Cl_2C_6H_2(C_2H_5)_2$	203 11
37	" 36	*x*-chloro-*x*-triethylbenzene	$ClC_6H_2(C_2H_5)_3$	196 71
38	" 40	*x*-bromoethylbenzene	$BrC_6H_4C_2H_5$	185 07
39	" 42	*x*-dibromoethylbenzene	$Br_2C_6H_3C_2H_5$	263 98
40	" 45	*x*-bromo-*x*-diethylbenzene	$BrC_6H_3(C_2H_5)_2$	213 12
41	" 47	*x*-bromoisopropylbenzene, *x*-bromocumene	$BrC_6H_4CH(CH_3)_2$	199 10
42	" 60	*x*-chloroisopropylbenzene, *x*-chlorocumene	$ClC_6H_4CH(CH_3)_2$	154 64
43	Allyl alcohol	allyl alcohol	CH_2CHCH_2OH	58 05
44	" chloride	" chloride	CH_2CHCH_2Cl	76 50
45	4-Aminobenzophenone	4-aminobenzophenone	$C_6H_5COC_6H_4NH_2$	197 23
46	Ammonium stearate, anhydrous	ammonium stearate, anhydrous	$NH_4C_{18}H_{35}O_2\cdot C_{18}H_{36}O_2$	585 98
47	Amyl acetate, tech	amyl acetate	$CH_3COOC_5H_{11}$	130 18
48	" " , high test	" acetate	$CH_3COOC_5H_{11}$	130 18
49	*sec.*-Amyl acetate	*sec* amyl acetate	$CH_3COOC_5H_{11}$	130 18
50	Amyl alcohol	isoamyl alcohol	$C_5H_{11}OH$	88 15
51	*pri-n*-Amyl alcohol	(1-pentanol) (normal butyl carbinol)	$CH_3(CH_2)_3CH_2OH$	88 15
52	*sec.*-Amyl alcohol	*sec.*-amyl alcohol	$C_5H_{11}OH$.	88 15
53	*tert.*-Amyl alcohol, refined	2 butanol,2-methyl	$CH_3CH_2C(CH_3)OHCH_3$	88 15
54	Amyl phthalate	diamyl phthalate	$C_6H_4(COOC_5H_{11})_2$	306 39
55	Amyl propionate	amyl propionate	$CH_3CH_2COOC_5H_{11}$	144 21
56	*N*-(*β*-phenoxyethyl)-Aniline	aniline,*N*-(*β*-phenoxyethyl)	$C_6H_5O(CH_2)_2NHC_6H_5$	213 27

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
29	cl. col. liq	almost none		866$\frac{25}{25}$
30	cl. col. liq	mild char		1 045$\frac{25}{25}$
31	cl. col. liq	mild, char		1 050$\frac{25}{25}$
32	cl. col. liq	faint char		1 210$\frac{25}{25}$
33	col. liq	none		1 208$\frac{25}{25}$
34	col. liq	char		1 017$\frac{25}{25}$
35	wh. cr. sold			1 552$\frac{60}{25}$
36	col. liq	aromatic		1 158$\frac{25}{25}$
37	col. liq	none		1 003$\frac{25}{25}$
38	col.-pa. straw liq	char		1 339$\frac{25}{25}$
39	cl. col. liq	fa		1 731$\frac{25}{25}$
40	col. liq	char		1 259$\frac{25}{25}$
41	col liq	char		1 294$\frac{25}{25}$
42	col liq	char		1 029$\frac{25}{25}$
43	col liq (poison)	lachrymatory, irritating	98 by wt	0 852$\frac{20}{20}$
44	col -straw. liq. (poisonous)	char	97 by wt	0 937$\frac{20}{20}$
45	lt. br cr sld	fa. char		
46	cream-colored wax-like sld	fa. fatty	tech	0 889$\frac{22}{22}$
47	w. wh liq	mild n res	90 93 by wt	868- 872$\frac{20}{20}$
48	w wh. liq	mild n res	85 88 by wt.	860- 864
49	w. wh. liq	mild n res	85 88	0 862-0 866$\frac{20}{20}$
50	w. wh liq	n res		811- 815$\frac{20}{20}$
51	w. white			0 82$\frac{20}{20}$
52	w wh liq	mild n res	99	810- 816$\frac{20}{20}$
53	w wh		98	0 81$\frac{20}{20}$
54	col. liq	sl pleas	99 100	1 022-1 026$\frac{20}{20}$
55	w. wh. liq	mild n. res	90 92	869- 873$\frac{20}{20}$
56	straw colored sld	amine-like		1 070$\frac{60}{25}$

See two following pages for additional data on above compounds

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
29	Alkazene 16	<−20		252 7-5%; 255–95%	204 8
30	" 20	<−70		182 8-5% 183 3–95%	149
31	" 21	<−70		181 2-5% 183 8–95%	147 2
32	" 24	<−70		224 5-5% 225 8–95%	201 2
33	" 25	<−70		220 6-5% 223 6–95%	204 8
34	" 28	<−70		217 8-5% 220 6–95%	195 8
35	" 32	53 2-53 6.	305		none
36	" 34	−55		249 0 5% 250 8–95%	249 8
37	" 36	<−60		249 9-5% 254 7–95%	235 4
38	" 40	−65		200 5 5% 202 8-95%	199 4
39	" 42	<−70		258 5-5% 260 6–95%	none
40	" 45	<−70		236 8-5% 238 8–95%	240 8
41	" 47	−30		212 4-5% 216 2–95%	204 8
42	" 60	<−20		191 3-5% 193 2–95%	174 2
43	Allyl alcohol	−129	97	<94° none; >99° none	85
44	" chloride	−134 5	45	<43° none >49° none	−20
45	4-Aminobenzophenone	119–122 2.			
46	Ammonium stearate, anhydrous	74–76	d. before boiling, *ca* 110		
47	Amyl acetate, tech			<110-none; 130-50%, >150-none	94
48	" " high test	−78 5	142 1	<110-none; 140-60%, >150-none	84
49	*sec*-Amyl acetate			123-init., 132-60%; >145-none	89
50	Amyl alcohol		131	<126 none >132 none	127
51	*pri-n*-Amyl alcohol	−78 5	137 9	134 5 138 5 95%	136
52	*sec*-Amyl alcohol			<105-none; 112-10%; 120–90%; >125–none	91
53	*tert*-Amyl alcohol, refined.			99 8-103 8-95%	70
54	Amyl phthalate	−30 (approx.)	264$^{99\ 6}$	256-269$^{99\ 5\,mm}$	359 6
55	Amyl propionate		160 3	<135-none; 150-30%; 165-90%; >175-none	106
56	*N*-(β-phenoxyethyl)aniline	43 8 48 5.	202^{10}.		338

See two preceding pages for additional data on above compounds.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
29	g. per 100 g: 22 meth. al.; eth., CCl_4, bz., acet.; i.w.			D
30	∞ meth. al., eth., bz., CCl_4, acet; i.w.			D
31	∞ meth. al., eth., bz., CCl_4, acet.; i.w.			D
32	∞ meth. al., eth., CCl_4, acet., bz.; i.w.			D
33	∞ acet., bz., CCl_4, eth., meth. al; i.w.			D
34	∞ eth., acet., bz., meth. al., CCl_4; i.w.			D
35	v.s. bz.; g. per 100 g.; 23 acet., 157 CCl_4, 166 eth., 2 meth. al.; i.w.			D
36	∞ eth., CCl_4, bz., acet.; g. per 100 g.: 50 meth. al.; i.w.			D
37	∞ eth., CCl_4, acet., bz.; g. per 100 g.: 38 meth. al.; i.w.			D
38	∞ meth. al., eth., bz., CCl_4, acet.; i.w.			D
39	∞ eth., CCl_4, bz., acet.; g per 100 g.: 50 meth. al.; i.w.			D
40	∞ eth., acet., bz., CCl_4; g. per 100 g.: 125 meth. al.; i.w.			D
41	∞ acet., bz., CCl_4, eth., meth. al.; i.w.			D
42	∞ acet, bz., CCl_4, eth., meth. al.; i.w.			D
43	∞ w	flavorings, perfumes, pharm.; raw mat. for plastics	drums, tins	S.C.
44	<.1 w	syn. pharm. & anesthetics mfg. plastics & synth. resins	drums, tins	S.C.
45	g. per 100 g.: 44 acet., 4 bz., .1 CCl_4, 2 eth., .2 meth. al., i.w.			D
46	disp. h.w.; s.h. al., hydrocarbons, oils	emulsifying, thickening, dispersing agt., cosmetics, waterproofing	drums, slabs	G.
47	1.744^{25}w	solv. cellu. nitrate; lacq. dopes, art. leather, coated paper, polishes	tank cars, drums, cans	C.S.
48	1.8^{25}w	solv. nitrocellulose, et. acetate. mfg. perfumes & flavors	tank cars, drums, cans	U.S.I.
49	0.8^{25}w	nitro. ethylcellu. solv. lacq.	tanks, drums, cans	U.S.I.
50	∞ com. org. solv	chemical syn	tank cars, drums, cans	U.S.I.
51	sl. s. w.; s. meth, al., ethyl ether., acet., bz., gasoline, acetate	mfg. of pharm. & synth. chem.	cans, drums	Sh.
52	8.2^{25}w	lacq thinner, chem. prep. base	tank cars, drums, cans	U.S.I.
53	partially s. w.; s. meth. al., ethyl eth., acet., bz., gasoline, ethyl acetate	dry-cleaning; coating mat	cans, drums	Sh.
54	0.01^{25} % by vol. wt	plasticizer, lubricant	drums, cans	C.S.
55	0.3^{25}	resins, nitro. solv.	tank cars, drums, cans	U.S.I.
56	v. s. eth., bz., acet., CCl_4, meth. al; i.w.	. . . . .	. .	D.

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
57	Arlacel A.	mannide monooleate	$C_6H_8O_2(OH)OCO(CH_2)_7$-$CH(C_8H_{17})CH$†	410.4†
58	" B	mannitan monooleate	$C_6H_8(OH)_3OCO(CH_2)_7$-$CH(C_8H_{17})CH$†	429†
59	" C	sorbitan monooleate	$C_6H_8O(OH)_3OCO(CH_2)_7$-$CH(C_8H_{17})CH$†	429†
60	Arlex	sorbitol	$C_6H_{14}O_6$	182.1
61	Atlas A-815	sorbide	$C_6H_8O_2(OH)_2$	146.1
62	" G-220	sorbitol tri-2-butylidene	$C_6H_8O_6(C_4H_8)_3$	
63	" G-221	" tributylidene	$C_6H_8O_6(C_4H_8)_3$	
64	" G-750	sodium sorbitol borate		
65	" G-2400	sorbitan tetrapropionate	$C_6H_8O(C_2H_5COO)_4$	388
66	" G-2800	mannitol polyoxyalkylene-deriv. of oleic acid		
67	" G-9046T	polyoxyalkylene deriv. of mannitan monolaurate		
68	" K-100	triisopropylidene mannitol	$C_6H_8O_6[C(CH_3)_2]_3$	302.36
69	" K-101	trimethylene mannitol	$C_6H_8O_6(CH_2)_3$	218.20
70	" K-103	triethylidene mannitol	$C_{12}H_{20}O_6$	260.28
71	" K-110	triisopropylidene sorbitol	$C_6H_8O_6[C(CH_3)_2]_3$	302.36
72	" K-111	trimethylene sorbitol	$C_6H_8O_6(CH_2)_3$	218.20
73	" K-113	triethylidene sorbitol	$C_{12}H_{20}O_6$	260.28
74	" NNO	mannitan monolaurate		
75	Benzene azophenol	*p*-hydroxy azobenzene	$C_6H_5N:NC_6H_4OH$	198.22
76	Benzene-*meta*-disulfonic acid	benzene-*meta*-disulfonic acid	$C_6H_4(SO_3H)_2$	238.23
77	Benzoyl acetone	benzoyl acetone	$C_6H_5COCH_2COCH_3$	162.18
78	Benzyl "Cellosolve"*		$C_6H_5CH_2OCH_2CH_2OH$	152.19
79	BK-5	butyl cinnamoyl pyruvate	$C_6H_5CH:CHCOCH_2COCO$-OC_4H_9	274.31
80	Bromoacetic acid	bromoacetic acid	$BrCH_2COOH$	138.96
81	5-Bromo- aspirin	acetyl-5-bromosalicylic acid	$BrC_6H_3(COOH)OCOCH_3$	259.06
82	2-Bromo-4 *tert*-butyl-phenol	2-bromo-4-*tert*-butyl-phenol	$BrC_6H_3(OH)C(CH_3)_3$	229.12

* Trade mark.
† Theoretical.

ORGANIC COMPOUNDS (Continued)

No	Physical form and color	Odor	Purity %	Sp. gr.
57	lt. amber oily liq.; ref. index 1.475^{25}	sl. char., pleasant; sl. oily taste	tech.	0.99–1.03
58	lt. amber oily liq.; ref. index 1.460^{25}	sl. char., pleasant; sl. oily taste	tech.	0.99–1.03
59	lt. amber oily liq.	faint, fatty	tech.	0.99–1.03
60	w. wh. to lt. straw-colored liq., ref. index 1.487^{25}	faint, sweet; bland sweet taste	83	1.322
61	pa. yel. liq.	carmel, with bitter taste	83	
62	lt. yel., non-hygroscopic fluid, liq.	sl. pungent; bitter taste	tech.	
63	lt. yel., non-hygroscopic fluid, liq.	sl. pungent; bitter taste		. . . .
64	w. wh. resin sol.; ref. index 1.452^{25}	. . .	80	1.47–1.54
65	lt. yel. mobile liq.; non-hygroscopic fluid	bland, ester-like; bitter taste	tech.	1.15^{20}
66	amber oily liq.; ref. index 1.471^{25}	faint, oily odor; sl. bitter taste	tech.	0.98–1.02
67	amber oily liq.; ref. index 1.4740	sl. sweet odor, sharp bitter taste	tech.	1.03–1.05
68	col. cr. need.	none; bitter taste	.	
69	col. cr. need.	none, bitter taste		
70	col. cr. need.	sl. pung., bitter taste		
71	col. cr. need.	none, bitter taste		
72	col. cr. need.	none, bitter taste		
73	lt. yel. liq.	none, bitter taste		
74	amber oily liq.	pleasant oily	tech.	1.00–1.05
75	tan cr. powd.	none . .		
76	cr. sld.	sl. like SO_2 .	ca. 80	
77	sld.		. .	
78	liq.	pleas. . .		$1.0700\frac{20}{20}$
79	yel. cr.	cinnamon like .	100	
80	wh.-pa. yel., deliq. cr. sld.	sharp, pen. . .	.	
81	wh. cr.	none .		.
82	cl. pa. straw colored liq.	mild	. .	$1.338\frac{25}{25}$

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
57	Arlacel A	−5 to 0°			395
58	" B.	11-14°			
59	" C.				395
60	Arlex				
61	Atlas A-815				
62	" G-220		145-165^{3mm}		
63	" G-221		162-167^{4mm}		
64	" G-750				
65	" G-2400				
66	" G-2800				
67	" G-9046T				610
68	" K-100	68-69	136-139^{4}		
69	" K-101	228-231		volatile with steam	
70	" K-103	171-172			
71	" K-110	39.5-40.5	127-130^{4}		
72	" K-111	211-214		volatile with steam	
73	" K-113		122-126^{4}	distilled with steam	
74	" NNO	15-16			385
75	Benzene azophenol	152.1-153.6			
76	Benzene-*meta*-disulfonic acid	109-115			
77	Benzoyl acetone	58			
78	Benzyl "Cellosolve"*	<−75	255.9		265
79	BK-5	63-64			
80	Bromoacetic acid	38.0-42.9			
81	5-Bromo aspirin	155.5-163.8			
82	2-Bromo-4-*tert*-butylphenol	<−20		109-5%, 129-95%	240.8

* Trade mark

See two preceding pages for additional data on above compounds.

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
57	s. most org. solv., i.w., polyal.; sl.s. veget.& animal oils, ether and glycols	w/o emulsifier; drugs, cosmetics	drums, cans	At
58	s. most org. solv.; sl s. veget. & animal oils, eth., & glycols; i.w., polyal.	w/o emulsifier; drugs, cosmetics	drums, cans	At.
59	s most org solv.; i w., polyal	w/o emulsifier; stab. to a and salts; cosmetics	drums, cans	At.
60	s.w., methanol, sl s pyridine, ethanolamines, acetic acid; i. hydrocarbons, other org solv	humectant, plasticizer cosmetics; leather finishing; glue	drums, cans	At.
61	s.w., lower al., ethylene, glycol, cellosolve, pyridine; i most other solv	humectant, solvent	drums, cans	At.
62	s hydrocarbons, eth, ketones; sl.s veget & mineral oils; i w.	plasticizer for vinyl polymers & cellu. deriv.	drums, cans	At.
63	s hydrocarbons, eth, ketone, al.; sl.s veg-mineral oils; i.w.	plasticizer for cellu. deriv & vinyl polymers	drums, cans	At.
64	s w; i most org solv	w sol resin binder, size, filler	drums, cans	At.
65	s hydrocarbons, eth, ketones, esters, v sl.s w.	plasticizer for vinyl polymers, synth. rubber, various cellu. deriv	drums, cans	At.
66	s veg oils, most org. solv. disp w	oil soluble emulsifying agt for Vitamin oils	drums, cans	At
67	s w, most org solv.; i. mineral & veget oils	emulsifier, wetting dispersing and solubilizing agt.	drums, cans	At
68	i.w., sl.s veget., animal oils; s. all organic solvents	antioxidant, color stab., source of mannitol plasticizer		At.
69	s. ketones, amines, eth., al.; sl.s. w., hydrocarbons, esters, oils	plasticizer, hardener for cellu. acetate and nitrate.	.	At.
70	s. al., eth.amines, ketones. sl.s. hydrocarbons, esters, eth.al. v.sl s.w.	plasticizer, hardening agt., alk. resistant, resins	..	At.
71	i.s.w., sl.s. veget. & animal oils, s. org. solv.	plasticizer, carrier for sorbitol and acetone		At.
72	s. al., amines, eth., ketones; sl s w., hydrocarbons, veget. and animal oils, esters, polyhydric al.	hardener or stiffener, alk. resistant resins		At.
73	s. al. eth., ketones, amines, esters; sl.s. hydrocarbons, veg. & animal oils, v. sl.s. w.	alkaline resistant resins, plasticizer		At.
74	s most org solv, dispersible w	insecticidal spreader	drums, cans	At
75	v.s. eth. g. per 100 g: 6 CCl_4, 2 bz., 31 al, i.w			D
76	v.s.w.; sl.s. al., eth., bz.; i.$CHCl_3$	electroplating	drums	Pa.
77	5^{20}% by wt. in w.	chem. inter.	cans (research quantities)	C. & C.
78	43^{23}% by wt. in w	perfume fixatives, solv. inks, dyes, resins	cans	C. & C.
79	> 2% veg. oils	light screen	barrels, bottles	U.S.I.
80	∞ w., al., eth., 26 g. per 100 g CCl_4			D
81	sl. s. eth., al., i.w., CCl_4, bz			D
82	∞ al., bz., CCl_4, eth, monochlorbenzene, pet. eth.; i.w.		.	D

No.	Trade name	Chemical name or synonyms	Formula	Mol wt.
83	4-Bromodiphenol	4-bromodiphenyl	$C_6H_5C_6H_4Br$	233 11
84	*p*-Bromophenol .	*p*-bromophenol	BrC_6H_4OH	173 02
85	2-Bromo-4-phenyl-phenol	3-bromo-4-hydroxy-diphenyl	$C_6H_5C_6H_3(OH)Br$	249 11
86	2-Bromopropane	isopropyl bromide	$CH_3CHBrCH_3$.	123 00
87	5-Bromosalicylic acid .	5-bromosalicylic acid	$BrC_6H_3COOH(OH)$	217 03
88	*o*-Bromotoluene	*o*-bromotoluene.	$BrC_6H_4CH_3$	171 04
89	*p*- "	*p*- "	$BrC_6H_4CH_3$	171 04
90	Butadiene	1,3-butadiene	$CH_2CHCH.CH_2$	54 09
91	" Pure	1,3-butadiene	$CH_2CHCHCH_2$	54 08
92	Butalyde	*n*-butyraldehyde	$CH_3(CH_2)_2CHO$	72 10
93	*n*-Butane, Pure	*n*-butane	$CH_3(CH_2)_2CH_3$	58 12
94	Butene-1, Technical	butene-1	$CH_2CHCH_2CH_3$	56 10
95	" -2, Technical	butene-2	$CH_3CH_2CH_3$	56 10
96	*n*-Butanol	*n*-butyl alcohol	$CH_3CH_2CH_2CH_2OH$	74 12
97	Butanol	" " "	$CH_3(CH_2)_2CH_2OH$	74 12
98	"	" " "	C_4H_9OH	74 12
99	*sec*-Butanol	*sec*- " "	$CH_3CH(OH)CH_2CH_3$	74 12
100	" " (-2)	" " "	$CH_3CH(OH)CH_2CH_3$	74 12
101	" "	" " "	C_4H_9OH	74 12
102	*n*-Butyl acetate	*n*-butyl acetate	$CH_3COOC_4H_9$	116 16
103	" " "	" " "	$CH_3COOC_4H_9$	116 16
104	" " "	" " "	$CH_3COOC_4H_9$	116 16
105	*sec*-Butyl acetate	*sec*-butyl acetate	$CH_3COOCH(CH_3)(C_2H_5)$	116 16
106	" " "	" " " .	$CH_3(C_2H_5)CHCOOCH_3$	116 16
107	" " "	" " "	$CH_3COOC_4H_9$.	116 16
108	Butyl acetyl ricinoleate	butyl acetyl ricinoleate	$C_{17}H_{32}(OCOCH_3)(COOC_4H_9)$	396 00
109	*tert*-Butyl alcohol	*tert*-butanol	$CH_3C(CH_3)(CH_3)OH$	74 12

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
83	wh. cr.	mild aromatic		.
84	wh.-pk. cr	phenolic		. ..
85	lt. colored cr. sld	fa. char		... ...
86	cl. col. mobile liq	mildly sweet		$1.304\frac{25}{25}$
87	wh. powd	fa. aromatic		...
88	pa.-straw colored liq	char. like bromobenzene		$1.422\frac{25}{25}$
89	wh. cr. sld	char. like bromobenzene		$1.400\frac{25}{25}$
90	inflam. liquified gas	hydrocarbon.	98 by wt	$0.618\frac{20}{4}$
91			99	$0.6222\frac{20}{4}$
92	w. wh. liq	char. pung	94	$.803-.809\frac{20}{20}$
93	flammable col. liq. or gas		99	$0.579\frac{20}{4}$
94	olefin ..		95	$0.595\frac{15.6}{15.6}$
95	olefin		95	$0.608\frac{15.6}{15.6}$
96	col. liq		99	$0.810-.813\frac{20}{20}$
97	w. wh. liq	n. res	95	$.810-.813\frac{20}{20}$
98	w. wh. liq	n. res	98-100	$.810-.813\frac{20}{20}$
99	w. wh. liq	char	98 by wt	$0.8065\frac{20}{4}$
100	liq	char	99-100	$0.807-.8107\frac{20}{20}$
101	w. wh. liq	mild n. res	99	$.808-.812\frac{20}{20}$
102	col. liq	char. ester	88-92	0.872-0.877
103	w. wh. liq	pleas. fruity, n. res	88-92	$.872-.880\frac{20}{20}$
104	w. wh. liq	mild, n. res	90-92	$0.874-0.878\frac{20}{20}$
105	col. liq	fruity	88-92 by wt	$0.860-.866\frac{20}{20}$
106	liq	char	85	$0.8598-.8658\frac{20}{20}$
107	w. wh. liq	mild, n. res	85-88	$0.862-.866\frac{20}{20}$
108	yel. oily liq	mild . .	95 .	$.94\frac{20}{20}$
109	w. cr. sld	sl. camphor-like .	99 by wt .	$0.7791\frac{20}{4}$

See two following pages for additional data on above compounds

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
83	4-Bromodiphenol	88 3–90 3..	311		291 2
84	*p*-Bromophenol	64 0–66 0.	237		>464
85	2-Bromo-4-phenylphenol	93 6–95 6.			
86	2-Bromopropane	−90		58 5–5%; 60 5–95%	none.
87	5-Bromosalicylic acid	165 2–167.7.			
88	*o*-Bromotoluene	−27		180 4–5%; 181 3–95%	174 2
89	*p*-Bromotoluene	25 5		183 3–5%; 184 1–95%	185
90	Butadiene	−108 7	−4 4		
91	" Pure		−4 75		
92	Butalyde	−99	75 7	71–78	64 4
93	*n*-Butane, Pure	−135	−0 6		−103
94	Butene-1, Tech.		6 1		
95	" -2, Tech		1 1–4 4		
96	*n*-Butanol	−90	117 9	<115–>118	116
97	Butanol	−89 (approx.)	117 7	<115-none; >118-none	95
98	"	−89 8	117 7	<115-none; >118-none	95
99	*sec*-Butanol	−114 7	99 5	<95-none; >101-none	85
100	" " , (2)			<94-none; 96-5%; 102–90%; >109-none	72
101	" Butyl alcohol	−114 7	99 5	<94-none; >96–10% 102–90%; 109-none	75
102	*n*-Butyl acetate	−75	126 3	118-128	100
103	" " "	−76 8	126 5	<110-none, >145-none	82 4
104	" " "	−76 8	126 5	<115-none, <127-70%, >135 none	81
105	*sec*-Butyl acetate		112 4	104-none, 108-10% 110 50%, 116 90%; 125 none	64
106	*sec*-Butyl acetate			104-none; 111-50% 116 95%, 125 none	66
107	" " "	−76 8	126 5	104-none, 111 10% 114 60%, 130-none	66
108	Butyl acetyl ricinoleate	−32 to −65		220 235[a-b]	230
109	*tert* " "	25 6	82 4	<78-none; >85-none 81–88 95%	60

• Trade mark

See two preceding pages for additional data on above compounds.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
83	g. per 100 g: 50 acet., 100 bz., 50 CCl_4, 34 eth, 3 meth.al; i.w.		.	D
84	v.s. meth. al., eth: g. per 100 g.: 88 acet., 40 bz., 3 CCl_4 1 w.			D
85	v.s.eth., acet. g. per 100 g.: 125 al., 32 bz., 8 CCl_4: i.w.			D
86	∞ al., acet., CCl_4, bz., eth; sl. s.w.			D
87	g. per 100 g.: 85 al., 70 eth., 1 bz., .3^{80} w.; i. CCl_4, i. w^{25}			D
88	∞ meth. al., eth., CCl_4, bz., acet.; i.w.			D
89	∞ meth.al., eth., CCl_4, bz., acet.; i.w.		.	D
90		mfg. synth. rubber	cylinders, tank cars	S.C.
91	.	copolymerizations to form synth. rubbers	...	P.P.
92	6.24^{25} w	mfg. butyric acid, flavoring extracts, medicines, perfumes, synth. resins	tank cars, drums, cans	C.S.
93		hydrocarbon research; refrig., solv	cylinders	P P
94		polymerization .	cylinders	P P.
95		resin mfg ; copolymerization	cylinders	P P
96	7.7^{20}% by wt. in w	dehydrating agt; solv		C. & C.
97	misc. all org solv.; 7 20^{25} w	blending agent; solv. resins, waxes, gums, oils, alkaloids; detergent; syn. base mat.	tank cars, comp. tank cars, drums	C.S.
98	20^{25}w	mfg. nitro. solv. gen. org. mfg. of derivatives	tank cars, drums	U.S.I.
99	24.4^{20}% by wt, in w.; w. in comp 56.0^{20}% by wt.	lacq. thinners, solv., mfg. org. chem.	tank cars	S.C.
100	19^{25}w	gen. solv	tank cars, drums, cans	St.
101	34^{25}w	mfg. chem. deriv., lacq. thinners	tank cars, drums, cans	U.S.I.
102	sl s. w.; ∞ com. org	medium boil. solv. nitro. cellu.; lacq., art. leather, plastics, photo. films	cans, drums, tank cars	C. & C.
103	misc. all com. org. solv .436^{25} w.	solv. nitro., lacq. etc.; perfume and flavor base	tank cars, drums	C.S.
104	1.2^{25} w.	nitro. solv.; textile sizing	tanks, drums, cans	U.S.I.
105	misc. caster, linseed oil, hydrocarbons	solv., lacq	tank cars, drums, cans	S.C.
106	.74^{25}w	lacq., solv .	tank cars, drums, cans	St.
107		nitro. solv., lacq. thinners; lacq. text. sizing	tank cars, drums, cans	U.S.I.
108	misc. most org. solv.; i w	plasticizing agt; emulsifying, lubricating detergent agent	tank cars; comp. tank cars, steel drums, cans	C.S.
109	misc. w., org. solv	extr. solv. drugs; blend. agt., insecticides, fumigant, denaturant. synth. resins, mfg. perfumes, disinfections	tank cars, drums, tins	S.C.

No	Trade name	Chemical name or synonyms	Formula	Mol. wt.
110	*n*-Butyl amine	*n*-butyl amine	$CH_3CH_2CH_2CH_2NH_2$	73.14
111	*sec*-Butyl carbinol	*pri*-active amyl alcohol (1-butanol 2-methyl)	$CH_3CH_2CH(CH_3)CH_2OH$	88.15
112	Butyl "Carbitol"*	diethylene glycol mono-butyl ether	$C_4H_9OCH_2CH_2OCH_2CH_2OH$	162.23
113	" " acetate	diethylene glycol mono-butyl ether acetate	$CH_3CO(OC_2H_4)_2OC_4H_9$	204.26
114	4-*tert*-Butyl catechol	4-*tert*-butyl-1,2-dihydroxy-benzene	$(OH)_2C_6H_3C(CH_3)_3$	166.21
115	Butyl "Cellosolve"*	ethylene glycol monobutyl ether	$C_4H_9OCH_2CH_2OH$	118.17
116	*n*-Butyl chloride	*n*-butyl chloride	$CH_3CH_2CH_2CH_2Cl$	92.57
117	4-*tert*-Butyl-2-chlorophenol	4-*tert*-butyl-2-chlorophenol	$ClC_6H_3(OH)C(CH_3)_3$	184.66
118	*p*-*tert*-Butyl-*o*-cresol	4-*tert*-butyl-2-methyl phenol	$(OH)C_6H_3CH_3C(CH_3)_3$	164.24
119	Butyl ether	butyl ether	$C_4H_9OC_4H_9$	130.23
120	" "	" "	$C_4H_9OC_4H_9$	130.23
121	" lactate	" lactate	$CH_3CHOHCOOC_4H_9$	146.18
122	Butyl oxalate	dibutyl oxalate	$(COOC_4H_9)_2$	202.25
123	" phthalate	" phthalate	$C_6H_4(CO_2C_4H_9)_2$	278.34
124	β-*n*-Butyloxyethyl salicylate	β-*n*-butyloxyethyl salicylate	$OHC_6H_4COOCH_2CH_2OC_4H_9$	238.28
125	4-*tert*-Butyl-2-phenylphenol	5-*tert*-butyl-2-hydroxydiphenyl	$C_6H_5C_6H_3OHC(CH_3)_3$	226.31
126	Butyl propionate	butyl propionate	$CH_3CH_2COOC_4H_9$	130.18
127	Butyl stearate	butyl stearate	$C_{17}H_{35}COOC_4H_9$	340.58
128	1,3-Butylene glycol	1,3-butylene glycol	$CH_3CH(OH)CH_2CH_2OH$	90.12
129	*n*-Butyraldehyde	*n*-butyric aldehyde	$CH_3CH_2CH_2CHO$	72.10
130	*n*-Butyric acid	*n*-butyric acid	$CH_3CH_2CH_2COOH$	88.10
131	Butyric anhydride	butyric anhydride	$(CH_3CH_2CH_2CO)_2O$	158.19
132	Calcium benzene-*meta*-disulfonate	calcium benzene-*meta*-disulfonate	$C_6H_4(SO_3)_2Ca$	276.29
133	*n*-Caproic acid	*n*-caproic acid	$CH_3(CH_2)_4COOH$	116.16
134	"Carbitol"*	diethylene glycol mono-ethyl ether	$C_2H_5OCH_2CH_2OCH_2CH_2OH$	134.17
135	"Carbitol"* acetate	diethylene glycol mono-ethyl ether acetate	$CH_3COOCH_2CH_2OCH_2CH_2OC_2H_5$	176.21
136	Catechol	pyrocatechol	$C_6H_4(OH)_2$	110.11
137	"Cellosolve"*	ethylene glycol monoethyl ether	$C_2H_5OCH_2CH_2OH$	90.12
138	"Cellosolve"* acetate	ethylene glycol monoethyl ether acetate	$CH_3COOCH_2CH_2OC_2H_5$	132.16

* Trade mark

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
110	liq	char. ammoniacal		$0.740\frac{20}{20}$
111	w. white			$0.81\text{–}0.82\frac{20}{20}$
112	col. liq	almost none	96	$0.954\text{–}0.960\frac{20}{20}$
113	liq	almost none	95 100	$0.9810\frac{20}{20}$
114	tan cr. sld	phenolic		$1.049\frac{60}{25}$
115	w. wh. liq	mild	99	$0.9019\frac{20}{20}$
116	liq			$0.8854\frac{20}{20}$
117	lt. straw-colored liq	char		$1.112\frac{25}{25}$
118	straw-colored liq	char		$.969\frac{25}{25}$
119	col liq	ethereal		0.7696
120	w. wh. liq	mild, ethereal	99 95	$.769\text{–}.771\frac{20}{20}$
121	w. wh. liq	mild n. res	95	$.974\text{–}.984\frac{20}{20}$
122	w. wh liq	mild	99	$.989\text{–}.993\frac{20}{20}$
123	w. wh. liq	none	99 100	$1.047\text{–}1.051\frac{20}{20}$
124	col. refractive liq	mild, pleas		$1.077\frac{25}{25}$
125	wh. cr sld. or visc liq	fa char		$1.022\frac{55}{25}$
126	w. wh. liq	mild, n. res	90 92	$.868\text{–}.872\frac{20}{20}$
127	lt. straw	faint	98 5	$.855\text{–}.862\frac{20}{20}$
128	col. liq	odorless		1.0059
129	col. liq	char pung. aldehyde	96	$0.803\text{–}.808\frac{20}{20}$
130	col liq	strong char	99 100	$0.957\text{–}.961\frac{20}{20}$
131	col. liq	pungent	95 100	$0.9681\frac{20}{20}$
132	lt gray powd	none		
133	col liq	char	98 100	$0.9295\frac{20}{20}$
134	col. sl. hyg. liq	mild, pleas		$1.024\text{–}1.030\frac{20}{20}$
135	col. liq	pleas, ester-like	95	$1.0114\frac{20}{20}$
136	wh cr	phenolic	100	1.371
137	w. wh liq	mild, agreeable, n res	99	0.928–0.933
138	w. wh. liq	pleas ester-like	95	0.971–.976

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
110	*n*-Butyl amine		78	73–92	<40
111	*sec*-Butyl carbinol	<−70	128	125–131–95%	122
112	Butyl "Carbitol"*	−73.9	230.7	220-none; 224-5% 232–95%	240
113	" " acetate	−32.2	264.4	235–250	240
114	4-*tert*-Butyl catechol	55.4–56.7	285		266
115	Butyl "Cellosolve"*	<−100	171.2	<163->174 none	165
116	*n*-Butyl chloride.	−123.1	78.0	71–86	<40
117	4-*tert*-Butyl-2-chlorophenol	<−20		234-5%, 251–95%	224.6
118	*p*-*tert*-Butyl-*o*-cresol	27		136.8-5%; 138–95%	244.4
119	Butyl ether	−94.1	142.4	137–143	100
120	" "	−96	140.9	<137-none; >143-none	87
121	" lactate	−43		149-none; 155–195-90%; 187–189-60%	159.8
122	" oxalate	−29.6	245.5	<240-5%; 248–90; >255 none	265
123	" phthalate		236–244^{50mm}	236–244^{50mm}	352
124	β-*n*-Butyloxyethyl salicylate	<−20		186-5%, 192.8–95%	314.6
125	4-*tert*-Butyl-2-phenylphenol	50		196-5%; 198.5–95%	320
126	Butyl propionate	−89.5	146.8	<120-none; <140-50%, <150-85%	109
127	Butyl stearate	19		220–225^{25}	370
128	1,3-Butylene glycol		206.5		250
129	*n*-Butylraldehyde	−99	75.7	<70-none; <80–95%	20
130	*n*-Butyric acid	−6.3	163.7	<158-none, >165 none	170
131	Butyric anhydride	−65.7	199.5	<190 none, >200 none	190
132	Calcium benzene-*meta*-disulfonate				. .
133	*n*-Caproic acid	−5.4	203.1	195–212	215
134	"Carbitol"*	<−76	201.9	185–205	210
135	"Carbitol"* acetate	−25	217.7	208–223	230
136	Catechol		130–137$^{2-3}$	130–137$^{2-3}$	
137	"Cellosolve"*	<−70	135.1	132–137	130
138	"Cellosolve"* acetate		156.3	145–165	140

* Trade mark.

See two preceding pages for additional data on above compounds.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
110	∞ w	chem. inter	drums	C. & C.
111	s. meth. al., ethyl eth., acet., bz., gasoline, ethyl acetate; sl. s.w.	org. syn	cars, drums	Sh.
112	∞ w	solv. nitro. & resins	cans, drums	C. & C.
113	misc. most org. liq.; 6.5^{20}% by wt. in w.	formation of nitro. & synth. resin coatings	cans, drums	C. & C.
114	v.s. meth. al., eth., CCl_4, bz., acet.; i.w.			D
115	∞ w	solv. lacq., nitro., resins	cans, drums	C. & C.
116	i.w	chem. inter	cans	C. & C.
117	∞ meth. al., eth., CCl_4, bz., acet., i.w.			D
118	∞ meth. al., eth., CCl_4, bz., acet., i.w.			D
119	0.05^{20}% by wt. in w	extr. agt. inert reaction medium	drums	C. & C.
120	s. most com. org. solv.; i. imm. w.	solv. gums, oils, org. a.; extr. ppnt. grignard solv.	drums, cans	C.S.
121	misc. org. solv.; 3.33^{25}w	solv. nitro., oils, dyes, nat. gums, synth. resins	tanks, comp. cars, drums	C.S.
122	1.6^{25}w	org. syn	tank cars, drums	U.S.I.
123	0.15^{25}w	nitro. plasticizer, paper coatings, linoleum, shatter-proof glass, airplane dope	tank cars, drums, cans	U.S.I.
124	∞ eth., CCl_4, bz., al., acet.; i.w.			D
125	v.s. meth. al., eth., CCl_4, bz., acet. i.w.			D
126	1.2^{25}w	cellu. nitrate solv	tank cars, drums, cans	U.S.I.
127	misc. org. liq.; 17^{12}w	plasticizer, lubricant, polish cosmetic base	drums, cans	C.S.
128	∞ w	mfg. plasticizer, resins, etc	cans	C. & C.
129	7.1^{20}% by wt. in w	prep. rubber accel., synth. resins, org. syn.	cans, drums	C. & C.
130	∞ w	drugs, deliming hides, lacq	drums	C. & C.
131	d w	esterfying agt	cans, drums	C. & C.
132	s.w	dyestuff inter	drums	Pa.
133	1.10^{20}% by wt. in w	formation esters	cans, drums	C. & C.
134	∞ w	solv. nitro.; non-shatterable glass	cans, drums	C. & C.
135	∞ w., misc. most org. solv	resin finishes; printing ink	cans, drums	C. & C.
136	s. w., al., eth. amyl al., acet	antioxidant, photo. developer, dye inter.	drums, barrels	Pa.
137	∞ w	lacq., nitrocellu. solv	cans, drums, cars	C. & C.
138	23^{20}% by wt. in w	solv. for nitro. & resins.	cars, drums.	C. & C.

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
139	*o*-Chloracetoacetanilide	*o*-chloracetoacetanilide	$CH_3COCH_2CONHC_6H_4Cl$	211.65
140	Chloracetyl chloride	chloracetyl chloride	$ClCH_2COCl$	112.95
141	Chloramine-B	sodium *N*-chlorobenzenesulfonamide	$C_6H_5SO_2Na{:}NCl.1\frac{1}{2}H_2O$	240.6
142	5-Chloroanthranilic acid	2-amino-5-chlorobenzoic acid	$ClC_6H_3NH_2COOH$	171.58
143	4-Chlorobenzophenone	4-chlorobenzophenone	$C_6H_5COC_6H_4Cl$	216.66
144	β-Chloroethyl acetate	β-chloroethyl acetate	$CH_3COOCH_2CH_2Cl$	122.55
145	2-Chloroethyl-2-xenyl ether	2-(β-chloroethoxy)diphenyl	$C_6H_5C_6H_4OCH_2CH_2Cl$	232.70
146	β-Chlorophenetole	β-phenoxyethyl chloride	$C_6H_5OCH_2CH_2Cl$	156.61
147	*o*-Chlorophenoxyacetic acid	*o*-chlorophenoxyacetic acid	$ClC_6H_4OCH_2COOH$	186.59
148	2-Chloro-4-phenylphenol	3-chloro-4-hydroxydiphenyl	$C_6H_5C_6H_3ClOH$	204.65
149	*x*-Chloro-(phenyl xenyl ether)	*x*-chloro(phenyl diphenyl ether)	$C_{18}H_{13}OCl$	280.74
150	Chloropicrin	chloropicrin	CCl_3NO_2	164.38
151	α-Chloropropionic acid	α-chloropropionic acid	$CH_3CHClCOOH$	108.53
152	1-Chloropropylene	1-chloro-1-propene	$CH_3CHCHCl$	76.53
153	*ortho*-Chlor phenol	*ortho*-chlorophenol	C_6H_4OHCl	128.56
154	Coumarin-3-carboxylic acid	coumarin-3-carboxylic acid	$C_6H_4(CHC(COOH))(OCO)$	190.15
155	Crotonaldehyde	crotonaldehyde	$CH_3CH{:}CHCHO$	70.09
156	Crotonaldehyde	crotonaldehyde	$CH_3CHCHCHO$	70.09
157	Crotonic acid	crotonic acid	$CH_3CH{:}CHCOOH$	86.09
158	Crotonyl alcohol	crotonyl alcohol	$CH_3CH{:}CHCH_2OH$	72.10
159	Crystalline sorbitan	monoanhydrosorbitol	$C_6H_8O(OH)_4$	164.16
160	Cumene	isopropylbenzene	$C_6H_5CH(CH_3)_2$	120.19
161	*p*-Cumyl phenol	α, α-dimethyl-*p*-benzylphenol	$C_6H_5C(CH_3)_2C_6H_4OH$	212.28
162	Cyanoacetic ester	ethyl cyanoacetate	$CH_2CNCOOC_2H_5$	113.11
163	Cyclohexane	hexahydrobenzene	$(CH_2)_6$	84.16
164	Cyclohexene	cyclohexene	$(CH_2)_4(CH)_2$	82.14
165	Cyclohexyl glycolate	cycloyhexyl glycolate	$(CH_2)_5CHOOC.CH_2OH$	158.2
166	Cyclohexyl levulinate	cyclohexyl levulinate	$(CH_2)_5CHOOCCH_2CH_2COCH_3$	198.25
167	Cyclohexyl stearate	cyclohexyl stearate	$(CH_2)_5CHOOCC_{17}H_{35}$	366.6

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr
139	wh. cr. sld .	odorless		
140	col. liq	sharp, pung	.	1.498
141	col. flat cr ..	essentially odorless .	99 .	
142	grayish-wh gran	fa. char	. .	. .
143	col. cr. sld	fa. pleas	..	.
144	col. liq	fruity	. .	$1.152\frac{25}{25}$
145	fine wh. cr		..	$1.142\frac{60}{25}$
146	col. liq .	pleas aromatic	. .	$1.147\frac{25}{25}$
147	wh cr sld	almost none		
148	wh cr	char	.	. .
149	pa. straw-colored visc	none		$1.162\frac{25}{25}$
150	liq	pen. tear gas	99.5	$1.651\frac{20}{4}$
151	col. liq	char		$1.263\frac{25}{25}$
152	col volatile liq	char		$0.935\frac{15}{25}$
153	wh liq	strong phenolic	*ca* 97	1.250^{18}
154	lt. tan cr powd	. .		.
155	straw colored, flam. liq	char. pung. irritating	90	0.866-0.876
156	w. wh.-yel liq inflam	char. lacrymatory	97-99	$0.852\frac{20}{4}$
157	straw-colored liq	.. .	.	0.966
158	liq	. .		0.873
159	col. cr	none; sweet with bitter aftertaste	v. high .	
160	cl. col mobile liq	pleas. char		$.861\frac{25}{25}$
161	wh.-lt. tan. cr sld	fa phenolic		.
162	col. liq .	sweetish ester-like		$1.059\frac{25}{25}$
163	col. liq	char. aromatic		$0.777\frac{25}{25}$
164	col. liq	char		$0.808\frac{25}{25}$
165	yel. liq	spicy	....	1.030^{27}
166	amber liq	spicy .	.	$1.023\frac{25}{25}$
167	cream-colored soft sld	spicy		0.925^{25}

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
139	*o*-Chloracetoacetanilide	107			none
140	Chloracetyl chloride		105		none
141	Chloramine-B	d, *ca* 170			
142	5-Chloroanthranilic acid	179 4-185 4.			
143	4-Chlorobenzophenone	64 5-72 1.	331		
144	*β*-Chloroethyl acetate	<−20		144 7-5%; 146 5 95%	150 8
145	2-Chloroethyl-2-xenyl ether	53 8-56 7.	323		320
146	*β*-Chlorophenetole	24 5		152 6-5%; 155 2-95%	224 6
147	*o*-Chlorophenoxyacetic acid	146 0-148 5.			
148	2-Chloro-4-phenylphenol	78-80	323		345 2
149	*x*-Chloro-(phenylxenylether)	−10	$>180^{10}$		314 6
150	Chloropicrin	−64	112 2 1, some d	110 5-113 5, 96%	none
151	*α*-Chloropropionic acid	<−20		183 6-5%; 189 5-95%	215 6
152	1-Chloropropylene	<−20		30 3-5%, 32 0-95%	<21 2
153	*ortho*-Chlor phenol	7	172-173	172-173	
154	Coumarin-3-carboxylic acid	189 4-190 4.			
155	Crotonaldehyde	−75	102 3	<82-none; <108-90%	55
156	Crotonaldehyde	−69	102 4	99-104	80 5
157	Crotonic acid	72	185		
158	Crotonyl alcohol		117		
159	Crystalline sorbitan	110-111			
160	Cumene	<−70		152-5%, 153-95%	96 8
161	*p*-Cumyl phenol	187^{10}			320
162	Cyanoacetic ester	<−20		205 3-5%, 209 1 95%	219 2
163	Cyclohexane	>0		80 3-81 1	32
164	Cyclohexene	<−20		83 1-84 2	21 2
165	Cyclohexyl glycolate				
166	Cyclohexyl levulinate				
167	Cyclohexyl stearate	28-29			

See two preceding pages for additional data on above compounds.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
139	. .	printing inks, coloring	cans, drums .	C. & C.
140	d.w	chem. inter .	. . . .	C. & C.
141	25^{20}w.; d. eth. al., acet.; i.bz.	germicide, oxidizing agt .	barrels, fiber containers	S.P.
142	g. per 100 g: 10 al.; i.w., bz., CCl_4, eth.			D
143	g. per 100 g.: 3 meth. al.; 57 eth.; 54 CCl_4; 95 bz., 94 acet.; i.w.	.		D
144	∞ meth. al., eth., CCl_4, bz., acet., g. per 100 g.: 3 w.			D
145	g. per 100 g: 12 meth. al.; 29 CCl_4, 51 isopropyl eth., v.s. bz., acet., v.sl.s. w.			D
146	∞ meth.al., isopropyl eth., CCl_4, bz., acet. v.sl.s. w.			D
147	g. per 100 g.: 5 w., 9 eth., 21 al.; i.bz., CCl_4.	. . . . . .	. .	D
148	g. per 100 g.: .03 w, 100 meth. al., 100 eth., 100 acet., 50 bz., 25 CCl_4			D
149	g. per 100 g.: meth. al.; eth., CCl_4, bz., acet.; i.w.			D
150	0.162^{25}w .	fumigant, tear gas	steel cylinders	An.
151	∞ w., acet., bz., CCl_4, eth., meth.al			D
152	∞ acet., bz., CCl_4, eth., meth.al.	.		D
153	s. al., eth	make catechol	drums	Pa.
154	g. per 100 g.: 0.9 al., 0.7 bz.; i.w.		.	D.
155	15.3^{20}% by wt. in w.	tear gases, chem. syn., warning agt.	cans, drums	C. & C.
156	∞ al. eth. benzol. toluol, kerosene, gasoline; 18.05 w.	dyestuffs, rubber accel., tear gas, purif. lubr. oils	drums	N.
157	8.3^{20}% by wt. in w	chem. inter	research quantities	C. & C.
158	15^{20}% by wt. in w.	inter. syn. drugs, esters	research quantities	C. & C.
159	s. w., pyridene, acet.a., al.; sl.s. dioxan, acet., meth.et.ketone; i. most other org. solv.	org. syn.	.	At.
160	∞ eth., CCl_4, bz., al.; i. w.	.		D
161	v.s. acet.; g. per 100 g.: 123 bz., 36 CCl_4; i.w.			D
162	2 g. per 100 g. w.; eth., CCl_4, bz. al., acet.			D
163	∞ acet., bz., CCl_4; i.w.		.	D
164	v.s. acet.; bz., meth. al., CCl_4, v.sl. s.w.	.	.	D
165	sl.s. w.; s. al., acet., toluene, naphtha, ethyl acetate	plsticizer for proteins	. . .	G
166	s. al., acet., ethyl acetate, toluene, naphtha; i.w.	plasticizer, solv	.	G
167	s.h. al., acet., toluene, naphtha; i.w.	plasticizer	.	G

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
168	*o*-Cyclohexylphenol.	*o*-cyclohexylphenol	$(HO)C_6H_4(C_6H_{11})$	176 25
169	*p*-Cyclohexylphenol	*p*-cyclohexylphenol	$(HO)C_6H_4(C_6H_{11})$	176 25
170	Decylene glycol .		$CH_3CH(OH)C(C_2H_5)$-$(C_4H_9)CH_2OH$	174 28
171	Diacetone alcohol (acetone free)	4-hydroxy-4-methyl-pentanone-2	$(CH_3)_2COHCH_2COCH_3$	116 16
172	Diacetone-(acetone free)	diacetone	$CH_3COCH_2C(CH_3)_2OH$	116 16
173	Diacetone alcohol (acetone free)	4-hydroxy-4-methyl-pentanone-2	$(CH_3)_2COHCH_2COCH_3$	116 16
174	Diacetone, tech	diacetone	$CH_3COCH_2C(CH_3)_2OH$	116 16
175	" alcohol, tech	4-hydroxy-4-methyl-pentanone-2	$CH_3COCH_2C(OH)(CH_3)CH_3$	116 16
176	" glucose	diacetone glucose	$C_{12}H_{20}O_6$	260 28
177	Diallyl ether	diallyl ether	$CH_2CHCH_2OCH_2CHCH_2$	98 14
178	4-4′-Diaminobenzophenone	4-4′-diaminobenzophenone	$(NH_2C_6H_4)_2CO$	212 24
179	4-4′-Diamino diphenyl ether	4,4′-diamino diphenyl ether	$NH_2C_6H_4OC_6H_4NH_2$	200 23
180	1,3-Diamino-isopropanol	1,3-diamino-2-propanol	$NH_2CH_2CHOHCH_2NH_2$	90 13
181	Diamyl phthalate	amyl phthalate	$C_6H_4(CO_2C_5H_{11})_2$	306 39
182	Di(*β*-ethyloxy)aniline	*N*-phenyldiethanolamine	$C_6H_5N(CH_2CH_2OH)_2$	181 23
183	Dibenzothioxin	phenothioxin	$C_6H_4SOC_6H_4$	200 24
184	Dibenzyl	dibenzyl	$C_6H_5CH_2CH_2C_6H_5$	182 25
185	Dibenzyl disulfide	dibenzyl disulfide	$C_6H_5CH_2SSCH_2C_6H_5$	246 37
186	4,4′Dibromodiphenyl	4,4′ dibromodiphenyl	$BrC_6H_4C_6H_4Br$	312 02
187	Di(*n*)butyl amine	di(*n*)butyl amine	$(CH_3CH_2CH_2CH_2)_2NH$	129 24
188	Di- -butylamine	dibutylamine	$(C_4H_9)_2NH$	129 23
189	Dibutyl phthalate	dibutyl phthalate	$C_6H_4(CO_2C_4H_9)_2$	278 34
190	" "	" "	$C_6H_4(COOC_4H_9)_2$	278 34
191	" tartrate	" tartrate	$(CO_2C_4H_9)_2(CHOH)_2$	262 30
192	2,5-Dichloraceto-acetanilide	2,5-dichloracetoacetanilide	$CH_3COCH_2CONHC_6H_3Cl_2$	246 09
193	Dichlorethyl ether	2-2′-dichlorethyl ether	$ClCH_2CH_2OCH_2CH_2Cl$	143 02
194	Dichlorisopropyl ether	dichlorisopropyl ether	$CH_3CH(CH_2Cl)OCH(CH_2Cl)$-$CH_3$	171 07

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
168	grayish-wh. sld	phenolic		1.018^{60}_{25}
169	grayish-wh. fine cr.	fa. phenolic		
170	liq			0.945^{20}_{20}
171	col. liq	pleas		0.937–.942
172	w. wh. liq	mild		$0.937–.943^{20}_{20}$
173	w. wh.	faint		$.937–.946^{20}_{20}$
174	w. wh. liq	mild	85–87 by wt	$.915–.920^{20}_{20}$
175	w. wh. liq	faint	85–87 by wt	$.9382^{20}_{4}$
176	cr. sld			
177	col. liq	pung	95	$.805^{20}_{4}$
178	lt. tan gran	none		
179	tan powd	faint		
180	wh.-pa. yel. hyg. cr. sld	amine-like		1.085^{60}_{25}
181	w. wh. liq	almost none	99–100	$1.022–1.026^{20}_{20}$
182	lt. tan sld	fa. amine-like		1.119^{60}_{25}
183	wh. cr	fa. pleas		1.226^{60}_{25}
184	sld			
185	pk. cr. sld	pung		
186	wh. cr	fa. aromatic		
187	liq	char., ammoniacal		0.7680^{20}_{20}
188	w. wh.	ammoniacal		0.76^{20}_{20}
189	stable, col. liq	fa. v. sl. aromatic	98	1.047–1.049
190	w. wh.	none	99–100	1.047–1.049
191	lt. straw	mild, pleas	98	$1.087–1.093^{20}_{20}$
192	wh. cr. sld			
193	col. liq	chloroform-like	99	$1.219–1.224^{20}_{20}$
194	col. liq	chloroform-like		1.1122

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
168	*o*-Cyclohexylphenol	47 3-55 5.	148^{10}		273 2
169	*p*-Cyclohexylphenol	129 2-131 4.	166		
170	Decylene glycol		130^{3}		>250
171	Diacetone alcohol	−42 8	167 9.	<135-none; >−170-none	170
172	Diacetone-acetone free	−44	164-166	130-180; 150-170 85%	153
173	Diacetone alcohol	−44	166	130-180	151
174	" tech	−63(approx)		60-180	39
175	" alcohol, tech	−44	166	<60-none, <100 none; <150-25%, >175-none	151
176	" glucose	110-111			
177	Diallyl ether		95		20
178	4-4′-Diaminobenzophenone	239 0-244 6.			
179	4,4′-Diamino diphenyl ether	178-185.			
180	1,3-Diaminoisopropanol	39 4	130^{10}		269 6
181	Diamyl phthalate		$247\text{-}255^{50}$	$247\text{-}255^{10}$	357
182	Di(β-ethyloxy)aniline	55	200^{10}		392
183	Dibenzothioxin	54 6-57 1.	180^{10}		323 6
184	Dibenzyl	52			
185	Dibenzyl disulfide	58 9-65 4.			
186	4,4′-Dibromodiphenyl	166 8-167 7.			
187	Di(*n*)butyl amine		159	150 180	135
188	Di-*n*-butylamine	<−50	161	153-172	135
189	Dibutyl phthalate	−35 (approx)	339 2		340
190	" "	<−10		$227\ 235^{37}$	347
191	" tartrate	21	204^{26}	197-204	270
192	2,5-Dichloracetoacetanilide	92-96			none
193	Dichlorethyl ether	−51 9	178 5	<170-none; >180-none	185
194	Dichlorisopropyl ether	−79 6	187 3 .	180-190	185

See two preceding pages for additional data on above compounds

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
168	v.s.acet., bz., eth.; 75 g. per 100 g.: CCl_4, v. sl. s. w.			D
169	v. sl. s. w.; g. per 100 g.: 70 acet.; 4 bz., 2 CCl_4, v.sl.s.w.			D
170	sl. s. w	chem. inter	research quantities	C. & C.
171	∞ w.	solv. nitro., cellu. acetate, oils, resins, waxes	cans, drums, tins	C. & C.
172	misc. w	thinner, preservative, anti-freeze	tank cars, comp. tank cars, drums, cans	C.S.
173	∞ w.	solv. nitro., cellu. acetate, resins, gums, lacq., thinners	tank cars, drums, tins	S.C.
174	misc. w	thinner, preservative, anti-freeze	tank cars, drums, cans	C S.
175	misc. dist. w.	high boil, solv. hydraulic brake fluid, photo. film	tank cars, drums	S.C.
176	s. w., acet., ethanol, meth.al.			C.P.
177	0.3w			S.D.
178	i. w., bz., CCl_4, eth., meth. al., acet			D
179	15 g. per 100 g. acet.; i.w., al., CCl_4, eth., bz.			D
180	s. w. al., acet.; i. bz. CCl_4, eth.			D
181	0.05^{25}w	nitro. solv. mfg. lacq., plastics	tank cars, drums, cans	U.S.I.
182	g. per 100 g.: 5 w., 1 CCl_4, 23 bz., 29 eth., v.s. acet., meth. al.			D
183	g. per 100 g.: 7 meth. al.; 165 eth., 100 CCl_4, 165 bz., 200 acet., i.w.			D
184			research quantities	C. & C.
185	s. bz., CCl_4, v.sl s al , i.w			D
186	g. per 100 g.: 3 meth. al., 2 eth.; 4 CCl_4,; 8 bz.; 3 acet.; i.w.			D
187	∞ w	mfg. rubber accel., dystuffs.	drums	C. & C.
188	∞ most org. solv ; i.w	rubber vulcanization accel., flotation reagents; dyestuffs, corrosion inhibitors	cans, drums	Sh.
189	$<0.02^{20}$% by wt. in w	solv. for resins, plasticizer	cans, drums	C. & C.
190	$.0418^{25}$w., misc. all org. liq.	solv. dyes, oils, resins, nitro., lubricant, perfume fixative, antifoaming agt., plasticizer	tanks, drums comp. cars	C.S.
191	misc. meth., et. & buty al., butyl, et. acetates, eth., acet , benzol., naphtha	plasticizer cellu. acetates; syn. resins, lubricant, mfg. rubber goods	drums, cans	C.S.
192		printing ink, coloring	cans, drums	C. & C.
193	1.07^{20}% by wt. in w	h. boiling solv., wetting agt.	cans, drums	C. & C.
194	0.17^{20}% by wt. in w	solv. extr. fats, waxes, greases	drums	C. & C.

No	Trade name	Chemical name or synonyms	Formula	Mol wt.
195	3,4-Dichloroaniline	3,4-dichloroaniline	$NH_2C_6H_3Cl_2$	162.02
196	*ortho*-Dichlorobenzene	*ortho*-dichlorobenzene	$C_6H_4Cl_2$	147.01
197	*para*-Dichlorobenzene .	*para*-dichlorobenzene	$C_6H_4Cl_2$ . .	147.01
198	2,4-Dichlorobenzophenone	2,4-dichlorobenzophenone	$ClC_6H_4COC_6H_4Cl$.	251.11
199	4,4′-Dichlorobenzophenone	4,4′-dichlorobenzophenone	$ClC_6H_4COC_6H_4Cl$ . . .	251.11
200	1,1-Dichloroethane	ethylidene dichloride	CH_3CHCl_2 .	98.97
201	2,4-Dichlorophenol	2,4-dichlorophenol	$Cl_2C_6H_3OH$	163.01
202	*x*-Dichloro-(phenyl xenyl ether)	*x*-dichloro-(phenyl diphenyl ether)	$C_{18}H_{12}OCl_2$.	315.19
203	Dicyclohexyl	dicyclohexyl	$C_6H_{11}C_6H_{11}$	166.30
204	1,2 Di-(-2-phenylphenoxy) ethane	1,2 di-(-2-xenoxy)ethane	$C_6H_5C_6H_4O(CH_2)_2OC_6H_4C_6H_5$	366.44
205	Diethanolamine	di(2-hydroxyethyl)amine	$(HOCH_2CH_2)_2NH$	105.14
206	Diethylaminoethanol	diethylaminoethanol	$(C_2H_5)_2NC_2H_4OH$	117.19
207	Diethyl benzene	diethyl benzene	$C_2H_5C_6H_4C_2H_5$	134.21
208	Diethyl "Carbitol"*	.	$(C_2H_5OC_2H_4)_2O$	162.23
209	Diethyl carbinol	*sec-n*-amyl alcohol	$(CH_3CH_2)_2CHOH$	88.15
210	Diethyl "Cellosolve"*		$C_2H_5OCH_2CH_2OC_2H_5$	118.17
211	" phthalate	" phthalate	$C_6H_4(COOC_2H_5)_2$	222.23
212	" sulfate	" sulfate	$(C_2H_5)_2SO_4$	154.18
213	Diethylamine	diethylamine	$(C_2H_5)_2NH$	73.14
214	Diethylene glycol	diethylene glycol	$HOCH_2CH_2OCH_2CH_2OH$.	106.12
215	Diethyl glycol	diethyl glycol	$HOCH_2CH_2OCH_2CH_2OH$	106.12
216	" glycol diacetate	" " diacetate	$(CH_3COOCH_2CH_2)_2O$	190.19
217	Diethylene glycol diglycolate	diethylene glycol diglycolate	$(CH_2CH_2OOCCH_2OH)_2O$	222.18
218	Diethylene glycol dilevulinate	diethylene glycol dilevulinate	$[CH_2CH_2OOC(CH_2)_2COCH_3]_2O$	270.4
219	Diethylene triamine	diethylene triamine	$NH_2C_2H_4NHC_2H_4NH_2$	103.17
220	Diglycol chlorohydrin	diglycol chlorhydrin	$ClCH_2CH_2OCH_2CH_2OH$.	124.57
221	" laurate	diglycol laurate .	$HOCH_2CH_2OCH_2CH_2OOC(CH_2)_{10}CH_3$†	288.42†
222	" myristate	diglycol myristate	$HOCH_2CH_2OCH_2CH_2OOC(CH_2)_{12}CH_3$†	316.47†

* Trade mark.
† Theoretical

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
195	fine lt. tan cr	mild	.. . ..	..
196	cl. col. liq	aromatic	. .	$1.303\frac{20}{4}$
197	gran. wh.-trans. sld	aromatic	100	1.520^{26}
198	wh. powd	faint	.	....
199	wh. cr	musty		. .
200	col. liq	sweet .		$1.168\frac{25}{25}$
201	wh. cr. sld	phenolic		$1.383\frac{60}{25}$
202	lt. straw-colored visc. liq			$1.233\frac{25}{25}$
203	col. liq	aromatic		$.885\frac{25}{25}$
204	fine wh cr	none		
205	col liq	ammoniacal	95–100	1.0985
206	col. hyg. liq	amine-like	98–100 .	0.8851
207	col. cl. mobile liq	pleas. char		$.868\frac{25}{25}$
208	col liq	almost none	99 .	0.9094
209	w. wh		..	$0.82\frac{20}{20}$
210	col. liq ..	sl. ethereal	95 .	$0.8424\frac{20}{20}$
211	w. wh. liq .	none	99–100	$1.118\text{–}1.120\frac{20}{20}$
212	w. wh. liq	fa. etheral	98 .	$1.177\text{–}1.182\frac{20}{20}$
213	cl. w. wh. liq	ammoniacal	98 .	$0.71\frac{20}{20}$
214	w. wh. liq	almost none		$1.117\text{–}1.120\frac{20}{20}$
215	w. wh. liq .	almost none		$1.1170\text{–}1.1200\frac{20}{20}$
216	w. wh. liq	ester-like	.	$1.1159\frac{20}{20}$
217	yel. liq .	faint		1.30^{30}
218	amber liq	pleas		1.145^{25}
219	hyg. visc. liq	char. amine-like		0.953–0.958
220	w. wh. liq			$1.1698\frac{20}{20}$
221	lt. straw-colored oily, liq	v. faint	tech .	0.963–.968
222	lt. colored, wax-like	v. faint . . .	tech . .	0.938^{38}

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
195	3,4-Dichloroaniline		71 0-73 2.	144^{10}	330 8
196	*ortho*-Dichlorobenzene..	−17 2....	173 ..	173–186	167
197	*para*-Dichlorobenzene.	53 04 . . .	173. .	. . .	158
198	2,4-Dichlorobenzophenone.	194^{10}. .	60–62 2.		366 8
199	4,4′-Dichlorobenzophenone	146 6–147 8.			
200	1,1-Dichloroethane	<−20		57 2–5%; 57 4–95%	39 2
201	2,4-Dichlorophenol	41–42 2 .	100^{10}		237 2
202	*x*-Dichloro-(phenyl xenyl ether)	<0	222^{10}		399 2
203	Dicyclohexyl.	3		238–5%, 239–95%	210 2
204	1,2 Di-(-2-phenylphenoxy) ethane	101 1–102 3.			. .
205	Diethanolamine	28	268 0		280
206	Diethylaminoethanol		162 1	158–165	140
207	Diethyl benzene	−70		180–5%, 182–95%	138 2
208	Diethyl "Carbitol"*	−47	187 9	180–190	180
209	Diethyl Carbinol	<−75	115 6	113 6–117 6; 95%	102
210	Diethyl "Cellosolve"*	−74	121 4	115–140	95
211	Diethyl phthalate	−40 5	296 1		305
212	Diethyl sulfate	−23 1	210 2	$106–111^{25}$, 190 of 200 cc.	250
213	Diethylamine	−50		not <53, not >59 5	<0
214	Diethylene glycol	−6 0	244 8	<230–none, <270–95%	290
215	Diethyl glycol	−6	245	<230–none, >270–none	295
216	Diethylene glycol diacetate.	19 1	250 0		275
217	Diethylene glycol diglycolate				.
218	Diethylene glycol dilevulinate				.
219	Diethylene triamine		206 7	185–215	215
220	Diglycol chlorhydrin		196 8		225
221	" laurate	11–14	315–325	240–325, 75%; rest in vacuo	290
222	" myristate	36–37	.		290

* Trade mark.

See two preceding pages for additional data on above compounds

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
195	g. per 100 g.: 6 CCl_4, 51 bz., 70 al., v.s. eth., i.w.	. . . .	. . .	D
196	s. al., eth.; i.w.	insecticide, deodorant, solv. org. syn.	drums, cans	S.P.
197	s. al., eth; i.w.	insecticide, fungicide, deodorant	barrels, drums, cans	S.P.
198	g. per 100 g.; 10 meth. al., 48 eth., 20 CCl_4, 190 bz., 150 acet.; i.w.	. . . .	. . .	D
199	g per 100 g.: 1 meth. al.; 2 eth.; 2 CCl_4; 12 bz.; 5 acet.; i.w.	. . . .	.	D
200	∞ meth.al., eth., CCl_4, bz., acet.; v.sl.s.w.	. . . .	.	D
201	v.s. acet., al., eth,; g. per 100 g.: 160 CCl_4, 5 w.	.		D
202	g. per 100 g.: 14 meth.al., >100 eth. >100 CCl_4, >100 bz., >100 acet.; i.w.	. .		D
203	g. per 100 g.: 7 meth.al.; ∞ eth., CCl_4, bz., acet.; i.w.	. . . .	. . . . .	D
204	g. per 100 g.: .02 w., .4 meth.al., 2 isopropyl eth., 9 CCl_4, 55 bz., 19 acet.	. . . .	. . . . .	D
205	∞ w.	absorb. a., gases, soft., moist. agt.	cans, drums.	C. & C.
206	∞ w., al	formation esters.	drums.	C. & C.
207	∞ bz., CCl_4, eth., s.al., i.w	. . . .	. . . .	D
208	∞ w	h. boil. reaction medium	drums	C. & C.
209	s.meth.al., ethyl eth., acet., bz., gasoline, ethyl acetate; sl.s.w.	mfg. pharmaceuticals	cans, drums	Sh.
210	21^{20}% by wt. in w	inert reaction medium	drums	C. & C.
211	$.09^{25}$% by vol. w.; misc. most org. liq.	plasticizer fixative, denaturant	drums, cans	C.S.
212	0.7^{20}% by wt. in w	ethylating agt	glass jug, cans, drums	C. & C.
213	s.w., meth. al., ethyl eth., acet., bz., gasoline, ethyl acetate	rubber chem., soaps	cans, drums	Sh.
214	misc. w., eth. al., acet.; imm. bz., CCl_4	antifreeze plasticizer, soft. agt.	cans, drums, tank cars	C. & C.
215	∞ w	chem. syn.; soft. agt.	tank cars, drums, cans	U.S.I.
216	∞ w.	h. boil. lacq. solv	cans	C. & C.
217	∞ w.; s. polar solv.; i.non-polar solv.	compatible with nitro., cellu. acetate, hygroscopic	. . . . . .	G
218	∞ w.; s. al., acet., ethyl acetate, toluene; i.naphtha	compatible with nitro. cellu. acetate, some vinyl resins	cans, drums	G
219	∞ w. & hydrocarbons	form soaps for derivatives	cans, drums	C. & C.
220	∞ w	chem. syn., plasticizer inter.	research quant.	C. & C.
221	disp. c.w.; s.al., hydrocarbons, oils	emulsifying, disp. agt. cosmetics, dry cleaning, dye solv.; furs and leather	drums, cans	G.
222	disp. h.w.; s.h.al., hydrocarbons, oils	emulsifying, thick., disp. agt.	drums, slabs	G.

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
223	Diglycol oleate	diglycol oleate	$HOCH_2CH_2OCH_2CH_2OOC-(CH_2)_7CH(C_8H_{17})CH$†	370 56†
224	" palmitate	" palmitate	$HOCH_2CH_2OCH_2CH_2OOC-(CH_2)_{14}CH_3$†	344 52†
225	" stearate	" stearate	$HOCH_2CH_2OCH_2CH_2OOC-(CH_2)_{16}CH_3$†	372 58†
226	2,4′Dihydroxybenzophenone	2,4′-dihydroxybenzophenone	$OHC_6H_4COC_6H_4OH$	214 21
227	4,4′Dihydroxybenzophenone	4,4′-dihydroxybenzophenone	$OHC_6H_4COC_6H_4OH$	214 21
228	Diisobutyl ketone	diisobutyl ketone	$(CH_3)_2CHCH_2COCH_2CH(CH_3)_2$	142 24
229	Diisopropanolamine	diisopropanolamine	$(CH_3CHOHCH_2)_2NH$	133 19
230	Dimethallyl ether	dimethallyl ether	$CH_2C(CH_3)CH_2OCH_2-C(CH_3)CH_2$	126 19
231	Dimethoxytetraglycol	dimethyl ether of tetraethylene glycol	$(CH_3OC_2H_4OC_2H_4)_2O$	222 28
232	Dimethylamine	dimethylamine	$(CH_3)_2NH$	45 08
233	Dimethyl dioxane	dimethyl dioxane	$OCH(CH_3)CH_2OCH_2CH(CH_3)$	116 16
234	" ethyl carbinol	(tert amyl alcohol) (2-methyl-2-butanol)	$CH_3CH_2C(CH_3)OHCH_3$	88 15
235	1,3-Dimethyl-1,3-diphenyl cyclobutane	1,3-dimethyl-1,3-diphenyl cyclobutane	$C_6H_5CCH_3(CH_2)_2CCH_3C_6H_5$	236 34
236	Dimethyl furane	dimethyl furane	$OC(CH_3):CHCH:C(CH_3)$	96 12
237	" phthalate	dimethyl phthalate	$C_6H_4(CO_2CH_3)_2$.	194 18
238	" "	dimethyl phthalate	$C_6H_4(COOCH_3)_2$	194 18
239	Dioctyl amine	dioctylamine	$[CH_3(CH_2)_3CH(C_2H_5)CH_2]_2NH$	241 45
240	Dioctylaminoethanol	dioctylaminoethanol	$[CH_3(CH_2)_3CH(C_2H_5)CH_2]_2:N(CH_2)_2OH$	285 50
241	Dioxane	1,4-diethylene dioxide	$O.(CH_2CH_2)_2:O$	88 10
242	Dioxolane	dioxolane	$OCH_2CH_2OCH_2$	74 08
243	1,1-Diphenylethane	1,1-diphenyl ethane	$C_6H_5CHCH_3C_6H_5$	182 25
244	Diphenyl phosphate	diphenyl phosphate	$C_6H_5OHPO_3C_6H_5 2H_2O$	286 22
245	*N,N′*-Diphenyl piperazine	*N,N′*-diphenyl piperazine	$C_6H_5N(CH_2)_4NC_6H_5$	238 32
246	Dipropyl ketone-(butyrone)	dipropyl ketone(butyrone)	$CH_3CH_2CH_2COCH_2CH_2CH_3$	114 18
247	Dipropylene glycol	dipropylene glycol	$(CH_3CHOHCH_2)_2O$	134 17
248	Epichlorohydrin	epichlorohydrin	$CH_2ClCHOCH_2$	92 53
249	Ethanol	ethyl alcohol	CH_3CH_2OH	46 07
250	"	" "	CH_3CH_2OH	46 07
251	β-(*p-tert*-Butylphenoxy) Ethanol	2-(4-*tert*-butylphenoxy) ethanol	$C_6H_4C(CH_3)_3OCH_2CH_2OH$	194 27

† Theoretical.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
223	lt. red oily liq	fatty	tech	0.930
224	lt. colored, wax-like	v. faint	tech	0.924^{46}
225	wh. wax-like sld	faint, fatty	tech.	0.960
226	straw colored cr	faint		
227	lt. tan gran	none		
228	col. liq	agreeable, ketone-like	95	$0.8089\frac{20}{20}$
229	col. liq	amine-like		$1.0089\frac{20}{20}$
230	col. liq	pungent	95	$0.816\frac{20}{40}$
231	w. wh. liquid	almost none		$1.0132\frac{20}{20}$
232	gas	strong amm	98	$.6865^{-6}$
233	w. wh. liq			$0.9268\frac{20}{20}$
234	w. wh.			$0.81\frac{20}{20}$
235	wh. cr	none		$.982\frac{50}{25}$
236	w. wh. liq			$0.8900\frac{20}{20}$
237	col. liq	faint	98	$1.192\text{-}1.194\frac{20}{20}$
238	lt. straw	v. faint	99–100	$1.192\text{-}1.194\frac{20}{20}$
239	col. liq	sl. ammoniacal		0.8062
240	visc. liq	amine-like		
241	col. liq	mild, n. res	99 by wt	$1.030\text{–}1.038\frac{20}{20}$
242	col. liq	pleasant ethereal		1.065
243	pa. straw colored liq	aromatic		$.987\frac{25}{25}$
244	wh.-pk. cr. powd	mild, phenolic		$1.242\frac{60}{25}$
245	wh.-pk. cr.			
246	col. liq	agreeable	95–100	$0.8162\frac{20}{20}$
247	col. liq	none		1.034–1.039
248	col. liq	fa., musty	95.	$1.181\frac{20}{4}$
249	w. wh. liq	char	99	$0.8090\text{–}0.8128\frac{20}{20}$
250	w. wh liq	char	99.9	$< .7944\frac{60}{60}$
251	cl. col. pa. straw, visc. liq	none		$1.014\frac{25}{25}$

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
223	Diglycol oleate	<0		240–330, 85%; none	290
224	" palmitate	46 5			290
225	" stearate	53–54			290
226	2,4-Dihydroxybenzophenone	139–143 6			
227	4,4′ Dihydroxybenzophenone	206 –218 8			
228	Diisobutyl ketone	41 5	168 1	165–170	140
229	Diisopropanolamine		116[5]		
230	Dimethallyl ether		134		23
231	Dimethoxytetraglycol	−21 4	275 8	255–285	285
232	Dimethylamine	−96	7.2-7 3[764]		20 8 (27% soln.)
223	Dimethyl dioxane		117 5		75
234	Dimethyl ethyl carbinol.	−11 9	101 8	not <99 5 not >103 0	70
235	1,3-Dimethyl-1,3-diphenyl cyclobutane	49		306 9–5% 308 7 95%	289 4
236	Dimethyl furane		94		45
237	" phthalate	5 5 .	281 8	280–285 95% within 2 0	300
238	" "	0 8 (approx.)	282	<280–none >290–none	295
239	Dioctylamine		281 1		270
240	Dioctylaminoethanol				
241	Dioxane .	10	101 1	95-none; 103 none	65
242	Dioxolane		74–75		35
243	1,1-Diphenylethane	−20		272 1-5%; 274 6-95%	264 2
244	Diphenyl phosphate	50–51			
245	*N*,*N*′-Diphenyl piperazine.	165 7-167 7.			
246	Dipropyl ketone (butyrone)	−32 1	143 7	138-145	105
247	Dipropylene glycol		231 8	215-240	280
248	Epichlorohydrin	−57	116		90
249	Ethanol	−114 4	78 3	<77-none, >80-none	70
250	"	−114 4	78 4		65
251	β-(*p*-*tert*-butylphenoxy)-Ethanol	13		146 5–5%; 155 5-95%	248

See two preceding pages for additional data on above compounds.

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
223	disp. c.w.; s.al., hydrocarbons, oils	emulsifying, disp. agt.; sprays, polishes	drums, cans	G.
224	disp. h.w.; s.h.al., hydrocarbons, oils	emulsifying, thick., disp. agt	drums, slabs	G.
225	disp. h.w.; s.al., hydrocarbons, oils	emulsifying, thick., disp. agt.; ceramic insulation; cosmetics, pharm., lubricant	drums, slabs	G.
226	g. per 100 g.: 44 eth., 44 meth. al.; 52 acet.; i.w., bz., CCl_4			D.
227	g. per 100 g.: .2 meth. al., 4 eth., .6 acet.; i.w., bz., CCl_4			D.
228	misc. most org. liq.; <0.06^{20}% by wt. in w.	syn; solv. rubber nitro., synth. resins	drums	C. & C.
229	∞ w	prep. of soap	drums	C. & C.
230	<0 2 w.			S.D.
231	∞ w., hydrocarbons	plasticizer neutral reaction medium mutual solv.	drums	C. & C.
232	s.w., al., eth., org.liq	dehairing agt.; acid gas absorb. solv.; gasoline stabilizer	drums, bottles	C.S.
233	4.33^{20}% by wt. in w	solv. rayon, cellu.ester	research quant.	C. & C.
234	s.w	chem.syn.	cases, drums	Sh.
235	g. per 100 g.: 8 meth.al.; 147 eth.; 104 CCl_4, 190 bz., 125 acet.; i.w.			D.
236	i.w.		research quant.	C. & C.
237	0.43^{20}% by wt. in w	plasticizer nitro., cellu.acetate, lacq., plastics	cans, drums	C. & C.
238	misc most com.org.solv ; 536 w.	plasticizer rubber mix., cellu. acetate; solv. gelatinizing agt.	drums, cans	C.S.
239	<0.02^{20}% by wt. in w	chem.inter	research quant.	C. & C.
240	i.w.	chem. inter	research quant.	C. & C.
241	∞ w., com.org.solv	solv	cans	C. & C.
242	∞ w	solv.cellu.esters	research quant.	C. & C.
243	∞ acet., bz., CCl_4, eth., meth.al.; i.w.			D.
244	v.s.al., s.w.; g. per 100 g.; 100 eth., 100 acet., 10 bz., 4 CCl_4			D.
245	g per 100 g.: .2 meth al., 2 eth., 3 CCl_4, 7 bz., 4 acet.; i.w.			D.
246	0.43^{20}% by wt. in w	h.boil.lacq.solv	research quant.	C. & C.
247	∞ w.	h.boil.solv. plasticizer	cans, drums	C. & C.
248	6 w.			S.D.
249	∞ w.; misc.com.solv	industrial chem	cans, drums, tank cars	C. & C.
250	∞ w.; misc.com.solv	solv.lacq., resins, flavors, oils, chem.syn.	tank cars, drums cans	U.S.I.
251	∞ meth.al., isopropyl eth., bz., acet.; s. CCl_4; i.w.			D.

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
252	(4-*tert*-butyl-2-chlorophenyl) (2-chloroethyl) Ether	β-(4-*tert*-butyl-2-chlorophenoxy)ethyl chloride	$ClC_6H_3C(CH_3)_3OCH_2CH_2Cl$	247 16
253	Ethyl acetate .	ethyl acetate	$CH_3COOC_2H_5$.	88 10
254	" "	" " . .	$CH_3COOC_2H_5$	88 10
255	" "	" "	$CH_3COOC_2H_5$	88 10
256	" acetoacetate	" acetoacetate	$CH_3COCH_2COOC_2H_5$.	130 14
257	" "	" "	$CH_3COCH_2COOC_2H_5$	130 14
258	" alcohol	" alcohol	C_2H_5OH	46 07
259	" benzene	" benzene .	$C_6H_5CH_2CH_3$ . . .	106 16
260	" borate	" borate	$(C_2H_5O)_3B$	146 00
261	2-Ethylbutyraldehyde	diethyl acetaldehyde	$(C_2H_5)_2CHCHO$	100 16
262	2-Ethylbutyric acid	" acetic acid	$(C_2H_5)_2CHCOOH$	116 16
263	Ethyl benzoylacetate	" benzoylacetate	$(C_6H_5COCH_2COOC_2H_5)$	192 20
264	" chloroformate	" chlorcarbonate	$ClCOOC_2H_5$	108 53
265	" carbonate	" carbonate	$(C_2H_5)_2CO_3$	118 13
266	*x*-Ethyl diphenyl ether	*x*-ethyl diphenyl ether	$C_6H_5OC_6H_4C_2H_5$	198 25
267	Ethyl ether	ethyl ether	$C_2H_5OC_2H_5$	74 12
268	" " , A C S	" " (sulphuric ether)	$(C_2H_5)_2O$	74 12
269	" formate	ethyl formate	$HCOOC_2H_5$	74 08
270	" "	" "	$HCOOC_2H_5$	74 08
271	" lactate	" lactate	$CH_3CHOHCOOC_2H_5$	118 13
272	" "	" "	$CH_3CHOHCOOC_2H_5$	118 13
273	" oxalate	" oxalate	$(COOC_2H_5)_2$	146 14
274	*p*-Ethyl phenol	*p*-ethyl phenol	$OHC_6H_4C_2H_5$	122 16
275	Ethyl phenyl ethanolamine	ethyl phenyl ethanolamine	$C_6H_5N(C_2H_5)CH_2CH_2OH$	165 23
276	" phthalate.	diethyl phthalate.	$C_6H_4(CO_2C_2H_5)_2$	222 23
277	2-Ethylbutyl alcohol.	2-ethylbutyl alcohol	$(C_2H_5)_2CHCH_2OH$	102 17
278	2-Ethylhexanol. .	octyl alcohol	$C_4H_9CH(C_2H_5)CH_2OH$	130 23

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
252	col.-pa. straw liq	fa. aromatic..	....	$1.149\frac{25}{25}$
253	w. wh. liq	pleasant........	95–98	$0.894–0.900\frac{20}{20}$
254	w. wh. liq........	n. res. pleas. fruity	85–88 by wt.	$.883–.888\frac{20}{20}$
255	w.wh. liq........	mild, n. res ..	99–100 ..	$.899–.902\frac{20}{20}$
256	col. liq.		97.5–100....	$1.023–1.028\frac{20}{20}$
257	almost w. wh	mild .	96	$1.027–1.030\frac{20}{20}$
258	liq	mild, n. res	99.9 ..	$0.7944\frac{15.56}{15.56}$
259	col. liq	aromatic .	.... ..	0.870
260	col. liq ...		98–100	0.864
261	col. liq..........	...	90–100.....	0.8170–0.823
262	w. wh. liq	faint	95–100 .	0.9170–.9220
263	lt. yel. liq	char	95.5 ..	$1.111–1.117\frac{20}{20}$
264	w. wh. liq	irritating, tear producing	96 .	$1.135–1.139\frac{20}{20}$
265	w. wh. liq.	mild n. res.	98–100 .	$.973–.977\frac{20}{20}$
266	lt. grn.-yel. liq ...	pleas. aromatic	.	$1.032\frac{25}{25}$
267	w. wh. flam. liq.	ethereal. ...	99–100	$0.715–.718\frac{20}{20}$
268	w. wh. liq .	char., n. res..	99.7	$> .7100\frac{20}{20}$
269	w. wh. liq	pleas. aromatic	95–100 by wt.	$.900–.930\frac{20}{20}$
270	w. wh. liq	pleas. char.. .	94–96..	$0.900–0.930\frac{20}{20}$
271	w. wh. liq	mild, n. res .	96–100	$1.020–1.036\frac{20}{20}$
272	w. wh. liq	mild, n. res .	96 ..	$1.020–1.036\frac{20}{20}$
273	w. wh. liq	mild, n. res	99 ..	$1.075–1.079\frac{20}{20}$
274	dk. strawcolored cr. sld	phenolic odor		$.984\frac{60}{25}$
275	col. liq .	amine-like	.. .	$1.04\frac{20}{20}$
276	w. wh. liq .	none ..	99–100	$1.117–1.121\frac{20}{20}$
277	col. liq ...	mild	99 ..	$0.830–0.835\frac{20}{20}$
278	col. liq .	mild	99	$0.832–0.837\frac{20}{20}$

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
252	(4-*tert*-Buty-2-chlorophenyl) (2-chloroethyl)Ether	−20		176.0–5%; 179.8–95%	339.8
253	Ethyl acetate	−83.5	77.1	<73–none, >80–none	40
254	" "	−83.6	77.1	<70–none, <72–10% >80–none	23
255	" "	−83.6	77.1	<75–none, >80–none	42
256	" acetoacetate	−43.3	180.7	<96–5%; >110 none	185
257	" "		180		171
258	" alcohol	−112	78.3		*ca* 57
259	" benzene	−92.8	135.7		85
260	" borate	−86.6	120.0	112–121	65
261	2-Ethylbutyraldehyde	−89.0	116.8	80–135	70
262	2-Ethylbutric acid	−9.4	194.0	185–200	210
263	Ethyl benzoylacetate		146^{10}	$<114^{10}$–none; $>148^{10}$–none	285
264	" chloroformate	−80.6	95		82
265	" carbonate	−43.0	126.8	<120–none, <128–90%, >130–none	89
266	*x*-Ethyl diphenyl ether	<−20		159.5–5%, 166.5–95%	294.8
267	Ethyl ether	−116.3	34.5		−40
268	" ", A.C.S	−116.3	34.5		<10
269	" formate	−80.5	54.3	<51–none; >55 none	−2.2
270	" "	−80	54	<51–none, >55–none	9
271	" lactate	−25	154	<102 none, >173–none	145
272	" "		153.9	<102–none; >173–none	129
273	" oxalate	−40.6	185.4	<180–none; >190–none	168
274	*p*-Ethyl phenol	37		216.6–5%; 219.3–95%	219.2
275	Ethyl phenyl ethanolamine		$268^{7.0}$	260–$276^{7.0}$	....
276	" phthalate	−5	200–$207^{5.0}$	200–$207^{5.0}$	325
277	2-Ethylbutyl alcohol		148.9	<140–none, >160 none, <145–5%; <155–95%	135
278	2-Ethylhexanol			<180–none, >190–none	185

See two preceding pages for additional data on above compounds.

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
252	∞ meth.al., eth., CCl_4, bz., acet.; i.w.	. . . .	.	D.
253	8.72^{20}% by wt. in w.; s.al., eth., $CHCl_3$	solv. syn. other compounds	cans, drums, cars	C. & C.
254	misc. et.al., butyl al., acet., $CHCl_3$, CCl_4, 7.6 w.	solv. nitro. lacq., prep. medicines, perfumes, flavors. denaturant	tans, drums, cans	C.S.
255	3.5^{25}w.	nitrocellu. solv., syn. base for org. chem., pharm., flavoring, denaturant	tank cars, drums, cans	U.S.I.
256	11.6^{20}% by wt. in w. ∞ al, eth., et. acet.	inter. dye and drugs	cans, drums	C. & C.
257	4.8^{25}w.	mfg. dyes, pharm...	drums, cans, bottles	U.S.I.
258	misc.w., most org. liq.	solv. lacq., varnishes, flavors, raw mat. in chem. syn.	bottles, cans, drums, tankcars	C.S.
259	i.w		research quant.	C. & C.
260	d.w	chem. syn., indust. solv	research quant.	C. & C.
261	0.31^{20}% by wt. in w	prep. of pharm., rubber accel., synth. resins	cans, drums	C. & C.
262	0.22^{20}% by wt. in w	inter. drugs, dyes	cans, drums	C. & C.
263	misc. com. org. solv	dye inter	drums, cans	U.S.I.
264	d.w	flotation agt; diethyl carbonate inter.	glass	U.S.I.
265	1.4^{25}w	neutral lacq. solv...	tans, drums, cans	U.S.I.
266	∞ meth. al., eth., CCl_4, bz., acet.; i.w	. . . .	.	D.
267	6.89^{20}% by wt. in w	solv. denaturant extr..	drums, tank cars	C. & C.
268	0.9^{25}w	lab. agt., solv., synth. base dry-cleaner, denaturant	drums	U.S.I.
269	9.15^{20}w.	fumigant, larvicide, synth. flavor prep., medicine	drums, cans	C.S.
270	misc. com. org. solv..	Vitamin B_1 syn	tank cars, drums, cans	U.S.I.
271	∞ w	solv	drums, cans.	C.S.
272	$∞^{25}$w	cellu. nitrate solv., cellu. acetate solv., resins solv	drums, cans.	U.S.I.
273	1.5^{25}w	dye inter. pharm. base, nitro. solv.	tank cars, drums, cans	U.S.I.
274	∞ meth. al., eth., CCl_4, bz., acet.; v.sl.s.w.	. . .	. . . . . .	D.
275	0.5^{20} % by wt. in w.	azo dyes	cans, drums...	C. & C.
276	0.7^{25}w	nitrocellu. plasticizer, cellu. acetate plasticizer, perfume fixative, insecticide, synth. resins	tank cars, cans drums	U.S.I.
277	0.43^{20}% by wt. in w. misc. most org. solv.	lacq., synth. resin, varnishes..	cans, drums ...	C. & C.
278	0.10^{20}% by wt. in w. misc. most org. solv.	defoaming agt., solv. synth. gums, waxes, resins, disp., wetting agt.	cans, drums..	C. & C.

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
279	2-Ethylhexoic acid.	2-ethylhexoic acid	$CH_3(CH_2)_3CH(C_2H_5)COOH$	144 21
280	Ethylidene diacetate.	ethylidene diacetate	$CH_3CH(OCOCH_3)_2$	146 08
281	2-Ethyl-3-propylacrolein	2-ethyl-3-propylacrolein.	$CH_3C_2H_4CH:C(C_2H_5)CHO$	126 19
282	Ethyl silicate	ethyl silicate	$(C_2H_5)_4Si:O_4$	208 30
283	" sodium oxalacetate	sodium ethyl oxalacetate	$C_2H_5OOCC(ONa)CHCOOC_2H_5$	210 17
284	Ethylene	ethylene	C_2H_4	28 05
285	" chlorhydrin, anhydrous	" chlorhydrin anhydrous	$HOCH_2CH_2Cl$	80 52
286	" diamine, anhydrous	" diamine, anhydrous	$H_2NCH_2CH_2NH_2$	60 10
287	" dichloride	" dichloride	$ClCH_2CH_2Cl$	98 97
288	" glycol	" glycol	$HOCH_2CH_2OH$	62 07
289	" "	" "	$HOCH_2CH_2OH$	62 07
290	" " silicate	" " silicate	$(HOCH_2CH_2O)_4Si$	272 30
291	" oxide	" oxide	$(CH_2)_2:O$	44 05
292	"Flexol" plasticizer 3GH	di-2-ethylbutyrate triethylene glycol	$C_5H_{11}COOC_2H_4(OC_2H_4)_2OOCC_5H_{11}$	346 46
293	"Flexol" plasticizer 3GO	di-2-ethyl hexoate triethylene glycol	$C_7H_{15}COOC_2H_4(OC_2H_4)_2OOCC_7H_{15}$	402 56
294	Furfural	2-furancarbonal 2-furfuraldehyde	$C_4H_3O\ CHO$	96 08
295	Furfuryl alcohol	2-furancarbinol	$C_4H_3O{\cdot}CH_2OH$	98 10
296	Fusel oil	isoamyl alcohol	$C_5H_{11}OH$	88 15
297	Glaurin	diethylene glycol monolaurate	$C_{11}H_{23}COOC_2H_4OC_2H_4OH$	288 42
298	*α-d*-Glucose pentaacetate	*α-d*-glucose pentaacetate	$C_{16}H_{22}O_{11}$	390.34
299	*β-d*-Glucose pentaacetate	*β-d*-glucose pentaacetate	$C_{16}H_{22}O_{11}$	390 34
300	Glucose pentabutyrate.	glucose pentabutyrate	$C_{26}H_{42}O_{11}$	530 60
301	Glucose pentapalmitate	glucose pentapalmitate	$C_{86}H_{162}O_{11}$	1372 17
302	Glucose pentapropionate	glucose pentapropionate	$C_{21}H_{32}O_{11}$	460 47
303	Glycerin dichlorohydrin	glycerin dichlorohydrin.	$CH_2ClCHClCH_2OH$	128 99
304	Glycerin-*α*-monochlorohydrin	glycerin-*α*-monochlorohydrin	$CH_2OHCH(OH)CH_2Cl$	110 54
305	Glycerol dichlorhydrin	1,3-dichloro-2-propanol	$CH_2ClCHOHCH_2Cl$	128 99
306	Glyceryl laurate	glyceryl laurate	$CH_2OHCHOHCH_2OOC(CH_2)_{10}CH_3$	274 39
307	" monoricinoleate	" monoricinoleate	$CH_2OHCHOHCH_2OOC(CH_2)_7CHCHCH_2CHOH(CH_2)_5CH_3$	372 53
308	" monostearate	" monostearate	$CH_2OHCHOHCH_2OOCC_{17}H_{35}$.	358 55

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
279	liq	mild	95-100	0 904-.909$\frac{20}{20}$
280	w. wh. liq	heavy, pleas. char	90.0+	
281	yel. liq	powerful	90-100	0 847- 853
282	col. liq	faint		0 933-938
283	lt. yel. fine gran. powd	none	92	
284	col gas	faint	99	1 260°760mm g/l
285	w. wh liq	faint ethereal	98	1 202-1 208$\frac{20}{20}$
286	col liq	ammoniacal	66 by wt	0 987$\frac{20}{20}$
287	col liq	chloroform-like	99	1 255-1 257$\frac{20}{20}$
288	w. wh. liq	mild, n. res		1 1150-1 1158$\frac{20}{20}$
289	w wh liq	mild n. res		1 1151-1 1156$\frac{20}{20}$
290	col liq			
291	col. gas, col. liq -low temp	pleas., agreeable		0 8707$\frac{20}{20}$
292	liq	mild	98 5-100	0 9947$\frac{20}{20}$
293	liq	mild	98 5-100	0 9655- 9705
294	yel.-amber liq	almond	99+	1 161$\frac{20}{20}$
295	yel.-dk. amber liq	mild	>95	1 130$\frac{25}{25}$
296	w wh. liq	n. res		811- 815$\frac{20}{20}$
297	lt yel oily liq	pleas		0960$\frac{25}{25}$
298	sld			
299	sld			
300	visc oil			
301	waxy sld			
302	visc. oil			
303	col liq	fa chloroform-like	95	1 362$\frac{20}{4}$
304	col. liq	none	95	1 320$\frac{20}{4}$
305	dk. amber-colored liq	char chlorohydrin-like		1 351$\frac{25}{25}$
306	cream-colored semi-sld	v faint		0 98$\frac{25}{25}$
307	amber colored, oily liq	fa	tech	1 02
308	cream-colored wax-like sld	fa. fatty	tech	0.97$\frac{20}{20}$

See two following pages for additional data on above compounds.

† Theoretical.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
279	2-Ethylhexoic acid	−118 4	226 9	220 230	260
280	Ethylidene diacetate		166		
281	2-Ethyl-3-propylacrolein		175	85-185	155
282	Ethyl silicate		168 1	160-170	125
283	" sodium oxalacetate				
284	Ethylene	−169 4	−103 9		
285	" chlorhydrin, anhydrous	−62 6	128 7	<122 none; <132-97%	140
286	" diamine, anhydrous	10 8	117 2	<115-none; >122-none	110
287	" dichloride	−35 5	83 5	<82 5-none, >84-none	70
288	" glycol	−12	197 2	<190 none, <202-95%	240
289	" "	−12	197	<190-none >210-none	260
290	" " silicate				
291	" oxide	−111	10 7		<20
292	"Flexol" plasticizer, 3GH		358		385
293	" " 3GO		215[5]		405
294	Furfural	−37	161 7	157-167 99%	132 8
295	Furfuryl alcohol	−20	171[750]	167-177 95%	167
296	Fusel oil			<110-none; >135-none	123
297	Glaurin	17-18	>280		
298	*α-d*-Glucose pentaacetate	112-113			
299	*β-d*-Glucose pentaacetate	131-132			
300	Glucose pentabutyrate		228[1 5]		
301	" pentapalmitate	*ca* 70			
302	" pentapropionate		205[1]		
303	Glycerin dichlorohydrin		182		200
304	" -α-monochlorohydrin		213		280
305	Glycerol dichlorhydrin	<−20		78 5%, 104-95%	195 8
306	Glyceryl laurate	24-25			
307	" monoricinoleate	<−16			
308	" monostearate	56 57			

See two preceding pages for additional data on above compounds

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
279	1.23^{20}% by wt. in w	org. syn	cans, drums	C. & C.
280	5.0% w	inter. anhydride mfg., acetylating agt., solv.	steel drums	S.C.L.
281	0.079^{20}% by wt. in w	warning agt., insecticides	cans, drums	C. & C.
282	d.w	perservative, w.-proofing agt.	cans, drums	C. & C.
283	d.w	mfg. dyes	barrels	U.S.I.
284		fuel gas for welding, ripening agt., gen. anaesthesia, synth. base mat.	cylinders	U.S.I.
285	∞ w	chem. syn	jugs, carboys, drums	C. & C.
286	∞ w	neutralizing agt., corrosion inhibitor	cans, drums	C. & C.
287	0.86^{20}% by wt. in w	solv. for oils, fats, waxes. extr. spotting agt.	cans, drums tank cars	C. & C.
288	∞ w	prep of esters, liq. coolant	cans, drums	C. & C.
289	∞ w	anti-freeze syn. resins	tank cars, cans	U.S.I.
290	∞ w		research quant	C. & C.
291	∞ w., com. org. solv	fumigant, org syn	cylinders	C. & C.
292	0.04^{20}% by wt. in w	plasticizer, soft agt	cans, drums	C. & C.
293		plasticizer	cans, drums	C. & C.
294	∞ al, eth., 8.3^{20}w	solv., resins, org syn	cans, drums, tanks	Q.O.
295	∞ al, eth.; s. w	solv., resins, wetting agt	cars, tanks, drums	Q.O.
296	misc com. org solv	lacq	tank cars, drums, cans	U.S.I.
297	s.al, hydrocarbons; i w	emulsifying, lubricant, plasticizer, solvent	drums, cans	G
298	s. eth., acet., bz; i.w., pet. eth, $CHCl_3$			C.P.
299	s eth, bz, acet, CCl_4, $CHCl_3$; i.w, pet. eth			C.P.
300	s. ethanol, meth. al, $CHCl_3$			C.P.
301	i.w			C.P.
302	s $CHCl_3$, eth., al., meth. al., i w			C.P.
303	13w			S.D.
304	∞ w			S.D.
305	∞ acet., bz., CCl_4, eth., meth al, 12 w			D.
306	disp w.; s. al., veg. oils; i. hydrocarbons	emulsifying, disp. agt	drums, cans	G.
307	disp.w.; s. al., veg. oils, hydrocarbon	emulsifying agt	drums, cans	G.
308	disp.h.w.; s.h.al., hydrocarbon, oils	emulsifying, thick. disp. agt	drums, slabs	G.

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
309	Glyceryl myristate	glyceryl myristate	$CH_2OHCHOHCH_2OOC(CH_2)_{12}CH_3$	302.45
310	" palmitate	" palmitate	$CH_2OHCHOHCH_2OOC(CH_2)_{14}CH_3$	330 5
311	Glycol diacetate	glycol diacetate	$(CH_3COO)_2C_2H_4$	146 14
312	Heptadecanol	heptadecanol	$C_{17}H_{35}OH$	256 46
313	Hexachlorocyclohexa-2, 5-diene-1-one	hexachlorophenol	$Cl_2C_6Cl_4:O$	300.80
314	*n*-Hexaldehyde	*n*-hexaldehyde	$CH_3CH_2CH_2CH_2CH_2CHO$	100 16
315	Hexamethyl mannitol.	hexamethyl ether of mannitol	$C_6H_8O_6(CH_3)_6$	266 33
316	Hexamethyl sorbitol	hexamethyl ether of sorbitol	$C_6H_8O_6(CH_3)_6$	266 33
317	*n*-Hexanol	*n*-hexanol	$CH_3(CH_2)_4CH_2OH$	102 17
318	Hydroxyacetic acid	glycolic acid	$OHCH_2COOH$	76 05
319	*p*-Hydroxybenzaldehyde	*p*-hydroxybenzaldehyde	OHC_6H_4CHO	122 12
320	*p*-Hydroxybenzoic acid	*p*-hydroxybenzoic acid	OHC_6H_4COOH	138 12
321	*p*-Hydroxybenzoic acid, ethyl ester	ethyl-*p*-hydroxybenzoate.	$OHC_6H_4COOC_2H_5$	166 17
322	*p*-Hydroxybenzoic acid, methyl ester	methyl-*p*-hydroxybenzoate	$OHC_6H_4COOCH_3$	152 14
323	4-Hydroxybenzophenone	4-hydroxybenzophenone	$C_6H_5COC_6H_4OH$	198 21
324	Hydroxyethyl ethylene diamine	hydroxyethyl ethylene diamine	$H_2NCH_2CH_2NHCH_2CH_2OH$	104 15
325	*β*-Hydroxyphenetole	*β*-phenoxy ethanol	$C_6H_5OCH_2CH_2OH$	138 16
326	4-Hydroxypropiophenone	4-hydroxy propiophenone	$CH_3CH_2COC_6H_4OH$	150 17
327	Indalone	*α,α*,-dimethyl-*α'*-carbobutoxy-dihydro-*γ*-pyrone	$OC(CH_3)CH_2C\,OCH:CCOOC_4H_9$	226 27
328	*x*-Iodo asprin (acetyl-*x*-iodosalicylic acid)	acetyl-*x*-iodosalicylic acid	$IC_6H_3COOHOCOCH_3$	306 07
329	*x*-Iodosalicylic acid	*x*-iodosalicylic acid	$IC_6H_3COOHOH$.	264 03
330	Isobutane, Pure	isobutane	$(CH_3)_2CHCH_3$	58 12
331	Isobutyl carbinol	(isoamyl alcohol) (3-methyl-1-butanol)	$(CH_3)_2CHCH_2CH_2OH$	88 15
332	Isocrotyl chloride	isocrotyl chloride	$CH_3C(CH_3)CHCl$	90 56
333	Isopentane, Pure	isopentane	$(CH_3)_2CHCH_2CH_3$	72 14
334	Isophorone	isophorone	$COCH:C(CH_3)CH_2C(CH_3)_2CH_2$	138 20
335	Isopropanol	isopropyl alcohol	$(CH_3)_2CHOH$	60 09
336	"	" "	C_3H_7OH	60 09
337	Isopropyl acetate	" acetate	$CH_3COOCH(CH_3)_2$	102 13

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
309	lt. colored, wax-like sld.. .	v. faint . .	tech. . .	0 954[44]
310	cream-colored, wax-likd sld	fa. fatty...	tech. . .	0.916[57]
311	w. wh. liq	none	98–100. .	1 104–1.109
312	liq .	mild . .	..	0 $8475\frac{20}{20}$
313	wh -grayish yel cr. powd	pung. char . . .	. . . .	. . ..
314	col. liq . ..	sharp aldehyde	90–100.......	0 820–0.826
315	col.-pa. yel. liq	sl. ethereal . .	.	1 02
316	col.-pa. yel. liq	sl. ethereal		1 02
317	col. liq .	mild. .		0 $819–0.823\frac{20}{20}$
318	wh. yel. cr	char		. . ..
319	wh.-pk. powd	fa. pleas .. .		. . ....
320	wh -buff cr. sld	. .		. ...
321	wh. cr .. .	none	.	. .
322	wh. cr	none .	.	. . ...
323	yel -tan gran	fa		... .
324	col. hyg .	mild amm	99–100	1 0280–1.0330
325	col.-pa. straw-colored liq	faint		1 $106\frac{25}{25}$
326	tan. gran	faint		... .
327	amber liq	mild	100	1 $08\frac{20}{20}$
328	wh. cr	.	.	. . ....
329	wh. powd .			. . . .
330	flammable col gas		99	0 $559\frac{20}{4}$
331	w. white .			0 $81–0\ 82\frac{20}{20}$
332	col. liq .	char	97	0 $919\frac{20}{4}$
333	col. liq. or gas	sweet, non-corrosive	99	0 $619\frac{20}{4}$
334	liq			0 9229
335	col. liq .	pleas. char . .	99 .	0 $7863–0.7893\frac{20}{20}$
336	w. wh. liq .	n. res. .	98 by wt.	$786–\ 790\frac{20}{20}$
337	w. wh. liq	mild, n res	95	0.866–0.871

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
309	Glyceryl myristate	47–48		....	.
310	" palmitate	54–55	.	. . .	
311	Glycol diacetate	41.5	190.5	183–195	220
312	Heptadecanol		308.5	.	310
313	Hexachlorocyclohexa-2,5-diene-1-one	104.9–105.9	.....		
314	*n*-Hexaldehyde	−59.2	128.6	90–150 ..	90
315	Hexamethyl mannitol	7	$134\text{–}6^{10}$		
316	" sorbitol	0	$134\text{–}6^{10}$		
317	*n*-Hexanol .	−44.6	157.2	<153–>160 none	165
318	Hydroxyacetic acid	76.2–77.9			
319	*p*-Hydroxybenzaldehyde	116.4–117.0			.
320	*p*-Hydroxybenzoic acid	213.8–215.0			.
321	*p*-Hydroxybenzoic acid, ethyl ester	114.5–115.0			..
322	*p*-Hydroxybenzoic acid, methyl ester	126–127			
323	4-Hydroxybenzophenone	125.6–131.0			
324	Hydroxyethyl ethylene diamine		24[illegible].7	232–250	275
325	β-Hydroxyphenetole	12.5		131.5–5%; 133.8–95%	244.4
326	4-Hydroxypropiophenone	137.0–148.8			
327	Indalone		113		315
328	*x*-Iodo aspirin (acetyl-*x*-iodosalicylic acid)	161–168			
329	*x*-Iodosalicylic acid	189.4–197.2			
330	Isobutane, Pure	−144	−12.1		−117
331	Isobutyl carbinol	−117.2	130.5	128–132	132
332	Isocrotyl chloride		68		35
333	Isopentane, Pure	−159	28		−68
334	Isophorone	−8.1	215.2	205–220	205
335	Isopropanol	−89.5	82.4	81.6–83.1	70
336	"	−89.5	82.3	<80.5–none; >82.5–none	71
337	Isopropyl acetate	−69.3	88.4	84.5–90.0	60

See two preceding pages for additional data on above compounds.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
309	disp. h.w.; s h.al., hydrocarbon, oils	emulsifying, thick.agt. .	drums, slabs. .	G.
310	disp.h.w.; s.h al., hydrocarbon, oils	emulsifying, thick disp.agt	drums, slabs	G
311	16.44[20]% by wt. in w	solv inks, lacq., perfume fix.	cans, drums	C. & C.
312	<0 01[20]% by wt. in w . .	perfume fix, plasticizer inter	cans, drums	C. & C.
313	s al, ethylene dichloride, $CHCl_3$, monochlorobz.pet.-eth.; i.w		. .	D.
314	0 54[20]% by wt. in w .	org. syn .	cans, drums	C. & C.
315	∞ w, org solv	solubilizer blending agt	.	At.
316	∞ w., org solv	solubilizer blending agt		At.
317	0 58[20]% by wt in w	synthesize hypnotics, antiseptics and pharm.	cans, drums	C. & C.
318	s w., eth ; i CCl_4, g per 100 g.: 90 al, 59 acet.		. .	D.
319	g per 100 g : 90 meth.al., 70 acet., 18 eth, 4 bz., 1 w.; v. s. al.		.	D.
320	g per 100 g · 50 meth, 30 acet., 23 eth, 5 w, i bz, CCl_4			D.
321	g per 100 g.. 72 acet., 83 meth., 45 eth, 1 CCl_4, 1 bz., 1 w			D
322	g per 100 g.: <1 bz., 50 acet., 25 eth., 59 meth al., .2 w			D
323	g per 100 g : 25 acet., 8 eth., 1 meth al, i w, bz., CCl_4			D.
324	∞ w	org syn	cans, drums	C. & C.
325	∞ meth.al., isopropyl eth., CCl_4, bz, acet, g per 100 g : 2 w	. .		D.
326	g per 100 g : meth.al., 8 acet, 4 eth ; i w, CCl_4, bz		.	D.
327	misc com.org. solv	light screen, insect repellent, solv	drums, cans	U.S.I.
328	sl.s eth, al, i w., CCl_4, bz			D.
329	g per 100 g . 72 eth, 6 al ; i w., CCl_4, bz			D.
330		reagent; refrigerant	cylinders	P P
331	s meth al, ethyl eth, acet, bz, gasoline, ethyl acetate, sl. s.w	photo chem syn pharm	cans, drums	Sh.
332	<0.1w ..	.	. ..	S.D.
333	imm w	blending agt; research	cans, drums	P P
334	1.2% by wt in w	solv "vinylite"* resins, lacq	drums	C. & C.
335	∞ w	solv gums, alkaloids, oils, germicide	cans, drums	C. & C.
336	∞[25] w	solv cosmetics, gums, alkaloids, oils, derivative base	tank cars, drums, cans	U.S.I.
337	2.91[20]% by wt. in w .	solv . . .	cans, drums. .	C. & C.

* Trade mark.

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
338	Isopropyl acetate. .	isopropyl acetate	$CH_3COOCH(CH_3)_2$	102 13
339	" " . . .	" " . .	$(CH_3)_2CHCOOCH_3$	102.13
340	" " .	" "	$CH_3COOCH(CH_3)_2$	102 13
341	" alcohol	isopropanol	$CH_3CH(OH)CH_3$. . .	60 09
342	" benzene	isopropyl benzene	$C_6H_5CH(CH_3)_2$	120 19
343	" ether	" ether	$(CH_3)_2CHOCH(CH_3)_2$	102 17
344	" "	" "	$(CH_3)_2CHOCH(CH_3)_2$	102.17
345	Malonic acid	malonic acid	$CH_2(COOH)_2$	104 06
346	Mannitol	*d*-mannitol	$C_6H_8(OH)_6$.	182 17
347	" hexaacetate	mannitol hexaacetate	$C_6H_8O_6(CH_3CO)_6$	434 39
348	" monoborate	" monoborate	$C_6H_{15}O_8B$	226 00
349	Melaniline octadecanoate	melaniline octadecanoate.	$(C_6H_5NH)_2CNHC_{17}H_{35}COOH$	495 7
350	Mesityl oxide	mesityl oxide	$(CH_3)_2C{:}CHCOCH_3$	98 14
351	" "	4-methyl-3-pentenone-2	$CH_3COCHC(CH_3)_2$	98 14
352	" "	mesityl oxide	$(CH_3)_2CCHCOCH_3$	98 14
353	Methallyl alcohol	isobutenol	$CH_2C(CH_3)CH_2OH$	72 10
354	" chloride	isobutenyl chloride	$CH_2C(CH_3)CH_2Cl$. . .	90 56
355	Methane, Pure. .	methane	CH_4	16 04
356	Methanol . .	methyl alcohol	CH_3OH .	32 04
357	"	" " .	CH_3OH	32 04
358	"	" "	CH_3OH . .	32 04
359	Methyl acetate	" acetate	CH_3COOCH_3 .	74 08
360	" ", C P	" "	CH_3COOCH_3 .	74 08
361	" ", tech.	" "	CH_3COOCH_3	74 08
362	" acetoacetate	" acetoacetate	$CH_3COCH_2COOCH_3$	116 11
363	" acetone	" acetone	$CH_3COCH_2CH_3$	
364	" amyl acetate	" isobutyl carbinol acetate	$CH_3COOCH(CH_3)$-$CH_2CH(CH_3)_2$	144 21

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
338	col. liq	none	95 by wt	0 866–0 871$\frac{20}{20}$
339	liq	char	85–88	0 8608–0 8648$\frac{20}{20}$
340	w. wh. liq	mild, n. res	85–88	860– 870$\frac{20}{20}$
341	w. wh. liq	pleas. sl. bitter taste	99	0 785–0 787$\frac{20}{20}$
342	col. liq	aromatic		0 862
343	col. liq	ethereal	99	0 722–0 726$\frac{20}{20}$
344	w wh liq	pung. ethereal	ca 99	0 7238$\frac{20}{4}$
345	wh. cr			
346	col. cr. powd	none; fa. sweet taste	100	1 51$^{15-20}$
347	wh cr	none; bitter taste		
348	col cr powd .	none, sharp taste		
349	amber balsam	fa. fatty		.
350	col. liq	mild .	86	0 852–0 856
351	straw yel liq	peppermint	95 by wt	0 8546$\frac{20}{4}$
352	straw colored liq	mild, ethereal		0 853–0 863$\frac{20}{20}$
353	col. liq , poisonous	char	98 .	0 852–0 856$\frac{20}{20}$
354	col -straw liq	char .	95	0 926–0 929$\frac{20}{20}$
355	col. gas	char pleas	99	0 554$^{0\ 76m.}$
356	col. liq		99 85	0 7929$\frac{20}{20}$
357	w wh liq	no foreign odor	99 8-100	792– 793$\frac{20}{20}$
358	w wh. liq	no foreign odor	99 8 by wt	7962$\frac{15}{4}$
359	col. liq	ester .	99	0 930–0 940
360	w. wh. mobile liq .	fragrant ester	97	930– 940$\frac{20}{20}$
361	w. wh. mobile liq. .	fragrant ester	82–85	904- 914$\frac{20}{20}$
362	col. liq . .	.	95–100	1 074–1 079$\frac{20}{20}$
363	w. wh. liq .	n. res . .	. . .	83- 88$\frac{20}{20}$
364	w. wh. liq .	mild, agreeable	95	0 855–0 860$\frac{20}{20}$

See two following pages for additional data on above compounds

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
338	Isopropyl acetate	−73.4	88.0	<84.5–none; >90–none	54
339	" "	−73.4		<81.5–none; 91.5–95%, >95–none	36
340	" "	−73.4	89.0	<81–none; 91–90% >95–none	59
341	" alcohol	−89.5	82.3	<81–none; >83–none	56
342	" benzene		152.5		130
343	" ether	−86.5	68.4	<63–none, >69–none	15
344	" "	−86.8	68.4[760]	<66–none; >70–none	16
345	Malonic acid	131.2–136.8			
346	Mannitol	167			
347	" hexaacetate	121–124			
348	" monoborate	78–80			
349	Melaniline octadecanoate				
350	Mesityl oxide	−46.4	128.0	123–132	90
351	" "	−59	129.5	<120–none, >135–none	83
352	" "	−59	128.7	110–40%, 126–131–60%	78
353	Methallyl alcohol		115	<109–none, >116–none	92
354	" chloride		72.2	<69–none; >77–none	14
355	Methane, Pure	182.6	161.4		
356	Methanol	−95.8	64.5	64.5–65.0	60
357	Methanol	−97.8	64.5	<64–none, >66–none	60
358	"	−97.8	64.5	<64–none; >65–95%, 66–none	52 (approx.)
359	Methyl acetate	−98.0	57.1	55–none, 58–none	25
360	" " , C.P.	−98.1	57.1	55–58	−16
361	" acetate, tech	−98.1	57.1	52–58	−16
362	" acetoacetate	−31.9	171.7	<91–10%, 90–95–85%	170
363	" acetone				
364	" amyl acetate	−55.8	146.3	<140–none, >150–none	110

See two preceding pages for additional data on above compounds.

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
338		solv	tank cars, drums	S.C.
339	3 2[25] w	lacq. solv	tank cars, drums, tank wagons, cans	St.
340	4 0[25] w	nitrocellu solv	tank cars, drums, cans	U.S I
341	∞ [25] w	solv , thinner lacq , germicide, preservative, dehydrating agt , mfg. pectin, antifreeze; rubb. al.	tank cars, drums	S.C.
342	1 w	chem syn	research quan't.	C. & C.
343	1 22[20]% by wt in w	dewaxing agt , solv	cans, drums, tank cars	C & C.
344	72 [10] w	solv oils, waxes, ethylcellu ; extr., delusterizing agt for art silk	tank cars, drums	S C
345	v s w , s acet , g per 100 g : 42 al , 8 eth ; 1 bz , CCl_4			D.
346	s w	fermentation industries, resins, pharm., form derivatives	cans, barrels.	At.
347	s al , amines, chlorinated solv , eth., ketones; sl s other org solv; i w	lacq hardener, plasticizer		At
348	s w., sl s ketones, polyhydric al , i. other org. solv	electrolytic condensors; syn of mannitol		At
349	s h.al., acet , ethyl acetate, naphtha, c toluene; i w			G.
350	2 78[20]% by wt in w	inter org syn	cans, drums	C. & C.
351	3 1[20] by wt in w; w in comp. 3 1[20] by wt	solv thinners, lacq. nitro., gums, resins	tank cars, drums	S C
352	3 4% by vol in w	industrial solv., chem syn , rust remover	drums	C.S.
353	15 w	mfg. synth. chem , plastics	drums, tins	S.C.
354	<0.1	fumigant; synthesis	drums, tins	S C.
355	imm w	research	cylinders	P P.
356	∞ w , eth al , org comp	org syn., antifreeze	cans, drums, tanks	C & C.
357	∞ w , org solv	solv antifreeze, synth perfume, resins, flavors, pharm , refrig	tank cars, drums	C S.
358	∞ [25] w	solv. embalming fluid, org. deriv base	tank cars, drums, cans	U.S.I.
359	24 2[20]% by wt in w	solv cellu nitrate, acetate, form lacq , varnishes, plastics, perfumes	cans, drums, tanks	C & C.
360	31 9[20] w , al ,eth , com hydrocarbon solv.	lacq solv , thinner; org syn , extr.fats, oils	drums	N
361	31.9[20]w al.,eth , com hydrocarbon solv.	lacq solv , thinner; org syn extr fats	drums	N
362	44.5[20]% by wt. in w	org syn	cans, drums	C & C.
363	misc com org solv	solvent	tank cars, drums cans	U S I
364	0.13[20]% by wt. in w	h boil.solv	cans, drums, cars	C. & C.

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
365	Methyl amyl alcohol	4,methyl pentanol-2	$(CH_3)_2CHCH_2CH(OH)CH_3$	102.17
366	" " carbinol	methyl amyl carbinol	$CH_3(CH_2)_4CHOHCH_3$	116 20
367	" *n*-amyl ketone	" *n*-amyl ketone	$CH_3CO(CH_2)_4CH_3$	114.18
368	*N*-Methylaniline	*N*-methylaniline	$C_6H_5NHCH_3$	107 15
369	Methyl "Carbitol"*	diethylene glycol monomethyl ether	$CH_3OCH_2CH_2OCH_2CH_2OH$	120 15
370	" " acetate		$CH_3COOC_2H_4OC_2H_4OCH_3$	162.18
371	" "Cellosolve"*	ethlene glycol monomethyl ether	$CH_3OCH_2CH_2OH$	76 09
372	" "Cellosolve"* acetate	ethylene glycol monomethyl ether acetate	$CH_3COOCH_2CH_2OCH_3$	118 13
373	" chloride	methyl chloride	CH_3Cl	50 49
374	" chloroform	1,1,1-trichloroethane	CH_3CCl_3	133.42
375	" dioxolane	methyl dioxolane	$OCH_2CH_2OCH(CH_3)$	88 10
376	" ethyl ketone	" ethyl ketone	$CH_3COCH_2CH_3$	72 10
377	" " "	" " "	$CH_3COC_2H_5$	72 10
378	" formate	" formate	$HCOOCH_3$	60 05
379	α-Methyl-*d*-glucoside	α-methyl-*d*-glucoside	$C_7H_{14}O_6$	194 18
380	Methyl-3-hydroxy-butyrate	methyl-3-hydroxybutyrate	$CH_3CHOHCH_2COOCH_3$	118 13
381	4-Methyl-2-hydroxy quinoline	4-methyl-2-hydroxy quinoline	$C_6H_4N{:}C(OH)CH{:}C(CH_3)$	160 19
382	Methyl isobutyl ketone	hexone	$(CH_3)_2CHCH_2COCH_3$	100.16
383	" " "	4-methylpentanone-2.	$(CH_3)_2CHCH_2COCH_3$	100 16
384	" lactate	methyl lactate	$C_3H_5O_3CH_3$	104 10
385	" phthalate	dimethyl phthalate	$C_6H_4(CO_2CH_3)_2$	194 18
386	1-Methyl-1-phenyl-ethylene	α-methyl sterene	$C_6H_5CCH_2CH_3$	118 17
387	α-Methyl tetraacetyl-*d*-glucoside	α-methyl tetraacetyl-*d*-glucoside	$C_{15}H_{22}O_{10}$	362 33
388	Methyl tetramethyl glucoside	methyl tetramethyl glucoside	$C_{11}H_{22}O_6$	250 29
389	Monoacetone glucose	monoacetone glucose	$C_9H_{16}O_6$	220 22
390	Monochlorobenzene	monochlorobenzene	C_6H_5Cl	112 56
391	Monoethanolamine	2-hydroxyethyl amine	$HOCH_2CH_2NH_2$	61 08
392	Monoethylamine	ethylamine	$C_2H_5NH_2$	45 08
393	Monoisopropanolamine	monoisopropanolamine	$CH_3CH(OH)CH_2NH_2$	75 11

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
365	w. wh. liq	mild	99	0.806–.811$\frac{20}{20}$
366	col. liq	mild		0.816–.821
367	w. wh. liq	agreeable	95–100	0.816–0.821$\frac{20}{20}$
368	straw colored liq	char. amine-like		.985$\frac{25}{25}$
369	col. liq	mild, n.res		1.030–1.040$\frac{20}{20}$
370	col. liq	mild	99	1.0396
371	w. wh. liq	mild, n. res	–89.5	0.961–0.966$\frac{20}{20}$
372	col. liq	pleas. ester	95–100	1.003–1.008
373	col. gas under press.-w. wh. liq	ethereal, fa. sweet	99.87	0.909$^{26.7}$
374	cl. col. liq	mild, chloroform-like		1.332$\frac{25}{25}$
375	col. liq			0.982
376	col. liq	typical ketone, less pung than acet.	99	0.8047$\frac{20}{4}$
377	liq	char	98	0.8037–0.8067$\frac{20}{20}$
378	w. wh. col. liq	pleas. ethereal	95–100 by wt	.95–.98$\frac{20}{20}$
379	sld			
380	col. liq			1.0559
381	sld			
382	w. wh. liq	none	95	0.799–0.804$\frac{20}{20}$
383	w. wh. liq		99 by wt	0.8004$\frac{20}{4}$
384	w. wh. liq	mild, n. res	95 by wt	1.087–1.097
385	w. wh. liq	none	99–100	1.192–1.194$\frac{20}{20}$
386	col. liq	styrene-like		.908$\frac{25}{25}$
387	sld			
388	visc. oil			
389	sld			
390	cl. col. liq	aromatic	tech	1.107$\frac{20}{4}$
391	w. wh. liq	distinct amm	97–100	1.017–1.027$\frac{20}{20}$
392	w. wh.		100	0.79–0.80$\frac{20}{20}$
393	liq	sl. amm.		0.981

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
365	Methyl amyl alcohol .		131 8 .	<125-none; >135-none	130
366	" " carbinol .	.	160 4	147-154	160
367	" *n*-amyl ketone.. .	-26 9	150 6	<147-none; <149-5%; <152-95%	120
368	*N*-Methylaniline .	-20		194 9-5%; 195 7 95%	185
369	Methyl "Carbitol"*.. .. .	. .	193 2	<185-none, >195-none	200
370	" " acetate.		209 1	203-212	180
371	" "Cellosolve"* .	-89 5	125 0	<122-none, >126-none	115
372	" " acetate	-65 1	144 5	<132-none >152-none	140
373	" chloride	-97 7 .	-24 22	-23 7-24 7 .	632
374	" chloroform. ...	.		74-5%; 74 8-95%	none
375	" dioxolane.. .		81-82		.. ..
376	" ethyl ketone .	-86 4	79 6 . ..	<79-none, >80 5-none	34
377	" " " ..	-86 4	.	78-5%; 82-85%; 84-none	24
378	" formate	-99 8	31 8 . .	<31 5-none; >35 0-none	-25 6
379	α-Methyl-*d*-glucoside ..	165-166			. ..
380	Methyl-3-hydroxybutyrate	..	174 9 ..	. .	180
381	4-Methyl-2-hydroxy quinoline	222	. . . .	..	. ..
382	Methyl isobutyl ketone	-77 2	116 0	<111-none; >117-none	75
383	" " "	-83 5	115 9	<114-none; >117-none	81
384	" lactate .	-66	144 8 .	<115-none; 141-145-60% >155-none	142
385	" phthalate	.	282	<186-none >194-none	310
386	1-Methyl-1-phenylethylene	<-20		164 9-5% 166 2-95%	129 2
387	α-Methyl tetraacetyl-*d*-glucoside	100-101	.		..
388	Methyl tetramethyl glucoside	$145-150^5$			. ..
389	Monoacetone glucose .	157-158			.....
390	Monochlorobenzene	-45 .	130 6	130 6-131 8	87 8 ...
391	Monoethanolamine	9 9 .	170 5	165-173, 90%	200
392	Monoethylamine	-80.6			<0
393	Monoisopropanolamine		45^5	.	. ...

* Trade mark.

See two preceding pages for additional data on above compounds.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
365	1.55^{20}% by wt. in w	lacq.form., prep.esters	cans, drums	C. & C.
366	0.35^{20}% by wt. in w.	plasticizer, xanthates, drugs, pharm., wetting agt.	drums	C. & C.
367	0.43^{20}% by wt. in w	solv.rubber, nitrocellu., syn. resins	cans, drums	C. & C.
368	.01 w, meth al., eth., CCl_4, bz, acet	. . .	. . .	D.
369	∞ w.; misc.most org. solv	solv.dyes, org syn	cans, drums	C. & C.
370	∞ w	lacq solv	research quant.	C. & C.
371	∞ w	rapid drying, varnishes, enamels; dyeing leather	cans, drums	C. & C.
372	∞ w., misc com.org.solv	solv. cellu.acetate	cans, drums	C. & C.
373	303$^{3-20}$w	refrigerant	steel cylinders	An
374	acet., al., bz., CCl_4, eth.; i.w.	. . .	.	D
375	59.0^{20}% by wt. in w	solv.cellu.esters	research quant.	C & C.
376	misc nitro lacq.solv.; imm.w.	solv., dewaxing lubr. oil, plastics; art leather, airplane dopes; synth.rubber	tank cars	S C.
377	23 4^{25}w	lacq., dewaxing, solv., art leather airplane dopes; printing; solv. synth.rubber	tank cars, tank wagons, drums, cans	St
378	28 95w	fumigants, larvacide	drums, cans	C S.
379	s.meth al., ethanol, w, i eth acet	. .	. . .	C.P.
380	∞ w	chem.inter	research quant	C. & C.
381	. .	chem.syn	research quant	C & C.
382	1 98^{20}w, misc. most org solv.	lacq solv extr	cans, drums	C & C.
383		solv cellu.acetate, natural & synth. resins, gums, waxes		S.C.
384	v.s. w., most org liq	solv.cellu.acetate	cans	C.S.
385	misc com org solv; imm gas	plasticizer.	tank cars, drums, cans	U S I.
386	∞ acet., bz., CCl_4, eth., meth.al., i.w.		.	D.
387	s.$CHCl_3$, acet., eth., CCl_4, et acet.			C.P.
388	5 w.; s $CHCl_3$; sl s. eth., pet. eth.			C.P.
389	s.w., ethanol, meth. al	.		C P.
390	s. al., eth; i w	mfg sulfur dyes, poison gases, phenol, aniline	tank cars	S.P.
391	∞ w	extr. CO_2	cans, drums	C & C.
392	s.w.; meth. al., ethyl eth., acet., bz., gasoline, ethyl acetate	mfg. dyestuff inter..	cans, drums	Sh
393	∞ w	prep. soaps with fatty acids	research quant	C & C.

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt
394	Monomethylamine ..	monomethylamine	CH_3NH_2 . . .	31.06
395	Mono-*n*-Butylamine	1-amino butane .. .	$C_4H_9NH_2$.	73 14
396	Morpholine	morpholine .	$O:(CH_2CH_2)_2:NH$	87.12
397	" ethanol	" ethanol	$CH_2CH_2OCH_2CH_2NCH_2CH_2OH$	131 17
398	" ethanol ethyl ether	" " ethyl ether	$CH_2CH_2OCH_2CH_2NC_2H_4OC_2H_5$	159 23
399	1-Naphthyl acetic acid	α-naphthalene acetic acid	$C_{12}H_{10}O_2$	186 20
400	Neohexane, Pure	2, 2 dimethyl butane	$(CH_3)_3CCH_2CH_3$.	86 17
401	*meta*-Nitro acet-*para*-toluide	*meta*-nitro acet-*para*-toluide	$CH_3CONHC_6H_3NO_2CH_3$	194 19
402	*meta*-Nitro *para*-toluidine	3-nitro-4-amino toluene	$C_6H_3CH_3NH_2NO_2$	152 15
403	Nonaethylene glycol hexaricinoleate	nonaethylene glycol hexaricinoleate	$C_{126}H_{230}O_{22}$	2096 7
404	Nonaethylene glycol monostearate	nonaethylene glycol monostearate	$HOCH_2CH_2(OCH_2CH_2)_8OC_{17}H_{35}CO$	680 5
405	Octaldehyde	2-ethylhexanal	$C_4H_9CH(C_2H_5)CHO$	128 21
406	Octyl acetate	octyl acetate	$CH_3COOCH_2CH(C_2H_5)C_4H_9$	172 26
407	" amine .	" amine	$CH_3(CH_2)_3CH(C_2H_5)CH_2NH_2$.	129 24
408	Paraldehyde, U S P XI Grade	paraldehyde	$(CH_3CHO)_3$	132 16
409	" tech	"	$(CH_3CHO)_3$.	132 16
410	Pentachloroethane	pentachloroethane	$CHCl_2CCl_3$ . .	202 31
411	Pentachlorophenol	pentachlorophenol	Cl_5C_6OH	266 35
412	Pentaerythritol	pentaerythritol.	$C(CH_2OH)_4$.	136 15
413	Pentaerythritol tetra-acetate	pentaerythritol tetra-acetate	$C(CH_2OOCH_3)_4$	304 29
414	*n*-Pentane, Pure	*n*-pentane .	$CH_3(CH_2)_3CH_3$	72 09
415	Pentaphen .	*p-tert*-amyl phenol	$C_5H_{11}C_6H_4OH$ . .	164 24
416	Perchlorobenzene	hexachlorobenzene	C_6Cl_6 .	284 80
417	Petrohol 91%	propanol-2	$CH_3CH(OH)CH_3$.	60 09
418	Petrohol 99%	propanol-2	$CH_3CH(OH)CH_3$ . . .	60 09
419	Phenetole	phenetole.	$C_6H_5OC_2H_5$	122 16
420	Phenoxyacetic acid	phenoxyacetic acid	$C_6H_5OCH_2COOH$	152 14
421	β-Phenoxy phenetole	1,2,diphenoxy ethane. .	$C_6H_5OCH_2CH_2OC_6H_5$	214 25

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
394	flam gas	strongly amm	98 .	$699\frac{-10.8}{15}$
395	w. wh	amm. ..	.	$0\ 74\text{-}0\ 76\frac{20}{20}$
396	col. liq	sharp, amm	98-100	0 999-1 004
397	liq			1 0724
398	liq		.	0 9648
399	w cr	none		......
400	flammable paraffin		99	$0\ 649\frac{20}{4}$
401	yel cr			..
402	orange-red monocl cr	typical nitro-comp	*ca* 98	1 312
403	amber liq	fa. fatty	. .	$0\ 960^{25}$
404	cream-colored soft sld	fa fatty		$1\ 005^{30}$
405	col liq	mild char		0 8196
406	col liq	ester	99 .	$0\ 870\text{-}0\ 875\frac{20}{20}$
407	liq	sl amm		0 792
408	w wh liq	pleas	99 .	$904\frac{20}{20}$
409	w wh liq	pleas	98 ..	$993\frac{20}{20}$
410	col liq	mild pleas	..	$1\ 670\frac{25}{25}$
411	wh cr	phenolic ..	.	....
412	wh cr powd	none		$1\ 35\frac{25}{4}$
413	wh cr powd	none	99 ..	..
414	flammable col liq or gas	sweet, non-corrosive	99	$0\ 626\frac{20}{4}$
415	yel liq		.	$0\ 92\text{-}0\ 93^{25}$
416	wh.-pa yel need			.
417	liq	char	90 9	$818\text{-}\ 8192\frac{20}{20}$
418	liq	char	99	$0\ 786\text{-}\ 7937\frac{20}{20}$
419	col. refractive liq	pleas char	. ..	$964\frac{25}{25}$
420	lt tan cr	none .	...	.. ..
421	wh cr	pleas	.	. . . ...

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
394	Monomethylamine	−92 5	−6 0 to −5 5[768]		32 5
395	Mono-n-Butylamine	−50 5	77 8 .	not <73 0; not >86 0	<40
396	Morpholine .	−3 1	128 9.	120–132	100
397	Morpholine ethanol		225 5 .		210
398	Morpholine ethanol ethyl ether		206 2		
399	1-Naphthyl acetic acid.	132 4–135 3			.
400	Neohexane, Pure	−98	49 5		−54
401	*meta*-Nitro acet-*para*-toluide	82–84			...
402	*meta*-Nitro-*para*-toluidine	114–115			
403	Nonaethylene glycol hexaricinoleate				
404	Nonaethylene glycol monostearate	25–30			. . .
405	Octaldehyde		164 1	150–165	125
406	Octyl acetate		198 6	<192–none, >202–none	190
407	" amine		167–168		. .
408	Paraldehyde, U S P XI Grade	11 min	124 5	120–125	111 2
409	Paraldehyde, tech	10 (approx)	124 5	100–127	111 2
410	Pentachloroethane	<−20.		159–5%, 161 4–95%	none
411	Pentachlorophenol	187 1–189 1			.
412	Pentaerythritol	257	276[30]		
413	Pentaerythritol tetra acetate	80–81	225[30]		. .
414	n-Pentane, Pure	130	36 0		−59
415	Pentaphen	not <91			232
416	Perochlorobenzene	229 9–230 6			.
417	Petrohol 91%	−85 8 ...		79 5–80 7	63
418	" 99%	−85 8 .		80 5–82.5	59
419	Phenetole	<−20 .	. . .	73–5%; 74 8–95% . .	145 4
420	Phenoxyacetic acid	99 9–101 5.		.	.
421	β Phenoxy phenetol	95 9–98 0...	. . . . . .		. . .

See two preceding pages for additional data on above compounds.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
394	v.s.w., al; s eth	tanning, dyestuffs	drums, bottles	C.S.
395	s.w., bz., acet., methyl al., gasoline, ethyl acetate, ethyl eth.	raw mat. mfg pharm., dyestuffs, rubber chem., emulsifying agt., desizing agt.	cans, drums	Sh
396	∞ w	corrosion inhibitor, solv dyes, resins, waxes, shellacs	cans, drums	C & C.
397	∞ w	syn drugs, rubber accel	research quant	C & C.
398	∞ w	syn drugs, rubber accel	research quant	C & C.
399	g. per 100 g: 83 meth al., 22 eth., 1 CCl_4, 7 bz., 71 acet., .04 w			D
400	imm w	research	cans, drums	P.P
401	s. al., meth al., eth., sl s w	dye inter	drums	Pa.
402	s.al., con. H_2SO_4; v sl s h w.	hansa yellows, toluidine toners	barrels	Pa
403	disp. w., s. org solv., i al.	lubricant, water-oil emulsifier, hydraulic fluids	drums	G
404	disp w., s al., acet., ethyl acetate, toluene, h naphtha	soapless emulsifier, thickener	drums	G
405	0.07^{20} w	blend. perfumes	drums	C & C
406	∞ w	solv. nitro. & resins	cans, drums	C & C
407		chem. syn	drums	C. & C
408	11.7^{20}w, ∞ com. solv	soporific	drums, tank cars	N.
409	11.7^{20}w	mfg. resins, plastics; tanning leather; lacq solv., plasticizer	drums, tank cars	N.
410	∞ meth al., eth., CCl_4, bz., acet., i w			D
411	g per 100 g: 53 acet., 11 bz., 4 CCl_4, 148 eth., 57 meth. al, 0.02 w.			D.
412	5.56^{25}w; v sl s al., i eth	prep alkyd resins, org. syn	cartons, drums barrels	N.
413	v s al., s. eth; v sl s w	plasticizer cellu acetate, nitrate lacq., plastics	cartons, drums.	N.
414	imm w	lab reagent	cans, drums	P P
415	s 10% KOH, oil, al., eth, bz., chloroform, acet., i.w.	germicide, fumigant, pharm	cans, bottles, barrels	Sh
416	v s eth; s CCl_4; sl s bz., i w., al			D.
417	∞^{25}w	solv., antiseptics, cosmetics	tank cars, drums, tank wagons, cans	St
418	∞^{25}w	solv. antiseptics, cosmetics	tank cars, drums, tank wagons, cans	St.
419	∞ bz., acet., CCl_4, eth., meth al.; i.w			D
420	v s.al; g per 100 g: 29 eth., 3 bz., 1 w; i CCl_4			D.
421	g per 100 g: 23 acet., 27 bz., 7 CCl_4, 9 eth., 2 meth. al; i w			D

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
422	Phenyl "Cellosolve"*		$C_6H_5OC_2H_4OH$	138.16
423	" diethanolamine	phenyl diethanolamine	$C_6H_5N(CH_2CH_2OH)_2$	181.23
424	x-Phenyl diphenyl ether	" xenyl ether	$C_6H_5OC_6H_4C_6H_5$	246.29
425	Phenyl ethane	ethyl benzene	$C_6H_5C_2H_5$	106.16
426	" ethanolamine	phenyl ethanolamine	$C_6H_5NHCH_2CH_2OH$	137.18
427	" methyl pyrazolone	" methyl pyrazolone	$C_6H_5N.N{:}C(CH_3)CH_2CO$	174.20
428	Phenyl morpholine	" morpholine	$C_6H_5NCH_2CH_2OCH_2CH_2$	163.21
429	Phorone	phorone	$(CH_3)_2C{:}CHCOCH{:}C(CH_3)_2$	138.2
430	Phosphen 1	diphenyl mono-(*p-tert* butyl phenyl) phosphate	$(CH_3)_3CC_6H_4OP(OC_6H_5)_2O$	382.39
431	" 2	di-(*p-tert*-butylphenyl) monophenyl phosphate	$C_{26}H_{31}O_4P$	438.49
432	" 3	diphenyl mono(*o*-chlorophenyl) phosphate	$C_{18}H_{14}O_4ClP$	360.73
433	" 4	di(*o*-chlorophenyl)monophenyl phosphate	$C_{18}H_{13}O_4Cl_2P$	395.18
434	" 5	diphenyl mono(*o*-xenyl) phosphate	$C_{24}H_{19}O_4P$	402.37
435	" 6	di(*o*-xenyl)monophenyl phosphate	$C_{30}H_{23}PO_4$	478.47
436	" 7	tri-(*p-tert*-butylphenyl) phosphate	$C_{30}H_{39}O_4P$	494.60
437	" 8	tri-*o*-chlorophenyl phosphate	$C_{18}H_{12}O_4Cl_3P$	429.63
438	" 9	tri-*o*-xenyl phosphate	$C_{36}H_{27}O_4P$	554.56
439	Piperazine	piperazine	$NHCH_2CH_2NHCH_2CH_2$	86.14
440	Propane, Pure	propane	$CH_3CH_2CH_3$	44.09
441	Propionic anhydride	propionic anhydride	$(CH_3CH_2CO)_2{:}O$	130.14
442	Propiophenone	ethyl phenyl ketone	$C_6H_5COC_2H_5$	134.17
443	Propyl *p*-hydroxybenzoate	propyl *p*-hydroxybenzoate	$C_{10}H_{12}O_3$	180.20
444	Propylene chlorhydrin anhydrous	chlorisopropyl alcohol	$CH_3CHOHCH_2Cl$	94.54
445	Propylene diamine, anhydrous	propylene diamine	$CH_3CH(NH_2)CH_2NH_2$	74.13
446	Propylene dibromide	" bromide	$CH_3CHBrCH_2Br$	201.91
447	Propylene dichloride	" dichloride	$CH_3CHClCH_2Cl$	112.99
448	Propylene glycol	1,2-dihydroxypropane	$CH_3CHOHCH_2OH$	76.09
449	Propylene glycol diricinoleate	propylene glycol diricinoleate	$CH_3CHCH_2(C_{17}H_{32}OHCOO)_2$	639.14
450	" " distearate	propylene glycol distearate	$CH_3CHCH_2(C_{17}H_{35}COO)_2$	609.14
451	" " monostearate	propylene glycol monostearate	$CH_3CHOHCH_2OOCC_{17}H_{35}$	342.54

* Trade mark.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
422	w. wh. liq	fa. aromatic		1 106–1.111
423	liq			
424	lt. yel. cr	none		1 109$\frac{30}{25}$
425	cl. col. mobile liq	pleas		866$\frac{25}{25}$
426	liq			1.094–1 099
427	wh. sld	none		
428	liq			
429	yel. liq	geranium-like		0 8791
430	cl -col. pa straw mobile perm liq.	none		1 16$\frac{25}{25}$
431	cl., col. visc. per. liq	none		1 11$\frac{25}{25}$
432	cl. col. pa straw mobile perm. liq.			1 3$\frac{25}{25}$
433	cl. col -pa. straw mobile perm. liq			1 34$\frac{25}{25}$
434	cl. col mobile liq	none		1 20$\frac{60}{4}$
435	cl. col visc. liq.			1 20$\frac{60}{4}$
436	wh cr. sld	none		
437	wh. sld or cl col. sld		1 38$\frac{60}{4}$	
438	wh. gran sld	none		
439	liq	amine-like		
440	col. flammable gas	char pleas. sweet	99 9	0 503$\frac{20}{4}$
441	col. liq	pungent	95–100	1 0119
442	pa lemon colored liq.	sweet pleas	ca 95	1 015
443	wh. cr	none		
444	w. wh liq	mild, n. res	46–54	1 1270$\frac{20}{20}$
445	col. liq	amm		0 8732
446	cl. col. heavy liq	sweet		1 943$\frac{25}{25}$
447	w. wh. liq	chloroform-like		1.157–1.163$\frac{20}{20}$
448	w wh liq	almost none	99	1 037–1.039$\frac{20}{20}$
449	amber oil	fa. fatty		0 942$\frac{25}{25}$
450	cr. colored sld	fa. fatty		0 965$\frac{25}{25}$
451	cr. colored soft sld	fa. fatty		0 93$\frac{25}{25}$

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
422	Phenyl "Cellosolve"*	14 0	244 7	240-248	250
423	" diethanolamine	58.			
424	x-Phenyl diphenyl ether	27.6	205^{10}		359 6
425	Phenyl ethane	<−70		135-5%; 137-95%	68
426	" ethanolamine	15 4	285 2	280-290	305
427	" methyl pyrazolone	128	289^{265}		
428	" morpholine	57	268^{760}		
429	Phorone	28 0	197 9		185
430	Phosphen 1	<0	$245\text{-}260^{5}$		>437
431	" 2	<0	$260\text{-}275^{5}$		482
432	" 3	<0	$240\text{-}255^{5}$		>419
433	" 4	<0	$255\text{-}270^{5}$		>437
434	" 5	<0	$250\text{-}285^{5}$		437
435	" 6		285-330		482
436	" 7	102-105	300^{5}		527
437	" 8	35		$255\text{-}265^{5}$	543
438	" 9	113-115			
439	Piperazine	104			
440	Propane, Pure	−190	−42 2		−140
441	Propionic anhydride	−43	169 0	160-175	163
442	Propiophenone	16 4-17 5	215-218, 80%	215-218, 80%	
443	Propyl p-hydroxybenzoate	96			
444	Propylene chlorhydrin		127 4		125
445	Propylene diamine, anhydrous		119 7		160
446	Propylene dibromide			139 6-5%; 142 6-95%	none
447	Propylene dichloride	<−80	95 9	<93-none; >99-none	70
448	Propylene glycol	<−60	188 2	<180-none; <195-90%; >210-none	225
449	Propylene glycol diricinoleate				
450	Propylene glycol distearate	34-35			
451	Propylene glycol monostearate	37-39			

* Trade mark.

See two preceding pages for additional data on above compounds.

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
422	2.67[20]% by wt. in wt	fixative for perfumes; org. syn.	cans, drums	C & C.
423	3.34[20]% by wt in w	inter	cans, drums	C & C
424	g per 100 g: 100 eth, 100 CCl_4, 100 bz, 100 acet.; i.w			D.
425	∞ eth, CCl_4, bz., al; i w			D.
426	4.58[20]% by wt in w	syn dyes, inter	cans, drums	C. & C.
427	1 0[20]% by wt. in w	inter org syn; pharm	drums, barrels	C & C.
428	1.0[20]% by wt. in w	syn.drugs, rubber accel	research quant	C & C
429	0 11[60]% by wt. in w	inter	cans, drums	C & C
430	∞ bz., CCl_4; v s.al; s V M P naphtha; i.w.			D
431	∞ CCl_4, bz, v s.al; s V.M P naphtha; i w			D
432	CCl_4, bz; v.s al, sl s V M P naphtha; i.w.			D
433	CCl_4, bz., v s al; sl s V M.P. naphtha; i w.			D
434	CCl_4, bz; v s al; sl s.V.M.P naphtha; i.w			D
435	∞ bz, CCl_4; v s.al.; s. V M P naphtha; i.w.			D
436	∞ bz., CCl_4, g. per 100 g: 2 al.; i.w.			D.
437	∞ bz., CCl_4; v s al; sl s V.M P naphtha; i w			D
438	g per 100 g: 8 bz., 1 CCl_4; sl s V.M.P naphtha; i w., al			D.
439	15[20]% by wt in w	syn drugs	research quant	C & C
440	imm w	refrig, reagent, org syn	cylinders	P P.
441	d.w	esterifying agt		C & C
442	s. eth, bz; i w		tins, bottles	Pa
443	g per 100 g: 105 acet, 100 meth al, 50 eth, 3 bz, .5 CCl_4; i w.			D.
444	∞ w	chem syn	jugs, carboys	C. & C.
445	∞ w	chem.syn	drums	C. & C.
446	acet., bz., CCl_4; vs eth; s al, g per 100 g. 0 2[25] w			D
447	0.3[20]% by wt. in w	cleaning comp, org syn	cans, drums	C. & C.
448	∞ w	solv, anti-freeze	cans, drums, tank cars	C & C
449	s. al., naphtha; i.w	hydraulic fluids, lubricants, plasticizer		G.
450	s. naphtha, h.al; i.w			G
451	s. acet., ethyl acetate, h.al., toluene, naphtha; i.w.	suppositories; emulsifier with soap		G

No.	Trade name	Chemical name or synonyms	Formula	Mol. wt.
452	Propylene oxide..	propylene oxide	CH_3CHCH_2O	58 08
453	" , Technical	propylene	CH_2CHCH_3	42 08
454	Pyrosal	antipyrene acetyl salicylate	$C_{20}H_{20}O_5N_2$.	368 38
455	Resorcin	*meta*-dihydroxy benzene	$C_6H_4(OH)_2$	110 11
456	Salicyl salicylic acid	salicyl salicylic acid	$C_{14}H_{10}O_5$	258 22
457	SOA*	sucrose octa acetate	$C_{12}H_{14}O_3(OOCCH_3)_8$	678 59
458	Sodium benzene-*meta*-disulfonate	sodium benzene *meta*-disulfonate	$C_6H_4(SO_3Na)_2$	282 21
459	" diphenyl-4-sulfonate	diphenyl-4-sulfonic acid	$C_{12}H_9O_3SNa$	256 25
460	Sorbitol hexaacetate	sorbitol hexaacetate	$C_6H_8O_6(CH_3CO)_6$	434 39
461	Span 20	sorbitan monolaurate	$C_6H_8O(OH)_3(OCOC_{11}H_{23})$†	346 3†
462	" 40	" monopalmitate	$C_6H_8O(OH)_3OCO(CH_2)_{14}CH_3$†	402 3†
463	" 60	" monostearate	$C_6H_8O(OH)_3OCO(CH_2)_{16}CH_3$†	430 4†
464	" 80	" monooleate	$C_6H_8O(OH)_3OCO(CH_2)_7$-$CH(C_8H_{17})CH$†	428 4†
465	" 85	" trioleate	$C_6H_8O(OH)[OCOC_{17}H_{33}]_3$†	957 0†
466	1,2,4,5-Tetrachlorobenzene	1,2,4,5-tetrachlorobenzene	$C_6H_2Cl_4$	215 90
467	Tetrachloro hydroquinone	tetrachloro hydroquinone	$C_6H_2O_2Cl_4$	247 90
468	2,3,4,6 Tetrachlorophenol	2,3,4,6 tetrachlorophenol	$C_6H_2OCl_4$	231 90
469	Tetrachloroquinone	chloranil	$Cl_4C_6O_2$	245 89
470	Tetradecanol	tetradecanol	$C_{14}H_{29}OH$	214 38
471	Tetraethanolammonium hydroxide	tetraethanolammonium hydroxide	$(HOCH_2CH_2)_4NOH$	211 26
472	Tetraethylene glycol	tetraethylene glycol	$HOCH_2(CH_2O)_3CH_2CH_2OH$	194 23
473	Tetraethylene pentamine	tetraethylene pentamine	$NH_2(CH_2CH_2NH)_3CH_2CH_2NH_2$	189 31
474	Tetraglycol dichloride	tetraglycol dichloride	$(ClCH_2CH_2OCH_2CH_2)_2O$	231 12
475	Tetrahydrofurfuryl alcohol	tetrahydro-2-furancarbinol	$C_4H_7O\ CH_2OH$	102 13
476	Tetrahydrofurfuryl glycolate	tetrahydrofurfuryl glycolate	$(CH_2)_3CHOCH_2OOC\ CH_2OH$	160 16
477	Tetrahydrofurfuryl levulinate	tetrahydrofurfuryl levulinate	$(CH_2)_3OCHCH_2OOC$ $(CH_2)_2COCH_3$	200 1
478	Tetrahydrofurfuryl oleate	tetrahydrofurfuryl oleate.	$(CH_2)_3OCHCH_2OOCC_{17}H_{33}$	366 6
479	Thiodiphenylamine	phenothiazine	$C_6H_4SNHC_6H_4$	199 26

* Trade mark.
† Theoretical.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp. gr.
452	w. wh liq			$0.831\text{-}0.836\frac{20}{20}$
453	olefin		95	$0.520\frac{20}{4}$
454	wh. powd			.
455	sl yel sld	fa, peculiar	>98	1.285^{15}
456	wh. powd	none		. .
457	wh cr powd	intensely bitter taste	99 min	1.28 (fused)
458	lt. pk sld	none		
459	fine wh cr	aromatic		
460	wh cr	none, bitter after-taste		1.34^{25}
461	amber colored viscous oily liq	fatty	tech	1.00-1.06
462	yel wax	faint, fatty	tech	1.00-1.05
463	yel brittle wax	faint, fatty	tech	0.98-1.03
464	amber-colored, viscous oily liq	fatty	tech	1.00-1.05
465	amber, oily liq	fatty	tech	0.92-0.98
466	lt tan cr	like *p*-dichlorobenzene		
467	lt tan powd	pung		
468	tan fl	strong char		$1.63\frac{60}{4}$
469	golden br cr sld	mild char		
470	col liq	mild		0.8355
471				
472	col hyg liq			1.1248
473	visc hyg liq	char amine-like		0.990-1.000
474	liq .			1.186
475	col -straw liq	mild	95 min	$1.052\frac{25}{25}$
476	amber liq	faint		$1.172\frac{25}{25}$
477	amber liq	faint		1.10^{30}
478	yel. liq	faint		0.927^{30}
479	pa yel lust. pl	fa char		. .

See two following pages for additional data on above compounds

No	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
452	Propylene oxide		34.1	<30 none, >40–5%	−35
453	" , Tech.	−185.2	−47.6		
454	Pyrosal	61.4–63.8			
455	Resorcin	109–110	$146–152^{5}$	$146–152^{5}$	
456	Salicyl salicylic acid	145.7–149.2			
457	SOA*	79–86	$260^{0.1}$	d 285	
458	Sodium benzene-*meta*-disulfonate				
459	Sodium diphenyl-4-sulfonate				
460	Sorbitol hexaacetate	98–100	$220–240^{12}$		
461	Span 20	14–16			400
462	" 40				415
463	" 60				450
464	" 80	10–12			410
465	" 85	−10			
466	1,2,4,5-Tetrachlorobenzene	136.0–139.0			none
467	Tetrachloro hydroquinone	235.0–236.1			
468	2,3,4,6-Tetrachlorophenol	55–62			none
469	Tetrachloroquinone	285–287			
470	Tetradecanol		263.2		285
471	Tetraethanolammonium hydroxide				
472	Tetraethylene glycol	−6.2	327.3		345
473	" pentamine		333	280–360	325
474	Tetraglycol dichloride		114^{5}		>250
475	Tetrahydrofurfuryl alcohol	<−80	$177–8^{743}$	170–180, 99%	167–176
476	Tetrahydrofurfuryl glycolate				
477	" " levulinate				
478	" " oleate				
479	Thiodiphenylamine	184.3–185.2			

* Trade mark.

See two preceding pages for additional data on above compounds.

No.	Solubility grams per 100 ml	Uses	Shipping container	Source of information
452	41 0[20]% by wt in w	fumigant, chem. syn .	cans, drums	C & C
453	imm. w ..	research	cylinders	P P
454	g per 100 g ; 126 al, 113 bz., 13 eth, 4[80] w, 1[25]w ; i CCl_4			D.
455	s w., al, eth, acet, amyl al.; sl. s bz glycerine	dyes, pharm	fiber containers, drums	Pa
456	g per 100 g : 66 acet, 45 al, 28 eth, 1 bz.; v.sl s. CCl_4; i.w			D
457	g per 100 g : 09 w., 9 0 al ; s.eth	anhydrous adhesive, waterproofing paper, insulating, lacq, plastics, rubbing al., denaturing	cartons, drums	N.
458	s.w	grinding aid for cement	fibre drums .	Pa
459	g per 100 g.. 1 5 w, 02 acet., .002 bz, 03 CCl_4, 03 eth, .06 meth. al			D
460	.27[25] w., 3 0[100] w	hardening agt, plasticizer org syn		At
461	disp w, s oil & org solv	emulsifier, wetting & drying agt; edible	drums, cans	At
462	disp h w, s warm oils, most org solv	emulsifier, thickening agt	drums, fiber containers	At
463	disp h w, s warm oils, most org solv	emulsifier, thickening agt	drums, fiber containers	At
464	disp w, s oils, most org solv	w o emulsifier, edible	drums, cans	At
465	s oils, org solv, sl w disp	w o emulsifier, dispersing agt	drums, cans	At
466	g per 100 g · 0.8 al, 6 CCl_4, 58 monochlorobenzene; i w			D
467	g per 100 g 45 acet, 0 2 bz, 04 CCl_4, 20 eth, 20 meth al, i.w.		.	D
468	v.s acet, al, bz, eth, meth al, v sl s w, g per 100 g . 31 CCl_4			D.
469	s. epichlorohydrin, sl s CCl_4; i.w., al, bz., eth	.. ...	..	D.
470	0 02[20]% by wt. in w	plasticizer inter, perfume fixatives	cans, drums	C & C.
471	∞ w	textile auxiliary .	research quant.	C. & C
472	∞ w	solv. nitro., gen., plasticizer	cans, drums	C. & C.
473	∞ w., most org solv	saponifying fatty acids	cans, drums	C & C.
474	sl s w	chem syn . . .	research quant	C. & C
475	∞ w., al, eth	solv, org syn, wetting agt., mfg plasticizer	cans, drums	Q.O.
476	s.w, al, acet, toluene; i naphtha	compatible nitro, ethyl cellu., cellu.acetate, vinylite resin	.	G
477	∞ w ; s.al., toluene, naphtha	compatible nitro., ethyl cellu, cellu acetate, vinylite	. .. .	G
478	s.al, toluene, naphtha, acet, ethyl acetate, i w	plasticizer .	. .. .	G.
479	g. per 100 g : 27 acet., 3 bz, 6 CCl_4, 7 eth, 2 meth al ; i w.	..	... ..	D.

No.	Trade name	Chemical name or synonyms	Formula	Mol wt.
480	2,4,6-Tribromophenol	2,4,6-tribromophenol	$C_6H_3OBr_3$	330 83
481	Tributyl citrate	tributyl citrate .	$(CH_2COOC_4H_9)_2C(OH)COOC_4H_9$	360 44
482	Tributyl phosphate	tributyl phosphate	$(C_4H_9)_3PO_4$.	266 32
483	Trichlorethylene	1,2,2-trichlorethylene	$ClCH:CCl_2$	131 40
484	2,4,5-Trichlorophenol	2,4,5-trichlorophenol	$C_6H_3OCl_3$	197 46
485	1,1,2,-Trichloropropane	1,1,2,-trichloropropane	$CH_3CHClCHCl_2$	147 44
486	1,2,3,-Trichloropropane	1,2,3,-trichloropropane	$CH_2ClCHClCH_2Cl$	147 44
487	1,2,3-Trichloropropane	1,2,3-trichloropropane	$CH_2ClCHClCH_2Cl$	147 44
488	Triethylamine	triethylamine	$(C_2H_5)_3N$	101 19
489	Triethanolamine	tri(2-hydroxyethyl)amine	$(HOCH_2CH_2)_3N$	149 19
490	Triethyl phosphate	triethyl phosphate	$(C_2H_5)_3PO_4$	182 16
491	Triethylene glycol	triethylene glycol	$HOC_2H_4OC_2H_4OC_2H_4OH$	150 17
492	" tetramine	" tetramine	$NH_2C_2H_4NHC_2H_4NHC_2H_4NH_2$	146 24
493	Triglycol dichloride	triglycol dichloride	$Cl(CH_2CH_2O)_2CH_2CH_2Cl$	187 07
494	Triisopropanolamine.	triisopropanolamine	$[CH_3CH(OH)CH_2]_3N$	191 27
495	Trimethylamine	trimethylamine	$(CH_3)_3N$	59 11
496	Trimethyl phosphate	trimethyl phosphate	$(CH_3)_3PO_4$	140 08
497	Tri-*n*-Butylamine	tributylamine	$(C_4H_9)_3N$	185 34
498	Triphenyl carbinol	triphenyl methanol	$C_{19}H_{16}O$	260 32
499	Tween 20	polyoxyalkylene deriv of sorbitan monolaurate		122 6†
500	" 40	polyoxyalkylene deriv of sorbitan monopalmitate		1282†
501	" 60	polyoxyalkylene deriv of sorbitan monostearate		1310†
502	" 61	polyoxyalkylene deriv of sorbitan monostearate		606†
503	" 80	polyoxyalkylene deriv of sorbitan monooleate		
504	" 81	polyoxyalklene deriv. of sorbitan monooleate		
505	" 85	polyoxyalklene deriv. of sorbitan trioleate		
506	**Undecanol-2**	**undecanol-2.**	$C_{11}H_{23}OH$ ..	**172 30**
507	**Urethan**............	**ethyl carbamate**......	$NH_2COOC_2H_5$..... ..	**89 09**
508	**Vinyl acetate**.........	**vinyl acetate**.........	$CH_2CHOCOCH_3$.....	**86.05**
509	" "	" "	$CH_3COOCHCH_2$....	**86.09**
510	" **chloride**........	" **chloride**........ ...	$CH_2:CHCl$................ .	**62.50**
511	" **chloride**........	**chloroethylene**..........	CH_2CHCl............ ...	**62.50**

† Theoretical.

ORGANIC COMPOUNDS (Continued)

No.	Physical form and color	Odor	Purity %	Sp gr
480	lt. pk cr	fa char sweet astringent taste	..	.
481	lt. straw stable, n. vol. liq .	none. . .	99 .	$1.043\text{–}1.049\frac{20}{20}$
482	w. wh liq	none .	99 95 . .	$.973\text{–}.983\frac{20}{20}$
483	w. wh liq .	pleas .	99 .	$1.47\text{–}1.48\frac{15}{15}$
484	tan fl	strong phenolic		.
485	cl col liq	sweetish char	.	$1.343\frac{25}{25}$
486	col. liq	chloroform-like	95 .	$1.398\frac{20}{4}$
487	cl. col liq	sweet char		$1.388\frac{25}{25}$
488	w wh			$0.73\frac{20}{20}$
489	visc hyg liq	sl. amm	80	$1.1240\text{–}1.1300\frac{20}{20}$
490	col liq	apple-like	97 by wt .	$1.068\text{–}1.072\frac{20}{20}$
491	col liq	almost none		$1.122\text{–}1.127\frac{20}{20}$
492	visc liq	char amine-like		0 980–0 985
493	col liq		.	1 195–1 120
494	wh cr sld	sl amm	.	1 0200
495	col gas	pung amm	98 .	$.662^{-5}$
496	w wh liq	mild	98 by wt .	$1.205\text{–}1.220\frac{20}{20}$
497	l yel .		.	$0.78\frac{20}{20}$
498	lt straw colored cr	fa		.
499	amber, oily liq	faint, fatty	tech	1 08–1 13
500	amber, oily liq.	faint, fatty	tech.	1 05–1 10
501	amber, oily liq	faint, fatty	tech	1 05–1 10
502	yel waxy solid	faint, fatty	tech	0 98–1 03
503	amber, oily solid	faint, fatty	tech. .	1 05–1 10
504	amber oily liq	faint, fatty	tech	1 00–1 05
505	amber oily liq	faint, fatty	tech.	1 03–1 05
506	col liq	mild		0 8363
507	wh. cr	slight	98 .	$1.06\frac{48.2}{4}$
508	w. wh. liq .	char. sharp; irritating to the eyes	99 0+	$0.9317\frac{20}{4}$
509	unstable to w. wh. liq.; stable to lt blue liq	pleas . . .	99 5. ..	$0.9335\text{–}.9345\frac{20}{20}$
510	w. wh. cl	. .	... .	$0.9121\frac{20}{20}$
511	col. liq. under press .	ethyl chloride-like .	... ...	0.908

See two following pages for additional data on above compounds.

No.	Trade name	Melting point, °C	Boiling point, °C	Distillation range, °C	Flash point, °F
480	2,4,6 Tribromophenol	91 5-92 6.	sublimes		none
481	Tributyl citrate .	−20	233 5[22 5]	234–236	365[25]
482	" phosphate	<−80	177–178[27]	175–184	294 8
483	Trichlorethylene		86 7	86–87 5, 95% . .	none
484	2,4,5-Trichlorophenol	60	252		none
485	1,1,2-Trichloropropane	<−20		132 0–5%; 134 3–95%	none
486	1,2,3,-Trichloropropane	. .	156		174
487	1,2,3-Trichloropropane	−15		155 4–5%; 156–95%	none
488	Triethylamine	−114 8	89 5	not <85; not >91	20
489	Triethanolamine	21 2	208[10]		365
490	Triethyl phosphate	−56 4	216	190–220; 210–5%	ca 240
491	Triethylene glycol	−7 2	287 3	<270–none, <290 85%, <300–95%	330
492	" tetramine		277 5	260–290	260
493	Triglycol dichloride	−31 5	241 3	230–245	250
494	Triisopropanolamine	46–50	305 4		305
495	Trimethylamine	−124	3 2 3 8[760]		
496	Trimethyl phosphate	−47 1	196	190–205, 90%	none
497	Tri-n-Butylamine	<−70	214	not <303; not <219	187
498	Triphenyl carbinol	160–161 2			
499	Tween 20	.			610
500	" 40				
501	" 60				
502	" 61				
503	" 80				
504	" 81				550
505	" 85				610
506	Undecanol-2		225 4		235
507	Urethan	48 50	183 .		
508	Vinyl acetate		72 5	72 73	−8
509	" "	<−60	71 8–73.0	71–73 5 .	
510	" chloride	−159 7	−13 9	<10–95%	<20
511	" "	. .	−14	.	<−22

See two preceding pages for additional data on above compounds.

ORGANIC COMPOUNDS (Continued)

No.	Solubility, grams per 100 ml	Uses	Shipping container	Source of information
480	v.s.acet., al., eth; v.sl.s.w.; g. per 100 g.: 12 CCl_4, 50 bz.		. ..	D.
481	i.,imm.w... . .	plasticizer cellu.nitrate, acetate, resins; antifoaming agt., lubricant, agt	. .	C.S.
482	.586 w .	plasticizer nitro. lacq., plastics, cellu, acetates	drums, cans	C.S
483	0 10^{25}% by wt. in w .	solv.degreaser	cans, drums	C. & C.
484	v.s al, bz., CCl_4, eth.; i w			D.
485	∞ acet, al bz., CCl_4, eth; i w.			D.
486	<0.1w			S.D
487	∞ acet., al., bz., CCl_4, eth ; i.w			D
488	∞ w., 18; s. meth al, ethyl eth, acet, bz, gasoline, ethyl acetate	prep ammonium comp ; textile	cans, drums	Sh
489	∞ w.,al; sl.s hydrocarbons	gas absorbent, form soaps, emulsifying agts	cans, drums tank cars	C. & C
490	∞ w ; s most org solv	solv plasticizer	cans, drums	C S.
491	∞ w	solv nitrocellu ; chem.syn	cans, drums	C & C.
492	∞ w	detergents, sofg agts; chem. syn	cans, drums	C & C.
493	1 89^{20}% by wt in w	chlorinated solv extr	cans, drums	C & C.
494	∞ w	emulsifying agt .	cans, drums	C & C.
495	v s w	synth chem.base; warning agt; insect attractant	drums, bottles	C S.
496	∞ w, most org liq	solvent	drums, cans	C.S.
497	∞ most org solv.; i w	hydraulic fluid formulation	cans, drums	Sh.
498	g per 100 g.: 22 acet, 16 bz, 16 eth, 2 CCl_4, 3 meth.al			D.
499	s w, most org solv, i. mineral, veget oils	emulsifier, wetting, disp ; solubilizing agent	drums, cans	At.
500	s w., most org. solv ; i mineral, veget. oils	emulsifier, dispersing, solubilizing agt	drums, cans	At
501	s.w., most org solv; i mineral, veget oils	emulsifier, dispersing, solubilizing agt	drums, cans	At.
502	s. org solv ; i w ; disp h.w.	emulsifier, thick. agt .	drums, cans .	At
503	s w., most org. solv.; i mineral, veget. oils	emulsifier, wetting, disp agt	drums, cans .	At.
504	disp w ; s all org solv	emulsifier, disp. agt. lubricant	drums, cans	At.
505	s w, most org solv ; i mineral, veg oils	emulsifier, wetting, dispersing, solubilizing agt.	drums, cans . .	At.
506	<0.02^{20}% by wt. in w	plasticizer inter., perfume fixatives	drums	C. & C.
507	180^{25}w, 125^{25} eth	pharm	drums, cans.	U.S.I.
508	2.5 w ..	inter resin, drug mfg	drums, tank cars	S C.L.
509	∞ al., eth.; i.w	mfg vinyl acetate resins .	drums, tank cars	N.
510	0.09^{20}% by wt. in w	mfg plastics	cylinders	C. & C.
511	v.s. CCl_4, eth.; s.al.; sl.s.w		.	D.

CONSTANTS OF VEGETABLE AND ANIMAL

No.	Common name	Scientific name	Class†
1	Almond	*Prunus amygdalus*	I
2	Beef marrow	*Adeps bovis*	IX
3	Beef tallow	*Adeps bovis*	IX
4	Beechnut	*Fagus sylvatica F. Americana*	V
5	Beeswax	*Apis mellifera*	XII
6	Black mustard	*Sinapis nigra*	II
7	Bone fat	*Sevum ossis*	IX
8	Butter fat	*Vaccae lactis adeps*	IX
9	Candlenut	*Aleurites moluccana*	VI
10	Candlenut	*Aleurites triloba*	VI
11	Carnauba wax	*Corypha cerifera*	XI
12	Castor	*Ricinus communis*	III
13	Chaulmoogra	*Taraktogenos Kurzii*	V
14	Chaulmoogra	U. S. P. 10th Revision	V
15	Chinese insect wax	*Coccus cerifera*	XII
16	Chinese vegetable tallow	*Stillingia sebifera*	VIII
17	Coconut	*Cocos butyracea, C. nucifera*	VIII
18	Cocoa butter (Cacao)	*Theobroma cacao*	VIII
19	Cod liver	*Gadus morrhua*	VII
20	Corn (maize)	*Zea mais*	V
21	Cotton seed	Species *Gossypium*	V
22	Cotton seed stearin	*Gossypium*	VIII
23	Croton	*Croton tiglium*	V
24	Goose fat	*Anser cinereus*	IX
25	Grape seed	*Vites vinefera*	III
26	Hazelnut	*Corylus avellana*	I
27	Hemp seed	*Cannabus sativa*	VI
28	Horse fat	*Equus caballus*	IX
29	Human fat		IX
30	Japan wax	*Rhus succedaneum*	VIII
31	Lard oil	*Oleum adipis*	IV
32	Lard oil (fatty tissue)	*Adeps*	IX
33	Laurel (bayberry)	*Laurus nobilis*	VIII
34	Linseed	*Linum usitatissimum*	VI
35	Menhaden	*Alosa menhaden (Brevortia tyrannus)*	VII
36	Mutton tallow	*Adeps ovis*	IX
37	Myrtle wax	*Myrica cerifera (M. Carolinensis)*	VIII
38	Neat's foot	*Oleum pedis bovis*	IV
39	Nutmeg butter (mace)	*Myristica officinalis*	VIII
40	Olive	*Olea Europaea sativa*	I
41	Palm	*Elaeis guineensis*	VIII
42	Palm kernel	*Elaeis guineensis* (W. Africa)	VIII
43	Palm kernel	*Elaeis guineensis* (S. America)	VIII
44	Peach kernel	*Amygdalus Persica*	I
45	Peanut	*Arachis hypogaea*	I
46	Poppy seed	*Papaver somniferum*	VI
47	Porpoise (body oil)	*Delphinus phocaena*	VII
48	Pumpkin seed	*Cucurbita pepo*	V
49	Rabbit fat	*Lepus cuniculus*	IX
50	Rape seed	*Brassica campestris*	II
51	Safflower	*Carthamus tinctorius*	VI
52	Seal	*Species Phoca*	VII
53	Sesame	*Sesamum indicum*	V

OILS, FATS AND WAXES

No.	Specific gravity at $\frac{15°}{15°}$ C.	Solidifying point °C.	Saponification value	Iodine value	Hehner's number
1	0.914–0.921	−15 to −20	183.3–207.6	93–103.4	96.0
2	0.9311–0.938	31 to 29	196–199 6	39–55.4	......
3	0.895	31 to 38	196–200	35.4–42.3	96–96.5
4	0.922	−17	191–196	97–111	95–96
5	0.961–0 968	60 5 to 62	88–96	8.8–10.7	....
6	0 915–0.919	−17	173–175	99–110	96
7	0.914–0.916	15 to 17	190–196	50–55	94–95
8	0.907–0.912$\frac{40°}{15°}$	19 to 24.5	210–230	26–28	87.6–89.6
9	0 925	<−18	189–195	163–164	95–96
10	0 927	<−18	202–204	139–143 8	....
11	0 995–0 999	80 to 87	79–84	13.5	....
12	0.960–0 967	−12 turbid, −17 to −18 solid	175–183	84	......
13	0.943–0 954	20 to 25	196–213	97.6–110.4	......
14	ca 0 950[25°]	<25	196–213	98–104	......
15	0 809–0 811	80 to 81	80 4–91.7	1 4	......
16	0 918–0 922	24 to 34	179–206	23–40.5	95.3
17	0 926	14 to 22	253 4–262	6 2–10	82.3–90 5
18	0.964–0 974	21.5 to 27 3	192 8–195	32 8–41 7	94–95
19	0.922–0.931	−3	171–189	137–166	95.3
20	0.921–0.928	−10 to −20	187–193	111–128	93–95
21	0 917–0 918$\frac{25°}{25°}$	+12 to −13	194–196	103–111 3	95.7
22	0 9188–0 923	16 to 22	195	89–103	95.9
23	0 942–0 944	−8 to −18	193–215	108–109	89.0
24	0 923–0 930	22 to 24	191–193	58–67	94.5–95 3
25	0 917–0 933	−10 to −17	171–191	94.3–135	92
26	0 917	−17 to −18	191–197	87	95.5
27	0 928–0 934	−15 to −28	190–195	145–161 7	......
28	0 919–0 933	20 to 45	195–200	75–86	95–98
29	0 9179	15	193 3–199	64	......
30	0 970–0 980	40 5 to 46	206.6–237 5	4.9–12 8	90–91
31	0 913–0 915	+4 to −2	193–198	62 5–79	97
32	0 934–0 938	27.1 to 29 9	195–203	47–66 5	93–95
33	0 880[100°]	24 to 25	198–199	68–80	......
34	0 930–0 938	−19 to −27	188–195	175–202	94.5–95.5
35	0 923–0 933	−5	189–192 9	148–185	......
36	0 937–0 953	36 to 41	195–196	48–61	95.5
37	0 995	39 to 43	205.5–211 7	3 9–9 5	92–94
38	0 913–0 918	−2 to +10	193–199	57 5–75	94.8–95.9
39	0 945–0 996	40 to 44	154–178	59 3–65	......
40	0 915–0.920	+2 turbid; −6 solid	185–196	79–88	95
41	0 924	....	200–205	49.2–58.9	94.5–97
42	0 866–0 873[100°]	20 to 24	243–255	10.5–17.5	91–91.5
43		27 4	220.2–231 4	25.5–31.6	......
44	0 918–0 925	−20	191–193	92–99.7	94–96
45	0 917–0 926	3	186–194	88–98	95
46	0 924–0 926	−16 to −18	193–195	128–141	95.4
47	0 926	−16	203 4	126.9	68.4
48	0 923–0 925	−15	188–193	121–130	96
49	0 934–0 936	22 to 24	199–203	70–99.8	99.5
50	0 913–0 917	−10	168–179	94–105	94.5–96.3
51	0 925–0 928	−13 to −18	188–203	122–141	95
52	0.915–0.926	3	187 5–196 2	130–152	93–96
53	0.919$\frac{25°}{25°}$	−4 to −16	188–193	103–117	95

CONSTANTS OF VEGETABLE AND ANIMAL

No.	Common name	Maumené number	Acid value	Acetyl value	Refractive index at 25° C.
1	Almond	51–53	0.5–3.5	9.6	1.4593–1.4646*
2	Beef marrow	...	1.6		1.4628
3	Beef tallow	...	0.25	2.7–8.6	...
4	Beechnut	...			1.4698
5	Beeswax	...	16.8–20.6	15.2	1.4538–1.4566*
6	Black mustard	43	5.7–7.3	...	1.4718
7	Bone fat	...	...	11.3	...
8	Butter fat	...	0.45–35.4	1.9–8.6	1.4555–1.4578*
9	Candlenut	...	2	9.8	1.4760–1.4790
10	Candlenut	...	...	...	1.4760–1.4790
11	Carnauba wax	.	4–8	55.2	1.4672–1.4701*
12	Castor	46–47	0.12–0.8	146–150.5	1.4771
13	Chaulmoogra	...	0.79–21.5	...	1.4777–1.4779
14	Chaulmoogra	...	...	...	...
15	Chinese insect wax	...	63	...	...
16	Chinese vegetable tallow	...	2.4	...	1.4470–1.4579*
17	Coconut	21	2.5–10.0	2.3–6.9	1.4477–1.4495*
18	Cocoa butter (Cacao)	...	1.1–1.9	1.97	1.4537–1.4580*
19	Cod liver	102–115	5.6	1.15	1.4758–1.4783
20	Corn (maize)	81–86	1.37–2.02	7.5–11.5	1.4733
21	Cotton seed	75–90	0.6–0.9	21–25	1.4743–1.4752 (15°)
22	Cotton seed stearin	...	...	...	...
23	Croton	...	27–30.9	19.8–38.6	1.4710*
24	Goose fat	.	0.59		1.4583–1.4626*
25	Grape seed	53	0.75	13.5–14.5	1.4713–1.4725
26	Hazelnut	36	...	3.2	1.4667
27	Hemp seed	97	0.45	...	1.4740–1.4745*
28	Horse fat	...	0–2.44		1.4618–1.4696*
29	Human fat	...	...		1.459–1.4613*
30	Japan wax	.	11–12	17.25–26.5	1.4560–1.4591*
31	Lard oil	41–45	1.56	...	1.4607*
32	Lard oil (fatty tissue)	...	0.5–0.8	2.6	1.4609–1.4620
33	Laurel (bayberry)		26.3	...	1.4783
34	Linseed	103–126	1–3.5	...	1.4797–1.4802
35	Menhaden	123–128	5–8	...	1.4787
36	Mutton tallow	...	1.7–14	...	1.4545–1.4585*
37	Myrtle wax	.	3–4.4	...	1.4511*
38	Neat's foot	43–49	0.1–0.6	7.7–9.3	1.4643–1.4685
39	Nutmeg butter (mace)	.	17.2	.	1.4704*
40	Olive	41.5–47	0.3–1.0	10.5	1.4657–1.4667
41	Palm	...	10	15.7	1.4603–1.4639*
42	Palm kernel	...	5–22	7.6	1.4492–1.4543*
43	Palm kernel	...	0.33–0.55		...
44	Peach kernel	42.5	1–1.5	6.5	1.4682–1.4701
45	Peanut	45–67	0.8	3.5	1.4620–1.4653*
46	Poppy seed	86–88	2.5	...	1.4739–1.4742
47	Porpoise (body oil)	50–61	1.2	...	1.4622–1.4625
48	Pumpkin seed	.	.	...	1.4724–1.4739
49	Rabbit fat	...	6.2–7.2		1.459*
50	Rape seed	51–64	0.36–1.0	14.75	1.4649–1.4659*
51	Safflower	.	0.6	16.1	1.4769
52	Seal	.	...	...	1.4742–1.4762
53	Sesame	65.5	9.8	...	1.4704–1.4717
54	Soja bean (Soya, Soy)	87–88	0.3–1.8	4.9	1.4723–1.4756

OILS, FATS AND WAXES (Continued)

No.	Reichert Meissl number	Unsaponifiable matter	Insoluble fatty acids: Melting point °C.	Insoluble fatty acids: Solidifying point °C.	Insoluble fatty acids: Iodine value	Insoluble fatty acids: Acid value
1	0.5	0.75	13–14	9 5–11.8	93.5–96.5	204
2	2.2	...	45–46	37.9–40	55.5	204.5
3	...	...	42 5–44	37.9–46.2	41.3	197.2
4	...	...	23–24	17	114	...
5	...	...	67 2	...	...	...
6	...	3 3	16–17	13.4–13 7	87–93	179.2
7	0 2–1 7	0 5–1 5	42 5-44	28	55.7–57.4	200
8	17 0–34 5	0 3–0 45	38–41	33–39	28–31	210–220
9	1 2	0.5–0 9	20–21	13	185 7	...
10	...		...	17 8	...	...
11	...	54–55	85	...	...	...
12	1 4	0.6	13	3	86 6–88 3	192 1
13		...	...	.	...	...
14		...	...		...	...
15	...	...	92.2	...	...	...
16	0 2–0.9	...	39–57	45.2–47 2; 50.9–52 5	34.2	182–208.5
17	6 6–7 5	0.2	24–27	21 2–25 2	8.4–8.8	258
18	0.3–1	...	48–53	47.2–49.2	32.6–39	190
19	0 2	0.54–2 68	21.8–38	17.5–24 3	164–171	204–207
20	4 3	1.5–2 8	17–20	14–16	113–125	198.4
21	0.95	1 1	34.5	32–35	111–115	201.6–203.9
22	...	...	27–30	35 1	94	...
23	12–13.6	0.55	...	17–19	111–112	201
24	0.2–0.98	...	36.6–40	31–34	65.3	202 4
25	0 46	1.6	23–25	18–20	99–132	187.4
26	0.99	0.5	22–25	19–20	87.5–90.1	200 6
27	...	1.08	17–21	15.6–16 6	141	...
28	1 64–2 14	...	31.3–53.4	37 7	83.9–87.1	202.6
29	0 25–0.55	...	35 5	30 5	64	...
30	...	1.1–1.6	54 5–59.6	53–56 5	...	213.7
31	...	0.6	33–38.4	27–33	...	...
32	...	...	37–46 6	36–42 4	...	...
33	1 6	...	...	...	81.6–82	...
34	0 95	0 4–1 2	20–24	16–20.6	179–209.8	196–198.8
35	1 2	0.6–1 43	...	...	...	...
36	...	...	33.5–49	40–48 5	34.8	198
37	0.5	...	47–48	46	...	230.9
38	0 9–1.2	0.12–0.65	29–41	16–26 5	62–77	201.2–206.3
39	1 1–4 2	...	42 5	40–45	31.6	...
40	0.6–1 5	0.4–1.0	26–30	16 9–26 4	86–90	193
41	0.9–1 9	...	50	42 5–45 5	53.3	204–207
42	5–6 8	...	25–28.5	20–25 5	12	251–265
43	...	...		...		...
44	...	...	10–18 9	13–13 5	94 1–101.9	205–209.9
45	0 4	0.5–0 9	...	30 5-39	95.5–103.4	201.6
46	0 6	0 43	20 5	17–19	139	199
47	46.9	16–17	.	...	126	207
48	4.45	...	26 5 29 8	26–28	...	...
49	0 7–2 8	.	39–50	35–41	64.4–101.1	210–218
50	0–0 79	1.48	18 5–20	11.7–13 6	100–106	...
51	0–0 2	.	11–17	7–12	132.5–148.2	199
52	0.2	0 3-1 0	22–23	13–17	186.5–201.8	190.4–198
53	1.1–1 2	0.95–1.32	25–35	23–32	109–112	196–201.6
54	0.5–2 8	1.27–1.54	26.2–27.5	21.2	122	...

No.	Common name	Scientific name	Class†
1	Soja bean (Soya, Soy).	*Soja hispida (Dolichos hispida)*	V
2	Sperm	*Physeter macrocephalus*	X
3	Spermaceti	*Cetacea Oils*	XII
4	Sunflower	*Helianthus annus*	VI
5	Tung (China wood)	*Aleurites Fordii*	VI
6	Tung (China wood)	*Aleurites montana*	VI
7	Walnut	*Juglans regia*	VI
8	Whale	*Balaena mysticetus*	VII
9	White mustard seed	*Sinapis alba*	II
10	Wool fat	*Adeps lanae*	XII

† Class I, Non-drying vegetable oil of the olive oil type, Class II, non-drying vegetable oil of the rape oil type, Class III, non-drying vegetable oil of the castor oil type; Class IV, non-drying animal oil, Class V, semi-drying vegetable oil; Class VI, drying vegetable oil; Class VII, fish and marine animal oil; Class VIII, vegetable fat; Class IX, animal fat, Class X, sperm oil; Class XI, vegetable non-glyceridic wax; Class XII, animal wax.

No.	Common name	Maumene' number	Acid value	Acetyl value	Refractive index at 25° C
1	Sperm	51	13 2	4 5–6 4	1 4573
2	Spermaceti	.	0 5–2 8	2 6	
3	Sunflower	72	11 2	.	1 4659–1 4721*
4	Tung (China wood)	.	2		1 515–1.520
5	Tung (China wood)		2		1 515–1 520
6	Walnut	96–110	2 5		1 4770
7	Whale	85–92	1 9	11–23	1.4679–1 4724
8	White mustard seed	44–49	5 4		1 4649
9	Wool fat	.	59 8	23	1 4784–1 4822*

* Refractive index at 40° C

OILS, FATS AND WAXES (Continued)

No.	Specific gravity at $\frac{15^\circ}{15^\circ}$ C.	Solidifying point °C.	Saponification value	Iodine value	Hehner's number
1	0.924–0 927	−10 to −16	189–193.5	122–134	93–94.5
2	0.878–0 884	15 5	120–137	80–84	....
3	0.905–0.945	42 to 49	126–135	3.5–9.3	....
4	0 924–0 926	−17	188–193	129–136	95
5	0.939–0 949	2 to 3	190–197	163–171	96.2
6	0 925	....	189–195	163–164	95–96
7	0 925–0 927	−27.5	190 1–197	139–150	93.4–95.4
8	0.917–0 924	0 to −2	160–202	90–146	93–95
9	0 912–0 916	−8 to −16	171–174	94–98 4	96–97
10	0 970–0.973	... ...	82–130	17–29	....

No	Reichert Meissl number	Unsaponifiable matter	Insoluble fatty acids			
			Melting point °C.	Solidifying point °C.	Iodine value	Acid value
1		39–42	13 4	16 1	88–99	23.6
2		51 5		. .	.	......
3	0 5	0 31	22–24	18–19 8	124–134	201.6
4	1 10	0 4–0 8	40–43.8	31.2–37	145–159.4	188.8
5	0 35	0 4–0 8	...	. . . .		. ...
6	0.92	0.5–1 0	15–20	14 3	150	. .....
7	14	1–4	14–27	10–24	130.3–132	.
8	......	.	15–16	9–10	94.7–110.4	181–185 8
9	8	39–44	41.8	40	17	. .

PHYSICAL AND CHEMICAL CONSTANTS OF

The following abbreviations are used: Class I, Resins; Class II, Oleo-
acid; al, alcohol; bz, benzene; chl., chloroform; eth., ether; eth. acet., ethyl
oil of turpentine; p. sol., partly soluble; sol., soluble; sl. sol., slightly soluble,

Name	Class	Specific Gravity	Melting Point °C.	Saponification No.	Iodine No.	Acid No.
Amber	I	1.05–1 10	250–325	85–150	62	15–35
Ammoniacum	III	1.2	....	160–77	....	100–6
Anime (East Indian)	I	1.03	230–40	60–90	128–37	18–27
Anime (West Indian)	I	....	. .	150–60	....	45–7
Benzoin	I	1 2	75–100	155–270	....	90–190
Canada Balsam	II	....	.. ..	90–6	....	80–90
Caoutchouc	I	...	..	.	71	81
Colophony	I	1 07–.09	120–50	150–200	112–7	150–80
Copaiba (Para)	II	0 9–1 0	..	.. .	..	30–68
Copaiba (Maracaibo)	II	0 9–1 0	...	.....	..	79–91
Copaiba (Maranham)	II	0.9–1 0	.....	. ..	.	72–90
Copal (Benin)	I	1 06– 08	120–66	125–150	61	100–34
Copal (Loango)	I	.. ..	.. .	126–34	..	106–15
Copal (Sierra Leone)	I	. .	....	146–50	. .	109–14
Copal (Manilla)	I		..	178	....	128
Dammar	I	1 00– 05	95–190	20–65	..	18 60
Dragon's Blood	I	1 2	120	150–60	.	..
Elemi		1 02– 08	75–120	25–45		18–25
Galbanum	III	1 11– 13	..	75–225		5–65
Guaiacum	I	1 2	85 90	..		70 80
Jalap	I	1 14– 15	150	. . .	.	12 25
Mastic	I	1 04– 07	105–20	82–92	64	50–71
Myrrh	III	1 12– 28	..	160–200	. .	59–72
Olibanum	III	1 2	.	65–120	..	45–88
Sandarac	I	1.04	135–50	143	..	140–55
Shellac	I	1 08– 13	. .	194 213	.	48 64
Storax	I	1 12	. ...	130 230	.. .	35–175
Tolu	II	1 1	. .	154–220	.	112–68
Turpentine (Common)	II	....	..	100–75	.. .	110 50
Turpentine (Larch)	II	1 1–1 2	....	75–125	...	75–100

RESINS, OLEO-RESINS AND GUM-RESINS

Resins; Class III, Gum-Resins; a, acid; acet., acetone; acet. a., glacial acetic acetate; insol., insoluble; lgr., ligroin; meth. al., methyl alcohol; oil turp., w., water.

Ester No.	% Volatile at 100° C.	% Ash	Solubility
71–91	...	0.3	p. sol in CS_2, oil turp; sl. sol. in al., meth. al., amyl al., bz., eth; insol. in acet. a., acet., chl.
60–70	2–15	2–7	p sol w., al., eth.
47–62	....	......	
100–15	...	0 05– 1	
30–175	4–10	0 2–3.0	sl. sol. w.; p sol. al.
4–8	....	......	sol in bz., chl., eth. acet., oil turp.; p. sol. in al., eth., lgr.
....	.....	......	sol. bz.; insol. acet.
7–22	0–0.5	0.02–.05	sol. in acet, al, meth. al, amyl al., bz., acet. a., chl., eth., eth. acet, CS_2, oil turp.; p. sol. in lgr.
2–18	.....	......	sol. in bz., chl, eth., oil turp.; p. sol. al., lgr., eth acet, CS_2; insol. w
1–8	.....	...	sol chl., eth., lgr.; p. sol. in al., eth. acet., oil turp.; insol w.
2–18	....	......	sol in bz., chl., eth., oil turp.; p. sol. al., lgr., eth acet, CS_2; insol. w.
.....	0.5–2.5	0.25–2.0	p sol acet. a, bz., chl, eth., oil turp · insol. in acet, al., meth al, lgr., CS_2.
....	.....	......	98 7 % sol in eth -al. mixture.
...	....	......	92.9 % sol in eth -al. mixture.
....	....	.....	
.....	0.1–1.0	0.01–.1	sol in bz, chl, CS_2; p. sol. in al., eth., acet, amyl al, lgr
...	....	3 6	sol in al, eth., bz; p sol in chl., eth. acet, lgr.
6–26	12–20	0 02–.1	sol, in eth., chl. bz, amyl al, CS_2; sl. sol. in lgr, p. sol. in acet. a, acet., al, meth. al., eth acet, oil turp.
50–175	1–30	1–25	15–20 % sol in w.; p. sol. in al.
	...	1–5	p sol in al, bz, eth., lgr., CS_2
120–5	.....	......	sol. in al.; p. sol. in acet. a., eth., chl.; insol. in w., bz, oil turp., CS_2
29	0.1–1 5	0 1–.2	p sol. in acet. a., acet., al., meth al. chl. oil turp.: sl. sol. in CS_2; sol. in amyl al, bz., eth.; insol. w.
108–31	....	1–8	p. sol. in w, al.
7–72	...	......	p sol. in al., acet., meth. al., amyl al., chl., eth., eth acet., oil turp.; sl. sol. in acet. a., bz.
1–33	0.05–.2	0 04–.1	sol. in acet, amyl al.; p. sol. in acet. a., al., meth al, bz., chl, eth., lgr., CS_2; sl. sol. in oil turp
137–63	...	0 72–1 4	p sol in acet a, meth. al., amyl al., bz., chl., eth, lgr, eth. acet., oil turp., CS_2
70–185	5–35	0–2	sol in acet. a, al, meth. al., amyl al.; sl. sol. in acet, bz, oil turp.; insol. in eth., lgr., CS_2
25–70	.....	....	sol in al, chl., eth acet.; sl. sol. in w.; p. sol. in bz, eth, lgr, oil turp.
5–55	....	....	sol in al, bz, chl., eth., eth acet., oil turp.; p. sol in lgr, CS_2
0–50	.....	.....	sol in acet a, al., meth. al., amyl al., bz., chl., eth, eth acet, oil turp.; p. sol. in lgr., CS_2

PHYSICAL CONSTANTS OF MINERALS

The following table presents data for about 350 of the more common minerals

In order to avoid duplication and save space, very few cross references are given in the body of the table. If the name sought is not found in the table, consult the **synonym index** given below.

Specific gravities are given at normal atmospheric temperatures, a more precise statement being valueless considering the large variations in natural minerals.

Hardness is given in terms of Moh's scale. (See under Hardness.)

Indices of refraction for the sodium line, λ = 5893 Å, unless otherwise indicated. Li, λ = 6708 Å. Indices will invariably be given in the order ω, ϵ or α, β, γ. Uniaxial crystals are considered positive if $\epsilon > \omega$, negative if $\omega > \epsilon$. Biaxial crystals are considered positive if β is nearer α in value than it is γ and negative if β is nearer γ than α.

ABBREVIATIONS

amor	amorphous	hex	hexagonal	rhbdr	rhombohedral
bet	between	int	internal	rhomb	rhombic
bl	blue	inter	intermediate	silv	silver
blk	black	iridesc	iridescent	sl	slightly
blksh	blackish	lt	light	somet	sometimes
blsh	bluish	monocl	monoclinic	st	steel
br	brown	oft	often	tarn	tarnishes
brnsh	brownish	opt	optically	tetr	tetragonal
col	colorless	pa	pale	tricl	triclinic
cub	cubic	prob	probably	trig	trigonal
dk	dark	purp	purple	var	variety
emer	emerald	(R)	radioactive	vlt	violet
expos	exposure	rar	rarely	wh	white
gold	golden	redsh	reddish	yel	yellow
grn	green	refl	reflection	yelsh	yellowish
grnsh	greenish				

SYNONYM INDEX

Compound sought	Listed	Compound sought	Listed
Aegirite	Acmite	+Fe Bronzite	Enstatite
Alalite	Diopside	Brown hematite	Limonite
Allanite	Orthite	Calcium-chromium garnet	Uvarovite
Alum stone	Alunite	Calcspar	Calcite
Amphibole	Hornblende	Caporcianite	Laumontite
Amphigene	Leucite	Carbonado	Diamond
Antimonite	Stibnite	Carbuncle, Al-Fe garnet	Almandite
Aphthitalite	Arcanite	Chalybite	Siderite
Arsenic nickel	Niccolite	Chessylite	Azurite
Asparagus-stone	Apatite	Chile saltpeter	Soda niter
Beauxite	Bauxite	China clay	Kaolinite
Black hematite	Psilomelane	Chlorite	Clinochlorite
Black lead	Graphite	Chrome-spinel	Picotite
Black mica	Biotite	Cobalt bloom	Erythrite
Blue iron ore	Vivianite	Cobalt glance	Cobaltite
Blue malachite	Azurite	Copper pyrites	Chalcopyrite
Blue stone	Chalcanthite	Copper uranite	Torbernite (R)
Blue vitriol	Chalcanthite		
Bortz	Diamond		
Brimstone	Sulfur		

SYNONYM INDEX (Continued)

Compound sought	Listed	Compound sought	Listed
Copperas	Melanterite	Magnetic pyrites	Pyrrhotite
Cromfordite	Phosgenite	Malacolite	Diopside
Crysolite	Olivine	Manganblende	Alabandite
Cymophane	Chrysoberyl	Manganese-aluminum garnet	Spessartite
Dark red silver ore	Pyrargyrite	Meershaum	Sepiolite
Desmine	Stilbite	Menaccanite	Ilmenite
Dialogite	Rhodochrosite	Microcosmic salt	Stercorite
Dichroite	Cordierite	Mispickel	Arsenopyrite
Disthene	Cyanite	Molybdenum glance	Molybdenite
Dry bone	Smithsonite	Needle zeolite	Natrolite
Elaeolite	Nephelite	Nickelin	Niccolite
Emerald	Beryl	Nigrine	Rutile
Epsom salt	Epsomite	Niobite	Columbite
Erubescite	Bornite	Noumeite	Garnierite
Facellite	Kaliophilite	Octahedrite	Anatase
Fahlerz	Tetrahedrite	Peanut ore	Wolframite
Fibrolite	Sillimanite	Pearl spar	Dolomite
Flint	Chalcedony	Pencil stone agalmatolite	Pyrophyllite
Fluorapatite	Apatite	Peridot	Olivine
Fluorspar	Fluorite	Pistacite	Epidote
Fool's gold	Pyrite	Plumbago	Graphite
Fowlerite	Rhodonite	Polianite	Pyrolusite
Glance	Galena	Potassium feldspar	Orthoclase
Glaserite	Arcanite	Purple copper ore	Bornite
Glauber salt	Mirabilite	Red copper ore	Cuprite
Grammatite	Tremolite	Red zinc ore	Zincite
Gray copper ore	Tetrahedrite	Rock salt	Halite
Gray manganese ore	Manganite	Ruby	Corundum
Green carbonate of copper	Malachite	Ruby silver ore	Proustite
Green lead ore	Pyromorphite	Sapphire	Corundum
Harmotomite	Harmotome	Silver glance	Argentite
Hebronite	Amblygonite	Soapstone	Talc
Hessonite	Grossularite	Soda-microcline	Anorthoclase
Hiddenite	Spodumene	Sodium feldspar	Albite
Horn mercury	Calomel	Spathic iron	Siderite
Horn silver	Cerargyrite	Sphene	Titanite
Hyacinth	Zircon	Stassfurtite	Boracite
Hydrargillite	Gibbsite	Steatite	Talc
Hydrohematite	Turgite	Stream tin	Cassiterite
Hypersthene	Enstatite	Tabular spar	Wollastonite
Ice stone	Cryolite	Tincal	Borax
Iceland spar	Calcite	Tinstone	Cassiterite
Idocrase	Vesuvianite	Titanic iron ore	Ilmenite
Iolite	Cordierite	Troosite, var. cont. Mn	Willemite
Iron pyrites	Pyrite	Urao	Trona
Iron spinel	Hercynite	Vermilion, natural	Cinnabar
Jargon	Zircon	Websterite	Aluminite
Kunzite	Spodumene	Wernerite	Scapolite
Lapis-Lazuli	Lazurite	Wheel ore	Bournonite
Lead carbonate	Cerussite	White iron pyrites	Marcasite
Lead oxide	Litharge	White lead ore	Cerussite
Leonhardite	Laumontite	White mica	Muscovite
Lime feldspar	Anorthite	Wood tin	Cassiterite
Lime-soda feldspar	Oligoclase	Zincblende	Sphalerite
Lithiophyllite	Triphylite	Zinc-spinel	Gahnite
Lithium mica	Lepidolite	Zinc vitriol	Goslarite
Lodestone	Magnetite		
Magnesium mica	Phlogopite		

No.	Name	Synonym	Formula	Sp gr
1	Acmite	aegirite	$Na_2O.Fe_2O_3.4SiO_2$	3.5–3.56
2	Actinolite		$Ca(Mg, Fe)_3(SiO_3)_4$	2.9–3.2
3	Agate See *chalcedony*			
4	Alabandite	manganblende	MnS	3.95–4.04
5	Albite	sodium feldspar	$Na_2O.Al_2O_3.6SiO_2$	2.61–2.64
6	Almandite	carbuncle, Al-Fe garnet	$Al_2O_3.3FeO.3SiO_2$	3.688–4.33
7	Aluminite	websterite	$Al_2O_3.SO_3.9H_2O$	1.66
8	Alunite	alum stone	$K_2Al_6(OH)_{12}(SO_4)_4$	2.58–2.75
9	Alunogenite	alunogen	$Al_2(SO_4)_3.18H_2O$	1.6–1.8
10	Amblygonite	hebronite	$AlPO_4.LiF$	2.98–3.15
11	Analcite	analcime	$Na_2O.Al_2O_3.4SiO_2.2H_2O$	2.22–2.29
12	Anatase	octahedrite	TiO_2	3.82–3.95
13	Andalusite		Al_2SiO_5 or $Al_2O_3.SiO_2$	3.1–3.2
14	Andesine	feldspar group	$(CaO,Na_2O)Al_2O_3.4SiO_2$	2.647–2.69
15	Andradite.	common garnet, black garnet	$3CaO.Fe_2O_3.3SiO_2$	3.64–3.9
16	Anglesite		$PbSO_4$	6.12–6.39
17	Anhydrite		$CaSO_4$	2.899–2.985
18	Anorthite	lime feldspar	$CaO.Al_2O_3.2SiO_2$	2.703–2.763
19	Anorthoclase	feldspar group, soda-microcline	$(Na,K)_2O.Al_2O_3.6SiO_2$	2.56–2.651
20	Anthophyllite		$(Mg,Fe)SiO_3$	2.857–3.2
21	Antigorite		$3MgO.2SiO_2.2H_2O$	2.55–2.62
22	Apatite	fluorapatite, asparagus-stone	$CaF_2.3Ca_3P_2O_8$	3.151–3.270
23	Apophyllite		$K_2O.8CaO.16SiO_2.16H_2O$	2.3–2.4
24	Aragonite		$CaCO_3$	2.85–2.94
25	Arcanite	aphthitalite, glaserite	$(K,Na)_2SO_4$	2.662
26	Argentite	silver glance	Ag_2S	7.24–7.40
27	Arsenic	native arsenic	As	5.64–5.78
28	Arsenopyrite	mispickel	$FeS_2.FeAs_2$	5.89–6.20
29	Atacamite		$3CuO.CuCl_2.3H_2O$	3.77–3.94
30	Augelite		$2Al_2O_3.P_2O_5.3H_2O$	2.77
31	Augite		$CaMg(SiO_3)_2 + (Mg,Fe)(AlFe)_2SiO_6$	3.2–3.6
32	Autunite	lime uranite	$CaO.2UO_3.P_2O_5.8H_2O.$	3.05–3.19
33	Axinite		$HCa_3Al_2BSi_4O_{16}$	3.22–3.314
34	Azurite	blue malachite, chessylite	$2CuCO_3.Cu(OH)_2$	3.77–3.83
35	Baddeleyite		ZrO_2	5.50–6.03
36	Barite	barytes	$BaSO_4$	4.3–4.6
37	Barysilite		$Pb_3Si_2O_7$	6.53–6.707
38	Bauxite	beauxite	$Al_2O_3.2H_2O$	2.55
39	Beccarite		$ZrO_2.SiO_2$	6.54–6.74
40	Benitoite		$BaTiSi_3O_9$	3.64–3.65
41	Bertrandite		$4BeO.2SiO_2.H_2O.$	2.571–2.60
42	Beryl.		$3BeO.Al_2O_3.6SiO_2$	2.63–2.91
43	Beryllonite.		$NaBePO_4$	2.845
44	Biotite	black mica	$(K,H)_2(Mg,Fe)_2(Al,Fe)_2(SiO_4)_3$	2.69–3.16

OF MINERALS

No.	Hardness	Crystalline form and color	Index of refract. (Na); n, ω, ϵ, α, β, γ	Angle of the optic axes, 2V °	′
1	6.0–6.5	monocl., blk , brnsh. or redsh.	1.763, 1.799, 1 813	62	13
2	5–6	monocl., grn., gray-grn or br.	1.611, 1.627, 1.636	75	
3					
4	3.5–4.0	cub., iron-blk.	(Li) 2.70		
5	6.0–6 5	tricl., gray, or rarely colored	1.525, 1.529, 1.536	70	
6	7 0–7.5	cub , deep red to brnsh.-red or blk.	1 801		
7	1–2	monocl	1 459, 1.464, 1.470		
8	3.5–4.0	hex (trig.), col., wh., yelsh., gray or redsh.	1.572, 1.592		
9	1.5–2.0	monocl. wh., yelsh. or redsh.	1.474, 1.476, 1.483		
10	6	tricl., wh. to grnsh., blsh., yelsh , grayish or brnsh wh.	1.579, 1.593, 1.597	50	
11	5.0–5.5	cub., col. or wh., yelsh, redsh or grnsh.	1.4874		
12	5.5–6 0	tetr , br , bl., blk.	2 554, 2.493		
13	7 0–7.5	rhomb., gray, redsh., grnsh., blsh.	1.632, 1.638, 1.643	84	30
14	5–6	tricl , wh., gray, grnsh., yelsh., flesh red	1.549, 1.553, 1.556	88	
15	6.5–7.0	cub , brnsh. red. br., blk., also yel. or grn.	1.857		
16	2.75–3.0	rhomb. or monocl., wh., gray, yel , bl., grn., (col.)	1.8771, 1.8823, 1.8937	75	24
17	3.0–3.5	rhomb. or monocl., col., wh , gray, bl., br. or redsh.	1.5693, 1.5752, 1.6130	43	41
18	6.0–6.5	tricl , col., wh. or grayish. (yelsh. blsh. or redsh.)	1.5755, 1.5832, 1.5885	77	
19	6 0–6.5	tricl.	1.523, 1.529, 1.531		
20	5.5–6.0	rhomb., br., yelsh. or grnsh., to emer. grn.	1.633, 1.642, 1.657	83	54
21	3–4	rhomb., brnsh. grn.	1.490, 1.502, 1.511		
22	4–5	hex , br., grn., gray, yel., red or wh.	1.634, 1 632		
23	4.5–5.0	tetr., col. or wh., grn., yel. or redsh.	1.537, 1.535		
24	3.5–4 0	rhomb., col., wh., yel , redsh., blsh. or blk.	1.5299, 1.6809, 1.6854	18	
25		rhbdr , wh.	1.4935, 1.4947, 1 4973		
26	2.0–2.5	cub , dk. lead gray			
27	3–4	hex , tin-wh., tarn. dk gray to blk.			
28	5.5–6.0	rhomb , silver-wh to grayish-wh.			
29	3 0–3.5	rhomb., bright or blksh. grn.	1.831, 1.861, 1.880		
30	4 5–5 0	monocl , col. to wh.	1 574, 1.576, 1.588	50	49
31	5–6	monocl., dk. grn. to blk.	1.712, 1.717, 1.733	60	
32	2 0–2.5	rhomb , yel.	1.553, 1.575, 1.577		
33	6 5–7.0	tricl , br., bl., gray, yel.	1.678, 1.685, 1.688	72	
34	3.5–4.0	monocl., bl.	1.730, 1.758, 1.838		
35	6 5	monocl., col.-yel., br., blk.	2.13, 2.19, 2.20		
36	2.5–3.5	rhomb., col., wh., yel., bl , br or red	1.6369, 1 6381, 1.6491	37	28
37	3	trig., wh.	2.070, 2.050		
38	1–3	amor., wh. br., yel. or redsh.	1.570		
39		....	1.9272, 1.9277, 1.9820	..	
40	6.0–6.5	hex., trig., bl , col.	1.757, 1.804		
41	6–7	rhomb., col , pa yel	1 591, 1.605, 1.614	74	51
42	7.5 8 0	hex , grn., bl., yel . redsh.	1.581, 1.575		
43	5.5–6.0	rhomb., col to wh , pa. yel.	1.5520, 1 5579, 1 5608	67	56
44	2.5–3 0	monocl., blk or dk. br or grn.	1.541, 1.574, 1.574		

No.	Name	Synonym	Formula	Sp. gr
1	Bismuth	native bismuth	Bi	9.70–9.83
2	Bloedite	blodite	$MgSO_4.Na_2SO_4.4H_2O$	2.22–2.28
3	Boracite	stassfurtite	$Mg_7Cl_2B_{16}O_{30}$	2.9–3.0
4	Borax	tincal	$Na_2B_4O_7.10H_2O$	1.69–1.72
5	Bornite	purple copper ore, erubescite	$FeS.2Cu_2S.CuS$	4.9–5.4
6	Bournonite	wheel ore	$PbCuSbS_3$	5.7–5.9
7	Brochantite		$CuSO_4.3Cu(OH)_2$	3.8–3.9
8	Bromyrite		$AgBr$	5.8–6.0
9	Brookite		TiO_2	3.87–4.084
10	Brucite		$MgO.H_2O$	2.38–2.4
11	Bunsenite		NiO	6.398
12	Cacoxenite		$FePO_4.Fe(OH)_3.4\frac{1}{2}H_2O$	3.38
13	Calamine See *hemimorphite, smithsonite*			
14	Calcite	calcspar, iceland spar	$CaCO_3$	2.711
15	Caledonite		$2(Pb,Cu)O.SO_3.H_2O$	6.4
16	Calomel	horn mercury	$HgCl$	6.482
17	Cancrinite		$4Na_2O.CaO.4Al_2O_3.2CO_2.9SiO_2.3H_2O$	2.42–2.50
18	Carnallite		$KCl.MgCl_2.6H_2O$	1.60
19	Carnotite		$K_2O.2UO_3.V_2O_5.3H_2O$	
20	Cassiterite	incl. tinstone, stream tin, wood tin	$SnSnO_4$	6.8–7.1
21	Celestite	celestine	$SrSO_4$	3.84–3.97
22	Cerargyrite	horn silver	$AgCl$	5.552
23	Cerussite	white lead ore	$PbCO_3$	6.46–6.57
24	Chabazite		$CaAl_2Si_6O_{16}.8H_2O$ (+Na,K)	2.08–2.16
25	Chalcanthite	blue vitriol, blue stone.	$CuSO_4.5H_2O$	2.12–2.30
26	Chalcedony	flint, agate	SiO_2	2.55–2.63
27	Chalcopyrite	copper pyrites	$CuFeS_2$	4.1–4.3
28	Chiolite		$5NaF.3AlF_3$	2.84–3.005
29	Chondrodite		$[Mg(F,OH)]_2Mg_3[SiO_4]_2$	3.10–3.22
30	Chromite		$FeO.Cr_2O_3$	4.32–4.57
31	Chrysoberyl	cymophane	$BeO.Al_2O_3$	3.50–3.84
32	Chrysocolla		$CuSiO_3.2H_2O$	2.40–2.42
33	Cinnabar	natural vermilion	HgS	8.0–8.2
34	Claudetite		As_2O_3	3.85–4.151
35	Cleveite (R)	A cryst. var. of uraninite		7.49
36	Clinochlorite	clinochlore	$H_8Mg_5Al_2Si_3O_{18}$	2.65–2.78
37	Cobaltite	cobalt glance	$CoAsS$	6.0–6.3
38	Colemanite		$Ca_2B_6O_{11}.5H_2O$	2.417–2.428
39	Columbite	niobite	$(Fe,Mn)(Cb,Ta)_2O_6$	5.26–7.30
40	Connellite		$CuSO_4.2CuCl_2.19Cu(OH)_2.H_2O$	3.4
41	Copiapite		$2Fe_2O_3.5SO_3.18H_2O$	2.1–2.2
42	Copper	native copper	Cu	8.8–8.9
43	Coquimbite		$Fe_2(SO_4)_3.9H_2O$	2.07–2.105
44	Cordierite	iolite, dichroite	$4(Mg,Fe)O.4Al_2O_3.10SiO_2.H_2O$	2.57–2.66
45	Corundum	ruby, sapphire	Al_2O_3	3.95–4.10

MINERALS (Continued)

No.	Hard-ness	Crystalline form and color	Index of refract. (Na); n; ω, ϵ; α, β, γ	Angle of the optic axes, 2V °	′
1	2.0–2.5	hex., redsh. wh.	....	.	
2	2.5	monocl., col. to grnsh., yelsh or red	1.486, 1.488, 1.489		
3	7	rhomb., wh., gray, yel or grn.	1.662, 1.667, 1.673	83	33
4	2.0–2.5	monocl., wh., grayish, blsh or grnsh.	1.4468, 1.4686, 1.4715	39	
5	3	cub., dk. redsh. br., tarn. blue, purp or iridesc.	......		
6	2.5–3.0	rhomb., st gray to iron blk.	......		
7	3.5–4.0	rhomb., emer. to blksh. grn.	1.730, 1.778, 1.803	77	
8	2–3	cub., yel to grn. or gray	2.253		
9	5.5–6.0	rhomb., br., yelsh, redsh. to iron blk.	2.583, 2.586, 2.741		
10	2.5	trig., wh., gray, blue or grn.	1.559, 1.580		
11	5.5	cub., grn.	(Li) 2.18		
12	3–4	hex., yel or brnsh.	1.582, 1.645		
13					
14	3	hex., col., wh or yelsh.; rar. pa. gray, red, grn., bl., vlt.	1.6583, 1.4864		
15	2.5–3.0	rhomb., deep grn.	1.818, 1.866, 1.909		
16	1–2	tetr., wh., yelsh, gray or br.	1.97325, 2.6559		
17	5–6	hex., wh., gray, yel., grn., bl., redsh.	1.524, 1.496		
18	1	rhomb., wh. or redsh.	1.466, 1.475, 1.494	70	
19	1–2	hex., rhomb., yel.	1.750, 1.925, 1.95		
20	6–7	tetr., br or blk., somet. red, gray, wh. or yel	1.997, 2.093		
21	3.0–3.5	rhomb., col., wh or yel., oft. blsh., redsh or grnsh	1.6220, 1.6237, 1.6309	51	12
22	1–1.5	cub. wh., gray, yelsh., grnsh., turns vlt., br or blk in light	2.0710		
23	3.0–3.5	rhomb., col., wh or gray	1.8037, 2.0763, 2.0780	8	34
24	4–5	hex (rhbdr.), col., wh., redsh., yelsh or br	1.480, 1.482	65 ±	
25	2.5	tricl., bl or grnsh bl.	1.5140, 1.5368, 1.5433	56	2
26	6	wh., grayish bl., br.-blk.	1.537 (1.533–1.539), 1.530		
27	3.5–4.0	tetr., brass to gold. yel. tarn. to bl., purp tints	....		
28	3.5–4	tetr., wh	1.349, 1.342		
29	6.0–6.5	monocl., wh., yel., red.-br.	1.607, 1.619, 1.639	80	
30	5.5	cub., blk.-brnsh blk.	...	2.16	
31	8.5	rhomb., grn.-yel	1.747, 1.748, 1.757		
32	2–4	amor., tetr. or hex., grn.-bl.-blk.	1.46–1.57		
33	2.0–2.5	hex., scarlet, redsh.-br., blk.	2.854, 3.201		
34	2.5	monocl.	1.871, 1.92, 2.01		
35	5.5	cub	.....		
36	2.0–2.5	monocl., grn to yelsh or wh	1.585, 1.586, 1.596		
37	5–6	cub., silv. wh., redsh or grayish			
38	4.0–4.5	monocl., col. to wh or yelsh.	1.5863, 1.5920, 1.6139	55	20
39	6	rhomb., br. to blk.	2.26, 2.29, 2.34	.	
40	.	hex., blue	1.724, 1.746		
41	2.5	monocl., yel.	1.530, 1.543, 1.595		
42	2.5–3.0	cub., red	. .		
43	2.0–2.5	hex. (trig.), wh., yelsh., brnsh.	1.5519, 1.5575		
44	7.0–7.5	rhomb., lt.-dk. blue	1.534, 1.538, 1.540	70	23
45	9	hex (trig. rhbdr.) col., red, yel., bl., br. or gray	1.768, 1.760		

No.	Name	Synonym	Formula	Sp. gr.
1	Cotunnite		$PbCl_2$	5.84
2	Cristobalite		SiO_2	2.27–2.34
3	Crocoite	crocoisite	$PbCrO_4$	5.9–6.1
4	Cryolite	ice stone	Na_3AlF_6 or $3NaF.AlF_3$	2.95–3.00
5	Cryolithionite		$3NaF.3LiF.2AlF_3$	2.777–2.778
6	Cuprite	red copper ore	Cu_2O	5.85–6.15
7	Cyanite	disthene	Al_2SiO_5 or $Al_2O_3.SiO_2$	3.559–3.675
8	Danburite		$CaO.B_2O_3.2SiO_2$	2.93–3.02
9	Datolite		$Ca(B.OH)SiO_4$	2.89–3.00
10	Derbylite		$6FeO.Sb_2O_3.5TiO_2$	4.512–4.530
11	Diamond	bortz, carbonado	C	3.150–3.525
12	Diaspore		$Al_2O_3.H_2O$	3.3–3.5
13	Diopside	malacolite, alalite	$CaMg(SiO_3)_2$	3.20–3.38
14	Dioptasite	dioptase	$H_2O.CuO.SiO_2$	3.05–3.35
15	Dolomite	pearl spar	$CaCO_3.MgCO_3$	2.80–2.99
16	Douglasite		$2KCl.FeCl_2.2H_2O$	2.16
17	Dysanalite		CaO,FeO,TiO_2, etc	4.02–4.26
18	Eglestonite		Hg_4Cl_2O	8.327
19	Embolite		$Ag(Br,Cl)$	5.31–5.81
20	Emery	mix of corundum, magnetite, hematite, quartz and spinel		3.75–4.31
21	Enargite		$3Cu_2S.As_2S_5$	4.43–4.55
22	Erythrite	cobalt bloom	$Co_3(AsO_4)_2.8H_2O$	2.912–2.948
23	Euclasite		$Be(AlOH)SiO_4$	3.051–3.103
24	Eudialite		$6Na_2O.6(Ca,Fe)O.20(Si,Zr)O_2.NaCl$	2.8–3.1
25	Eulytite		$3SiO_2.2Bi_2O_3$	6.106
26	Enstatite	+Fe, bronzite, hypersthene	$MgO.SiO_2$	3.10–3.43
27	Epidote	pistacite	$4CaO.3(Al,Fe)_2O_3.6SiO_2.H_2O$	3.07–3.50
28	Epsomite	epsom salt	$MgSO_4.7H_2O$	1.68
29	Fayalite		Fe_2SiO_4	3.91–4.34
30	Feldspars See *orthoclase, microline, albite, labradorite, andesine, anorthoclase or anorthite*			
31	Ferberite		$FeWO_4$	6.801–7.109
32	Fluorite	fluorspar	CaF_2	2.97–3.25
33	Forsterite		Mg_2SiO_4	3.191–3.33
34	Franklinite		$(Fe,Mn,Zn)(FeO_2)_2$	5.07–5.22
35	Gahnite	zinc-spinel	$ZnAl_2O_4$	4.478–4.602
36	Galena	galenite, glance	PbS	7.3–7.6
37	Ganomalite		$4CaO.6PbO.6SiO_2.H_2O$	5.57–5.7
38	Garnet See *almandite, andradite, grossularite, spessartite, uvarovite*			
39	Garnierite	noumeite	$H_2(Ni,Mg)SiO_4$ (variable)	2.27–2.87
40	Gay-Lussite		$CaCO_3.Na_2CO_3.5H_2O$	1.93–1.95
41	Gehlenite		$CaO.MgO.Al_2O_3.SiO_2$	2.9–3.07
42	Geikielite		$(Mg,Fe)O.TiO_2$	3.98–4.0
43	Gibbsite	hydrargillite	$Al_2O_3.3H_2O$	2.3–2.42
44	Glauberite		$Na_2SO_4.CaSO_4$	2.7–2.85
45	Glaucophane.	glaucophanite	$NaAl(SiO_3)_2.(Fe,Mg)SiO_3$	2.991–3.15
46	Gold	native gold	Au	14.56–19.33

MINERALS (Continued)

No.	Hardness	Crystalline form and color	Index of refract. (Na); n; ω, ϵ; α, β, γ	Angle of the optic axes, 2V °	′
1	soft	rhomb., wh., yelsh.	2.1992, 2.2172, 2.2596	.	.
2	6–7	pseudo-isometric?	1.486	.	.
3	2.5–3.0	monocl., red.	(Li): 2.31, 2.37, 2.66	. . .	.
4	2.5	monocl., col. to wh.; rar. redsh., brnsh. or blk.	β 1.364	.	.
5	2.5–3.0	. . . .	1.339	. . .	. .
6	3.5–4.0	cub., red.; rar. br.-blk.	2.705	. . .	.
7	4–7	tricl., bl., gray, wh., grn. or blk.	1.712, 1.720, 1.728	82	
8	7	rhomb., yel.-col.	1.632, 1.634, 1.636	88	
9	5.0–5.5	monocl., col., wh., yelsh., redsh., grnsh.	1.625, 1.653, 1.669	74	
10	5	rhomb., blk.	(Li): 2.45, 2.51	.	. . . . .
11	10	cub., col. or sl. yelsh., also yel., red, grn., blue or blk.	2.4173	. .	. . . .
12	6.5–7.0	rhomb., gray, wh., pink, yel., br.	1.702, 1.722, 1.750	84	
13	5–6	monocl., lt. to dk. grn., col., gray, yel., rar. bl.	1.664, 1.671, 1.694	59	
14	5	trig., emer. grn.	1.644, 1.697	. . .	. . . .
15	3.5–4.5	hex. (trig. rhbdr.), wh., yel., redsh., br., blk., rar. col.	1.6817, 1.5026	.	. . . . .
16			1.488, 1.500	. . . .	. . . .
17	5–6	cub., iron blk.	2.330	. . . .	. . . .
18	2–3	cub., brnsh., yel., blk. on expos.	(Li) 2.49	. . .	. . . .
19	1–1.5	grayish grn. to yelsh-grn., yel.	2.15	. .	. . . .
20	7–9	dk. gray to blk.	. . . .	. . . .	. . . .
21	3	rhomb., gray to blk.	. .		. . .
22	1.5–2.5	monocl., red., pink or pearl gray	1.6263, 1.6614, 1.6986		. .
23	7.5	monocl., col., pa. grn., blue	1.652, 1.655, 1.671		. . . .
24	5–6	hex., red to br.	1.606, 1.611		
25	4.5	cub., br. to yel. or col.	2.05	.	.
26	5–6	rhomb., grayish or yelsh., wh., grnsh. or brnsh.	1.650, 1.653, 1.658	31	
27	6–7	monocl., yelsh to blksh. grn., rar. red or col.	1.729, 1.754, 1.768		.
28	2.0–2.5	rhomb., col. or wh.	1.4326, 1.4554, 1.4609	51	25
29	6.5	rhomb., yel.-blk.	1.835, 1.877, 1.886		. . .
30					
31	4.0–4.5	monocl., br. to blk.	(Li) β 2.40		. . .
32	4	cub., col., oft. yel., bl., grn., vlt.; rar. red	1.4339		. . .
33	6–7	rhomb., wh., grnsh, yelsh.	1.635, 1.651, 1.670		.
34	5.5–6.5	cub., iron blk.	(Li) 2.360		. .
35	7.5–8.0	cub., grn., br., blk.	1.780		.
36	2.5	cub., lead gray to blk.	3.912		. . .
37	3	tetr., col., gray.	1.910, 1.91, 1.945		.
38					
39	2–3	amor., bright grn., pa. grn. to wh.	1.59	.	
40	2–3	monocl., wh. to yelsh.	1.4435, 1.5156, 1.5233	33	46
41	5.5–6.0	tetr., grayish grn. to br.	1.666, 1.661		. .
42	6	hex. (trig.), bluish or brnsh. blk.	2.31, 1.95		.
43	2.5–3.5	monocl., wh., grnsh., redsh. to yel.	1.566, 1.566, 1.587		.
44	2.5–3.0	monocl., pa. yel., gray, or red	1.515, 1.532, 1.536	7	
45	6.0–6.5	monocl., blue	1.621, 1.638, 1.638	43	58
46	2.5–3.0	cub., yel.	. . .	.	. . . .

No.	Name	Synonym	Formula	Sp. gr.
1	Goslarite	zinc vitriol	$ZnSO_4.7H_2O$	1.9–2.1
2	Göthite		$Fe_2O_3.H_2O$	4.0–4.4
3	Graphite	plumbago, black lead	C (traces of Fe, SiO_2, etc.)	2.09–2.25
4	Grossularite	hessonite	$3CaO.Al_2O_3.3SiO_2$	3.4–3.6
5	Gummite (R)		$(Pb,Ca,Ba)SiU_3O_{12}.5H_2O(?)$	3.9–5.16
6	Gypsum		$CaSO_4.2H_2O$	2.314–2.328
7	Halite	rock salt	NaCl	2.135–2.170
8	Hambergite		Be_2HBO_4	2.347–2.36
9	Hanksite		$9Na_2SO_4\ 2Na_2CO_3.KCl$	2.562
10	Harmotome	harmotomite	$(K_2,Ba)O.Al_2O_3\ 5SiO_2.5H_2O$	2.345–2.50
11	Hausmannite		Mn_3O_4	4 722–4.856
12	Hauynite		$5(Na_2,Ca)O\ 3Al_2O_3.6SiO_2\ 2SO_3$	2.4–2.5
13	Helvite		$3(Be,Mn,Fe)_2SiO_4.(Mn,Fe)S$	3.16–3.37
14	Hematite		Fe_2O_3	4 9–5.3
15	Hemimorphite	calamine	$2ZnO\ SiO_2.H_2O$	3.45
16	Hercynite	iron spinel	$FeAl_2O_4$	3 91–3.95
17	Herderite		$CaPO_4\ BeFOH$	2.952–3 012
18	Heulandite		$CaO\ Al_2O_3\ 6SiO_2.5H_2O$	2 16–2.249
19	Hopeite		$3ZnO\ P_2O_5\ 4H_2O$	3.03
20	Hornblende	amphibole	$Ca(Mg,Fe)_3(SiO_3)_4,Al_2(Mg,Fe)_2(AlO_3)_2(SiO_3)_2,Fe(Mg,Fe)_2(FeO_3)_2(SiO_3)_2$	3.0–3.5
21	Hübnerite		$MnO.WO_3$	7 2–7.5
22	Hutchinsonite		$(Tl,Ag,Cu)_2S\ As_2S_3 + PbS.As_2S_3(?)$	4.6
23	Hydronephelite		$HNa_2Al_3Si_3O_{12}\ 3H_2O$	2 263–2 48
24	Hydrotalcite		$MgCO_3\ 5Mg(OH)_2.2Al(OH)_3\ 4H_2O$	2.04–2.091
25	Ilmenite	menaccanite, titanic iron ore	$FeO.TiO_2$	4 44–4.90
26	Iodyrite	iodargyrite	AgI	5 60–5 707
27	Jarosite		$K_2Fe_6(OH)_{12}.(SO_4)_4$.	3 15 3 26
28	Kainite		$MgSO_4\ KCl.3H_2O$	2 067–2.188
29	Kaliophilite	phacellite	$KAlSiO_4$	2 49–2 67
30	Kaolinite	china clay, kaolin	$Al_2O_3.2SiO_2.2H_2O$	2.60–2.63
31	Kieserite		$MgSO_4.H_2O$	2 57
32	Labradorite	Labrador feldspar, inter bet albite and anorthite	$NaAlSi_3O_8$, $CaAl_2Si_2O_8$, ratio 1:1 to 1:3	2 70 2.72
33	Lanarkite		$Pb_2O\ (SO_4)$	6 3–6.8
34	Lanthanite		$La_2(CO_3)_3.9H_2O$	2 6–2.74
35	Laubanite		$Ca_2Al_2Si_5O_{15}\ 6H_2O$	2 23
36	Laumontite	leonhardite, caporcianite	$CaO.Al_2O_3.4SiO_2.4H_2O$	2.23–2 42
37	Laurionite		$PbCl_2.Pb(OH)_2$	6.24
38	Lazulite		$(Fe,Mg)O.Al_2O_3.P_2O_5.H_2O$	3.057–3.122
39	Lazurite	lapis-lazuli	$3Na_2O_3\ 3Al_2O_3.6SiO_2.2Na_2S$	2.38–2.45
40	Leadhillite		$Pb(OH)_2\ PbSO_4.2PbCO_3$	6.26–6.44

MINERALS (Continued)

No.	Hardness	Crystalline form and color	Index of refract. (Na); n; ω, ϵ; α, β, γ	Angle of the optic axes, 2V ° ′
1	2.0-2.5	rhomb., wh. or yelsh.	1.457, 1.480, 1.484	
2	5.0-5.5	rhomb., yel., red or br.	2.26, 2.39, 2.40	
3	1-2	hex., blk., dk. gray.	....	
4	6.5-7.0	cub., yel., grn., br., red or wh.	1.735	
5	2.5-3.0	gumlike masses, redsh. yel. to brnsh.	1.61	
6	1.5-2.0	monocl., wh.; oft. yel., red, br., blk.	1.5205, 1.5226, 1.5296	58 5
7	2.5	cub., col.-yelsh., oft. redsh.-bl., gray or blk.	1.5442	
8	7.5	rhomb., grayish wh.	1.5595, 1.5908, 1.6311	
9	3.0-3.5	hex., wh. to yel.	1.481, 1.461	
10	4.5	monocl., wh., gray, yel., red or br.	1.503, 1.505, 1.508	43
11	5.0-5.5	tetr., brnsh.-blk. to blk.	(Li): 2.46, 2.15	
12	5.5-6.0	cub., bl., grn., red, yel.	1.496	
13	6.0-6.5	cub., yel., yelsh.-br., grn. or redsh.-br.	1.739	
14	5.5-6.5	hex. (trig.), st. gray-blk.	(Li): 3.01, 2.94	
15	4.5-5.0	rhomb. wh., yel., br., blsh. or grnsh	1.614, 1.617, 1.636	46 10
16	7.5-8.0	cub., blk.	1.800	
17	5	monocl., yel., grnsh. wh.	1.592, 1.612, 1.621	68 2
18	3.5-4.0	monocl., wh., red, gray, brown	1.498, 1.499, 1.505	
19	2.5-3.0	rhomb., grayish wh.	1.572, 1.590, 1.590	54 44
20	5-6	monocl., dk. grn. to blk.	1.629, 1.642, 1.653	84
21	4.5-5.5	monocl., brnsh. red, yel. to blk.	2.170, 2.220, 2.320	
22	1.5-2.0	rhomb., scarlet to red	3.078, 3.176, 3.188	
23	4.5-6.0	hex., wh., dk. gray	1.490, 1.502	
24	2	hex., wh.	1.512, 1.498	
25	5-6	hex. (trig.), iron-brnsh. blk.	....	
26	1	hex., pa. yel. or grn.	2.21, 2.22	
27	2.5-3.5	rhomb., ocher-yel., br.	1.820, 1.715	
28	2.5-3.0	monocl., wh.-gray or redsh.	1.494, 1.505, 1.516	
29	6	hex. or fine threads, col.	1.537, 1.533	
30	2.0-2.5	monocl., wh., yelsh., redsh., blsh., grnsh., brnsh.	1.561, 1.565, 1.567	
31	3.0-3.5	monocl., col.-wh. or yelsh.	1.523, 1.535, 1.586	57
32	5.0-6.0	tricl., gray, br. or grnsh.	1.559, 1.563, 1.568	
33	2.0-2.5	monocl., grnsh., wh., pa. yel. or gray	1.93, 1.99, 2.02	...
34	2.5-3.0	rhomb., grayish wh., pink, yelsh.	1.520, 1.587, 1.613	
35	4.5-5.0	wh.	1.475, 1.486	
36	3-4	monocl., wh., yel., gray or red	1.513, 1.524, 1.525	
37	3.0-3.5	rhomb., col.	2.0767, 2.1161, 2.1580	
38	5-6	monocl., azure-blue	1.603, 1.632, 1.639	69
39	5.0-5.5	cub., dk.-lt. bl., vlt. or grnsh. bl.	1.500	
40	2.5	monocl.	1.87, 2.00, 2.01	

No.	Name	Synonym	Formula	Sp gr
1	Lepidocrocite		$Fe_2O_3.H_2O$	4.09
2	Lepidolite	lithium mica	$KLi[Al(OH,F)_2]Al(SiO_3)_3$	2.799-2.9
3	Leucite	amphigene	$K_2O.Al_2O_3.4SiO_2$	2.45-2.51
4	Lewisite		$5CaO.2TiO_2.3Sb_2O_5$.	4.950
5	Limonite	brown hematite	$2Fe_2O_3.3H_2O$	3.6-4.0
6	Litharge	lead oxide, lithargite.	PbO	9.13
7	Magnesite		$MgCO_3$	2.95-3.2
8	Magnetite	lodestone	Fe_3O_4	4.967-5.180
9	Malachite	green carbonate of copper	$CuCO_3.Cu(OH)_2$	3.90-4.03
10	Manganite	gray manganese ore	$Mn_2O_3.H_2O$	4.2-4.4
11	Manganosite		MnO	5.18
12	Marcasite	white iron pyrites	FeS_2	4.61-4.90
13	Marialite		$3NaO_2.3Al_2O_3.18SiO_2.2NaCl$	2.50-2.692
14	Marshite		CuI	5.59-5.62
15	Mascagnite		$(NH_4)_2SO_4$	1.76-1.77
16	Matlockite		$PbO.PbCl_2$	7.21
17	Meionite		$4CaO.3Al_2O_3.6SiO_2$	2.70-2.815
18	Melanterite	copperas	$FeSO_4.7H_2O$	1.89-1.90
19	Melilite		$Na_2(Ca,Mg)_{11}(Al,Fe)_4(SiO_4)_9$	2.9-3.4
20	Mellite		$Al_2O_3.C_{12}O_9.18H_2O$	1.55-1.65
21	Mendipite		$2PbO.PbCl_2$	7-7.1
22	Microcline		$K_2O.Al_2O_3.6SiO_2$	2.54-2.57
23	Microlite		$6CaO.3Ta_2O_5.CbOF_3$	5.405-5.562
24	Miersite		$4AgI.CuI$	5.64
25	Milarite		$K_2O.4CaO.2Al_2O_3.24SiO_2.H_2O$	2.5-2.59
26	Mimetite		$9PbO.3As_2O_5.PbCl_2$.	6.98-7.25
27	Mirabilite	glauber salt	$Na_2SO_4.10H_2O$	1.40-1.481
28	Moissanite	carborundum, artificial	SiC	3.2
29	Molybdenite	molybdenum glance	MoS_2	4.7-4.8
30	Monazite		$(Ce,Nd,Pr,La)PO_4(+Th_3[PO_4]_4)$	5.2(4.9-5.3)
31	Monetite		$HCaPO_4$	2.75-2.863
32	Monticellite		$CaMgSiO_4$.	3.03-3.25
33	Montroydite		HgO	11.14
34	Muscovite	white mica	$K_2O.3Al_2O_3.6SiO_2.2H_2O$	2.76-3.00
35	Nantokite.		$CuCl$	3.930
36	Natrolite	needle zeolite	$Na_2O.Al_2O_3.3SiO_2.2H_2O$	2.18-2.25
37	Nephelite	nepheline, elaeolite	$(Na,K)_8Al_8Si_9O_{34}$ or $NaAlSiO_4$	2.55-2.65
38	Newberyite		$HMgPO_4.3H_2O$	2.10
39	Niccolite	arsenic nickel, nickelin	$NiAs$	7.33-7.67
40	Noselite	nosean	$5Na_2O.3Al_2O_3.6SiO_2.2SO_3$	2.25-2.4
41	Oligoclase	lime-soda feldspar	$NaAlSi_3O_8 + CaAl_2Si_2O_8$	2.62-2.672
42	Olivenite		$4CuO.As_2O_5.H_2O$	4.1-4.4
43	Olivine	chrysolite, peridot	$(Mg,Fe)_2SiO_4$	3.26-3.40
44	Opal		$SiO_2.xH_2O$	2.1-2.3

MINERALS (Continued)

No	Hardness	Crystalline form and color	Index of refract. (Na); n; ω, ϵ; α, β, γ	Angle of the optic axes, 2V ° ′
1		rhomb.	1.94, 2.20, 2.51	......
2	2.5-4.0	monocl., pink, oft. wh.-gray or vlt.	1.560, 1.598, 1.605	.....
3	5.5-6.0	cub., wh., gray	1.508, 1.509	......
4	5.5	cub., yel.	2.20	......
5	5.0-5.5	prob. amor., br.-yelsh.	......	......
6	2	tetr., yel.	2.510, 2.610, 2.710	......
7	3.5-4.5	hex. (trig. rhbdr.), col., wh.-yelsh., br.-blk.	1.700, 1.509	......
8	5.5-6.5	cub., iron blk.	......	......
9	3.5-4.0	monocl., lt-dk. grn.	1.655, 1.875, 1.909	......
10	4-5	rhomb., iron blk. to steel gray	2.24, 2.24 (Li), 2.53	......
11	5-6	cub., emer. grn., blk. on expos.	2.16	......
12	6.0-6.5	rhomb., pa. yel. to steel gray	......	......
13	5.5-6.0	tetr.	1.539, 1.537	......
14	2.5-3.0	cub., br.	2.346	......
15	2.0-2.5	rhomb., lem. yel., yelsh., gray	1.5209, 1.5230, 1.5330	......
16	2.5-3.0	tetr., yelsh. or grnsh.	2.150, 2.040	......
17	5.5-6.0	tetr. col. to wh.	1.597, 1.560	......
18	2	monocl., var. shades of grn. to yel.	1.4713, 1.4782, 1.4856	85 27
19	5-6	tetr., wh., yel., grnsh., redsh., br.	1.634, 1.629	......
20	2.0-2.5	tetr., yel.	1.539, 1.511	......
21	2.5-3.0	rhomb., wh.	2.24, 2.27, 2.31	......
22	6.0-6.5	tricl., wh., yelsh., gray, grn. or red.	1.522, 1.526, 1.530	83
23	5.5	cub., yel., br., rar. red	1.925	......
24	2	cub., bright yel.	2.20	......
25	5.5-6.0	hex. col., grn., glassy	1.532, 1.529	......
26	3.5	hex., yel., br., wh. or col.	2.135, 2.118	......
27	1.5-2.0	monocl., wh.	1.394, 1.396, 1.398	76
28	9.5	hex., grn., bluish-blk.	2.654, 2.697	......
29	1.0-1.5	hex., blue gray	......	......
30	5.0-5.5	monocl., red or yelsh. br.	1.786, 1.788, 1.837	14
31	3.5	tricl., yel., wh.	1.515, 1.518, 1.525	......
32	5.0-5.5	rhomb., col. to gray	1.651, 1.662, 1.668	......
33	1.5-2.0	rhomb., orange red	2.37, 2.50, 2.65	......
34	2.5-3.0	monocl., col. or pa. yel., gray or br.; rar. rose	1.561, 1.590, 1.594	40 (?)
35	2.0-2.5	cub., col. to wh. or grayish	1.93	......
36	5.0-5.5	rhomb. wh. also redsh., yelsh., grnsh.	1.480, 1.482, 1.493	63
37	5.5-6.0	hex. col. wh., yelsh., gray or red	1.542, 1.538	......
38	3.0-3.5	rhomb., wh. cryst.	1.514, 1.518, 1.533	......
39	5.0-5.5	hex., lt. copper-red	......	......
40	5.5	cub., grayish, blsh., brnsh.	1.495	......
41	6-7	tricl., wh., gray, grnsh., redsh.	1.539, 1.543, 1.547	......
42	3	rhomb., olv. grn., dk. grn. to br.	1.747, 1.788, 1.829	......
43	6.5-7.0	rhomb., olv. grn., or grayish grn. to yelsh. br.	1.662, 1.680, 1.699	88 54
44	5.5-6.5	amor., col., wh., yel., br., red, grn.; int. refl.	1.41-1.46	......

No.	Name	Synonym	Formula	Sp gr.
1	Orpiment		As_2S_3	3 4–3 5
2	Orthite	allanite	$Ca_2(Al,Ce,Fe)_2(Al.OH)(SiO_4)_3$	3.0–4.2
3	Orthoclase	potassium feldspar.	$K_2O.Al_2O_3.6SiO_2$ . . .	2.56
4	Parisite		$CaO.2CeOF.3CO_2$	4 320–4.42
5	Pectolite		$HNaCa_2(SiO_3)_3$	2 74–2 88
6	Penfieldite		$PbO.2PbCl_2$	
7	Penninite		$5(Mg,Fe)O.Al_2O_3.3SiO_2$-$4H_2O$	2 6–2.85
8	Percylite		$PbCl_2.CuO.H_2O$	4 675–4 71
9	Periclase		MgO	3 64 3 674
10	Perovskite		$CaO.TiO_2$	3 95–4 039
11	Petalite		$Li_2O.Al_2O_3.8SiO_2$	2.386–2 465
12	Pharmocosiderite		$3Fe_2O_3.2As_2O_3.13H_2O$.	2 9–3 0
13	Phenacite		$2BeO.SiO_2$	2 944–3 041
14	Phlogopite	magnesium mica	$(K,H)_3Mg_3Al(SiO_4)_3$ ..- $(+Na,Fe,F)$	2 737–2.869
15	Phosgenite	cromfordite	$PbCl_2,PbCO_3$	6 0–6.305
16	Picotite	chrome-spinel	$(Mg,Fe)O.(Al,Cr)_2O_3$	4 08
17	Pitchblende (R)	See *uraninite*		
18	Platinum	native platinum	Pt	13 35–19 00
19	Pleonaste	iron-magnesium spinel	$(Mg,Fe)O.Al_2O_3$	3 5–3 6
20	Pollucite		$2Cs_2O.2Al_2O_3.9SiO_2$-H_2O	2.868–2 901
21	Powellite		$CaO.MoO_3$	4 356–4.526
22	Prehnite		$2CaO.Al_2O_3.3SiO_2.H_2O$	2.80–2 95
23	Proustite	ruby silver ore	$3Ag_2S.As_2S_3$	5 51–5.64
24	Pseudobrookite		$2Fe_2O_3.3TiO_2$	4 4–4 9
25	Psilomelane	black hematite	MnO_2,BaO,H_2O,K_2O,-etc	3 7–4 7
26	Pyrargyrite	dark red silver ore	$Ag_6Sb_2S_6$	5 77–5 86
27	Pyrite	iron pyrites, fool s gold	FeS_2	4 95–5 17
28	Pyrochlorite	pyrochlore	$RNb_2O_6.R(Ti,Th)O_3$	4 2–4 36
29	Pyrochroite		$Mn(OH)_2$	3 258
30	Pyrolusite	polianite	$MnO_2(+nH_2O)$	4 73 4.86
31	Pyromorphite	green lead ore	$PbCl_2.3Pb_3(PO_4)_2$	6 50–7 12
32	Pyrophyllite	pencil stone agalmatolite	$Al_2O_3.4SiO_2.H_2O$	2 66 2 90
33	Pyrrhotite	magnetic pyrites	Fe_5S_6 to $Fe_{16}S_{17}$.	4 53–4 66
34	Quartz		SiO_2	2.59–2.660
35	Raspite		$PbO.WO_3$..... . .	
36	Realgar		AsS	3 56
37	Rhodochrosite	dialogite	$MnCO_3$	3 30–3 76
38	Rhodonite	fowlerite	$MnO.SiO_2$	3 40–3 68
39	Rutile	nigrine	TiO_2	4 18–5 13
40	Sassolite		$B(OH)_3$	1 48
41	Scapolite	wernerite	$nNa_4Al_6Si_9O_{24}Cl$ + $mCa_4Al_6Si_6O_{25}$	2 6–2 8
42	Scheelite		$CaWO_4$	5.88–6 14
43	Schorlomite		$3CaO.(Fe,Ti)_2O_3.3(Si,Ti)O_2$	3 783–3.88
44	Scolecite	....	$CaO.Al_2O_3.3SiO_2.3H_2O$	2 16 2 4

OF MINERALS (Continued)

No	Hard-ness	Crystalline form and color	Index of refract. (Na); n; ω, ϵ; α, β, γ	Angle of the optic axes, 2V °	'
1	1.5–2.0	monocl., lem. yel.	(Li) β 2.72	.	
2	5.5–6.0	monocl., br. to blk.	β 1.682	..	.
3	6	monocl., col., wh., pa. yel., flesh red to gray.	1.518, 1.524, 1.526	69	43
4	4.5	trig., rhbdr., brnsh., yel.	1.5690, 1.6700	.	
5	4 5–5 0	monocl , col., wh., grayish wh.	1.595, 1 606, 1.634	60	
6	.	hex , wh.	2 13, 2.21	..	
7	2 0–2 5	pseudo-rhbdr., grn., vlt., pink, rose red; rar. yelsh. or silver wh.	1.576, 1.579	..	
8	2.0–2.5	cub., blue	2 05	..	
9	5.5–6.0	cub.	1.7364	..	
10	5.5	cub., yel., redsh. br., grayish blk.	β 2.38	.	
11	6.0–6.5	monocl., col., wh., gray; rar. redsh or grnsh.	1.504, 1.510, 1.516	83	34
12	2 5	monocl., grn., yelsh. br.	β 1 676	..	.
13	7.5–8.0	tricl., col , yel., red, br.	1.6542, 1.6700	..	
14	2.5–3.0	monocl., wh.-gray., yelsh. br. to brnsh. red	1.562, 1.606, 1.606	.	
15	2 75–3.0	tetr , col., gray or yel	2.114, 2.140	.	
16	..	yelsh. br., grnsh. br. to blk.	2.950	.	
17					
18	4–6	cub., silvery metal	...		
19	. ..	br., blk., dk. grn.	...		
20	6.5	cub., col.	1.521		
21	3.5	tetr., yel., grn. or blsh.	1.967, 1.978	..	.
22	6.0–6.5	rhomb., lt grn., wh. or gray	1.616, 1.626, 1.649	67	
23	2 0–2.5	hex., scarlet to vermilion	3 0877, 2.7924	..	.
24	6	rhomb , dk br. to blk.	(Li): 2.38, 2.39, 2.42	.	
25	5–6	cryptocryst., iron blk. to gray	...		
26	2.5	hex. (trig.), dk. red to gray or blk.	(Li): 3.084, 2.881	.	
27	6 0–6.5	cub , pa. brass to gold yel.	...	..	
28	5 0–5.5	cub. br -blk.	1.960–2.000	.	
29	2 5	trig , rhbdr., wh.; dk. on expos.	1.723, 1.681	.	
30	2 0–2.5	rhomb., blk., steel gray	...	.	
31	3.5–4.0	hex., grn., yel., gray, br. or wh.	2.042, 2.050, 2.050	.	
32	1–3	monocl., wh., grn., yelsh., grayish	1.552, 1.588, 1.600	.	
33	3 5–4.5	hex , yel., red to dk. br.	...	..	
34	7	hex (trig.), col. or yel., rose, br., grn., bl., gray	1.544, 1.553	..	
35		monocl , brnsh yel.	2 27, 2.27, 2.30	.	
36	1 5–2 0	monocl., red, yel	(Li) 2 46, 2.59, 2.61	..	
37	3 5–4 5	hex (trig), red, pink, gray, br., rar col.	1 817, 1.5973	.	
38	5.5 6 5	tricl , red, pink, yelsh., grnsh., brnsh., blk	1.733, 1.740, 1.744	.	
39	6 0–6.5	tetr , redsh. br., red, yelsh , blsh , vlt., blk	2.6158, 2.9029	.	
40	1	tricl , wh. scales	1 340, 1.456, 1.459	..	
41	5–6	tetr , col , wh., gray, grnsh., blsh., redsh.	1.570, 1.549	..	
42	4 5–5 0	tetr , col., wh., yel., br., grn., redsh.	1.918, 1.934	..	.
43	7.0 7 5	blk.	1.980	.	
44	5 0 5 5	monocl	1.512, 1.519, 1.519	36	

No.	Name	Synonym	Formula	Sp gr
1	Scorodite		$FeAsO_4 \cdot 4H_2O$	3 1–3.3
2	Selenite, colorless tr	ansparent gypsum, which	see	
3	Sellaite		MgF_2 .	2 972–3 170
4	Senarmontite		Sb_2O_3 . .	5 22–5.30
5	Sepiolite	meerschaum	$2MgO \cdot 3SiO_2 \cdot 2H_2O$	2 02
6	Serpentine	incl chrysotile or asbestos and verd-antique	$3MgO \cdot 2SiO_2 \cdot 2H_2O$	2 50–2.65
7	Siderite	spathic iron, chalybite	$FeCO_3$	3 00–3.88
8	Sillimanite	fibrolite	$Al_2O_3 \cdot SiO_2$..... .	3.23–3.25
9	Silver	native silver	Ag	10 1–11.1
10	Smaltite		$CoAs_2$.	6.4–6.6
11	Smithsonite	calamine, dry bone	$ZnCO_3$.	4.30–4.45
12	Sodalite		$Na_4(AlCl)Al_2(SiO_4)_3$	2.14–2 40
13	Soda niter	Chile saltpeter	$NaNO_3$.	2 24–2 290
14	Spessartite	manganese-aluminum garnet	$3MnO \cdot Al_2O_3 \cdot 3SiO_2$	4 0–4.3
15	Sphalerite	zincblende	ZnS . .	3 90–4.11
16	Spinel		$MgO \cdot Al_2O_3$	3.5–4.1
17	Spodumene	hiddenite, kunzite	$Li_2O \cdot Al_2O_3 \cdot 4SiO_2$	β2 644–2 64
18	Staurolite		$5Al_2O_3 \cdot 2FeO \cdot 4SiO_2 \cdot H_2O$	3 65–3.77
19	Stercorite	microcosmic salt	$HNa(NH_4)PO_4 \cdot 4H_2O$	1 615
20	Stibiotantalite		$Sb_2O_3 \cdot Ta_2O_5$	6 6 7 9
21	Stibnite	antimonite	Sb_2S_3	4 52–4.62
22	Stilbite	desmine	$(Na_2,Ca)O \cdot Al_2O_3 \cdot 6SiO_2 \cdot 6H_2O$	2 09–2.24
23	Stolzite		$PbO \cdot WO_3$	7 87–8 13
24	Strengite		$FePO_4 \cdot 2H_2O$	2 84–2 87
25	Strontianite		$SrCO_3$	3 680–3 714
26	Struvite		$(NH_4)_2O \cdot 2MgO \cdot P_2O_5 \cdot 12H_2O$	1.65–1.72
27	Sulfur	brimstone	S . .	2 05–2.09
28	Sylvite	sylvine	KCl	1.988
29	Talc	soapstone, steatite	$3MgO \cdot 4SiO_2 \cdot H_2O$	2 7–2 8
30	Tantalite		$(Fe,Mn)[(Cb,Ta)O_3]_2$	6.5–8.20
31	Tapiolite		$Fe(Ta,Nb)_2O_6$	7.3–7.8
32	Terlinguaite		Hg_2ClO .. .	8.723–8.728
33	Tetrahedrite	gray copper ore, fahlerz	$4Cu_2S \cdot Sb_2S_3$.	4 4–5.1
34	Thaumasite		$3CaO \cdot SiO_2 \cdot CO_2 \cdot SO_3 \cdot 15H_2O$	1.83–1.877
35	Thenardite.		Na_2SO_4	2 68–2 69
36	Thermonatrite		$Na_2CO_3 \cdot H_2O$	1.5–1.6
37	Thomsenolite		$NaF \cdot CaF_2 \cdot AlF_3 \cdot H_2O$	2 93–3 0
38	Thomsonite		$(Na_2Ca)O \cdot Al_2O_3 \cdot 2SiO_2 \cdot 3H_2O$	2.196–2 4
39	Thorianite (R).		$(ThU)O_2(+He,Ce,La,Pb,Fe)$	9.32–9.33
40	Thorite (R)		$ThSiO_4(+He)$	blk 4.5–5 yel 5 2–5.4
41	Titanite	sphene .	$CaO \cdot TiO_2 \cdot SiO_2$	3.40–3.56
42	Topaz .		$(AlF)_2SiO_4$ or $[Al(F,OH)]_2SiO_4$	3.4–3.65
43	Torbernite (R)	copper uranite ...	$Cu(UO_2)_2P_2O_8 \cdot 12H_2O$	3 22–3.60
44	Tourmaline	.	$(H,Li,Na,K)_9Al_3[B\text{-}OH]_2Si_4O_{19}(+Fe_2O_3,FeO,MgO,MnO)$?	2.9–3.2
45	Tremolite	grammatite .	$CaMg_3(SiO_4)_3$	2 9–3.2
46	Tridymite		SiO_2 . .	2.28–2.33

MINERALS (Continued)

No.	Hardness	Crystalline form and color	Index of refract. (Na); n; ω, ϵ; α, β, γ	Angle of the optic axes, 2V ° ′
1	3.5–4 0	rhomb., grn., br.	1.765, 1.774, 1.797	. . .
2				
3	5	tetr , col.	1.378, 1.390	. . . .
4	2 0–2 5	cub., col. to grayish	2.087	. . . .
5	2.0–2 5	monocl., wh., yelsh , grayish	β, 1.55	. . .
6	2.5–4.0	monocl (opt.), fibrous var., asbestos; gray to grnsh. or brnsh.	1.490–1.571	. .
7	3.5–4 5	hex , brnsh. to blk., gray, grn., wh.	1.875, 1 633	
8	6 0–7.5	rhomb., gray, br., yelsh., grnsh.	1.638, 1.642, 1.653	25–30
9	2.5–3 0	cub , wh.; tarn. to gray or blk.	0.18	. .
10	5.5–6.0	cub , tin wh. to lt steel gray	. .	
11	4.5–5 0	hex. (trig), wh.-yel. or br.; rar. grn., bl.	1.818, 1.618	
12	5.5–6.0	cub , bl., wh , grn , redsh. or gray	1.483	
13	1.5–2 0	hex , col., wh , yelsh., gray, redsh., br.	1.5874, 1.3361	.
14		cub , dk. red to brnsh. red	1.811	
15	3.5–4.0	cub , wh , yel., br., blk.	2.368	
16	8	cub , col or red, bl., grn., yel., br., blk.	1.723	. . . .
17	β 5 5–6 0	monocl , wh , gray, grn , pink or purp.	1.660, 1.666, 1 676	
18	7.0–7.5	rhomb., redsh br , blk., yelsh. br., gray	1.736, 1.741, 1.746	88
19	2	monocl , wh	1.439, 1 441, 1.469	
20	5 0–5.5	rhomb., br , redsh yel , yel.	2 374, 2.404, 2.457	.
21	2	rhomb., lead gray or blk	3.194, 4 046, 4.303	.
22	3.5–4.0	monocl., col., wh., also br., yel., redsh.	1.494, 1.498, 1.500	30
23	2.75–3 0	tetr , grn to gray or br.	2.2685, 2 182	.
24	3–4	rhomb , pa red	1 730, 1.732, 1.762	.
25	3.5–4 0	rhomb , col , wh., gray, yel., grn.	1.516, 1.664, 1.666	
26	2	rhomb , wh or yelsh.	1.495, 1 496, 1.504	.
27	1.5–2.5	rhomb , yel.	1.95047,2.03832,2.24052	68 58
28	2	cub , col , wh., blsh. or yelsh.-red	1 4903	. .
29	1 0–1 5	monocl , wh , grnsh wh , lt. grn.	1.539, 1 589, 1 589	
30	6	rhomb , blk to redsh. br.	2.26, 2.29, 2 34	
31	6	tetr , blk	(Li)· 2.270, 2 420	
32	2–3	monocl , yel to olive grn.	(Li): 2 35, 2 64, 2 66	.
33	3.0–4 5	cub , st. gray to iron blk.	. . .	
34	3 5	hex.	1.507, 1 468	. . .
35	2–3	rhomb , wh. to brnsh.	1 464, 1 474, 1.485	
36	1.0–1.5	rhombic	1 420, 1 495, 1.518	. .
37	2	monocl.	1 407, 1 414, 1.415	. .
38	5 0–5.5	rhomb , wh., redsh. grn. to br.	1 497, 1 503, 1.525	53 50
39	6.5	cub , blk.	. . .	. . . .
40	4.5–5.0	tetr , blk or or. yel. (orangite)		.
41	5.0–5.5	monocl , yel , grn., br , redsh or blk	1 900, 1 907, 2 034	23 9
42	8	rhomb., col. or yel., lt. blue, grn or pink	1 619, 1.620, 1.627	65 17
		Brazil	1.6294, 1.6308, 1.6375	49 31
43	2.0–2 5	tetr , grn	1.592, 1 582	.
44	7.0–7.5	hex (rhbdr), blk.-br -bl.-grn., red; rar. wh or col	1.6366, 1.6193 (col.)	. . . .
45	5–6	monocl , wh., gray, grnsh., yelsh.	1.609, 1 623, 1 635	88
46	7	rhomb , col or wh	1 460, 1 47, 1.473	. .

No.	Name	Synonym	Formula	Sp gr.
1	**Triphylite-lithiophyllite**		$Li(Fe,Mn)PO_4$	3.42–3.56
2	**Trögerite (R).**		$(UO_2)_3As_2O_8.12H_2O.$	3.3
3	**Trona** ..	urao	$Na_2CO_3.HNaCO_3.2H_2O$	2.11–2.147
4	**Turgite**	hydrohematite	$2Fe_2O_3.H_2O$ ...	4.29–5.00
5	**Turquois**		$H_5(CuOH)[Al(OH)_2]_6(PO_4)_4$	2.60–2.89
6	**Uraninite (R)**	pitchblende; incl. cleveite (+Th,A,He), nivenite (+Yt), Bröggerite (+Th)	$UO_3.UO_2,PbO$, etc	6.5–9.7
7	**Uranite lime (R)**	See autunite		
8	**Uvarovite**	calcium-chromium garnet	$3CaO.Cr_2O_3.3SiO_2$	3.418–3.81
9	**Valentinite**		Sb_2O_3	5.566
10	**Vanadinite** .		$9PbO.3V_2O_5.PbCl_2$	6.7–7.2
11	**Variscite**		$AlPO_4.2H_2O$	2.47–2.54
12	**Vesuvianite**	idocrase	$Ca_6[Al(OH,F)]Al_2(SiO_4)_5$	3.35–3.45
13	**Villiaumite**		NaF	2.79
14	**Vivianite**	blue iron ore	$Fe_3(PO_4)_2.8H_2O$	2.58–2.693
15	**Wagnerite**		$Mg_3P_2O_8.MgF_2$	2.985–3.14
16	**Wavellite**		$4AlPO_4.2Al(OH)_3.9H_2O$	2.316–2.356
17	**Whewellite**		$CaC_2O_4.H_2O$	2.23
18	**Willemite**	troostite, var. cont. Mn	Zn_2SiO_4, (+Mn)	3.89–4.19
19	**Witherite**		$BaO.CO_2$	4.28–4.35
20	**Wolframite**	peanut ore	$(Fe,Mn)WO_4$	7.14–7.54
21	**Wollastonite**	tabular spar	$CaSiO_3$	2.80–2.92
22	**Wulfenite**		$PbMoO_4$	6.7–7.0
23	**Xenotime**	xenotimite	$Y_2O_3.P_2O_5$	4.45–4.56
24	**Zeunerite (R)**		$Cu(UO_2)_2As_2O_8.8H_2O$	3.28
25	**Zincite**	red zinc ore	ZnO	5.43–5.70
26	**Zircon**	hyacinth, jargon	$ZrSiO_4$	4.02–4.86

MINERALS (Continued)

No	Hardness	Crystalline form and color	Index of refract. (Na); n; ω, ϵ; α, β, γ	Angle of the optic axes, 2V ° ′
1	4.5–5.0	rhomb., grnsh. gray, bluish, pink, yel. to br.	1.688, 1.688, 1.692	.
2	soft	monocl.	1.585, 1.630, 1.630	..
3	2.5–3.0	monocl., gray or yelsh. wh.	1.410, 1.492, 1.542	....
4	5.5–6.0	dk. redsh. blk. or br., red	(Li): 2.450, 2.550, 2.550	
5	5	tricl., blue, grn.	1.61, 1.62, 1.65	...
6	5.5	cub. or amor., gray, br.-blk.	......	....
7				
8	6.5–7.5	cub., emer. grn.	1.838	.....
9	2.5–3.0	rhomb., wh., gray	2.18, 2.35, 2.35	.
10	3	hex., yel., br. or red	2.354, 2.299	.
11	4	rhomb., grn.	1.551, 1.558, 1.582	
12	6.5	tetr., yel., grn., br., rar. bl., red, blk.	1.716, 1.718	
13	3.5	cub.	1.336	.
14	1.5–2.0	monocl., col. to bl. or blsh. grn. on expos.	1.579, 1.603, 1.633	
15	5.0–5.5	monocl., col., yel., grayish, grnsh., redsh.	1.569, 1.570, 1.582	37 49
16	3.5–4.0	rhomb., col., gray, yel., grn., blue, blk.	1.525, 1.534, 1.552	.
17	2.5	monocl., col.	1.491, 1.555, 1.650	
18	5.5	hex. (trig.-rhbdr.), wh. or grn. yel.-redsh.-br.	1.694, 1.723	.
19	3.00–3.75	rhomb., col., grayish wh. or yelsh.	1.529, 1.676, 1.677	
20	5.0–5.5	monocl., dk. gray or brnsh. blk.	2.310, 2.360, 2.460	
21	4.5–5.0	monocl., wh.-gray, yel., red or br.	1.616, 1.629, 1.631	40
22	2.5–3.0	tetr., yel., red, grn., gray, wh.	(Li): 2.402, 2.304	
23	4–5	tetr., yel.-br., brnsh. red-gray	1.721, 1.816	
24	2.0–2.5	tetr.	1.643–1.623	..
25	4.0–4.5	hex., red or yel.	2.008, 2.029	
26	7.5	tetr., col., pa. yel., gray, yelsh. grn., br., redsh.-br.	1.9239, 1.9682	..

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS*

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Aluminum				
99.2Al	Aluminum 2S	2.71	23.94×10^{-6}	660
97Al, 3Cu	...	.	24	640
95Al, 5Cu	Lynite, body alloy		26	650
95Al, 4.2Cu, 0.6Mn, 0.5Si, 0.4Fe	Zeppelin rod	.	....	.
95Al, 2Cu, 1.5Mg, 0.8Fe, 0.2Si, 0.01Mn	Lynite, piston	...	...	.
94Al, 4Cu, 0.5Mg, 0.5Mn, coated with 99.7 + Al	Alclad 17 ST	2.96	21.96	538–46
93Al, 7-8.5Cu, ≯1.7 other elements	Lynite, 146			
92Al, 9.3–11Cu, ≯2 other elements	Lynite, 122			.
90Al, 7.8Cu, 1.5Zn, 1.3Fe	Lynite, crank case		.	
89Al, 11Cu, 0.5Mg	Lynite, piston	...		
89Al, 12–14Cu, ≯2 other elements	Lynite, 109	.....		
99Al, 0.4Fe, 0.4Si, 0.1Zn, 0.06Cu	Zeppelin braces	...		
90 Al, 10Mg	Magnalium	2.50	24	600
70Al, 30Mg	Magnalium	2.00		435
98Al, 1.25Mn	Aluminum Alloy 3S	2.74	23.04	640–55
95Al, 5Si	Aluminum-silicon 43	2.58	21.96	577–630
91Al, 9Zn		2.80	26	650
90Al, 7.8Zn, 0.7Cu, 0.5Fe, 0.4Si, 0.3Mn, 0.1Sn	Zeppelin angles	.	. .	
89Al, 9Zn, 0.7Cu, 0.5Si, 0.5Mn, 0.4Fe, 0.2Sn	Zeppelin channels			
77Al, 21Zn, 1.1Cu, 0.5Fe, Pb, Sn	Liberty pistons			
70Al, 30Zn	....	....	26	610
Bismuth				
53Bi, 32Pb, 15Sn	Eutectic fusible alloy			96
52Bi, 40Pb, 8Cd	Eutectic fusible alloy			91.5
50Bi, 27.1Pb, 22.9Sn	Rose metal			
50Bi, 27Pb, 13Sn, 10Cd	Eutectic fusible alloy, Lipowitz alloy			70–4
50Bi, 25Pb, 12.5Sn, 12.5Cd	Wood's metal	9.70		65.5
40Bi, 40Pb, 20Sn	Bismuth solder			111
54Bi, 26Sn, 20Cd	Eutectic fusible alloy			103
45Bi, 17Sn, 30Pb, 5–10Hg	Fusible tea spoons	...	.....	....
Cerium				
70–3Ce, 17–24Zn, 1.6–6Fe, 0–2.4Al, Mn	Ignition pin alloy			
61Ce, 37Fe	Ignition pin alloy	.	.	.....
Cobalt				
Co, Cr, W Alloy	Stellite No. 1 Alloy	8.59	14.4×10^{-6}	1250
Co, Cr, W Alloy	Stellite No. 6 Alloy	8.38	16.9×10^{-6}	1275
Co, Cr, W Alloy	Stellite No 12 Alloy	8.40	15.8×10^{-6}	1263
Co, Cr, W Alloy	Stellite Star J-Metal	8.76	14.6×10^{-6}	1270
Co, Cr, W Alloy	Stellite "2400" Alloy			

* See also Supplementary Table following this table

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Copper				
99.9 + Cu	Deoxidized copper	8.50	17.71×10^{-6}	1082
99.90 + Cu, 0.01P	Deoxidized copper	8.91	17.71	1082
90Cu, 10Al	Aluminum bronze	7.6	16.5	1050
90Cu, 9Al, 1Fe	Resistac	....	....	1066
80–90Cu, 8–10Al, 6–7Fe	Ampco Metal	7.20	....	649
88–96.1Cu, 2.3–10.5Al, Fe, Sn	Aluminum bronze	7.50–8.19	....	1038–71
50Cu, 25Au, 25Ag	Cooper's pen metal	.....	...	.....
47Cu, 33Au, 20Ag	Gold 8 carat	.....	.	.....
40Cu, 31Au, 19Ag, 10Pd	Palladium gold	.....	. .	.....
77Cu, 15Pb, 8Sn	"B" Alloy, P.R.R.	....		...
95Cu, 5Mn	Manganese bronze	8.8		1060
82–6Cu, 4–15Mn, 2–12Ni, Fe	Manganin	....		.
82Cu, 15Mn, 3Ni	Manganin	8.5		
70Cu, 25Mn, 5Ni	Manganin	.		
61Cu, 26Mn, 13Al	Magnetic alloy	.		
88.5Cu, 5Ni, 5Sn, 1.5Si	Barberite	8.80		1070
80Cu, 20Ni	Nickeline	8.5		1185
75 Cu, 25Ni	Nickel coinage, U.S.A.	.		1205
75Cu, 20Ni, 5Zn	....	8.58	16.40	1150
65Cu, 18Ni, 17Zn	Nickel silver 18% A.	8.75	18.36	1110
60Cu, 40Ni	Constantan	8.4	.	1280
55–65Cu, 12–18Ni, 11–17Zn, 8–12 Fe, 0.5–1Si	Glass mold alloy, U.S.P. 1,360,773	..		.
57Cu, 20Ni, 20Zn, 3Al	Typewriter metal	.		. .
55Cu, 18Ni, 27Zn	Nickel silver 18% B.	8.69		1055
45–60Cu, 40–55Ni, 0–1.4Mn, 0.1C, Fe	Constantan	.....		..
45Cu, 33Ni, 16Sn, 5.5Zn, 1Bi	Sea water bronze	..	....	.
67–81Cu, 19–30Pt, 0–4Zn	Cooper's gold	.	....	
94.8–96Cu, 3–4Si, 1–1.2Mn	....	8.46	16.99	1000
98.55Cu, 1.40Sn	Phono-electric wire	.	.....	.
95.5Cu, 4.3Sn, 0.2P	Phosphor bronze 30	8.91	18.90	1050
95Cu, 4Sn, 1Zn	Coinage bronze	8.96	...	
92–7Cu, 1–8Sn, 0–2Zn	Medal bronze	. ..		..
91.6Cu, 8.25Sn, 0.15P	Phosphor bronze 47	8.91		....
90Cu, 10Sn, trace P	Phosphor bronze 209	9.00		.
90Cu, 10Sn	Bronze, gun metal	8.8	18	1000
88Cu, 10Sn, 2Zn	U.S. Government bronze, spec. G	.	.	....
82Cu, 16Sn, 2Zn	Bronze bearings	..		.
83Cu, 14Sn, 3.5Pb	Naval journal bearing, spec. HX	..	..	.....
83Cu, 14Sn, 3.5Zn	Naval journal bearing, spec. H	...	. .	.....
83Cu, 14Sn, 3Zn, 0.8Pb	U.S. Government bronze, spec H	...	...	.....
79.7Cu, 10Sn, 9.5Sb, 0.8P	Phosphor bronze	8.8	.....	.....
78Cu, 22Sn	Bell metal	8.7	.....	870
67Cu, 33Sn	Bronze, speculum metal	8.6	18.6	745
58Cu, 28Sn, 9.5Pt, 3.5Zn, 1.5As	Cooper's mirror		...	....

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Copper				
90Cu, 10Zn	Commercial bronze; red brass	8.80	18.18×10^{-6}	1050
89Cu, 9Zn, 2Pb	Hardware bronze	8.83	18.18	1050
85Cu, 15Zn	Red brass	8.75	18.72	1030
85Cu, 13Zn, 2Sn	Pen metal			
84Cu, 16Zn	Medal metal			
70Cu, 29Ni, 1Sn	Adnic		16.29	1205
70Cu, 29Zn, 1Sn	Admiralty	8.17	20.16	935
67-72Cu, 28-33Zn, Pb, Fe	Spring brass			
67-70Cu, 30-33Zn, Pb, Fe	Cartridge brass			
67Cu, 33Zn	Brass, ordinary yellow	8.40	18.5	940
64Cu, 25Zn, 8.5Pb, 2.5Sn	Ship nail brass			
61.2Cu, 37.3Zn, 0.9Sn, 0.4Pb, 0.2Fe				
61Cu, 39Zn	Pin wire brass			905
60-1Cu, 31-7Zn, 1.4Sn, 0.7-.9Pb	Pewter, for clock work			
60Cu, 40Zn	Muntz metal			840
60Cu, 25Zn, 15Ni	German silver		18.4	
60Cu, 19Zn, 10Al, 6Fe, 5Mn	Hytensl bronze			980
58Cu, 42Zn	Solder, very refractory			850
58Cu, 17.5Zn, 11.5Ni, 11Co, 2Ag	Chinese silver			
57Cu, 28Zn, 15Sn	Solder, very soft, white			
55Cu, 45Zn	For brazing			880
55Cu, 25Zn, 20Ni	German silver, common formula			
53Cu, 43Zn, 1.3Sn, 0.3Pb	Solder, hard yellow			
53Cu, 39Zn, 2.7Sn, 2.5Ni, 1.7Mn, 0.2Al	Manganin			
52Cu, 26Zn, 22Ni	German silver	8.45		
51Cu, 32Zn, 9.5Pb, 6.4Ni, 1.6Sn	Dienett's German silver			
50Cu, 50Zn	Solder, refractory			900
50-7Cu, 43-50Zn	Solder, hard			
50-62Cu, 20-32Zn, 12-30Ni	German silver, Birmingham			
50-60Cu, 20-5Zn, 20-5Ni	German silver, Austrian (Gersdorf)			
46Cu, 34Zn, 20Ni	German silver, best			
Gold				
79Au, 21Al	Roberts-Austen (purple gold)			750
92Au, 8Cu	Standard gold, Great Britain			900
90Au, 10Cu	Coinage	17.17		940
84Au, 16Cu	Jewelry			895
75Au, 24Cu	Jewelry			925
67Au, 25Cu, 8Ag	Pen metal			
67Au, 8-27Cu, 6.6-26Ag	Gold 16 carat			
62Au, 13Cu, 11Ag	Gold 15 carat			
58Au, 14-28Cu, 4-28Ag	Gold 14 carat			
50Au, 50Cu	Dark red gold			1000
50Au, 35Cu, 15Ag	Gold solder 12 carat			

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point C.
Gold				
42Au, 38–46Cu, 12–20Ag	Gold 10 carat	.	.....	.....
86Au, 5.7–17Fe, 0–8.6Ag	Gray gold		...	.....
75Au, 25Fe	Blue gold	.	.....	1165
75–85Au, 8–10Ni, 2–9Zn	White gold	. .	...	.....
90Au, 10Pd	White gold, palladium gold	. .	.....	1265
60–90Au, 10–40Pd	Rhotanium	.	.....	...
80Au, 20Pd	Palau	. .	...	1375
60Au, 40Pt	Platinum gold, white	.	.	1500
92Au, 4.9Ag, 3.1Cu	Gold 22 carat dental, dark	. . .	...	....
91.66Au, 4.16Ag, 4.16Cu	Gold 22 carat	.		..
92Au, 0–8.3Ag, 0–8.3Fe	Pale yellow gold	..	.	. ..
84Au, 8.3–11Ag, 6–8.3Cu	Gold 20 carat	.	..	...
75Au, 17Ag, 8.3Cu	Gold solder 16 carat			...
75Au, 10–20Ag, 5–15Cu	Gold 18 carat	.		.
63–75Au, 13–31Ag, 6.3–12Cu	Gold solder 18 carat	.		....
70Au, 25Ag, 5Ni or Pt	Platinum substitute, electrical		.	...
68Au, 25Ag, 7.5Pt	Platinum substitute, electrical			...
63Au, 23Ag, 15Cu	Gold solder, best	.	.	....
58Au, 30Ag, 12Cu	Gold 14 carat dental			..
55Au, 32Ag, 14Cu	Gold solder, easy melt	.		....
50 Au, 33Ag, 17Cu	Gold solder 14 carat	.		....
41Au, 37Ag, 21Cu, 0.6 brass	Gold solder 10 carat	.	. ..	..
40Au, 37Ag, 23Cu	Gold solder 8 carat	.....	......	.....
Iridium				
95Ir, 5Pt	....	22.38	..	....
Iron				
99.94Fe, 0.025S, 0.017Mn, 0.012C, 0.005P	Armco ingot iron	7.86	...	1530
98.5Fe	Wrought iron	7.70	. .	1510
80Fe, 20Al	Ferro-aluminum	6.30	. .	1480
99Fe, 1C	Steel	7.83	12.0	1430
97Fe, 3C	Cast iron, white	7.60	.. ..	1150
94Fe, 3.5C, 2.5Si	Cast iron, gray	7.0	11.2	1230
Fe, 30–40Co, 5–9W, 1.5–3Cr, 0.4–0.8C	K. S. Magnet steel	..	.	..
Fe, 0.45Cu, 0.07Mo, 0.03C	Toncan copper; molybdenum iron	7.83	11.99	1525
Fe, + 10Cr, < 0.5Mn, + 0.25C	Stainless steel	7.75		1510
90–2Fe, +8Cr, 0.4Mn, < 0.12C	Stainless steel	7.75	11.00	1450
90Fe, +8Cr, 0.4Mn, < 0.12C	Stainless iron	7.75	11.00	1450
88Fe, 16–7Cr, 0.4Mn, 0.1C max.	Stainless iron	.	9.99	...
86–8Fe, 12–4Cr, 0.3C	Carpenter stainless steel 2	7.75	......	1425
86–8Fe, 12–4Cr, <0.5Mn, < 0.1C, trace Ni	Defirust rustless iron	7.75	......	1480

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Iron				
86–8Fe, 12–4Cr, 0.1C.....	Carpenter stainless steel 1	7.78	....	1490
85–9 Fe, 10–4 Cr, <0.5Mn, <0.13C.	Stainless iron .	7.78	10.19	1490
82–6Fe, 12–6Cr, <0.5Ni, <0.05Si, <0.5 Mn, <0.12C...	Ascoloy 33.	7.64	10.89	1495
86 7Fe, 12.5Cr, 0.35Mn, 0.35Ni, 0.12C.. .. .	Sterling stainless steel T	7 75	9 99	1430
86.4Fe, 13 5Cr, 0.1C.....	Stainless I	7.75	10 91	. ..
84–6Fe, 12.5–4.5Cr, 0.5Mn max., 0.5Si max., 0.5Ni min., 0.12–0.18C	Enduro S15.	7.86	10.89	1475
84–6Fe, 12.5–4.5Cr, 0.5Mn max., 0.5Si max., 0.25Ni, 0.05–.12C .	Enduro S	7.86	10.89	1500
85 8Fe, 13 5Cr, 0.35Mn, 0.35C	Sterling stainless steel A	7 75	10.30	1425
85 6Fe, 14Cr, 0.35C	Stainless A	7 75	10.91	. .
85Fe, 13–4Cr, 2Ni max., 0.3–.6Mn, 0.12C max	Enduro KM1	7.75	9 99	1490
82–4Fe, 16–8Cr, <0.5Mn, C	Duraloy B	7.61	.	1510
84 3Fe, 12Cr, 2.15C, 0.75V, 0.75Co . .	Crocar.	.....	. ...	. .
82–4Fe, 16–8Cr, <0.5Mn, <0.1C, trace Ni	Special defirust rustless iron	7.75		1480
81–3Fe, 16.5–8.5Cr, 0.75Si, 0.1C max	Enduro A	7 64	11.00	1510
82 8Fe, 16 5Cr, 0.65C	Stainless B .	.....		.
82 5Fe, 16.5Cr, 0.65C, 0.35Mn ...	Sterling stainless steel B	7.72	10 91	1425
82Fe, 16–8Cr, 0.5Mn, 0.5Ni, 0.35C	Sweetaloy 16	7 83	11 00	1495
79–82Fe, 16–9Cr, <0.5Mn, <0.5Ni, <0.5Si, <0.12C	Ascoloy 66	7.64	..	. .
79–82Fe, 16.5–8.5Cr, 0.5Mn max., 0.5–1.25Si max., 0.25Ni max., 0.1C max	Enduro A.	7 86	10 80	1490
79–81Fe, 16.5–18Cr, 1–1.1C, 0.75–1Si, 0 35–.5Mn	Delhi hard ...	7 75	9 99	1500
78.7Fe, 20Cr, 1Cu, 0.3C..	Carpenter stainless steel 3	7.70	.	1475
71–6Fe, 17–9Cr, 7–10Ni, <0.05Mn, 0.2C ...	Defistain rustless iron	7 83	.	1455
71–5Fe, 17–9Cr, 8–9Ni, <0.5Mn, 0.06–.25C.	Midvale V2A. ...	7 89	16 99	1450
70–5Fe, 25–30Cr, <0.5Mn, 0.25C, trace Ni.	Defiheat rustless iron...	7.89	....	1595
70–5Fe, 17–20Cr, 7–10Ni, <0.5Mn, <0.5Si, <0.2C	Allegheny metal........	7 86–.95	17 30	1430–70
69–75Fe, 16.5–9.5Cr, 7–10Ni, 0.75Si max., 0.5Mn max., 0.15C max......	Enduro KA2..........	7.86	15 98	1400

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C
Iron				
74Fe 18Cr, 8Ni, 0.18C...	Stainless N...... . .	.....	$18\ 00 \times 10^{-6}$	.....
71–4Fe, 17.5–19Cr, 8–9Ni, 0.5Mn, 0.15C max. . .	Rezistal KA2...... ...	7.86	15.98	.....
73.5Fe, 18Cr, 8Ni, 0.35Mn, 0.15C .	Sterling nirosta steel ..	7 92	16.99	1425
73Fe, 18Cr, 9Ni, 0.5Mn, C	Duraloy 18–8 .. .	7 86	14.99	1475
70–3Fe, 27–30Cr, 0.5Mn, C	Duraloy A	7 61	....	1510
72 4Fe, 18Cr. 9.5Ni, 0.1C	Carpenter stainless steel 4	7 72	....	1400
70–2Fe, 17.5–19Cr, 8–9Ni, 2–2.5Si, 0.1–.2C	Rezistal 2C....... ..	7 86	15 98	.....
68–72Fe, 26–30Cr, <1Mn, <0.6Ni, <0.6Si, <0.25C	Ascoloy 55	7 61	10.19	.....
70Fe, 28Cr, 0.5Mn, 0.5Ni, 0.5C .	Sweetaloy 19.	7.86	11.00	1495
70Fe, 19Cr, 9Ni, 1Cu, 1Mo, 0.2C. . . .	Stainless U	.....	18.00	.....
69Fe, 18–20Cr, 8–10Ni, 0.5 Mn, 0.15C	Sweetaloy 17........	7.86	15 98	1450
68 1Fe, 20Cr, 7Ni, 4W, 0.35C, 0 5Mn .	Midvale HR....... ..	8.03	....	.....
60–6Fe, 22–5Cr, 10–3Ni, <1Mn, <0 5Si, <0 2C	Ascoloy 44....... ...	7.86–.95	16 20	1400–25
57–62Fe, 28–30Cr, 8–10Ni, 1.5Si, 0.5–.7C, 0.4–.5Mn	Misco C	7 89	.... .	1540
60Fe, 28Cr, 10Ni, 0.5Mn, 0.35C	Sweetaloy 22	7 97	.	1495
50–4Fe, 25–6Cr, 19–21Ni, 2–3Si, 0.2C	Rezistal 7... . .		.... .	....
85–8Fe, 11–4Mn, 1–1.3C.	Rol-Man Manganese steel	.	....	1290
86Fe, 13Mn, 1C.........	Manganese steel ...	7 81	....	1510
96.5Fe, 3 5Ni . . .	Nickel steel	.	.. .	1530
95.1Fe, 3Ni, 1.5Cr, 0.4C	Nickel-chrome steel...	....	....	.....
79Fe, 15Ni, 2.5Cr, 3Si, 0.6C . .	Durimet D	. . .	....	1430
74.2Fe, 25Ni, 0.8C	Ferro-nickel..........	8 1	18	1500
70 9Fe, 20Ni, 8Cr, 0.75Mn, 0 4C .	Cyclops 17 Metal	8 00	. . .	1425–80
70Fe, 25Ni, 5Si, 0 25C .	Durimet A	7 89		1500
67 8Fe, 32Ni, 0.2C	Ferro-nickel, valve steel	8 0	4	1480
67Fe, 22Ni, 10Cr, 0.5Mn, 0.2C ...	Sweetaloy 18...... .	7 97	18 90	1450
63.8Fe, 36Ni, 0.2C ..	Invar.......	8.0	0 8	1495
57–61Fe 24–6Ni, 10–2Cr, 4 5–5 5Si, 0.15C	Rezistal 255C.........	7.81	.. .	.....
51–8Fe, 25–8Ni, 13–5Cr, 3–4W, 1–1.5Mn, 0.4–0.5–C	Midvale ATV 3........	8.11	.. .. .	.....
57Fe, 25Ni, 15Cr, 0.3C. .	Pyrasteel.............	7.89	17.10	1450
47–56Fe, 33–9Ni, 10–2Cr, 1.1–1.8Mn, 0.25–.35C .	Midvale ATV 1........	8.06	....	1450
53–6Fe, 24–6Ni, 17–8Cr, 2.5Si, 0.15–.25C..... .	Rezistal 4............	7.78	16.29	......

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Iron				
53.85Fe, 46Ni, 0.15C	Platinite	8.2	7.5×10^{-6}	1470
47–52Fe, 34–6Ni, 10–2Cr, 4.5–5.5Si, 0.15C	Rezistal 355C	7.81	...	...
Fe, 35–7Ni, 15–7Cr, 1.4–1.6Si, 0.6–.8Mn, 0.5–.7C	Standard Misco	7.97	13.50	1540
50Fe, 35Ni, 15Cr	Chromax castings	7.81	12.19	1480
48Fe, 35Ni, 12Cr, 5Si, 0.25C	Durimet B	7.89	...	1500
45Fe, 36Ni, 18Cr, 0.5Mn, 0.3C	Sweetaloy 20	7.97	...	1495
97.6Fe, 2Si, 0.4C	Silicon steel		...	...
73–97Fe, 1–24Si, 2–3C, 0.1P, 0.04–.14S	Mechanite metal		...	..
84.86Fe, 13.5Si, 1C, 0.4Mn, 0.18P, 0.05S	Tantiron	7.83	..	1315
84.3Fe, 14.5Si, 0.85C, 0.35Mn	Duriron	7.00	15.59	1265
94.5Fe, 5W, 0.5C	Tungsten steel		.	
75Fe, 18W, 6Cr, 0.3V, 0.7C	High speed steel		.	.
66Fe, 17W, 10Cr, 3.5C, 2.5Mo	Cristite 1	7.61	15.59	..
Lead				
99.8Pb, 0.2As	Lead shot			
94Pb, 6Sb	Battery plates			300
92–4Pb, 6–8Sb	Antimonial lead	11.0	27.00	245–90
90Pb, 10Sb	Magnolia			270
85Pb, 15Sb	...	10.4	19.5	250
84.33Pb, 14.38Sb, 0.61Fe, 0.68Zn	Car box metal			..
82Pb, 15Sb, 3Sn	Type metal			
75Pb, 19Sb, 5Sn, 1Cu	White metal	9.5		238
70Pb, 18Sb, 10Sn, 2Cu	Type metal		.	...
92Pb, 8Cd	Aluminum solder, U.S.P. 1,333,666		.	310
99.93Pb, 0.08Cu	Chemical lead	11.35	28.98	327
87Pb, 13Sn, 1Cu	Lead foil (Calin)		.	...
72Pb, 21Sn, 7Sb	Marine babbitt			
67Pb, 33Sn	Solder, plumber's	9.4	25.0	275
56–60Pb, 10–40Sn, 4.5–30Sb	Type metal, common		...	.
58Pb, 26Sn, 15Sb, 1Cu	Type metal, standard			
50Pb, 50Sn	Solder, half and half		24	225
Mercury				
80Hg, 20Bi	Bismuth amalgam			90
70Hg, 30Cu	Dentist's amalgam		...	..
Nickel				
99–99.5Ni(+Co), 1–0.25C, 1–0.25Si, 1–0.3Mn, 1–0.55Fe, 1–0.25Cu	Nickel	8.86	.	1450
Ni–Cr steel alloy of high Si content	Elcomet	8.03	...	...
80Ni, 20Cr	Chromel A	8.4	.	...
80Ni, 20Cr	Tophet A	8.50	13.00	1345
80Ni, 20Cr	Nichrome IV	8.50	13.21	1395

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Nickel				
58Ni, 22Cr, 6-7Cu, 4Mo, 2W, 1Mn, 6-7Fe	Illium (Illium G) .	8.31	13.50	1300
60Ni, 20Cr, 10Fe, 1.75Mn, 0.5C	Firearmor	8.00	13.99	1330
73Ni, 17.5Co, 6.5Fe, 2.5Ti, 0.2Mn	Konel .	8.61	10.66	1450-1500
90Ni, 3Cu, 1.5Al, 10 ± Si	Hastelloy D ..	7.81	11.59	1160
60–70Ni, 25–35Cu, 1–3Fe, 0.25–2Mn, 0.02–1.5Si, 0.5–.3C	Monel metal	8.80	.	1330
60Ni, 33Cu, 6.5Fe	Monel metal	8.90	14	1360
75Ni, 12Fe, 11Cr, 2Mn.	Nichrome wire or ribbon		..	. .
61Ni, 23Fe, 16Cr	Chromel C	8.24	. .	...
60–2Ni, 23–6Fe, 10–11Cr, 2–2.5W, 1.2–1.5Mn, 0.3–35C	Midvale BTG	8.47	..	1450
60Ni, 28Fe, 12Cr	Tophet C	8.19	13.70	1350
60Ni, 25Fe, 15Cr, 0.7C	Nichrome castings	8.08	12.10	.
60Ni, 24Fe, 16Cr, 0.1C	Nichrome	8.17	13.70	1350
60Ni, 20Fe, 20Mo	Hastelloy A	8.80	10.71	1300
35Ni, 17Fe, 15Cr, 1.75Mn, 0.5C	Zorite	7.92	...	1300
Ni, 2–6Mn, Fe, Cu	Spark plug wire		.	
Ni, Fe, Mo	Hastelloy C	8.91	. ..	1350
60Ni, 20Pt, 10Pd, 10V	Palau	.		.
Magnesium				
93.8Mg, 6Al, 0.2Mn	Dowmetal E	1.79	0.000027	616
90.8Mg, 6Al, 0.2Mn, 3Zn	Dowmetal H	1.83	0.000027	613
92.6Mg, 6.5Al, 0.2Mn, 0.7Zn	Dowmetal J	1.80	0.000027	618
98.5Mg, 1.5Mn	Dowmetal M	1.76	0.000027	649
90.8Mg, 8.5Al, 0.2Mn, 0.5Zn	Dowmetal O	1.80	0.000027	610
88.9Mg, 10Al, 0.1Mn, 1Zn	Dowmetal P	1.82	0.000027	596
90.2Mg, 9Al, 0.2Mn, 0.6Zn	Dowmetal R	1.81	0.000027	604
96.8Mg, 3Al, 0.2Mn, 3Zn	Dowmetal X	1.80	0.000027	635
Palladium				
67Pd, 33Ag	Palladium alloy			1415
90Pd, 10Rh	Palladium alloy			
Platinum				
80–100Pt, 0–20Ir.	Platinum-iridium		7.5–8.8	
90Pt, 10Ir	Platinum-iridium	21.61	8.8	
55Pt, 28Ir, 7Rh, 3Cu, 4Fe, Pd, As..	Platinum-iridium (natural)			
80–100Pt, 0–20Rh...	Platinum-rhodium for thermocouples		8.8	
90Pt, 10Rh .	Platinum-rhodium			
50Pt 38Ag, 12Cu..	Cooper's pen metal			
Silver				
92.5Ag, 7.5Cu .	Standard silver		18	920
92.5Ag, 5.75Cu, 1.75Cd.	Standard cadmium silver			..
92Ag, 8Cu	Silver-rupee			920
90Ag, 10Cu	Silver U.S.coins	10.3		890

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Silver				
80Ag, 20Cu	Jewelry	..	18×10^{-6}	820
80Ag, 13Cu, 6.8Zn	Silver solder, hard	..	.	....
70–5Ag, 20–3Cu, 5–7.5Zn	Silver solder, medium	. .	. .	....
66Ag, 23Cu, 10Zn	Silver solder, French			..
63Ag, 30Cu, 7.5Zn	Silver solder, common	..	.	....
55Ag, 29Cu, 12Au, 5.5Zn	Gold solder, very easy melt	.. .	. . .	.... .
70Ag, 25Pd, 5Co	Platinum substitute (Cooper's)			...
73Ag, 27Pt	Platinum solder		.	1160
70 Ag, 25Pt, 5Ni	Platinum substitute (Cooper's)	.	....	
66.7Ag, 33.3Pt	Platinum silver	.	. .	1230
40Ag, 40Sn, 14Cu, 6Zn	Silver solder, Bu. Stands.	.	. . ..	..
Tantalum				
99.5Ta	Tantalum	16.6	6.50	2850
Tin				
78Sn, 9Al, 8Zn, 5Cd	Aluminum solder, Bu. Stands. SN1		. .	.
70–94Sn, 3.7–15Sb, 1.8–5Cu, 0–9Pb, 0–5Zn	Brittania metal, German		.	.
90–1Sn, 7–8Sb, 1.4Cu	Brittania metal, plate			
90Sn, 10Sb	Brittania			255
90Sn, 7Sb, 3Cu	Babbitt			
85–90Sn, 9–11Sb, 0–3Zn, 0.2–1Cu	Brittania metal, cast		.	.
85–90Sn, 5–10Sb, 1–3Cu, 0–3Zn, 0–2Bi	Brittania metal, English	.	.	
89Sn, 7.3Sb, 3.7Cu	Babbitt metal			.
85–8Sn, 5.6–15Sb, 1–5Bi, 0.1–3.7 Cu, 0–1.5Zn	Brittania metal, spoons			...
82Sn, 12Sb, 6Cu	White metal			.
80Sn, 20Sb	..	.		320
75Sn, 12.5Sb, 12.5Cu	Antifriction	7.53	. .	233
72Sn, 24Sb, 3.9Cu	Brittania metal, plate (Ludenscheidt)			
68Sn, 32Cd	...	7.70		180
85Sn, 6.8Cu, 6Bi, 1.7Sb	Pewter			.
83Sn, 8.4Cu, 8.3Sb	Hard babbitt			
97Sn, 3Cu	Rhine metal	7.35		300
74–89Sn, 0–20Pb, 0–7.6Sb, 0–3.5Cu, Zn	Pewter			......
88Sn, 8Pb, 4Cu, 0.5Sb	Tinfoil			...
67Sn, 33Pb	Solder, tinman's			180
60Sn, 40Pb	Tinsel			
50Sn, 32Pb, 18Cd	Eutectic fusible alloy	.	.	145
86Sn, 9Zn, 5Al	Aluminum solder, Bu Stands. SN4	.	.	.
86Sn, 9Zn, 5Al, 0.25P	Aluminum solder, Bu. Stands. SN3		.	
73Sn, 21Zn, 5Pb, 1P, Sn	Aluminum solder, Seifert		...	..
69Sn, 26Zn, 2.4Al, 2.4P	Aluminum solder, Bu. Stands. SN2	..	......	....

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition	Name	Sp. gr.	Thermal expansion coefficient per °C.	Melting point °C.
Tin				
62Sn, 15Zn, 11Al, 8.3Pb, 2.5Cu, 1.2Sb	Aluminum solder, Sterling . . .	. .	.	. . . .
55Sn, 33Zn, 11Al, 1Cu . . .	Aluminum solder, Soluminum . . .	. . . .	.	. . .
48Sn, 48Zn, 3Cu, 1Pb, 1Sb	Brittania metal, cast. . .	. . .		. . .
41Sn, 28Zn, 3Cu, 0.6Mn, 0.1Al .	Aluminum solder, U.S.P. 1,332,899.	. . . .	. . . .	. . . . .
Tungsten				
W_2C	Blackor .	14 0		. .
W, 0 5–0 75ThO_2	Tungsten filaments			
WC + 13% Co .	Carboloy	14 10	6	. .
Zinc				
96Zn, 4Al, 05Mg	ASTM Alloy XXIII SAE Alloy 903 Zamak-3	6 7	0000269	380 9
95Zn, 4Al, 1Cu, 05Mg	Zamak-5	6 7	0000274	380 6
93Zn, 4Al, 3Cu, .05Mg	ASTM Alloy XXI SAE Alloy 902 Zamak-2	6 8	0000277	379 5
95Zn, 5Al	. . . .	6.80	28	380
90Zn, 6Al, 4Cu.	Aluminum solder, Geophysical Lab., Carnegie Inst. . . .	.		.
65Zn, 20Al, 15Cu	Aluminum solder, Wust No. 2 .	.		. .
50Zn, 30Al, 20Cu	Aluminum solder, Wust			
75Zn, 20Cd, 5Al . .	Aluminum solder, Bu. Stands. ZN1			
67Zn, 33Cu .	Solder, readily fusible	.	20	795
60Zn, 40Cu	Solder, white .	.	21	840
50Zn, 44Cu, 3 3Sn, 1 2Pb	Solder, nearly white			.
45–57Zn, 35–45Cu, 8–10Ni	Solder, brazing		. .	
69Zn, 26Sn, 5Cu, 3Sb	Zinc babbitt		.	
63Zn, 21Sn, 12Pb, 3.2Cu	Battery plates . . .	.		
50Zn, 49Sn, 0 7Sb, 0.2Cu.	Aluminum solder, Roesch.	.		. .

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Supplementary Table

Composition	Name	Sp. gr.	Thermal expansion coeff per °C	Melting point °C.
Aluminum				
98.8Al, 1.2Mn	Wrought Aluminum alloy 3S			
97.75Al, 1.3Mg, 0.25Cr, 0.7Si	Wrought Aluminum alloy 53S			
98.4Al, 1.0Si, 0.6Mg	Aluminum alloys 51S			
98.15Al, 1.0Si, 0.6Mg, 0.25Cr	Wrought Aluminum alloy A51S			
97.25Al, 2.5Mg, 0.25Cr	Wrought Aluminum Alloy 52S			
97.2Al, 2.5Cu, 0.3Mg	Aluminum alloys A17S			
96.2Al, 3.8Mg	Sand-casting Aluminum alloys 214			
96Al, 4.0Cu	Sand-casting Aluminum alloys 195			
95Al, 4.0Cu, 0.5Mn, 0.5Mg	Wrought Aluminum alloy 17S			
93.5Al, 4.0Cu, 0.5Mg, 2.0Ni	Wrought Aluminum alloy 18S			
93.4Al, 4.5Cu, 0.6Mn, 1.5Mg	Wrought Aluminum alloy 24S			
93.2Al, 1.3Cu, 5.0Si, 0.5Mg	Sand-casting Aluminum alloys 355			
92.7Al, 7.0Si, 0.3Mg	Sand-casting Aluminum alloys 356			
91.6Al, 1.4Cu, 5.0Si, 0.75Mn, 0.5Mg, 0.75Ni	Wrought Aluminum alloy A355			
90.0Al, 10Mg	Sand-casting Aluminum alloy 220			
89.3Al, 7.5Cu, 1.2Fe, 2.0Zn	Sand-casting Aluminum alloy 112			
87.5Al, 12.5Si, 0.8Ni	Aluminum Alloys, 47			
85.4Al, 0.8Cu, 12.0Si, 1.0Mg, 0.8Ni	Aluminum Alloys, 32S			
Chromium				
66-70Cr, 4-6C, 24-30Fe	High carbon ferrochromium			1200 1300
67-72Cr, 0.06-2.00C, 32.94-26Fe	Low carbon ferrochromium			1255 1350
Copper				
97.6Cu, 1.4Sn, 1.0Si	Tin-Silicon Bronze	8.78	17.9 × 10^{-6}	1041
97.0Cu, 3Si	Silicon Bronze	8.55	17.9 × 10^{-6}	1024
90.85Cu, 7.15Al, 2.0Si	Aluminum Silicon Bronze Rod	7.70	17.9 × 10^{-6}	990
67.0Cu, 31.0Zn, 2.0Al	Aluminum Brass Condenser Tubing	8.33		970
70.0Cu, 30.0Ni	Cupro Nickel Condenser Tubing	8.94	16.0 × 10^{-6}	1227
62.25Cu, 35.75Zn, 2.0Pb	Leaded Brass Sheet	8.50		921
60.75Cu, 35.85 Zn, 3.4Pb	Free Turning Brass Rod	8.50	20.4 × 10^{-6}	885
60.0Cu, 39.0Zn, 1.0Sn	Naval Brass	8.42	21.1 × 10^{-6}	888

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (CONTINUED)

Composition	Name	Melting point °C
Iron		
98.755–98.355Fe, .90–1.05C, .25–.50Mn, .040P, .055S	Steel, S.A.E. No. 1095	
98.31–97.61Fe, .25–.35C, .80–1.10Cr, .40–.60Mn, .15–.25Mo, .040P, .050S	Steel, S.A.E. No. X4130	
98.16–97.46Fe, .35–.45C, .80–1.10Cr, .60–.90Mn, .040P, .050S	Steel, S.A.E. No. 5140	
98.03–97.13Fe, .12–.17C, .40–.60Cr, .70–.90Mn, .15–.25Mo, .40–.60Ni, .20–.35Si	Natl. Emergency Steel, NE8613	
98.01–97.21Fe, .35–.45C, .60–.90Mn, .80–1.10Cr, .15–.25Mo, .040P, .050S	Steel, S.A.E. No. 4140	
97.72–97.22Fe, .48–.53C, 1.60–1.90Mn, .20–.35Si	Natl. Emergency Steel, NE1350	
97.72–96.97Fe, .28–.33C, .40–.60Cr, 1.20–1.5Mn, .40–.60Si	Natl. Emergency Steel, NE9630	
97.91–97.21Fe, .45–.55C, .80–1.10Cr, .60–.90Mn, .035P, .040S, 0.15V	Steel, S.A.E. No. 6150	
97.51–96.31Fe, .35–.45C, .45–.75Cr, .60–.90Mn, 1.00–1.50Ni, .040P, .050S	Steel, S.A.E. No. 3140	
97.36–96.16Fe, .35–.45C, .60–.90Cr, .60–.90Mn, 1.00–1.50Ni, .040P, .050S	Steel, S.A.E. No. X3140	
97.21–96.36Fe, .35–.45C, .50–.80Mn, .20–.30Mo, 1.65–2.00Ni, .040P, .050S	Steel, S.A.E. No. 4640	
96.87–96.07Fe, .95–1.10C, .25–.45Mn, .20–.35Si, 1.30–1.60Cr, 0.35Ni, 0.08Mo	Natl. Emergency Steel, NE52100C	
96.76–95.46Fe, .35–.45C, .60–.90Cr, .50–.80Mn, .20–.30Mo, 1.50–2.00Ni, .040P, .050S	Steel, S.A.E. No. X4340	
96.57–95.60Fe, .38–.45C, .95–1.0Al, 1.40–1.80Cr, .40–.70Mn, .30–.45Mo	Nitriding Steels N135, Modified	
95.71–94.81Fe, .35–.45C, .60–.90Mn, 3.25–3.75Ni, .040P, .050S	Steel, S.A.E. No. 2340	
94.94–93.64Fe, 0.17C, 1.25–1.75Cr, .30–.60Mn, 3.25–3.75Ni, .040P, .050S	Steel, S.A.E. No. 3312	
94.76–93.86Fe, .10–.20C, .30–.60Mn, 4.75–5.25Ni, .040P, .050S	Steel, S.A.E. No. 2515	
93.85–92.18Fe, .20–.37C, 1.10–1.40Al, 1.00–1.30Cr, .40–.70Mn, .20–.30Mo, 3.25–3.75Ni	Nitriding Steels, N125N	
81.20–77.00Fe, .50–.70C, 3.00–4.00Cr, .30Mn, 15.00–18.00W	Steel, S.A.E. No. 71660	
80.5–65Fe, 4.5–5C, 15–30Mn	Spiegeleisen	1065–1225
73.91–68.49Fe, .08C, 17.00–20.00Cr, .20–.70Mn, .75Mo, 8.00–10.00Ni, .030P, .030S	Steel, S.A.E. No. 30905	
71.11–65.61Fe, 0.08C, 17.5–20Cr, 1.25Mn, 8–10Ni, 2–3Si, .03P, .03S	Enduro 18–8–B	
67.9Fe, .10C, 17Cr, 3.0Mo, 12Ni	Stainless 316	
63.55–39.5Fe, 0.2–3.5C, 35–45V	Ferrovanadium	1425–1475
56.75–52.75Fe, 0.25C, 24–26Cr, 19–21Ni	Stainless 310	
Magnesium		
98.5Mg, 1.5Mn	Wrought Magnesium Alloys No. AM3S	
95.8Mg, 3Al, 1Zn, 0.2Mn	Wrought Magnesium Alloys No. AM52S	
93.7Mg, 2.5Al, 0.3Mn, 3.5Cd	Dowmetal L	
93.1Mg, 6.5Al, 0.2Mn, 0.2Si	Dowmetal EX	
91.6Mg, 7Al, 1.2Zn, 0.2Mn	Wrought Magnesium Alloys No. AM-C57S	
91Mg, 3.5Al, 0.5Mn, 5Sn	Wrought Magnesium Alloys No. AM65S	
90.8Mg, 8.5Al, 0.5Zn, 0.2Mn	Wrought Magnesium Alloys No. AM-C58S	

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (CONTINUED)

Composition	Name	Melting point °C.
Magnesium		
90.8Mg, 6Al, 3Zn, 0.2Mn	Casting Magnesium Alloys No. AM265	
89.8Mg, 10Al, 0.2Mn	Casting Magnesium Alloys No. AM240.	
89.4Mg, 10Al, 0.1Mn, 0.5Si	Dowmetal K	
89.3Mg, 10Al, 0.2Mn, 0.5Si	Casting Magnesium Alloys No. AM230	
88.8Mg, 9Al, 2Zn, 0.2Mn	Casting Magnesium Alloys No. AM260	
Manganese		
80–85Mn, 0.3–1.0C, 19.7–14Fe	Low carbon ferromanganese	
78–82Mn, 6–8C, 16–10Fe	Standard ferromanganese	1255
Molybdenum		
55–65Mo, 45–35Fe	Ferromolybdenum	1625
Silicon		
74–79Si, 26–21Fe	75% Ferrosilicon	1175
Tungsten		
78–83W, 1.0C, 21–16Fe	Ferrotungsten	1800–1900

PROPERTIES OF COMMERCIAL PLASTICS

Compiled by Lauchlin M. Currie—1943

Trade Names of Plastics

Trade Names	Type	Composition	No.	Made By
Alvar	T.P.	Polyvinyl acetal	11	S
Ameroid	T.P.	Casein	2	A
Bakelite	T.S.	Phenol Formaldehyde	7, 9	B
Bakelite	T.S.	Urea Formaldehyde	17	B
Bakelite	T.P.	Cellulose acetate	3	B
Bakelite	T.P.	Polystyrene	14	B
Beetle	T.S.	Urea Formaldehyde	17	Be
Butacite	T.P.	Polyvinyl Acetal	11	Du
Catalin	T.S.	Phenol Formaldehyde	7, 9	Ca
Catalin	T.S.	Melamine Formaldehyde	18	Ca
Celluloid	T.P.	Cellulose Nitrate	3	Ce
Crystalite	T.P.	Acrylate and Methacrylate Resin	1	Rh
Durez	T.S.	Phenol Formaldehyde	7	Dz
Durite	T.S.	Phenol Formaldehyde	7	Dr
Durite	T.S.	Phenolic Furfural	10	Dr.
Ethocel	T.P.	Ethylcellulose	6	D, H
Ethofoil	T.P.	Ethylcellulose	6	D
Fibestos	T.P.	Cellulose Acetate	3	Mo
Formica	T.S.	Phenol Formaldehyde (Lamination)	8	F
Formvar	T.P.	Polyvinyl Formal	11	S
Gelva	T.P.	Polyvinyl acetate	12	S
Haveg	T.S.	Phenol Formaldehyde (Lamination)	8	Ha
Indur	T.S.	Phenol Formaldehyde	7	R
Koroseal	T.P.	Modified Polyvinyl Chloride	13A	Gr
Loalin	T.P.	Polystyrene	14	Ca
Lucite	T.P.	Methyl Methacrylate Resin	1	Du
Lumarith	T.P.	Cellulose Acetate	3	Ce
Lustron	T.P.	Polystyrene	14	Mo
Makalot	T.S.	Phenol Formaldehyde	7	M
Marblette	T.S.	Phenol Formaldehyde	9	Ma
Melmac	T S.	Melamine Formaldehyde	18	Be
Micarta	T.S.	Phenol Formaldehyde (Lamination)	8	W
Nitron	T.P.	Cellulose Nitrate	5	Mo
Nixonoid	T.P.	Cellulose Nitrate	5	N
Nixonite	T.P.	Cellulose Acetate	3	N
Opalon	T.S.	Phenol Formaldehyde (cast)	9	Mo
Parlon	T.P.	Rubber Derivative	16	H
Plaskon	T.S.	Urea Formaldehyde	17	P
Plaskon	T.S.	Melamine Formaldehyde	18	P
Plastacele	T.P.	Cellulose Acetate	3	Du
Plexiglas	T.P.	Acrylate and Methacrylate Resin	1	Rh
Plioform	T.P.	Rubber Derivative	15	Gy
Pliolite	T.P.	Rubber Derivative	15	Gy
Prystal	T.S.	Phenol Formaldehyde (cast)	9	Ca
Protectoid	T.P.	Cellulose Acetate	3	Ce
Pyralin	T.P.	Cellulose Nitrate	5	Du
Resinox	T.S.	Phenol Formaldehyde	7	Mo
Saflex	T.P., T.S.	Polyvinyl Butyrals	11	Mo
Saflex F	T P.	Polyvinyl Formals	11	Mo
Saran	T.P.	Vinylidene Chloride	19	D
Styron	T.P.	Polystyrene	14	D
Tenite	T P	Cellulose Acetate	3	T
Tenite II	T.P.	Cellulose Acetate Butyrate	4	T
Textolite	T.S	Phenol Formaldehyde	7, 8	Ge
Tornesit	T P	Rubber Derivative	16	H
Vinylite A	T.P.	Polyvinyl Acetate	12	C
Vinylite Q	T P.	Polyvinyl Chloride	13A	C
Vinylite V	T.P.	Vinyl chloride-acetate copolymer	13 13A	C
Vinylite X	T.P.	Polyvinyl Butyral	11	C

PROPERTIES OF COMMERCIAL PLASTICS (Continued)

Manufacturers of Plastics

Code Designation	Manufacturer	Producers of
A	American Plastics Corp. 50 Union Square, New York City	2
B	Bakelite Corporation 30 E. 42 Street, New York City	3, 7, 9, 14, 17
Be	Beetle Products Division American Cyanamid Company 30 Rockefeller Plaza, N.Y.C.	17, 18
C	Carbide and Carbon Chemicals Corp. 30 East 42 St., New York City	11, 12, 13, 13A
Ca	Catalin Corporation No. 1 Park Ave., New York City	7, 9, 14, 18
Ce	Celluloid Corporation 10 E. 40th Street, New York City	3, 5
D	Dow Chemical Company Midland, Michigan	6, 14, 19
Du	E. I. duPont de Nemours and Co. Plastics Department 10th and Market Street Wilmington, Del.	1, 3, 5, 11
Dz	Durez Plastics and Chemicals, Inc. North Tonawanda, N. Y.	7
Dr	Durite Plastics 5010 Summerdale Ave. Philadelphia, Pa	7, 10
F	Formica Insulation Company 4671 Spring Grove Avenue Cincinnati, Ohio	8
Ge	General Electric Co., Plastic Dept No. 1 Plastics Ave., Pittsfield, Mass.	7, 8
Gr	B. F. Goodrich Company Akron, Ohio	13A
Gy	Goodyear Tire and Rubber Co., Inc. Akron, Ohio	15
Ha	Haveg Corporation East Newark, Delaware	8
H	Hercules Powder Co. 999 Market Street Wilmington, Del.	3, 6, 16
M	Makalot Corporation 262 Washington Street Boston, Mass.	7
Ma	Marblette Corporation 37-21 30th Street Long Island City, N.Y.	9
Mo	Monsanto Chemical Co. Plastics Division Springfield, Mass.	3, 5, 7, 11
N	Nixon Nitration Works Nixon, N. J.	3, 5
P	Plaskon Company, Inc. 2121 Sylvan Ave., Toledo, Ohio	17, 18
R	Reilly Tar and Chem. Corporation 500 Fifth Ave., New York City	7
Rh	Rohm and Haas Co., Inc. 222 W. Washington Square Philadelphia, Pa.	1
Sc	Shawinigan Chemicals, Ltd P. O. Box 6072, Montreal, Canada	11, 12

Manufacturers of Plastics (Continued)

Code Designation	Manufacturer	Producers of
S	Shawinigan Products Corp. 350 Fifth Avenue New York City	11, 12
T	Tennessee Eastman Corp. Kingsport, Tenn.	3, 4
W	Micarta Division Westinghouse Elect. and Mfg. Co. Trafford, Pa.	8

	GROUP NUMBER	1	2
	Resin Group and Sub-Group or Filler	ACRYLATE & METHACRYLATE	CASEIN
	Type	Thermoplastic	Thermoplastic
	Typical Trade Names	Crystalite Lucite Plexiglas	Ameroid
1	**Forms Available** . . . . . Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	Cs, I, Lq, P, R, S, T	R, S, T
2	Clarity . . .	Transparent	Translucent
3	Color Possibilities . .	Unlimited	Unlimited
4	Odor .	None	None
5	Taste	None	None
6	**Working Properties**		Usually machined
a	Molding Qualities	Good to excellent	Poor
b	Compression Molding—Temp °F	280–370°F	200–225°F
c	Compression Molding—Pressure, lbs/in²	1000–7000	2000–2500
d	Injection Molding—Temp °F	325–500°F	
e	Injection Molding—Pressure, lbs/in²	10,000–30,000	
7	Compression Ratio—Vol Dry Powder/Vol Solid	1.6–2.5	
8	Shrinkage Allowance in Molding	0.001–0.006	
9	Tendency to Cold Flow	Very slight	
10	Machining Qualities	Fair to excellent	Good
11	Other Forming Qualities B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—swaging, T M—transfer molding	B, I, E—Special Technique	Sw Limited
	Physical Properties		
12	Specific Gravity . .	1.16–1.20	1.34–1.35
13	Specific Volume—in³/lbs	23.8–23.0	20.7–20.5
14	Refractive Index—n_D	1.49–1.51	
15	**Electrical Properties** (See Note 2)		
a	D.C. Resistivity—30°C, ohm-cm	10^{15}	
b	Dielectric Strength—Volts/Mil	500	400–700
c	Dielectric Constant—60–1000 Cycle	3–3.7	
	Dielectric Constant—10^6 Cycle .	2.7–3.3	6.1–6.8
d	Power Factor—60–1000 Cycle	0.05–0.07	
	Power Factor—10^6 Cycle	0.015–0.03	0.052

COMMERCIAL PLASTICS (Continued)

	3		4	5
	CELLULOSE ACETATE		CELLULOSE ACETO-BUTYRATE	CELLULOSE NITRATE
	SHEET	MOLDED		
	Thermoplastic	Thermoplastic	Thermoplastic	Thermoplastic
	Bakelite Lumarith Plastacele Protectoid	Fibestos Hercules Nixonite Tenite	Tenite II	Celluloid Nitron Nixonoid Pyralin
1	F, R, S, T	P, F, S, T, R	P, S	F, L, Lq, P, R, S, T
2	Transparent	Transparent	Transparent	Transparent
3	Unlimited	Unlimited	Unlimited	Unlimited
4	None to very slight	None to very slight	None to slight	Slight camphor
5	None to very slight	None to very slight	None to slight	Slight camphor
6				
a	Excellent	Fair to excellent	Fair to excellent	Good
b	200–320°F	180–390°F	260–370°F	135–250°F
c	500–5000	500–5000	500–5000	1500–5000
d		300–450°F	310–420°F	
e		8000–32,000	8000–32,000	
7		2.0–2.8	2.0–2.4	
8	0.002–0.010	0.001–0.010	0.001–0.010	
9	Very slight	Slight	Very slight	Very slight
10	Good to excellent	Fair to excellent	Good to excellent	Good to excellent
11	B, Sw, Sp	E, I, Sh, Sp, T.M good	E, I, Sp, Sw, T M.	All generally excellent
12	1.27–1.60	1.27–1.60	1.14–1.23	1.35–1.60
13	21.8–17.3	21.8–17.3	24.3–22.5	20.5–17.3
14	1.47–1.51	1.46–1.50	1.47–1.49	1.46–1.58
15				
a	10^{10}–10^{13}	10^{10}–10^{13}	10^{8}–10^{12}—50% R H	10^{10}–10^{11}
b	290–1800	290–900	250–900	300–1500
c	3.5–7.5 (60) 3.0–5.3	3.0–6.4 (60) 3.2–6.2	3.4–6.4 (60) 3.2–6.2	6.7–8.8 (60) 6.15–6.2
d	0.02–0.07 (60) 0.04–0.09	0.01–0.06 (60) 0.01–0.06	0.01–0.06 (60) 0.01–0.55	0.06–0.15 (60) 0.07–0.10

	GROUP NUMBER	1	2
	Resin Group and Sub-Group or Filler	ACRYLATE & METHACRYLATE	CASEIN
16	**Thermal Properties**		
a	Burning Rate	Slow	Very slow
b	Heat Distortion	50–85°C	149°C
c	Softening Point	66–123°C	94°C
d	Specific Heat—cal./gm. °C	0.35–0.40	
e	Thermal Conductivity—cal./sec. cm. °C ...	(1–10) × 10⁻⁴	
f	Thermal Expansion ...	(8–9) × 10⁻⁵/°C	(4.1–6.8) × 10⁻⁵/°C
17	**Mechanical Properties**		
a	Modulus of Elasticity—10⁵ lbs in²	4 6	5.1–5 7
b	Tensile Strength—lbs./in.²	4000–10,000	7,600–10,000
c	Elongation—%	1 15	2 5
d	Compression Strength—lbs./in²	10,000–15,000	27,000–53,000
e	Hardness—Brinell No 2 5 mm. ball, 25 kg. load	18–20	23
f	Impact Strength, Izod	0 2–0 4	1 0
18	**Physical Chemical Properties**		
a	Effect of Sunlight	Very slight	Slight fading
b	Ultra Violet Light....	Transmits most	Slight fading
19	Effect of Aging—Room Temp	None	Drier – harder
20	Effect of Water—Hot	Softens	Softens
	Effect of Water—Cold		Softens slowly
21	Water Absorption—% 24 Hour Immersion –25°C	0 3–0 5	7 14
22	General Resistance to		
a	Acids—Weak.	Excellent	Good
b	Acids—Strong	Excellent except oxidizing	Decomposes
c	Alkalies—Weak	Excellent	Softens
d	Alkalies—Strong	Excellent	Decomposes
e	Alcohols	Swells or dissolves	Good
f	Ketones	Dissolves	Good
g	Esters	Dissolves	Good
h	Hydrocarbons—Aromatic	Dissolves	Good
i	Hydrocarbons—Aliphatic	Good	Good
j	Oils—Mineral	Excellent	Good
k	Oils—Animal	Excellent	Good
l	Oils—Vegetable	Excellent	Good

COMMERCIAL PLASTICS (Continued)

	3		4	5
	CELLULOSE ACETATE		CELLULOSE ACETO-BUTYRATE	CELLULOSE NITRATE
	SHEET	MOLDED		
16				
a	1.5–2.0 (slow). . .	1.5–2.5 (slow) .	1.5 (slow)	Very high
b	50–100°C . . .	41–102°C	47–102°C	43–66°C .
c	60–120°C	60–130°C . .	60–127°C . .	60–90°C . .
d	0.3–0.4 .	0.3–0.45. . . .	0.3–0.4	0.34–0.38
e	(4.5–8.7) × 10^{-4}	(4.0–8.7) × 10^{-4}	(4–8) × 10^{-4}	(3.1–5.5) × 10^{-4}
f	(5–16) × 10^{-5}/°C	(8–16) × 10^{-5}/°C	(11–17) × 10^{-5}/°C	(6.5–16) × 10^{-5}/°C.
17				
a	1.0–3.5	0.6–4.0 .	0.6–3.5	1.5–4. . .
b	3000–11,000	1700–10,000 . .	2400–7500 . .	5000–12,000
c	7.5–55	8–80	13–82	4–60
d	4000–30,000	5000–27,000 .	7200–22,500 .	20,000–30,000
e	6–11 (10 kg.)	1.5–15 (10 kg.)	6–12 . .	8–11 (10 kg.)
f	1.5–4.0. .	0.3–4.6	0.5–7.5	2.0–8.0 . . .
18				
a	Very slight	Very slight	Slight, varies	Yellows, becomes brittle
b	Slight yellowing	Slight yellowing	Slight	Yellows, becomes brittle
19	Slight shrinkage.	Slight shrinkage	Slight	Hardens slightly
20	Softens and swells	Softens and swells		Softens
	Swells slightly	Swells slightly		Slight .
21	2.5	1.0–4.7	0.8–2.1	0.6–2.6
22				
a	Fair	Fair	Fair	Fair to good
b	Decomposes	Decomposes	Decomposes	Attacked by oxidizing acids
c	Fair	Fair .	Fair	Fair to good .
d	Decomposes	Decomposes	Decomposes	Decomposes .
e	Soluble	Soluble	Poor	Soluble . .
f	Soluble	Soluble	Soluble	Soluble
g	Soluble	Soluble .	Soluble	Soluble .
h	Good	Good	Good	Good
i	Good	Good	Good	Good .
j	Good	Good	Good	Good
k	Good	Good	Good	Good .
l	Good	Good	Good	Good

	GROUP NUMBER	6	
	Resin Group and Sub-Group or Filler	ETHYL CELLULOSE	Wood Flour Filled
	Type	Thermoplastic	Thermosetting
	Typical Trade Names	Ditzler Ethocel Ethofoil Lumarith Nixon, Hercules	*Molded and* *Cast*
1	**Forms Available** Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	F, I, Lq, P, R, S, T	P, R, S, T
2	Clarity	Transparent	Opaque
3	Color Possibilities	Unlimited	Limited
4	Odor	None to noticeable aldehydic	None to
5	Taste	None to noticeable aldehydic	None
6	**Working Properties**		
a	Molding Qualities	Good to excellent	Excellent
b	Compression Molding—Temp °F	320 380°F	280 360°F
c	Compression Molding—Pressure, lbs in ^{2}	1000 5000	2000 4500
d	Injection Molding—Temp °F.	350-400°F	275 375°F
e	Injection Molding—Pressure, lbs in ^{2}	3000 30,000	2000 10,000
7	Compression Ratio—Vol Dry Powder Vol Solid	2 2-2 7	1 8 5 7
8	Shrinkage Allowance in Molding	0 001-0 008	0 005-0 010
9	Tendency to Cold Flow	Slight	None
10	Machining Qualities	Good	Good to fair
11	Other Forming Qualities B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—swaging, T M—transfer molding	B, E, I, Sp, Sw, T M	T.M , I
	Physical Properties		
12	Specific Gravity	1 05-1 25	1 25 1 52
13	Specific Volume—in ^{3} lbs	26 4 22 2	22 2 18 2
14	Refractive Index—^nD	1 47	
15	**Electrical Properties** (See Note 2)		
a	D C Resistivity 30°C, ohm-cm	10^{13} 10^{15}	10^{10} 10^{12}
b	Dielectric Strength Volts Mil	400 1700	275 500
c	Dielectric Constant 60-1000 Cycle	2 5 4 0 (1000)	4 15
	Dielectric Constant —10^6 Cycle	2 0-3 5	4 8
d	Power Factor 60-1000 Cycle	0 005 0 038 (1000)	0 04-0 30
	Power Factor—10^6 Cycle	0 007-0 03	0 035-0 10

	7		8	
	PHENOL-FORMALDEHYDE COMPOUNDS			
	MOLDED		LAMINATED	
	Mineral Filled	Macerated Fabric Filler	Paper Base	Fabric Base
	Thermosetting	Thermosetting	Thermosetting	

Laminated Products—Bakelite, Durez, Durite, Micarta, Catalin, Haveg, Indur, Makalot, Resinox, Textolite, Formica
Products—Bakelite, Catalin, Gemstone, Marblette, Opalon, Prystal

1	P, R, S, T	P, R, S, T	L, S, T	L, S, T
2	Opaque	Opaque	Opaque	Opaque
3	Limited	Limited	Limited	Limited
4	Slight—Some Characteristically Phenolic—Most Phenolic When Hot			
5	None	None	None	None
6				
a	Poor to excellent	Poor to good		
b	270–350°F	270–350°F	275–350°F	275–350°F
c	2000–6000	2000–8000	1000–3000	1000–3000
d	275–350°F			
e	2000–15,000			
7	2.0–12.5	2.5–17.8	1.5–3	1.5–3
8	0.001–0.007	0.003–0.007		
9	None	None	None	None
10	Poor to good	Fair to good	Fair to good	Fair to good
11	T M, I	T M		
12	1.59–2.09	1.36–1.47	1.30–1.40	1.30–1.40
13	17.4–13.3	20.4–18.8	21.3–19.8	21.3–19.8
14				
15				
a	10^{9}–$10^{1?}$	10^{9}–10^{11}	10^{10}–10^{13}	10^{10}–10^{12}
b	225–450	150–450	400–1300	150–600
c	4.5–50	4.5–10		
	4–20	4–6	3.6–5.5	4.5–7
d	0.01–0.30	0.08–0.30		
	0.005–0.20	0.03–0.10	0.02–0.08	0.02–0.08

	GROUP NUMBER	6	
	Resin Group and Sub-Group or Filler	ETHYL CELLULOSE	Wood Flour Filled
16	**Thermal Properties**		
a	Burning Rate	2.0–6.7	Very low
b	Heat Distortion	45–93°C	115–140°C
c	Softening Point	93–135°C	None.
d	Specific Heat—cal./gm. °C	0.25–0.46	0.35–0.40
e	Thermal Conductivity — cal./sec. cm °C	$(3.8\text{–}6.3) \times 10^{-4}$	$(4\text{–}12) \times 10^{-4}$
f	Thermal Expansion	$(10\text{–}14) \times 10^{-5}$ °C	$(3.0\text{–}7.5) \times 10^{-5}$/°C
17	**Mechanical Properties**		
a	Modulus of Elasticity—10^5 lbs./in.^{2}	1.7–5.0	8–15
b	Tensile Strength—lbs./in.^{2}	2000–12,000	4000–11,000
c	Elongation—%	2–40	0.6
d	Compression Strength—lbs./in.^{2}	10,000–20,000	16,000–36,000
e	Hardness—Brinell No. 2.5 mm ball, 25 kg load	. . .	30–45
f	Impact Strength, Izod	0.6–6.5	0.15–0.45
18	**Physical Chemical Properties**		
a	Effect of Sunlight	Slight	
b	Ultra Violet Light	Slight	
19	Effect of Aging—Room temp.	None to slight	None
20	Effect of Water—Hot	None	←
	Effect of Water—Cold	None	←
21	Water Absorption—% 24 Hour Immersion—25°C	0.7–2.0	0.2–0.75
22	General Resistance to		
a	Acids—Weak	Fair to good	Good
b	Acids—Strong	Poor	← De
c	Alkalies—Weak	Good	←
d	Alkalies—Strong	Good	Decomposed
e	Alcohols	Fair	Good
f	Ketones	Fair	Excellent
g	Esters	Poor	Excellent
h	Hydrocarbons—Aromatic	Poor	Excellent
i	Hydrocarbons—Aliphatic	Good	Excellent
j	Oils—Mineral	Fair to good	Excellent
k	Oils—Animal	Poor	Excellent
l	Oils—Vegetable	Poor to fair	Excellent

COMMERCIAL PLASTICS (Continued)

	7		8	
	PHENOL-FORMALDEHYDE COMPOUNDS			
	MOLDED		LAMINATED	
	Mineral Filled	Macerated Fabric Filled	Paper Base	Fabric Base
16				
a	Nil. .	Approximately Nil	Very low	Very low. . . .
b	115–160°C.	115–160°C.	>160°C	>160°C . .
c	None	None	None . .	None . .
d	0.25–0.35 . . .	0.30–0.35. . . .	0.3–0.4 . .	0.3–0.4
e	$(8\text{-}20) \times 10^{-4}$. .	$(3\text{-}7) \times 10^{-4}$. .	$(5\text{-}8) \times 10^{-4}$ . .	$(5\text{-}8) \times 10^{-4}$. .
f	$(1.5\text{-}4.0) \times 10^{-5}$/°C.	$(1\text{-}6) \times 10^{-5}$/°C . .	$(1.7\text{-}2.5) \times 10^{-5}$/°C.	$(1.7\text{-}3) \times 10^{-5}$/°C
17				
a	10–45	7–12	4–30 . .	3.5–15 . . .
b	3500–10,000.	5000–8000	7000–18,000	8000–15,000
c	0.6 . . .	0.7 . . .		
d	10,000–36,000 .	20,000–32,000 . .	20,000–40,000	20,000–44,000
e	. . . . .	32–40	24–40 .	30–45 .
f	0.11–1.50	0.4–4.8	0.3–7.6 . .	0.8–15.0 . . .
18				
a	Light Shades May Discolor and			
b	Surface Resistance Be Reduced			
19	None	None	Mechanical and Electrical properties improved	
20	Insulation Value Reduced →			
	Insulation Value Reduced →			
21	0.01–0.3 . .	0.5–2.5	0.3–9.0	0.3–9.0
22				
a	Good	Good . .	Good .	Good
b	Decomposed by Oxidizing Acids—Reducing and Organic Acids No Effect →			
c	Little to Marked Effect—Depending on Alkali →			
d	Decomposed . .	Decomposed	Decomposed	Decomposed
e	Good .	Good	Good	Good
f	Excellent	Excellent .	Excellent	Excellent
g	Excellent	Excellent	Excellent.	Excellent
h	Excellent	Excellent	Excellent	Excellent
i	Excellent	Excellent	Excellent . . .	Excellent .
j	Excellent	Excellent	Excellent . .	Excellent
k	Excellent .	Excellent	Excellent. . . .	Excellent
l	Excellent	Excellent	Excellent	Excellent

	GROUP NUMBER	9	10
	Resin Group and Sub-Group or Filler	PHENOL-FORMALDEHYDE COMPOUNDS (Contd) CAST UNFILLED	PHENOLIC FURFURAL FILLED
	Type	Thermosetting	Thermosetting
	Typical Trade Names	See 7 & 8	Durite
1	**Forms Available** Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	Cs	Cs, I, Lq, P
2	Clarity	Transparent	Opaque
3	Color Possibilities	Unlimited	Limited
4	Odor	Most phenolic when hot	
5	Taste	None	
6	**Working Properties**		
a	Molding Qualities	Not moldable	Fair to excellent
b	Compression Molding—Temp °F		300–400°F
c	Compression Molding—Pressure, lbs /in²		500 10,000
d	Injection Molding—Temp °F		250–375°F
e	Injection Molding—Pressure, lbs. in²		300–30,000
7	Compression Ratio—Vol Dry Powder Vol Solid		2 5 15 0
8	Shrinkage Allowance in Molding		0 002 0 006
9	Tendency to Cold Flow	None	None
10	Machining Qualities	Fair to excellent	Fair to good
11	Other Forming Qualities B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—swaging, T M—transfer molding	May be softened and bent into simple shapes	E, T M
	Physical Properties		
12	Specific Gravity	1 20–1 70	1 3 2 0
13	Specific Volume—in³ lbs	23 0–16 3	21 3–13 9
14	Refractive Index—nD	1 5–1 7	
15	**Electrical Properties** (See Note 2)		
a	D.C. Resistivity—30°C. ohm-cm	10^{8}–10^{14}	10^{9}–10^{12}
b	Dielectric Strength—Volts/Mil	76–450	200 600
c	Dielectric Constant—60–1000 Cycle	5–31	4 20 (1000)
	Dielectric Constant—10^6 Cycle	4 7–14 5	5 18
d	Power Factor—60–1000 Cycle	0.01–0.50	0 04 0 15
	Power Factor—10^6 Cycle	0 01–0 13	0 035 0 10

COMMERCIAL PLASTICS (Continued)

	11	12	13
	VINYL RESINS		
	POLYVINYL ACETALS UNFILLED	POLYVINYL ACETATE	COPOLYVINYL CHLORIDE-ACETATE
	Thermoplastic	Thermoplastic	Thermoplastic
	Alvar Formvar See Note 1	Gelva Vinylite A	Vinylite V
1	F, I, Lq, P, S	I, Lq, P	F, I, L, Lq, P, R, S, T
2	Transparent to opaque	Transparent	Transparent to opaque
3	Unlimited	Unlimited	Unlimited
4	None	None	None
5	None	None	None
6			
a	Fair to excellent	Poor	Good to excellent
b	210-335°C		240-340°C
c	150-3500		500-2000
d	250-340°F		250-340°F
e	15,000-30,000		3,000-30,000
7			2 00
8			0 001 max
9	Slight	Appreciable	Slight
10	Fair to good		Good to excellent
11			B, E, I, Sh, Sw, Sp, T M. all good
12	1 05-1 23	1 19	1 34-1 37
13	26 4-22 5	23 2	20 7-20.2
14	1 46-1.50	1.467	1 53
15			
a	5×10^{10} – $>10^{14}$—50%, R H		10^{14}-10^{16}
b	360-1600	950-1200	400-500, ⅛″ thick
c	2 7-5 6 (60) 3.33-3 92	2 8-3 7	3 1-3 6 3 0-3 4
d	0 007-0 115 0 007-0 06	0 007	0 01-0 04 (60) 0 01-0 02

1 Of the acetals, polymerized vinyl butyral is plasticized and sheeted for use in safety glass lamination. Typical trade-names: Saflex, Butacite, Vinylite X.

	GROUP NUMBER	9	10
	Resin Group and Sub-Group or Filler	PHENOL-FORMALDEHYDE COMPOUNDS (Contd.) CAST UNFILLED	PHENOLIC FURFURAL FILLED
16	**Thermal Properties**		
a	Burning Rate	Very low	Very low
b	Heat Distortion	35–90°C	132–146°C
c	Softening Point		Chars 204–290°C
d	Specific Heat—cal./gm °C	0.3–0.4	0.3–0.4
e	Thermal Conductivity—cal./sec. cm. °C.	$(3\text{–}5)\times10^{-4}$	$(3.5\text{–}20)\times10^{-4}$
f	Thermal Expansion	$(4\text{–}15)\times10^{-5}$/°C	$(2\text{–}4.5)\times10^{-5}$/°C
17	**Mechanical Properties**		
a	Modulus of Elasticity—10^5 lbs./in.^{2}	1.3–15	7–45
b	Tensile Strength—lbs./in.^{2}	3000–12,000	5000–11,000
c	Elongation—%		
d	Compression Strength—lbs./in.^{2}	13,000–33,600	24,000–36,000
e	Hardness—Brinell No. 2.5 mm. ball, 25 kg. load	30–45	30–46 (50 kg.)
f	Impact Strength, Izod	0.1–1.5	0.3–4.6
18	**Physical Chemical Properties**		
a	Effect of Sunlight	Color may fade	Light shades discolor
b	Ultra Violet Light		
19	Effect of Aging—Room temp.	Hardens slightly	Hardens slightly
20	Effect of Water—Hot	Insulation value reduced	Insulation value reduced
	Effect of Water—Cold		
21	Water Absorption—% 24 Hour Immersion—25°C	0.01–0.6	0.1–1.4
22	General Resistance to		
a	Acids—Weak	Good	Good
b	Acids—Strong	Decomposed by oxidizing acids	Decomposed by oxidizing acids
c	Alkalies—Weak		Good
d	Alkalies—Strong	Decomposed	Decomposed
e	Alcohols	Good	Good
f	Ketones	Excellent	Excellent
g	Esters	Excellent	Excellent
h	Hydrocarbons—Aromatic	Excellent	Excellent
i	Hydrocarbons—Aliphatic	Excellent	Excellent
j	Oils—Mineral	Excellent	Excellent
k	Oils—Animal	Excellent	Excellent
l	Oils—Vegetable	Excellent	Excellent

COMMERCIAL PLASTICS (Continued)

	11	12	13
	VINYL RESINS		
	POLYVINYL ACETALS UNFILLED	POLYVINYL ACETATE	COPOLYVINYL CHLORIDE-ACETATE
16			
a	Slow	Slow	Nil
b	47-100°C	40-50°C	60-69°C
c	47-200°C	65-175°C	60-65°C
d	About 0.30	0.389	0.244
e	$(3.4\text{-}4.4)\times10^{-4}$	3.8×10^{-4}	$(3.5\text{-}4.1)\times10^{-4}$
f	$(7.8\text{-}22.3)\times10^{-5}/°C$	$8.6\times10^{-5}/°C$	$6.9\times10^{-5}/°C$
17			
a	3.5-4.0		3.5-4.1
b	2000-12,000	1500-5000	8000-10,000
c	4-450		None
d			
e			12-25
f	0.44-1.2		0.2-1.2
18			
a	Slight	None	Darkens on prolonged exposure
b	Slight	Slight	Darkens on prolonged exposure
19	Slight	None	None to slight
20		Softens and whitens	Softens
	Butyrals absorb 18%	Softens and whitens	None
21	0.6-5.0	2	0.05-0.15
22			
a	Attacked	Good	Excellent
b	Attacked	Poor	Excellent
c	Excellent	Good	Excellent
d	Good	Poor	Excellent
e	Fair to soluble	Soluble	Excellent
f	Swells	Soluble	Poor—dissolves
g	Swells	Soluble	Poor—dissolves
h	Swells	Soluble	Poor—swells
i	Depends	Excellent	Excellent
j	Excellent	Excellent	Excellent
k	Excellent	Excellent	Excellent
l	Excellent	Excellent	Excellent

	GROUP NUMBER	13A	14
	Resin Group and Sub-Group or Filler	POLYVINYL CHLORIDE (& COPOLYMER) PLASTICIZED	POLYSTYRENE
	Type	Thermoplastic	Thermoplastic
	Typical Trade Names	Koroseal Vinylite (Copolymer)	Bakelite Loalin Lustron Styron
1	**Forms Available** Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	Cs, F, I, L, Lq, P, R, S, T	F, I, L, Lq, P, R, S, T
2	Clarity . . .	Transparent—opaque	Transparent
3	Color Possibilities	Unlimited	Unlimited
4	Odor .	Varies	None
5	Taste	Varies	None
6	**Working Properties**		
a	Molding Qualities	Fair to good	Excellent
b	Compression Molding—Temp °F	250–350°C	240 375°F
c	Compression Molding—Pressure, lbs./in.²	500-1000	1000-10,000
d	Injection Molding—Temp °F	250–350°F	300 500°F
e	Injection Molding—Pressure, lbs./in.²	18,000-30,000	10,000 40,000
7	Compression Ratio—Vol. Dry Powder/Vol. Solid		2 0–2 3
8	Shrinkage Allowance in Molding	0 016–0 10	0 002 0 008
9	Tendency to Cold Flow .	Slight	Very slight
10	Machining Qualities	Fair to good	Fair to good
11	Other Forming Qualities B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—swaging, T.M—transfer molding	E, I Calendering	B, E, I, T M. Compression molding
	Physical Properties		
12	Specific Gravity .	1 2–1 7	1 054-1 070 .
13	Specific Volume—in.³/lbs .	23 0–16 3 .	26 3-25 9 .
14	Refractive Index—nD	1 544	1 592 1 597
15	**Electrical Properties** (See Note 2)		
a	D C. Resistivity—30°C, ohm-cm	5×10^{12}-10^{16} (25°C)	10^{17} 10^{19}
b	Dielectric Strength—Volts/Mil	300–2000	See Note 2
c	Dielectric Constant—60-1000 Cycle	6 5 12 (60)	2 5–2 7
	Dielectric Constant—10^6 Cycle	4 2	2 5 2 7
d	Power Factor—60-1000 Cycle	0 055–0.136 (60)	0 00006-0.0008
	Power Factor—10^6 Cycle	0 100 .	0 0001 0 0008

2 In general for all plastics, dielectric strength is a function of the thickness For polystyrene in particular· Instantaneous Dielectric Strength—0 005 in thick - 3500v/mil, 0 015 in thick = 2200 v/mil; 0 125 in thick = 500-700 v/mil Complete information concerning thicknesses tested is not available for other plastics

COMMERCIAL PLASTICS (Continued)

	15	16	17
	RUBBER COMPOUNDS		UREA FORMALDEHYDE
	MODIFIED ISOMERIZED RUBBER	CHLORINATED	
	Thermoplastic	Thermoplastic	Thermosetting
	Plioform Pliolite	Tornesit Parlon	Bakelite Beetle Plascon
1	Lq, P, F	P	I, L, P
2	Transparent	Translucent	Translucent...
3	Unlimited	Pastels	Unlimited pastels.
4	None	Slight..	None
5	None	Slight	None
6			
a	Good	Fair	Excellent
b	260-300°F	280-380°F	280-330°F
c	1200-4000	2000-6000	1500-6000
d		300-400°F	
e		3,000-10,000	
7	3.0	2 2-2.6	2.2-3.0
8	0 060		0.005-0.011...
9	Slight	Slight	None
10	Fair	Good	Fair
11			
12	1.06	1 64	1.45-1.55
13	26 1	16.9	19.1-17.9
14		1 56	1.54-1.6
15			
a	$(5-7) \times 10^{16}$	$2\ 5 \times 10^{13}$	$10^{6}-10^{13}$..
b		2300	650-720
c	2.7(60)	3	6.6-9 5 (60) 5.5-7.7 .
d	0 006 (60) 0.002	0 003 (60) 0 006	0 035-0 10 (60) 0 01-0.035 ..

	GROUP NUMBER	13A	14
	Resin Group and Sub-Group or Filler	POLYVINYL CHLORIDE (& COPOLYMER) PLASTICIZED	POLYSTYRENE
16	**Thermal Properties**		
a	Burning Rate	Depends on plasticizer	Slow
b	Heat Distortion	77–121°C	72–88°C
c	Softening Point		88–121°C
d	Specific Heat—cal./gm °C	0.30–0.51	0.31–0.33
e	Thermal Conductivity—cal./sec. cm °C.	$(3.9–4.0)\times10^{-4}$	$(1.9–3.2)\times10^{-4}$
f	Thermal Expansion	$(7–25)\times10^{-5}$/°C	$(6–8)\times10^{-5}$/°C
17	**Mechanical Properties**		
a	Modulus of Elasticity—10^5 lbs./in.^{2}		1.7–6
b	Tensile Strength—lbs./in.^{2}	850–9000	3000–10,000
c	Elongation—%	Up to 550	1.5–5
d	Compression Strength—lbs./in.^{2}		11,0000–17,000
e	Hardness—Brinell No. 2.5 mm ball, 25 kg. load		20–30
f	Impact Strength, Izod	Does not shatter	0.2–0.5
18	**Physical Chemical Properties**		
a	Effect of Sunlight	None to slight fading	Slight yellowing
b	Ultra Violet Light		
19	Effect of Aging—Room temp	None	None
20	Effect of Water—Hot	Slight	None to 60°C
	Effect of Water—Cold	None	None
21	Water Absorption—% 24 Hour Immersion—25°C	0.1–0.6	0.00–0.06
22	General Resistance to		
a	Acids—Weak	Excellent	Excellent
b	Acids—Strong	Good to excellent	Good
c	Alkalies—Weak	Excellent	Excellent
d	Alkalies—Strong	Good to excellent	Excellent
e	Alcohols	Varies	Excellent
f	Ketones	Soluble	Swells
g	Ester	Soluble	Soluble
h	Hydrocarbons—Aromatic	Poor—swells	Soluble
i	Hydrocarbons—Aliphatic	Varies	Fair to good
j	Oils—Mineral	Varies	Poor to excellent
k	Oils—Animal	Varies	Poor to excellent
l	Oils—Vegetable	Varies	Poor to excellent

COMMERCIAL PLASTICS (Continued)

	15	16	17
	RUBBER COMPOUNDS		UREA FORMALDEHYDE
	MODIFIED ISOMERIZED RUBBER	CHLORINATED	
16			
a	Slow	Nil	Very low
b	75–105°C	60°C	127–138°C
c	75–105°C	80–110°C	None
d		0.37–0.43	0.4
e	$(2.6–2.9)\times10^{-4}$	3.0×10^{-4}	7.1×10^{-4}
f	$(7–8)\times10^{-5}$/°C	$(12–13)\times10^{-5}$/°C	$(2.5–3.0)\times10^{-5}$/°C
17			
a	4.7	1–6	12–16
b	4300	2700–5000	5500–13,000
c	0.013	0.5–2.2	<1
d	8500–11,000		24,000–35,000
e	85–90 (Shore)	70–80 (Shore)	48–54 (10 mm. 500 kg.)
f	2.6–6.2	0.14–2.8	0.14–0.36
18			
a	Slight craze	Darkens	None
b			
19	None	Slight embrittlement	Hardens slightly
20	Softens	Varies None	
21	0.02	0.1–0.3	0.75–3.0
22			
a	Good	Excellent	Good
b	Good for HCl, H_2SO_4	Excellent	Decomposes
c	Good	Excellent	Depends on alkali
d	Good	Excellent	Decomposes
e	Good	Excellent	Good to excellent
f	Good	Poor	Good to excellent
g	Good	Poor	Good to excellent
h	Poor	Poor	Excellent
i	Poor	Good	Excellent
j	Poor	Good	Excellent
k	Poor	Poor	Excellent
l	Poor	Poor	Excellent

	GROUP NUMBER	18	19
	Resin Group and Sub-Group or Filler	MELAMINE FORMALDEHYDE FILLED	VINYLIDENE CHLORIDE
	Type	Thermosetting	Thermoplastic
	Typical Trade Names	Catalin Melmac Plaskon	Saran Velon
1	**Forms Available** . Cs—cast forms, F—film, I—impregnating varnishes, L—laminations, Lq—lacquers, P—powder or granules, R—rods, S—sheets, T—tubes	I, L, P, Lq	F, P, R, S, T
2	Clarity	Opaque to translucent	Opaque to translucent
3	Color Possibilities	Dark to unlimited	Dark to unlimited
4	Odor	None	Slight
5	Taste	None	Slight
6	**Working Properties**		
a	Molding Qualities	Excellent	Good—special technique
b	Compression Molding—Temp °F	280–340°F	220–350°F
c	Compression Molding—Pressure, lbs /in ^{2}	1000–6000	500–5000
d	Injection Molding—Temp °F	290 330°F (T M)	300–400°F
e	Injection Molding—Pressure, lbs /in ^{2}	5000–18,000 (T M)	10,000–30,000
7	Compression Ratio—Vol Dry Powder/Vol Solid	2-12	2
8	Shrinkage Allowance in Molding	0 004–0 012	0 004–0 12
9	Tendency to Cold Flow	None	Slight
10	Machining Qualities	Fair	Good
11	Other Forming Qualities B—blowing, E—extrusion, I—injection, Sh—shearing, Sp—spinning, Sw—swaging, T M —transfer molding	T M	E, I, Sh, T M special technique
	Physical Properties		
12	Specific Gravity	1 49–1 86	1 68–1 75
13	Specific Volume—in ^{3}/lbs	18 6–14 9	16 5–15 8
14	Refractive Index—n_D	1 6	1 60–1 63
15	**Electrical Properties** (See Note 2)		
a	D C Resistivity—30°C ohm-cm	$2\ 4 \times 10^{11}$	10^{14}–10^{16}
b	Dielectric Strength—Volts/Mil	390	350 500
c	Dielectric Constant—60–1000 Cycle	6 4–11 6	2 5–5 0
	Dielectric Constant—10^6 Cycle	6 7	2 5–5 0
d	Power Factor—60–1000 Cycle	0 07 0 17 (60)	0 03–0 15
	Power Factor—10^6 Cycle	0 041	0 03–0 15 .

	GROUP NUMBER	18	19
	Resin Group and Sub-Group or Filler	MELAMINE FORMALDEHYDE FILLED	VINYLIDENE CHLORIDE
16	**Thermal Properties**		
a	Burning Rate	Very low	Self extinguishing
b	Heat Distortion	130–141°C	66–82°C
c	Softening Point	None	116–138°C
d	Specific Heat—cal./gm.°C	.	0.32.
e	Thermal Conductivity—cal./sec. cm °C	.	2.2×10^{-4}
f	Thermal Expansion . .	$(1.8\text{–}4.5) \times 10^{-5}$/°C	15.8×10^{-5}/°C
17	**Mechanical Properties**		
a	Modulus of Elasticity—10^5 lbs./in.^{2}	12–16	0.2–2.0 .
b	Tensile Strength—lbs./in.^{2}	5500–7000	4000–7000
c	Elongation—%	<0.5	10–40
d	Compression Strength—lbs./in.^{2}	30,000	7500–8500
e	Hardness—Brinell No. 2.5 mm. ball, 25 kg. load		
f	Impact Strength, Izod	0.27–0.90	2–8
18	**Physical Chemical Properties**		
a	Effect of Sunlight.	None .	Darkens slightly
b	Ultra Violet Light		Darkens slightly
19	Effect of Aging—Room Temp.	Hardens slightly	Slight
20	Effect of Water—Hot .	None	Slight under 74°C
	Effect of Water—Cold	None .	None .
21	Water Absorption—% 24 Hour Immersion—25°C.	0.07–0.6	<0.1
22	General Resistance to		
a	Acids—Weak	Excellent	Excellent .
b	Acids—Strong	Good to decompose	Good to excellent
c	Alkalies—Weak	Good to excellent	Excellent
d	Alkalies—Strong	Good to excellent	Good except NH_3
e	Alcohols	Excellent	Excellent
f	Ketones	Excellent	Good
g	Esters	Excellent	Good
h	Hydrocarbons—Aromatic	Excellent	Good
i	Hydrocarbons—Aliphatic	Excellent	Excellent
j	Oils—Mineral	Excellent	Excellent
k	Oils—Animal	Excellent	Excellent
l	Oils—Vegetable	Excellent	Excellent

PLASTICS COMPARATOR

The figure 1 indicates relative excellence, higher figures indicate relative lower order of excellence. The all important matter of cost is purposely omitted.

PLASTIC MATERIAL	Toughness (Impact Strength)	Flexural Strength	Tensile Strength	Color Stability	Cold Flow	Water Resistance	Acid Resistance	Caustic Resistance	Solvent Resistance	Dimensional Change on Aging	Heat Resistance	Flammability	Heat Insulation	Specific Gravity	Hardness	Loss Factor	Resistivity	Dielectric Strength	Moldability Around Inserts
Phenolic: General Purpose	10	3	3	7	1	6	3	4	1	4	2	3	2	8	5	10	7	4	2
Phenolic Low-Loss	11	3	7	7	1	3	4	4	1	2	3	1	7	12	3	4	3	3	2
Phenolic, Heat-Resistant	9	4	8	7	1	3	4	4	1	1	1	1	7	13	2		8	8	2
Phenolic: Acid and Alkali-Resistant	10	5	8	7	1	4	2	3	1	5	3	2	2	5	4			7	3
Phenolic: Shock-Resistant	2	1	5	7	1	7	4	5	1	6	3	4	3	10	5		9	8	1
Phenolic: Transparent	7	1	3	7	1	4	3	3	1	5	3	2	2	6	4	7	5	6	3
Urea	8	1	1	1	2	9	4	4	1	7	7	5	5	11	1	9	4	2	4
Polystyrene	7	2	7	4	4	1	1	1	3	3	6	6	1	1	6	1	1	1	6
Cellulose-Acetate	4	6	9	3	8	11	4	6	3	9	5	6	4	7	9	8	6	5	5
Aceto-Butyrate	1	5	10	3	6	8	4	4	3	8	4	6	6	4	8	3			5
Ethyl-Cellulose	3	2	6	6	7	10	4	2	3	8	5	6	4	2	8	2	2	1	5
Methyl-Methacrylate	6	1	4	2	5	5	2	2	3	8	9	6	2	3	7	5		2	6
Vinyl (No Filler)	5	1	2	4	3	1	1	1	2	3	8	4	2	9	7	6	2	1	5

PHYSICAL PROPERTIES OF NATURAL AND SYNTHETIC RUBBER STOCKS

Compiled by I. B. Prettyman

This table was compiled, for the most part, from the literature. Every effort has been made to give values for stocks of comparable formulation and vulcanization for any one property. It was manifestly impossible to do so between properties. Furthermore, the polymers themselves varied in the proportions of base materials and in the methods of preparation, often in an undisclosed manner. Finally, it is to be realized that changes are constantly being made, both in the polymers and in the stock formulations, and that often variations may be effected for the purpose of enhancing one or more of the specific properties, as desired.

Type of polymer	Natural rubber (Hevea)	Butadiene-styrene copolymer	Butadiene-acrylonitrile copolymer	Polychloroprene (neoprene)	Isobutylene-diolefin copolymer (butyl)	Alkylene polysulfide
RAW POLYMER						
Specific gravity, 25°C	0.92	0.94	1.00	1.25	0.91	1.35
Heat capacity, 25°C (Int. joules × gm^{-1} × $°C^{-1}$)	1.88	1.97	1.97	....	....	....
VULCANIZED PURE GUM TYPE COMPOUND						
D.-C. resistivity, 25°C (ohm × cm)	10^{17}	10^{15}	10^{10}	10^{11}	10^{17}	10^{13}
Dielectric constant, 1 kc/sec., 25°C	2.7	2.9	13	9	2.4	6
Power factor, 1 kc/sec., 25°C (%)	0.23	0.32	5.5	3	0.30	
Permeability to gas (cc at NTP/cm^2/cm thickness/sec/cm Hg)						
Hydrogen	47×10^{-10}	11×10^{-10}	20×10^{-10}	12×10^{-10}	....	4×10^{-10}
Air	11×10^{-10}	....	....	....	1×10^{-10}	....
VULCANIZED CARBON BLACK TYPE COMPOUND						
Tensile strength based on original section, 25°C (kg × cm^{-2})	315	230	280	245	210	110
Elongation at break, 25°C (%)	600	580	580	580	640	600
Stress at 300% elongation based on original section, 25°C (kg × cm^{-2})	120	120	135	125	55	70

PHYSICAL PROPERTIES OF NATURAL AND SYNTHETIC RUBBER STOCKS (Continued)

Type of polymer	Natural rubber (Hevea)	Butadiene-styrene copolymer	Butadiene-acrylonitrile copolymer	Polychloroprene (neoprene)	Isobutylene-*diolefin* copolymer (butyl)	Alkylene *polysulfide*
Static shear modulus (shear strain in 0.01 to 0.05 range) (megadynes $\times$ cm^{-2})						
30°C	18	25	15	14	18	....
100°C	13	10	10	11	9	....
Dynamic shear modulus at 60 cycles/sec (shear strain in 0.05 to 0.15 range)(megadynes $\times$ cm^{-2})						
30°C	24	54	27	27	35	....
100°C	14	17	13	18	13	....
Hysteresis index (frequency $\times$ internal friction) measured in shear at 60 cycles/sec (shear strain in 0.05 to 0.15 range)(megagm $\times$ cm^{-1} $\times$ sec^{-2})						
30°C	3.0	8.8	5.1	5.0	4.6	....
100°C	1.1	3.0	1.5	2.0	2.0	....
Ball rebound (1.9 cm steel ball dropped 100 cm on sample 1.9 cm thick) (%)						
−20°C	12	13	13	8	15	....
20°C	45	37	33	35	9	....
100°C	71	47	63	67	50	....
Compression set (A.S.T.M. method B, 30% constant deflection 22 hr. at 70°C) (%)	35	42	27	49	38	80
Stress relaxation (time for 0.076 cm thick sample to relax to 60% of 10 sec. stress value, 50% elong., 100°C) (hr)	3.7	14	16	1.5	5	....
Tear resistance (Crescent test) (kg $\times$ cm^{-1})	125	55	50	75	75	50
Weather exposure cracking (elongated) (rating)	4	5	3	0	0	0

PHYSICAL PROPERTIES OF NATURAL AND SYNTHETIC RUBBER STOCKS (Continued)

Type of polymer	Natural rubber (Hevea)	Butadiene-styrene copolymer	Butadiene-acrylonitrile copolymer	Polychloroprene (neoprene)	Isobutylene-diolefin copolymer (butyl)	Alkylene polysulfide
Swelling in solvents, volume in 7 days (%)						
Gasoline 25°C	150	100	15	20	300	1
Benzene 25°C	190	210	160	150	150	90
Mineral oil 70°C	130	70	1	10	200	0
Water 70°C	3	2	3	3	....	12
Cold stiffening index (temp. to reach bending modulus of 700 kg × cm^{-2}, 20 min. exposure) (°C)	−47*	−40	−30	−37*	−40	−40*
Cold brittle point (Bell Lab. impact type test) (°C)	−54	−60	−38	−40	−40	−37
Volume compressibility (pressure of 300 kg × cm^{-2}) (bar^{-1})	37×10^{-6}	36×10^{-6}	33×10^{-6}	31×10^{-6}	....	....
Thermal diffusivity (25°C to 100°C) ($cm^2 \times sec^{-1}$)	.0010	.0012	.0012	.0012	....	....
Thermal conductivity (25°C to 100°C) ($cal \times sec^{-1} \times cm^{-1} \times °C^{-1}$)	.00039	.00046	.00049	.00046	....	....

* Modulus of 700 kg × cm^{-2} may be reached at higher temperatures upon extended exposure.

PHYSICAL PROPERTIES OF COMMON WOODS

Values of density marked * are for air dry samples.

Common name	Botanical name	Density, oven-dry g/cm³	Density, oven-dry lbs./ft.³	Modulus of rupture, air dry kg/mm²	Modulus of elasticity, air dry kg/mm²
Applewood or wild apple	*Pyrus malus*	0 745	46 51	8 96	894
Ash, black	*Fraxinus nigra*	0 526	32 84	8 97	1126.
Ash, blue	*Fraxinus quadrangulata*	0 603	37 65	9.82	984.
Ash, green	*Fraxinus pennsylvanica lanceolata*	0 610	38 08	10 04	1170
Ash, white	*Fraxinus americana*	0 638	39 83	11 01	1249
Aspen	*Populus tremuloides*	0 401	25 03	6 04	838
Aspen, large tooth	*Populus grandidentata*	0 412	25 72	6 38	996.
Balsa (Tropical America)	*Ochroma*	*0 12–0 20	7 49–12 49		
Basswood	*Tilia glabra or Tilia americanus*	0 398	24 85	6 13	1029.
Beech	*Fagus grandifolia or Fagus americana*	0 655	40 89	10 25	1180
Beech, blue	*Carpinus caroliniana*	0 717	44 76	8 48	752
Birch, gray	*Betula populifolia*	0 552	34 46	6 88	797
Birch, paper	*Betula papyrifera*	0 600	37 46	8 79	1119
Birch, sweet	*Betula lenta*	0 714	44 58	11 81	1520.
Birch, yellow	*Betula lutea*	0 668	41 70	11 88	1482.
Buckeye, yellow	*Aesculus octandra*	0 383	23 91	5 36	829
Butternut	*Juglans cinerea*	0 404	25 22	5 72	830
Cedar, eastern red	*Juniperus virginiana*	0 492	30 72	6 07	612
Cedar, northern white	*Thuja occidentalis*	0 315	19 67	4 56	568.
Cedar, southern white	*Chamaecyparis thyoides*	0 352	21 98	4 77	655.
Cedar, (Tropical American)	*Cedrela odorata*	*0 37 0 70	23 10–43 70		
Cedar, western red	*Thuja plicata*	0 344	21 48	5 38	819.
Cherry, black	*Prunus serotina*	0 534	33 34	8 81	1046.
Cherry, wild red	*Prunus pennsylvanica*	0 425	26 53	6 10	892
Chestnut	*Castanea dentata*	0 454	28 34	6 16	870.
Corkwood	*Leitneria floridana*	0 207	12 92		
Cottonwood, eastern	*Populus deltoides*	0 433	27 03	6 14	972.

PHYSICAL PROPERTIES OF COMMON WOODS

Values of density marked * are for air dry samples.

Common name	Botanical name	Density, oven-dry g/cm³	Density, oven-dry lbs./ft.³	Modulus of rupture, air dry kg/mm²	Modulus of elasticity, air dry kg/mm²
Cypress, southern	*Taxodium distichum*	0.482	30 09	7 44	1010.
Dogwood (flowering)	*Cornus florida*	0 796	49 69	10 72	1085.
Douglas fir (coast type)	*Pseudotsuga taxifolia*	0 512	31 96	8 44	1357.
Douglas fir (mountain type)	*Pseudotsuga taxifolia*	0 446	27 84	6 72	981
Ebony, Andaman marble-wood (India)	*Diospyros kurzii*	*0 978	61 06	7 80	1270.
Ebony, Ebène marbre (Mauritius, E. Africa)	*Diospyros melanida*	*0 768	47 95	5 55	1007.
Elm, American	*Ulmus americana*	0 554	34 59	8 44	948.
Elm, rock	*Ulmus racemosa* or *Ulmus thomasi*	0 658	41 08	10 55	1086.
Elm, slippery	*Ulmus fulva* or *pubescens*	0 568	35 46	9 29	1050.
Eucalyptus, Karri (W. Australia)	*Eucalyptus diversicolor*	*0 829	51 75	12 16	1885.
Eucalyptus, Mahogany (New South Wales)	*Eucalyptus hemilampra*	*1 058	66 05	11 50	1608.
Eucalyptus, West Australian mahogany	*Eucalyptus marginata*	*0 787	49 13	10 54	1462.
Fir, balsam	*Abies balsamea*	0 414	25 85	5 42	879.
Fir, Douglas (See Douglas Fir)					
Fir, silver	*Abies amabilis*	0 415	25 91	6.69	1076.
Greenheart (British Guiana)	*Nectandra rodioei*	*1 06-1.23	66.18-76 79		
Gum, black	*Nyssa sylvatica*	0 552	34 46	6 82	839.
Gum, blue	*Eucalyptus globulus*	0 796	49 69	11.75	1683.
Gum, red	*Liquidambar styraciflua*	0 530	33 09	8 40	1045.
Gum, tupelo	*Nyssa aquatica*	0 524	32 71	6 85	889.
Hemlock, eastern	*Tsuga canadensis*	0 431	26 91	6.06	846.
Hemlock, mountain	*Tsuga martensiana*	0.480	29.97	6 95	797.
Hemlock, western	*Tsuga heterophylla*	0 432	26 97	6 51	1015.
Hickory, bigleaf shagbark	*Hicoria laciniosa*		50.53	12 91	1335.

PHYSICAL PROPERTIES OF COMMON WOODS

Values of density marked * are for air dry samples.

Common name	Botanical name	Density, oven-dry		Modulus of rupture, air dry kg/mm²	Modulus of elasticity, air dry kg/mm²
		g/cm³	lbs./ft.³		
Hickory, mockernut	*Hicoria alba*		51 21	13 56	1570
Hickory, pignut	*Hicoria glabra*		51 21	14 25	1603
Hickory, shagbark	*Hicoria ovata*		52 17	14 39	1525.
Hornbeam	*Ostrya virginiana*	0 762	47 57	10 22	1199
Ironwood, black	*Rhamnidium ferreum*	1 077	67 24	18.10	2100.
Jacarandá, Brazilian rosewood	*Dalbergia nigra*	*0 85	53 07		
Larch, western	*Larix occidentalis*	0 587	36 65	8 24	1188
Locust, black or yellow	*Robinia pseudacacia*	0 708	44 20	13 63	1448
Locust, honey	*Gleditsia triacanthos*	0 666	41 58	10 59	1165
Magnolia, cucumber	*Magnolia acuminata*	0 516	32 21	8 91	1276
Mahogany (W. Africa)	*Khaya ivorensis*	*0 668	41 70	<12 38	1079.
Mahogany (E. India)	*Swietenia macrophylla*	*0 54	33 71	6 73	817.
Mahogany (E. India)	*Swietenia mahogani*	*0 54	33 71	7 10	890
Maple, black	*Acer nigrum*	0 620	38 71	9 37	1141
Maple, red	*Acer rubrum*	0 546	34 09	9 35	1155
Maple, silver	*Acer saccharinum*	0 506	31 59	6 34	805.
Maple, sugar	*Acer saccharum*	0 676	42 20	10 97	1290
Oak, black	*Quercus velutina*	0 669	41 77	9 66	1153
Oak, bur	*Quercus macrocarpa*	0 671	41 89	7 21	723
Oak, canyon live	*Quercus chrysolepis*	0 838	52 32	9 26	1149.
Oak, chestnut	*Quercus montana*	0 674	42 08	9 45	1114
Oak, laurel	*Quercus laurifolia*	0 703	43 89	8 98	1182.
Oak, live	*Quercus virginiana*	0 977	60 99	12 95	1381.
Oak, pin	*Quercus palustris*	0 677	42 27		
Oak, post	*Quercus stellata or Quercus minor*	0 738	46 07	9 30	1063
Oak, red	*Quercus borealis*	0 657	41 02	10 02	1274.
Oak, scarlet	*Quercus coccinea*	0 709	44 26		
Oak, swamp chestnut	*Quercus prinus*	0 756	47 20	9 73	1247.

PHYSICAL PROPERTIES OF COMMON WOODS

Values of density marked * are for air dry samples.

Common name	Botanical name	Density, oven-dry		Modulus of rupture, air dry kg/mm²	Modulus of elasticity, air dry kg/mm²
		g/cm³	lbs./ft.³		
Oak, swamp white	*Quercus bicolor or Quercus platanoides*	0 792	49 44	12 36	1446
Oak, white	*Quercus alba*	0 710	44 33	10 68	1251
Persimmon	*Diospyros virginiana*	0 776	48 45	12 72	1443.
Pine, eastern white	*Pinus strobus*	0 373	23 29	6 26	898
Pine, jack	*Pinus banksiana or Pinus divaricata*	0 461	28 78	5 70	868
Pine, loblolly	*Pinus taeda*	0.593	37 02	9 09	1354
Pine, longleaf	*Pinus palustris*	0 638	39 83	10 90	1445.
Pine, pitch	*Pinus rigida*	0 542	33 84	7 40	965.
Pine, red	*Pinus resinosa*	0 507	31 65	8 81	1264.
Pine, shortleaf	*Pinus echinata*	0 584	36 45	9 34	1345
Poplar, balsam	*Populus balsamifera or Populus candicans*	0 331	20 66	4 76	716.
Poplar, yellow	*Liriodendron tulipifera*	0 427	26 66	6 52	1058
Redwood	*Sequoia sempervirens*	0 436	27 22	7 56	958.
Sassafras	*Sassafras variafolium*	0 473	29 53	6 43	790.
Satinwood (Ceylon)	*Chloroxylon swietenia*	*1 031	64 37	9 68	1101.
Sourwood	*Oxydendrum arboreum*	0 593	37 02	8 24	1083
Spruce, black	*Picea mariana*	0 428	26 72	7 24	1069
Spruce, red	*Picea rubra or Picea rubens*	0 413	25 78	7 15	1071.
Spruce, white	*Picea glauca*	0 431	26 91	6 38	1001.
Sycamore	*Platanus occidentalis*	0 539	33 65	7 12	1002.
Tamarack	*Larix laricina or Larix americana*	0 558	34 84	8 23	1154.
Teak (India)	*Tectona grandis*	*0 582	36 33	9 04	1195.
Walnut, black	*Juglans nigra*	0 562	35 09	10 42	1185.
Willow, black	*Salix nigra*	0.408	25 47	4 42	513.

PHYSICAL PROPERTIES OF PIGMENTS

Rutherford J. Gettens

Trial Data on Painting Materials—Pigments and Inert Materials
Technical Studies, **VIII**, 1939

Pigment Name and Chemical Composition[1]	Specific Gravity[2]	Particle Characteristics[3]	Refractive Index[4]
Aluminum hydrate, $Al(OH)_3$	2 45	v. fine amorph part.	n_Σ *c* 1.50–1.56 [M*]
Aluminum stearate, $Al(C_{18}H_{35}O_2)_3$	0 99	agg. of spher. gr.	1.49 (w. bi.) [W]
Anhydrite, $CaSO_4$	2.93	cryst. frag.	α1.570, γ1.614, β1.575 [LB]
Antimony oxide, Sb_2O_3	5 75	v. fine cryst.	{ valentinite, α2.18, γ and β 2.35 / senarmonite, 2 09 (isot.) } [LB,M*]
Antimony vermilion, Sb_2S_3	..	v. fine red glob.	n_{Li} 2.65 (isot.) [M*]
Asphaltum (bitumen), carbonaceous	.	irr. amorph. part.	1.64–1.66 [M*]
Azurite, $2CuCO_3.Cu(OH)_2$	3 80	cryst frag.	α1.730, γ1.838, β1.758 [LB]
Barytes (barite, nat.) $BaSO_4$	4 45	cryst. frag.	α1.636, γ1.648, β1.637 [LB]
(blanc fixe, art.), $BaSO_4$	4 36	v. fine cryst. agg.	1.62–1.64 [M*]
Barium yellow, $BaCrO_4$	4 49	v. fine cryst. gr.	1.94–1.98 (bi.) [M]
Blue verditer, $2CuCO_3.Cu(OH)_2$		fibrous agg.	α_Σ1.72, γ_Σ slightly > 1.74 [M*]
Bone black C + $Ca_3(PO_4)_2$	2 29	irr. coarse lumps	1.65–1.70 (for larger translucent gr) [M]
Cadmium red, CdS (Se)	4 5	min. round. gr.	2.64 (bright red)–2.77 (deep red) (isot.) [M*]
Cadmium red lithophone, CdS(Se) + $BaSO_4$	4 30	min. round. gr.	2.50–2.76 (for CdS (Se) part) (isot.) [M*]
Cadmium yellow, CdS	4 35	min. round. gr.	2.35–2.48 (isot.) [M*]
Cadmium yellow lithophone, CdS + $BaSO_4$	4 25	fine comp. gr.	2.39–2.40 (for CdS part) [M*]
Cerulean blue, $CoO.nSnO_2$		round. gr.	1.84 (isot.) [M*]
Chalk (whiting), $CaCO_3$	2 70	hollow spherulites	ϵ_Σ *c* 1.510, ω_Σ *c* 1.645 [M*]
Charcoal black, C		irr splintery part	(opaque)
China clay (kaolinite), $Al_2O_3.2SiO_2.2H_2O$	2 60	fine, vermicular cryst	α1.558, γ1 565, β1.564 (all ± .005) [LB,M*]
Chrome green (med.) $Fe_4[Fe(CN)_6]_3$ + $PbCrO_4$	4 06	fine green agg.	*c* 2.4 (cf. Prussian blue and chrome yellow) [M*]
Chrome red, $PbCrO_4.Pb(OH)_2$	6 7	tabular cryst.	α2.42, γ2 7+, β2 7 [M]
Chrome yellow (med.) $PbCrO_4$	5.96	fine prism. gr.	$\alpha_{620m\mu}$ < 2.31, $\gamma_{650m\mu}$ 2.49 [M]
Chromium oxide green, opaque, Cr_2O_3	5.10	fine cryst. agg.	n_{Li} 2.5 [M]
Chrysocolla, $CuSiO_3.nH_2O$	2 4	crypt. agg.	α1.575, γ1.598, β1.597 [LB]

PHYSICAL PROPERTIES OF PIGMENTS (Continued)

Pigment Name and Chemical Composition[1]	Specific Gravity[2]	Particle Characteristics[3]	Refractive Index[4]
Cobalt blue, $CoO.Al_2O_3$	3.83	round. gr.	n var.; max. c 1.74$_{blue}$ (isot.) [M]
Cobalt green, $CoO.nZnO$	.	spher. gr.	1.94–2.0 (w. bi.) [M*]
Cobalt violet, $Co_3(PO_4)_2$		round. gr.	ϵ1.65–1.79 (dull violet), ω1.68–1.81 (salmon) (s. bi.) [M]
Cobalt yellow, $CoK_3(NO_2)_6.H_2O$	....	fine dendritic cryst.	1.72–1.76 (isot.) [W]
Diatomaceous earth, SiO_2	2.31	min. fossil forms	n mostly 1.435, some 1.40 [M*]
Egyptian blue, $CaO.CuO.4SiO_2$	....	cryst. frag.	ϵ1.605, ω1.635 [APL]
Emerald green, $Cu(C_2H_3O_2)_2.3Cu(AsO_2)_2$	3.27	spherulites and disks	α_Σ1.71, γ_Σ1.78 (w. pleo.) [M*]
Gamboge, organic resin	....	irr. amorph. part.	1.582–1.586 [W]
Graphite, C	2.36	irr. plates	(opaque) [M]
Green earth (celadonite and glauconite), Fe, Mg, Al, K, hydrosilicate	2.5–2.7	round. irr. gr.	n var. c 1.62 (porous) [M*]
Gypsum, $CaSO_4.2H_2O$	2.36	fine cryst. gr.	α1.520, γ1.530, β1.523 [LB]
Indian yellow, $C_{19}H_{16}O_{11}Mg.5H_2O$	.	prisms, plates	1.67 (w. bi.) [M*]
Iron oxide red (haematite), Fe_2O_3	5.2	min. cryst.	ϵ_{Li} 2.78, ω_{Li} 3.01 [M]
Lamp black, C	1.77	min. round. part.	(opaque)
Lithopone (regular), ZnS (28–30%), $BaSO_4$ (72–70%)	4.30	fine comp. gr.	2.3 (ZnS)–1.64 ($BaSO_4$) [M]
Malachite, $CuCO_3.Cu(OH)_2$	4.0	cryst. frag.	α1.655, γ1.909, β1.875 [LB]
Manganese blue, $BaMnO_4 + BaSO_4$	.	gr. and stubby prisms	c 1.65 [W]
Manganese violet, $(NH_4)_2Mn_2(P_2O_7)_2$	.	fine cryst. gr.	α1.67, γ1.75, β1.72, (for violet) [M]
Massicot (litharge), PbO	9.40	min. flakes	α_{Li} 2.51, γ_{Li} 2.71, β_{Li} 2.61 [M]
Mayan blue, Fe, Mg, Ca, Al, silicate (?)	..	porous irr. agg.	β_Σ1.54 (irr.; bi. and pleo.) [M*]
Mica (muscovite), $H_2KAl_3(SiO_4)_3$	2.89	platy frag.	α1.563, γ1.604, β1.599 [LB]
Molybdate orange, Pb(Mo, S, Cr, P)O_4	...	min. round. gr.	β_{Li} 2.55 (s. bi.) [M*]
Naples yellow, $Pb_3(SbO_4)_2$	....	round. gr.	2.01–2.28 (isot.) [M*]
Ochre, yellow (goethite), $Fe_2O_3.H_2O$, clay, etc.	2.9–4.0	irr. spherulites	n_Σ2.0 (isot. part); $(\alpha\beta)_\Sigma$2.05–2.31, γ_Σ2.08–2.40 (bi. part) [M*]
Orpiment, As_2S_3	3.4	min. flakes	α_{Li} 2.4 ±, γ_{Li} 3.02, β_{Li} 2.81 [LB]
Prussian blue, $Fe_4[Fe(CN)_6]_3$	1.83	colloidal agg.	1.56$_{460m\mu}$ [M*]
Pumice (volcanic glass), Na, K, Al, silicate		vesicular vitr. frag.	c 1.50 (isot.) [M*]

PHYSICAL PROPERTIES OF PIGMENTS (Continued)

Pigment Name and Chemical Composition[1]	Specific Gravity[2]	Particle Characteristics[3]	Refractive Index[4]
Realgar, As_2S_2	3 56	cryst. frag.	α_L, 2.46 γ_L, 2.61 β_L, 2.59 [LB]
Red lead, Pb_3O_4 (c 95%)	8 73	crypt. agg.	2.42_L, (w. bi.; pleo.) [M]
Sepia, organic		angular frag.	(opaque) [M*]
Sienna, burnt, Fe_2O_3, clay, etc.	3 56	uneven, round. part.	c 1.85 (var.) (isot.) [M]
Sienna, raw (goethite), $Fe_2O_3.H_2O$, clay, etc.	3 14	uneven sperulites	1.87–2.17 (mostly 2.06) (isot) [M*]
Silica (quartz), SiO_2	2 66	cryst. frag.	ϵ1.553, ω1.544 [LB]
(chalcedony), SiO_2	2 6	crypt. agg.	ϵ, ω 1.54 [LB, M*]
Smalt, K, Co(Al), silicate (glass)		splintery vitr. frag.	1.49–1.52 [M*]
Strontium yellow, $SrCrO_4$		small needles	α, β (or ω) 1.92, γ (or ϵ) 2,01 (‖ ext.) [M*]
Talc, $3MgO.4SiO_2.H_2O$	2 77	platy frag.	α1.539, γ1.589, β1.589 [LB]
Titanium barium white, TiO_2 (25%) + $BaSO_4$ (75%)	4 30	min. round. gr.	$n_\Sigma c$ 1.7–2 5 [M*]
Titanium calcium white, TiO_2 (25%) + $CaSO_4$ (75%)	3 10	prism. or ragged gr.	mostly 1.8–2.0 (irr.) (bi.) [M*]
Titanium dioxide (anatase), TiO_2	3 9	min. round. gr.	ϵ and ω2.5 (w. bi) [M*]
(rutile), TiO_2	4 2	round, or prism. gr.	ϵ2.9, ω2.6 [M*]
Ultramarine blue (art.), $Na_{8-10}Al_6Si_6O_{24}S_{2-4}$	2 34	uniform small round. gr	n 1.51_{green}, 1.63_{red} (isot.) [M]
(nat., lazurite), $3Na_2O.3Al_2O_3.6SiO_2.2Na_2S$	2 4	angular, broken frag.	1.50 ± (isot.) [LB]
Ultramarine violet		round, gr, (blue, rose, and violet)	c 1.56 (isot.) [M*]
Umber, burnt, Fe_2O_3 + MnO_2, clay, etc.	3 64	uneven, round. gr.	mostly 2.2–2.3 [M*]
Umber, raw, Fe_2O_3 + MnO_2 + H_2O, clay, etc.	3 20	uneven, round. gr.	mostly 1.87–2.17 [M*]
Van Dyke brown, bituminous earth	1 66	irr. amorph. part.	1.62–1.69 [M*]
Verdigris (copper basic acetate) $Cu(C_2H_3O_2)_2$.-$2Cu(OH)_2$		cryst. frag.	α1.53, γ1.56 [M]
Vermilion (art.), HgS	8 09	hexagonal gr. and pr.	ϵ_L, 3.14, ω_L, 2.81 [M]
(nat., cinnabar), HgS	8 1	cryst. frag.	ϵ_L, 3.146, ω_L, 2.819 [LB]
Viridian (chromium oxide, transparent), Cr_2O_3.-$2H_2O$	3 32	spherul. gr.	α, β_Σ1.82, γ_Σ2.12 [M*]
White lead (basic carbonate), $2PbCO_3.Pb(OH)_2$	6 70	v. fine cryst.	ϵ1.94, ω2.09 [M]
Zinc white (ordinary), ZnO	5 65	v. fine cryst gr.	ϵ2.02, ω2.00 [M]
(acicular), ZnO	...	spicules, fourlets	ϵ2 02, ω2.00 [M]
Zinc yellow, $ZnCrO_4$	3 46	min. spher. gr.	1.84–1.9 (irr.; bi.) [M*]

*

PHYSICAL PROPERTIES OF PIGMENTS (Continued)

[1] Abbreviations: art. = artificial; med. = medium; nat. = natural. The chemical formulas are those commonly accepted in chemical and mineralogical literature, but they may not compare exactly with structural formulas based on X-ray diffraction data or even on critical chemical analysis.

[2] The figures for specific gravity of the artificial pigments are mainly from H. A. Gardner, and those on the mineral pigments are chiefly from E. S. Larsen and H. Berman.

[3] Symmetry terms (monoclinic, orthorhombic, etc.) are omitted because pigments are so finely divided that it is rare when observations on crystal symmetry can be made. The term, "spherulitic," as used here means aggregates that tend toward radial structure and spherical shape. "Amorphous" describes materials that are microscopically formless but may be truly crystalline on the basis of X-ray diffraction data. Abbreviations: agg. = aggregate(s); amorph. = amorphous; comp. = composite; crypt. = cryptocrystalline; cryst = crystal(s); frag. = fragment(s); glob. = globule(s); gr. = grain(s); irr. = irregular; min. = minute, part = particle(s); prism. = prismatic; round. = rounded; spher. = spheroidal; spherul. = spherulitic; var. = variable; v = very; vitr. = vitreous.

[4] Unless otherwise indicated, all refractive index measurements are by sodium light. Σ is the symbol used by H. E. Merwin to indicate greater or less indefiniteness or irregularity in the case of aggregates, especially in respect to refractive index. Abbreviations: bi = birefringent; *c* = *circa;* ext. = extinction; isot. = isotropic; $\|$ = parallel; pleo. = pleochroic; s. = strongly; w. = weakly. The letters in brackets refer to the authorities for the refractive index data; M = H. E. Merwin; M* = H. E. Merwin, data by private communication, hitherto unpublished; W = C. D. West, data by private communication, hitherto unpublished; LB = E. S. Larsen and H. Berman; APL = A. P. Laurie and co-authors.

*

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ

Common Name	Chemical Name	Formula
Acetic ether	Ethyl acetate	$CH_3CO_2C_2H_5$
Acid of sugar	Oxalic acid	$(CO_2H)_2$
Aldehyde	Acetaldehyde	CH_3CHO
Alum Alum flour Alum meal	Generally refers to potassium aluminum sulfate	$K_2Al_2(SO_4)_4 \cdot 24H_2O$
Alumina	Aluminum oxide	Al_2O_3
Alumino-ferric	A mixture of aluminum and sodium sulfates	....
Alundum	Fused alumina	Al_2O_3
Aniline	Phenyl amine	$C_6H_5NH_2$
Aniline salt	Aniline hydrochloride	$C_6H_5NH_2 \cdot HCl$
Antichlor	Sodium thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$
Antifebrin	Acetanilide	$C_6H_5NHCOCH_3$
Antimony bloom	Antimony trioxide	Sb_2O_3
Antimony black Antimony glance	Antimony trisulfide	Sb_2S_3
Antimony red Antimony vermilion	Antimonous oxysulfide	$Sb_2S_3 + Sb_2O_3$
Antimony white	Antimonous oxide	Sb_2O_3
Antimony yellow	Basic lead antimonate	$PbO\ Sb_2O_5$
Aqua fortis	Nitric acid	HNO_3
Aqua regia	Nitric acid and hydrochloric acid	$HNO_3 + 3HCl$
Argol	Crude potassium acid tartrate	$KHC_4H_4O_6$
Arsenic glass	Arsenous oxide	As_2O_3
Aspirin	Acetyl-salicylic acid	$C_6H_4(CO_2H)(OCOCH_3)$
Azurite	Basic copper carbonate	$2CuCO_3 \cdot Cu(OH)_2$
Bakelite	Resin from phenol + formaldehyde	....
Baking soda	Sodium bicarbonate	$NaHCO_3$
Barium white	Barium sulfate	$BaSO_4$
Baryta	Barium oxide	BaO
Barytes	Barium sulfate (natural)	$BaSO_4$
Bauxite	Hydrated alumina	$Al_2O_3 \cdot 2H_2O$
Beet sugar	Sucrose	$C_{12}H_{22}O_{11}$
Bentonite	Impure aluminum silicate	....
Benzine	Gasoline, petrol	....
Benzol	Benzene	C_6H_6
Bichrome	Potassium dichromate	$K_2Cr_2O_7$
Bitter salt	Magnesium sulfate	$MgSO_4 \cdot 7H_2O$
Black ash	Impure sodium carbonate	....
Blanc-fixe	Barium sulfate (artificial)	$BaSO_4$
Bleaching powder	Calcium chloro-hypochlorite	$CaOCl_2$
Blende	Natural zinc sulfide	ZnS
Blue copperas Blue stone Blue vitriol	Copper sulfate	$CuSO_4 \cdot 5H_2O$
Blue salts	Nickel sulfate	$NiSO_4 \cdot 7H_2O$
Blue verditer	Basic copper carbonate	$2CuCO_3 \cdot Cu(OH)_2$
Bone ash	Impure calcium phosphate	....
Bone black	Crude animal charcoal	C
Boracic acid	Boric acid	H_3BO_3
Borax	Sodium tetraborate	$Na_2B_4O_7 \cdot 10H_2O$
Bremen blue	Basic copper carbonate	$xCuCO_3 \cdot yCu(OH)_2$
Brimstone	Sulfur	S

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Burnt alum	Anhydrous potassium aluminum sulfate	$K_2Al_2(SO_4)_4$
Burnt lime	Calcium oxide	CaO
Burnt ochre; Burnt ore	Ferric oxide	Fe_2O_3
"Butter of"	Refers to the chloride	....
Cadmium yellow	Cadmium sulfide	CdS
Calamine	Zinc silicate	$2ZnO{\cdot}SiO_2{\cdot}H_2O$
Calcite	Mineral calcium carbonate	$CaCO_3$
Caliche	Impure sodium nitrate	$NaNO_3$
Calomel	Mercurous chloride	$HgCl$
Camphor, artificial	Pinene hydrochloride	$C_{10}H_{17}Cl$
Cane sugar	Sucrose	$C_{12}H_{22}O_{11}$
Carbolic acid	Phenol	C_6H_5OH
Carbonic acid; Carbonic anhydride	Carbon dioxide	CO_2
Carborundum	Silicon carbide	SiC
Carnallite	Magnesium potassium chloride	$MgCl_2\ KCl{\cdot}6H_2O$
"Caustic"	Refers to the hydroxide of a metal	....
Ceruse	Basic lead carbonate	$2PbCO_3{\cdot}Pb(OH)_2$
Chalk	Calcium carbonate	$CaCO_3$
Chili niter; Chili saltpeter	Sodium nitrate	$NaNO_3$
China clay	Aluminum silicate	$Al_2O_3{\cdot}2SiO_2{\cdot}2H_2O$
Chinese red	Basic lead chromate	$PbCrO_4{\cdot}PbO$
Chinese white	Zinc oxide	ZnO
Chloramine T	Sodium p-toluene-sulfochloramide	$(CH_3C_6H_4SO_2NCl\text{-}Na){\cdot}3H_2O$
Chloride of lime	Calcium chloro-hypochlorite	$CaOCl_2$
Chloride of soda	Sodium hypochlorite solution	$NaOCl$
Chrome alum	Potassium chromium sulfate	$K_2Cr_2(SO_4)_4{\cdot}24H_2O$
Chrome green	Chromium oxide	Cr_2O_3
Chrome red	Basic lead chromate	$PbCrO_4{\cdot}PbO$
Chrome yellow	Lead chromate	$PbCrO_4$
Chromic acid	Chromium trioxide	CrO_3
Cinnabar	Mercuric sulfide	HgS
Cobalt black	Cobalt oxide	CoO
Cobalt green	Cobalt zincate	$CoZnO_2$
Common salt	Sodium chloride	$NaCl$
Copperas	Ferrous sulfate	$FeSO_4{\cdot}7H_2O$
Corn sugar	Glucose	$C_6H_{12}O_6{\cdot}H_2O$
Corrosive sublimate	Mercuric chloride	$HgCl_2$
Corundum	Aluminum oxide	Al_2O_3
Cream of tartar	Potassium hydrogen tartrate	$KHC_4H_4O_6$
Cresylic acid	Mixture of *o*, *m*, and *p*-cresol	$CH_3C_6H_4OH$
Cupferron	Nitrosophenylhydroxylamine	$C_6H_5N(NO)OH$
Dekaline	Decahydronaphthalene	$C_{10}H_{18}$
Derby red	Basic lead chromate	$PbO{\cdot}PbCrO_4$
Derinatol	Basic bismuth gallate	$Bi(OH)_2{\cdot}C_7H_5O_5$
Dextrose	Glucose	$C_6H_{12}O_6{\cdot}H_2O$
Dutch liquid	Ethylene chloride	$(CH_2Cl)_2$

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Eau-de-Javelle	Potassium hypochlorite solution	$KOCl$
Eau-de-Labarraque	Sodium hypochlorite solution	$NaOCl$
Emerald green	Copper aceto-arsenite	$Cu(C_2H_3O_2)_2 \cdot 3Cu\text{-}As_2O_4$
Emery powder	Impure aluminum oxide	Al_2O_3
Epsom salts	Magnesium sulfate	$MgSO_4 \cdot 7H_2O$
Essence of bitter almonds	Benzaldehyde	C_6H_5CHO
Essence of mirbane	Nitrobenzene	$C_6H_5NO_2$
Everitt's salt	Potassium ferrous ferrocyanide	$K_2Fe_2(CN)_6$
Feldspar	Potassium aluminum silicate	$K_2Si_3O_7 \cdot Al_2Si_3O_9$
Ferro prussiate	Potassium ferrocyanide	$K_4Fe(CN)_6$
Fixed white	Barium sulfate	$BaSO_4$
Flowers of sulfur	Sulfur	S
"Flowers of" a metal is a	synonym for the oxide	
Fluorspar	Calcium fluoride	CaF_2
Formalin	Forty per cent solution of formaldehyde in water	$HCHO$
Formin	Hexamethylene tetramine	$(CH_2)_6N_4$
Freezing salt	Crude sodium chloride	$NaCl$
French chalk	Hydrated silicate of magnesium	$Mg_3Si_4O_{11} \cdot H_2O$
French verdigris	Basic copper acetate	$Cu_2(C_2H_3O_2)_3(OH)_2$
Fruit sugar	Fructose	$C_6H_{12}O_6$
Fuller's earth	Hydrated magnesium and aluminum silicates	....
Fulminate of mercury	Mercuric fulminate	$Hg(ONC)_2$
Fusel oil	Mixed amyl alcohols	$C_5H_{11}OH$
Gasoline	Benzine, petrol	....
Galena	Natural lead sulfide	PbS
Glauber's salt	Sodium sulfate	$Na_2SO_4 \cdot 10H_2O$
Glucose	Dextrose	$C_6H_{12}O_6 \cdot H_2O$
Glycerin	Glycerol	$C_3H_5(OH)_3$
Grain alcohol	Ethyl alcohol	C_2H_5OH
Grape sugar	Glucose	$C_6H_{12}O_6 \cdot H_2O$
Green verditer	Basic copper carbonate	$CuCO_3 \cdot Cu(OH)_2$
Green vitriol	Ferrous sulfate	$FeSO_4 \cdot 7H_2O$
Gypsum	Calcium sulfate	$CaSO_4 \cdot 2H_2O$
Hartshorn salt	Ammonium carbonate carbamate	$NH_4HCO_3 \cdot NH_4CO_2\text{-}NH_2$
Heavy spar	Barium sulfate	$BaSO_4$
Hexamine	Hexamethylene tetramine	$(CH_2)_6N_4$
Horn silver	Silver chloride	$AgCl$
Hydrosulfite	Sodium hyposulfite	$Na_2S_2O_4$
Hypo	Sodium thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$
Iron black	Precipitated antimony	Sb
Indian red	Ferric oxide	Fe_2O_3
Iron mordant	Ferric sulfate	$Fe_2(SO_4)_3$
Kainit	Double salt of potassium magnesium sulfate and magnesium chloride	$K_2Mg(SO_4)_2 \cdot MgCl_2\text{-}6H_2O$
Kaolin	Aluminum silicate	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$
Kieselguhr	Siliceous earth	SiO_2
Kieserite	Mineral magnesium sulfate	$MgSO_4$
King's yellow	Arsenous sulfide	As_2S_3
Lampblack	Impure carbon	C

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Lanolin	Cholesterol	$C_{27}H_{46}O$
Laughing gas	Nitrous oxide	N_2O
Lemon chrome	Barium chromate	$BaCrO_4$
Levulose	Fructose	$C_6H_{12}O_6$
Lime	Calcium oxide	CaO
Litharge	Lead monoxide	PbO
Lithopone	Zinc sulfide + barium sulfate	$ZnS + BaSO_4$
Liver of sulfur	Mixed potassium sulfides	....
Lunar caustic	Silver nitrate	$AgNO_3$
Lysol	Cresol soap solution	....
Magnesia	Magnesium oxide	MgO
Magnesite	Magnesium carbonate	$MgCO_3$
Malachite	Basic copper carbonate	$CuCO_3 \cdot Cu(OH)_2$
Manganese black	Manganese dioxide	MnO_2
Marble	Calcium carbonate	$CaCO_3$
Marsh gas	Methane	CH_4
Massicot	Lead monoxide	PbO
Methanol	Methyl alcohol	CH_3OH
Metol	*p*-Monomethylamine-*m*-cresol sulfate or chloride	$[C_6H_3(OH)CH_3NH\text{-}CH_3]_2 \cdot H_2SO_4$
Microcosmic salt	Sodium ammonium hydrogen phosphate	$Na(NH_4)HPO_4 \cdot 4H_2O$
Milk of barium	Barium hydroxide	$Ba(OH)_2$
Milk of lime	Calcium hydroxide	$Ca(OH)_2$
Milk of magnesium	Magnesium hydroxide	$Mg(OH)_2$
Milk of sulfur	Precipitated sulfur	S
Milk sugar	Lactose	$C_{12}H_{22}O_{11} \cdot H_2O$
Minium	Lead tetroxide	Pb_3O_4
Mohr's salt	Ferrous ammonium sulfate	$Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$
Molybdenite	Molybdenum disulfide	MoS_2
"Muriate of" a metal	Chloride of the metal	....
Muriatic acid	Hydrochloric acid	HCl
Naphtha (Petroleum)	A petroleum distillate	....
Naphtha (Solvent)	A coal tar distillate	....
Natron	Sodium carbonate	$Na_2CO_3 \cdot 10H_2O$
Niter	Potassium nitrate	KNO_3
Nitro-lime	Calcium cyanamide	$CaNCN$
Nitrous ether	Ethyl nitrite	C_2H_5ONO
Nordhausen acid	Fuming sulfuric acid	$H_2SO_4 + SO_3$
Oil of bitter almond	Benzaldehyde	C_6H_5CHO
Oil of garlic	Allyl sulfide	$(C_3H_5)_2S$
Oil of mirbane	Nitrobenzene	$C_6H_5NO_2$
Oil of mustard, artificial	Allyl isothiocyanate	C_3H_5NCS
Oil of pears	Amyl acetate	$CH_3CO_2C_5H_{11}$
Oil of pineapple	Ethyl butyrate	$C_3H_7CO_2C_2H_5$
Oil of vitriol	Concentrated sulfuric acid	H_2SO_4
Oil of wintergreen, artificial	Methyl salicylate	$o\text{-}HOC_6H_4CO_2CH_3$
Oleum	Fuming sulfuric acid	$H_2SO_4 + SO_3$
Olifiant gas	Ethylene	C_2H_4
Orpiment	Arsenic trisulfide	As_2S_3
Paris blue	Ferric ferrocyanide	$Fe_4[Fe(CN)_6]_3$
Paris green	Copper aceto-arsenite	$Cu(C_2H_3O_2)_2 \cdot 3CuAs_2O_4$
Pearl ash	Potassium carbonate	K_2CO_3
Permanent white	Barium sulfate	$BaSO_4$

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Petroleum ether	Benzine	.....
Phenic acid	Phenol	C_6H_5OH
Phosgene	Carbonyl chloride	$COCl_2$
Phosphate rock	Calcium phosphate	$Ca_3(PO_4)_2$
Picric acid	*sym*-Trinitrophenol	$C_6H_2(NO_2)_3OH$
Plaster of Paris	Calcium sulfate	$CaSO_4\cdot\frac{1}{2}H_2O$
Plumbago	Graphite	C
Precipitated chalk	Calcium carbonate	$CaCO_3$
Prussian blue	Ferric ferrocyanide	$Fe_4[Fe(CN)_6]_3$
Prussic acid	Hydrocyanic acid	HCN
Putty powder	Impure stannic oxide	SnO_2
Pyrites	Ferrous di-sulfide	FeS_2
Pyroligneous acid	Crude acetic acid	CH_3CO_2H
Pyroligneous spirit	Methyl alcohol	CH_3OH
Pyrolusite	Manganese dioxide	MnO_2
Quick lime	Calcium oxide	CaO
Quicksilver	Mercury	Hg
Quinol	Hydroquinone	$C_6H_4(OH)_2$(1, 4)
Realgar	Arsenic disulfide	As_2S_2
Rectified spirit	Alcohol 90–5%	C_2H_5OH
Red antimony	Antimony oxysulfide	$Sb_2O_3\cdot 2Sb_3S$
Red lead	Lead tetroxide	Pb_3O_4
Red liquor	Aluminum acetate solution	$Al(C_2H_3O_2)_3$
Red precipitate	Oxide of mercury	HgO
Red prussiate of potash	Potassium ferricyanide	$K_3Fe(CN)_6$
Rochelle salt	Potassium sodium tartrate	$KNaC_4H_4O_6\cdot 4H_2O$
Rock salt	Sodium chloride	NaCl
Rouge	Ferric oxide	Fe_2O_3
Saccharin	Benzoic sulfimide	o-$C_6H_4\cdot SO_2\cdot NHCO$
Sal ammoniac	Ammonium chloride	NH_4Cl
Salol	Phenyl salicylate	$C_6H_4(OH)(CO_2C_6H_5)$(1, 2)
Salt	Sodium chloride	NaCl
Salt cake	Impure sodium sulfate	Na_2SO_4
Salt of amber	Succinic acid	$(CH_2CO_2H)_2$
Salt of lemon Salt of sorrel	Potassium acid oxalate	$KHC_2O_4\cdot H_2O$
Salt of tartar Salt of wormwood	Potassium carbonate	K_2CO_3
Salt peter	Potassium nitrate	KNO_3
Salvarsan	3, 3′-Diamino-4, 4′-dihydroxy-arsenobenzene dihydrochloride	$[(HO)(NH_2)C_6H_3As]_2\cdot 2HCl$
Satin white	Calcium sulfate	$CaSO_4\cdot 2H_2O$
Scheele's green	Copper hydrogen arsenite	$CuHAsO_3$
Schlippe's salt	Sodium thioantimonate	$Na_3SbS_4\cdot 9H_2O$
Silica	Silicon dioxide	SiO_2
Slaked lime	Calcium hydroxide	$Ca(OH)_2$
Soda (washing)	Sodium carbonate	$Na_2CO_3\cdot 10H_2O$
Soda crystals	Sodium carbonate	$Na_2CO_3\cdot 10H_2O$
Soda lime	Mixture of calcium oxide and sodium hydroxide	CaO + NaOH
Sodium hyposulfite	Sodium thiosulfate	$Na_2S_2O_3\cdot 5H_2O$
Soft soap	Potash soap	.....
Soluble glass	Sodium silicate	$Na_2SiO_3 + H_2O$
Soluble tartar	Potassium tartrate	$2K_2C_4H_4O_6\cdot H_2O$
Spirit of hartshorn	Ammonia solution	NH_4OH
Spirit of salt	Hydrochloric acid	HCl
Spirit of wine	Ethyl alcohol	C_2H_5OH

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Stassfurtite	Magnesium borate and chloride double salt	$2Mg_3B_2O_{15} \cdot MgCl_2$
Sugar of lead	Lead acetate	$Pb(C_2H_3O_2)_2 \cdot 3H_2O$
Sugar of milk	Lactose	$C_{12}H_{22}O_{11} \cdot H_2O$
Sulfuric ether	Diethyl ether	$(C_2H_5)_2O$
Superphosphate	Impure calcium acid phosphate	$CaH_4(PO_4)_2$
Sylvine	Potassium chloride	KCl
Sylvinite	Sylvine with rock salt	....
Table salt	Sodium chloride	NaCl
Talc	Hydrated magnesium silicate	$Mg_3Si_4O_{11} \cdot H_2O$
Tartar	Crude potassium bitartrate	$KHC_4H_4O_6$
Tartar emetic	Potassium antimonyl tartrate	$2K(SbO)C_4H_4O_6 \cdot H_2O$
Tetralin	Tetrahydronaphthalene	$C_{10}H_{12}$
Tin crystals	Stannous chloride	$SnCl_2$
Tin white	Stannic hydroxide	$Sn(OH)_4$
T. N. T.	Trinitrotoluene	$C_6H_2(CH_3)(NO_2)_3$ (1, 2, 4, 6)
Toluol	Toluene	$C_6H_5CH_3$
Trona	Natural sodium carbonate	$Na_2CO_3.NaHCO_3.3H_2O$
Turnbull's blue	Ferrous ferricyanide	$Fe_3[Fe(CN)_6]_2$
Ultramarine yellow	Barium chromate	$BaCrO_4$
Unslaked lime	Calcium oxide	CaO
Vanillin	Methyl ether of protocatechualdehyde	$C_6H_3(OH)(OCH_3)$-CHO(1, 2, 4)
Venetian red	Ferric oxide	Fe_2O_3
Verdigris	Basic copper acetate	$2Cu(C_2H_3O_2)_2 + CuO(?)$
Vermilion	Red mercuric sulfide	HgS
Vitriol	Sulfuric acid	H_2SO_4
"Vitriolate of"	"Sulfate of"	....
Washing soda	Sodium carbonate	$Na_2CO_3 \cdot 10H_2O$
Water glass	Sodium silicates dissolved in water	....
White acid	Hydrofluoric acid and ammonium fluoride	$H_2F_2 + NH_4F$
White arsenic	Arsenous oxide	As_2O_3
White lead	Basic lead carbonate	$2PbCO_3 + Pb(OH)$
White vitriol	Zinc sulfate	$ZnSO_4 \cdot 7H_2O$
Whiting	Calcium carbonate	$CaCO_3$
Witherite	Barium carbonate	$BaCO_3$
Wood alcohol Wood naphtha Wood spirit	Methyl alcohol	CH_3OH
Xylol	Xylene	$C_6H_4(CH_3)_2$
Yellow prussiate of potash	Potassium ferrocyanide	$K_4Fe(CN)_6 \cdot 3H_2O$
Zinc blende	Mineral zinc sulfide	ZnS
Zinc vitriol	Zinc sulfate	$ZnSO_4 \cdot 7H_2O$
Zinc white	Zinc oxide	ZnO

Pigments named in the above list refer to the pure substance and not to mixtures often sold under the same name.

TRADE NAMES OF DYESTUFF INTERMEDIATES

Trade Name	Chemical Name
A acid	1, 7-Dihydroxynaphthalene-3, 6-disulfonic acid
Alizarin	1, 2-dihydroxyanthraquinone
Amino-G acid	2-Naphthylamine-6, 8-disulfonic acid
Amino-R acid	2-Naphthylamine-3, 6-disulfonic acid
Andresen's acid	1-Naphthol-3, 8-disulfonic acid
Anisidine	o-Aminophenol methyl ether
Anthrachrysone	1, 3, 5, 7-Tetrahydroxyanthraquinone
Anthraflavic acid	2, 6-Dihydroxyanthraquinone
Anthranilic acid	o-Aminobenzoic acid
Anthrarufin	1, 5-Dihydroxyanthraquinone
Armstrong's acid	Naphthalene-1, 5-disulfonic acid
Badische acid	2-Naphthylamine-8-sulfonic acid
Bayer's acid	2-Naphthol-8-sulfonic acid
Benzidine	p, p′-Diamino-diphenyl
Brönner's acid	2-Naphthylamine-6-sulfonic acid
β acid	Anthraquinone-2-sulfonic acid
Chromotrope acid	1, 8-Dihydroxynaphthalene-3, 6-disulfonic acid
Chrysazin	1, 8-Dihydroxyanthraquinone
Cleve's acids	1-Naphthylamine-6- and -7-sulfonic acids
Cleve's acid	1-Naphthylamine-5-sulfonic acid
Cleve's acid	1-Naphthylamine-6-sulfonic acid
Cleve's acid	1-Naphthylamine-3-sulfonic acid
Cleve's acid	1-Naphthylamine-7-sulfonic acid
Cresotic acids	Cresol carboxylic acids
Croceine acid	2-Naphthol-8-sulfonic acid
Dahl's acid	2-Naphthylamine-5-sulfonic acid
Dahl's acid II	1-Naphthylamine-4, 6-disulfonic acid
Dahl's acid III	1-Naphthylamine-4, 7-disulfonic acid
Disulpho acid S	1-Naphthylamine-4, 8-disulfonic acid
DTS	Dehydrothio-p-toluidine sulfonic acid
δ acid	1-Naphthol-4, 8-disulfonic acid 1-Naphthylamine-4, 8-disulfonic acid
Ebert and Merz's acid	Naphthalene-2, 7-disulfonic acid
Ebert and Merz's acid	Naphthalene-2, 6-disulfonic acid
Ewer and Pick's acid	Naphthalene-1, 6-disulfonic acid
ε acid	1-Naphthol-3, 8-disulfonic acid 1-Naphthylamine-3, 8-disulfonic acid
F acid	2-Naphthol-7-sulfonic acid
Freund's acid	1-Naphthylamine-3, 6-disulfonic acid
G acid	2-Naphthol-6, 8-disulfonic acid
Gallic acid	3, 4, 5-Trihydroxybenzoic acid
γ-acid	2-Amino-8-naphthol-6-sulfonic acid
H acid	1-Amino-8-naphthol-3, 6-disulfonic acid
Histazarin	2, 3-Dihydroxyanthraquinone
Isoanthraflavic acid	2, 7-Dihydroxyanthraquinone
J acid	2-Amino-5-naphthol-7-sulfonic acid
K acid	1-Amino-8-naphthol-4, 6-disulfonic acid
Kalle's acid	1-Naphthylamine-2, 7-disulfonic acid
Ketone base	Tetramethyldiaminobenzophenone
Koch's acid	1-Naphthylamine-3, 6, 8-trisulfonic acid
L acid	1-Naphthol-5-sulfonic acid
Laurent's acid	1-Naphthylamine-5-sulfonic acid
Lepidine	4-Methylquinoline
Leucotrope	Phenyldimethylbenzylammonium chloride
M acid	1-Amino-5-naphthol-7-sulfonic acid
Mesidine	2, 4, 6-Trimethylaniline
Metanilic acid	Aniline-m-sulfonic acid
Michler's ketone	Tetramethyldiaminobenzophenone
Naphthazarin	5, 6-Dihydroxy-1, 4-naphthoquinone
Naphthionic acid	1-Naphthylamine-4-sulfonic acid
o-Naphthionic	1-Naphthylamine-2-sulfonic acid
Naphthol A. S.	Anilide of -hydroxynaphthoic acid

TRADE NAMES OF DYESTUFF INTERMEDIATES
(Continued)

Trade Name	Chemical Name
Naphthoresorcin	1, 3-Dihydroxynaphthalene
Nevile and Winther's acid	1-Naphthol-4-sulfonic acid
Nigrotic acid	1, 7, 3, 6-Dihydroxysulfonaphthoic acid
Nitroso base	p-Nitrosodimethylaniline
NW acid	Nevile and Winther's acid
Peri acid	1-Naphthylamine-8-sulfonic acid
p-Phenetidine	p-Aminophenol ethyl ether
Phenyl-gamma acid	2-Phenylamino-8-naphthol-6-sulfonic acid
Phenyl Peri acid	Phenyl-1-naphthylamine-8-sulfonic acid
Phosgene	Carbonyl chloride
Phthalic acid	o-Benzenedicarboxylic acid
Picramic acid	2-Amino-4, 6-dinitrophenol
Picric acid	2, 4, 6-Trinitrophenol
Primuline base	p-Toluidine heated with sulfur.
Purpurin	1, 2, 4-Trihydroxyanthraquinone
Pyrogallol	1, 2, 3-Trihydroxybenzene
Quinaldine	2-Methylquinoline
Quinazarin	1, 4-Dihydroxyanthraquinone
R acid	2-Naphthol-3, 6-disulfonic acid
2 R acid	2-Amino-8-naphthol-3, 6-disulfonic acid
Red acid	1, 5-Dihydroxynaphthalene-3, 7-disulfonic acid
RG acid	1-Naphthol-3, 6-disulfonic acid
Resorcinol	1, 3-Dihydroxybenzene
S acid	1-Amino-8-naphthol-4-sulfonic acid
2 S acid	1-Amino-8-naphthol-2, 4-disulfonic acid
Salicylic acid	o-Hydroxybenzoic acid
Schaffer's acid	2-Naphthol-6-sulfonic acid
Schollkopf's acid	1-Naphthol-4, 8-disulfonic acid 1-Naphthylamine-4, 8-disulfonic acid 1-Naphthylamine-8-sulfonic acid
Sulfanilic acid	Aniline-p-sulfonic acid
Thiocarbanilide	Diphenylthiourea
Tobias acid	2-Naphthylamine-1-sulfonic acid
Tolidine	Di-p-aminoditolyl
Toluidine	Amino toluene
Xylidine	Amino xylene
Yellow acid	1, 3-Dihydroxynaphthalene-5, 7-disulfonic acid

THE PRONUNCIATION OF CHEMICAL WORDS

Reprinted by permission from a report of the Nomenclature, Spelling, and Pronunciation Committee of the American Chemical Society* as published in News Edition, Industrial and Engineering Chemistry, **12**, 202 (1934).

GENERALIZATIONS

(1) Accenting names of chemical substances on the final syllable is to be discouraged in all cases where the preference for such an accent is not emphatic. The names *amine*, *arsine*, *quinone*, and *sulfone* and words ending in these names (also the suffix *-phenone*) represent most of the exceptions. The general trend of the accent in the English language is recognized by authorities to be away from the end and toward the beginning of the word. However, when the last syllable of a word is a significant suffix, as *-al* for aldehydes, it is not slurred by chemists.

(2) In the interest of uniformity and in accordance with a general trend of English pronunciation in America, the ending *-ide* should be pronounced *-īd*. This appears to be uniformly the practice in inorganic chemistry. Many organic names are so pronounced also. Certain organic terms, however, are pronounced *-ĭd* by many, as *acetanilide*, *imide*, *phthalimide*, *lipide*, *amide*, and several words ending in *-amide*.

(3) For chemical names ending in *-ine*, usage is divided between the pronunciations *-ēn* and *-ĭn*, with a tendency in favor of *-ēn*. Since a distinction in spelling is made by many between names of bases ending in *-ine* and names of nonbases ending in *-in*, the pronunciation *-ēn* for the ending *-ine* is to be encouraged. (It is unfortunate that this conflicts in sound with the pronunciation of the ending *-ene*, but it is believed that this will cause confusion only with a very few words, as benzine and benzene, fluorine and fluorene. As to the pronunciation *-īn*, usage, at least in America, is very strongly against it, and it would conflict with the pronunciation of the new ending *-yne* adopted for names of acetylene hydrocarbons.) Quinine, because of strong popular usage, is an exception.

(4) The pronunciation *-ōl* for the ending of names of alcohols and phenols (except the word alcohol itself!), whether regrettable or not, seems firmly fixed and should be recognized. Emphasis on a significant ending is probably an influence in this practice. Chemical terms not belonging to the above classes, but generally pronounced *-ōl*, should be spelled with a final *e*; examples, *mole*, *pyrrole*. This is in accordance with the recommendation of the International Committee on Organic Nomenclature. For *sol* and words ending in *-sol*, the spelling *-ol* and the pronunciation *-ŏl* should be encouraged.

(5) The ending *-yl* should be pronounced *-ĭl*. The pronunciation *-ēl* is apparently a Germanism and, although still in use

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to some extent is to be discouraged. The pronunciation -*īl*, apparently common in England, is seldom heard in the United States.

(6) The ending -*ile* (as in nitrile). Usage is divided among the pronunciations -*īl*, -*ĭl*, and -*ēl*. The second of these is identical with the pronunciation recommended for -*yl*, and the third is apparently a Germanism. The pronunciation -*īl* should be favored.

(7) The endings -*acic*, -*alic*, -*anic*, -*aric*, -*elic*, *enic*, -*eric*, -*etic*, -*idic*, -*ilic*, -*inic*, -*isic*, -*onic*, -*opic*, -*oric*. A rather extensive study of the pronunciation of such endings shows a preference for a *short* vowel preceding -*ic* in all but a few cases. This result is in accord with age-old general English usage and is to be approved. *Acetic* (ă-sē'tĭk) is a very emphatic exception. Other exceptions are *cetic* (sē'tĭk) and *ceric* (sē'rĭk) and adjectives derived from the names of unsaturated hydrocarbons (because of the influence of the significant -*ene* ending).

(8) The ending -*olic*. This ending is an exception to the rule for words ending in -*ic* [compare (7)], perhaps owing to the influence of words ending in -*ol*. Inasmuch as ten cases out of twelve studied favor the long *ō*, some of them by very large majorities, it is recommended that this ending be uniformly pronounced -*ō'lik*.

(9) Adjectives ending in -*ic* should be accented on the next to the last syllable, as glycer'ic, not gly'ceric. In names of salts the accent, following the trend indicated in (1) above, usually moves one syllable (occasionally more) towards the beginning of the word, as gly'cerate, sal'icylate.

(10) The ending -*ime*. In oxime, at least, this should be pronounced -*ēm*, to accord with usage, though this is contrary to the normal English trend.

(11) The ending -*oin* should be pronounced as two syllables, -*ō-ĭn*, with the accent coming on the preceding syllable (as, bĕn'zō-ĭn, fū'rō-ĭn). In certain words where the addition of a chemical suffix causes two vowels to come together there is a natural tendency to merge them and thus change their sound, as thebaine, linalool. While concession must be made to usage in particular cases, as cocaine, the pronunciation of such vowels separately is to be encouraged. The use of the dieresis is helpful, as linaloöl.

(12) Words ending in -*valent* should be so pronounced that the last two syllables are -vā'lĕnt; as trī-vā'lĕnt (not trĭv'â-lĕnt).

THE WORD LIST

The words listed below are, except for a few deletions, the ones on which the committee's study was based. After each word there is given one or more pronunciations (shown by respelling and the use of symbols as explained at the head of

the list). When only a single pronunciation is shown this means that usage and perhaps other influences are so strongly in favor of it that no alternative is proposed. When more than one pronunciation is shown an attempt has been made to place these in the order of preference. The provision of two, occasionally three, pronunciations indicates that usage is divided without a marked show of preference (this is true of many words throughout the English language), or that there is some conflict between usage and the other influences properly taken into consideration. The word "usage" in parentheses following a pronunciation signifies that usage supports it to a considerable extent, notwithstanding other dictates.

Again let it be said that there is no attempt to proclaim "This pronunciation is right and this one is wrong." Usage, chemical nomenclature considerations, derivation, and the rules of good English (a compromise has sometimes been necessary) suggest certain preferences and these we have tried to ascertain.

Key to Pronunciation

The symbols used in the respelling for pronunciation have the following values: āle, senȧte, ăm, *ă*ccount, ärm; ēve, ėvent, ĕnd, rec*ĕ*nt, makẽr; īce, ĭll; ōld, ȯbey, ôrb, ŏdd, c*ŏ*nnect; ūse, u̇nite, ûrn, ŭp, circ*ŭ*s; fo͞od; oil; **ch**air; **g**o; **th**in.

abietic	ăb'ĭ-ĕt'ĭk	
acetal	ăs'ĕt-ăl	
acetaldehyde	ăs'ĕt-ăl'dė-hīd	
acetaldoxime	ăs'ĕt-ăl-dŏk'sēm	
acetamide	ăs'ĕt-ăm'īd	ăs'ĕt-ăm'ĭd (*usage*) *ă*-sĕt'*ă*-mīd
acetanilide	ăs'ĕt-ăn'ĭ-līd	ăs'ĕt-ăn'ĭ-lĭd (*usage*)
acetic	*ă*-sē'tĭk	
acetoacetate	ăs'ė-tȯ-ăs'ė-tāt	*ă*-sē'tȯ-ăs'ė-tāt
acetoacetic	ăs'ė-tȯ-*ă*-sē'tĭk	*ă*-sē'tȯ-*ă*-sē'tĭk
acetone	ăs'ė-tōn	
acetonitrile	ăs'ė-tȯ-nī'trīl	ăs'ė-tȯ-nī'trĭl (*usage*)
acetonyl	*ă*-sĕt'ȯ-nĭl	ăs'ė-tȯ-nĭl
acetophenone	ăs'ė-tȯ-fė-nōn'	*ă*-sē'tȯ-fė-nōn'
acetoxime	ăs'ĕt-ŏk'sēm	
acetyl	ăs'ė-tĭl	
acetylene	*ă*-sĕt'ĭ-lēn	
aci-	ăs'ĭ-	
acrolein	*ă*-krō'lė-ĭn	
acyclic	ȧ-sī'klĭk	
acyl	ăs'ĭl	
adiabatic	ăd'ĭ-*ă*-băt'ĭk	
adrenaline	ăd-rĕn'*ă*-lēn	ăd-rĕn'*ă*-lĭn (*usage*)
alantolic	ăl'ăn-tō'lĭk	

alizarin	ă-lĭz'ă-rĭn	
alkaline	ăl'kă-lĭn	ăl'kă-līn
allotropy	ă-lŏt'rȯ-pĭ	ăl'ȯ-trō'pĭ
allylamine	ăl'ĭl-ă-mēn'	
aluminum	ă-l͞oo'mĭ-nŭm (*usage*)	ă-lū'mĭ-nŭm
amide	ăm'īd	ăm'ĭd (*usage*)
amido	ă-mē'dȯ	ăm'ĭ-dȯ
amine	ă-mēn'	
amino	ă-mē'nȯ	
ammine	ăm'ēn	
ammino	ăm'ĭ-nō	ă-mē'nō (*usage*)
amyl	ăm'ĭl	
anhydride	ăn-hī'drīd	
aniline	ăn'ĭ-lēn	ăn'ĭ-lĭn (*usage*)
anisic	ă-nĭs'ĭk	
anthranil	ăn'thră-nĭl	
anthranilate	ăn-thrăn'ĭ-lāt	
anthranilic	ăn'thră-nĭl'ĭk	
antimonic	ăn'tĭ-mŏn'ĭk	ăn'tĭ-mō'nĭk (*usage*)
antimonyl	ăn'tĭ-mȯ-nĭl	
aqua	ăk'wȧ	
aqueous	ā'kwė-ŭs	
arabitol	ă-răb'ĭ-tōl	
arabonic	ăr'ă-bŏn'ĭk	
arachidic	ăr'ă-kĭd'ĭk	
arecoline	ă-rē'kȯ-lēn	ă-rē'kȯ-lĭn (*usage*)
arsenic (acid)	är-sĕn'ĭk	är'sė-nĭk (*usage*)
arsine	är-sēn'	
arsonic	är-sŏn'ĭk	
asphalt	ăs'fôlt	
assay	ăs'ā (*usage*)	ă-sā'
asymmetric	ā'sĭ-mĕt'rĭk	ăs'ĭ-mĕt'rĭk
atropine	ăt'rȯ-pēn	
auricyanide	ô'rĭ-sī'ă-nīd	ô'rĭ-sī'ă-nĭd (*usage*)
avitaminosis	ȧ-vī'tă-mĭn-ō'sĭs	
azelaic	ăz'ė-lā'ĭk	
azide	ăz'īd	
azine	ăz'ēn	
azobenzene	ăz'ȯ-bĕn'zēn	
barium	bā'rĭ-ŭm	băr'ĭ-ŭm
behenic	bė-hĕn'ĭk	
benzamide	bĕn-zăm'īd	bĕn-zăm'ĭd (*usage*)
benzanilide	bĕn-zăn'ĭ-līd	bĕn-zăn'ĭ-lĭd (*usage*)
benzene	bĕn'zēn	
benzil	bĕn'zĭl	
benzilic	bĕn-zĭl'ĭk	
benzine	bĕn'zēn	

benzohydrol	bĕn′zô-hī′drōl	bĕn′zô-hī-drōl′ (*usage*)
benzoin	bĕn′zô-ĭn	
benzophenone	bĕn′zô-fê-nōn′	
benzoyl	bĕn′zô-ĭl	bĕn′zô-ēl (*usage*)
benzyl	bĕn′zĭl	
betaine	bē′tâ-ēn	
betulinamaric	bĕt′û-lĭn-ă-măr′ĭk	
biuret	bī′û-rĕt′ (*usage*)	bĭ′û-rĕt
bivalent	bī-vā′lĕnt	
borneol	bôr′nê-ōl	
boron	bō′rŏn	bôr′ŏn
bromal	brō′măl	
bromide	brō′mīd	
bromine	brō′mēn	
buret	bû-rĕt′	
butadiene	bū′tă-dī′ēn	
butanolide	bû-tăn′ô-līd	bû-tăn′ô-lĭd (*usage*)
butyl	bū′tĭl	
butyronitrile	bū′tĭ-rô-nī′trīl	bū′tĭ-rô-nī′trĭl (*usage*)
cacodyl	kăk′ô-dĭl	
cacodylate	kăk′ô-dĭl-āt	kăk′ô-dĭl′āt
caffeine	kăf′ê-ēn	kăf′ê-ĭn (*usage*) kăf′ēn (*popular*)
calorimetric	kăl′ô-rĭ-mĕt′rĭk	
camphanic	kăm-făn′ĭk	
campholenic	kăm′fô-lē′nĭk	kăm′fô-lĕn′ĭk
campholic	kăm-fō′lĭk	
caproate	kăp′rô-āt	
caprylate	kăp′rĭ-lāt	
carbamate	kär′bă-māt	kär-băm′āt (*usage*)
carbamide	kär-băm′īd	kär-băm′ĭd (*usage*)
carbanilide	kär-băn′ĭ-līd	kär-băn′ĭ-lĭd (*usage*)
carbethoxy	kär′bĕth-ŏk′sĭ	
carbinol	kär′bĭ-nōl	
carbonyl	kär′bô-nĭl	
cataphoresis	kăt′ă-fô-rē′sĭs	
catechol	kăt′ê-chōl	kăt′ê-kōl (*usage*)
cerebroside	sĕr′ê-brô-sīd	sê-rē′brô-sīd
ceric	sē′rĭk	sĕr′ĭk
cetic	sē′tĭk	
cetyl	sē′tĭl	sĕt′ĭl
chalcone	kăl′kōn	chăl′kōn (*usage*)
chelidonic	kĕl′ĭ-dŏn′ĭk	kē′lĭ-dŏn′ĭk (*usage*)
chloral	klō′răl	
chloride	klō′rīd	
chlorophyllide	klō′rô-fĭl′īd	
cholesterol	kô-lĕs′tẽr-ōl	
cholic	kō′lĭk	

choline	kō'lēn	
choloidanic	kŏl'oi-dăn'ĭk	
chromyl	krō'mĭl	
cinene	sī'nen	sĭn'ēn
cinnamal	sĭn'*ă*-măl	
cinnamate	sĭn'*ă*-māt	sĭ-năm'āt
cinnamic	sĭ-năm'ĭk	
citrate	sĭt'rāt	
clupeine	klōō'pē-ēn	
cobalticyanide	kȯ-bôl'tī-sī'*ă*-nĭd	kȯ-bôl'tĭ-sī'*ă*-nĭd (*usage*)
cocaine	kȯ-kān' (*popular*)	kō'kȧ-ēn
codeine	kō'dē-ēn	
colchicine	kŏl'chĭ-sēn (*usage*)	kŏl'kĭ-sēn
colloid	kŏl'oid	
comenic	kȯ-mĕn'ĭk	
coniceine	kȯ-nĭs'ē-ēn	
coniine	kō'nĭ-ēn	
constitutive	kŏn'stĭ-tū'tĭv	kŏn-stĭt'ū-tĭv
convallamarin	kŏn-văl'*ă*-măr'ĭn	
coumaric	kōō-măr'ĭk	kŭ-măr'ĭk (*usage*)
coumarin	kōō'm*ă*-rĭn	kū'm*ă*-rĭn (*usage*)
creatine	krē'*ă*-tēn	krē'*ă*-tĭn (*usage*)
cresol	krē'sōl	
cresyl	krĕs'ĭl	krē'sĭl
crotonic	krȯ-tŏn'ĭk	
cyanamide	sī'ăn-ăm'īd	sī'ăn-ăm'ĭd (*usage*) sī-ăn'*ă*-mīd
cyanogen	sī-ăn'ȯ-jĕn	
cyclic	sī'klĭk	
cyclohexane	sī'klȯ-hĕk'sān	
cysteine	sĭs'tē-ēn	
decyl	dĕs'ĭl	
decylene	dĕs'ĭ-lēn	
desoxy	dĕs-ŏk'sĭ	
diacetyl	dī-ăs'ē-tĭl	
diazo	dī-ăz'ȯ	
dichromate	dī-krō'māt	
diethylamine	dī-ĕth'ĭl-*ă*-mēn'	
dinaphthol	dī-năf'thōl	
dioxindole	dī'ŏk-sĭn'dōl	dī-ŏk'sĭn-dōl
diphenic	dī-fĕn'ĭk	
diphenylethane	dī-fĕn'ĭl-ĕth'ān	
dipropargyl	dī'prȯ-pär'jĭl	
distillate	dĭs'tĭ-lāt	dĭs'tĭ-lāt
dynamite	dī'n*ă*-mīt	
elaidic	ĕl'ȧ-ĭd'ĭk	
elemolic	ĕl'ē-mō'lĭk	
enol	ē'nōl	

enolic	ē-nō'lĭk	
enterokinase	ĕn'tẽr-ō-kī'nās	ĕn'tẽr-ō-kĭn'ās
enzyme	ĕn'zīm	
enzymic	ĕn-zī'mĭk	
ephedrine	ĕf'ē-drēn	ē-fĕd'rĭn (*usage*)
ergosterol	ẽr-gŏs'tẽr-ōl	
erythrose	ĕr'ĭ-thrōs	ē-rĭth'rōs
ethoxide	ĕth-ŏk'sīd	
ethyl	ĕth'ĭl	
ethylidene	ĕth-ĭl'ĭ-dēn	ĕth'ĭl-ĭ-dēn
ferricyanide	fĕr'ĭ-sī'ȧ-nīd	
fluorene	flo͞o'ō-rēn	
fluorescein	flo͞o'ō-rĕs'ē-ĭn	flo͞o-ôr'ē-sēn (*usage*)
fluorine	flo͞o'ō-rēn	
formamide	fôrm-ăm'īd	fôrm-ăm'ĭd (*usage*)
fructose	frŭk'tōs	
fulminic	fŭl-mĭn'ĭk	
fumaric	fū-măr'ĭk	
furan	fū'răn	
furfural	fûr'fŭr-ăl	
furoin	fū'rō-ĭn	
galalith	găl'ȧ-lĭth	
geraniol	jē-rā'nĭ-ōl	
gitogenic	jĭt'ō-jĕn'ĭk	
gluconic	glo͞o-kŏn'ĭk	
glucosamine	glo͞o'kōs-ȧ-mēn'	
glucoside	glo͞o'kō-sīd	
glutamic	glo͞o-tăm'ĭk	
glutaric	glo͞o-tăr'ĭk	
glutathione	glo͞o'tȧ-thī'ōn	
glyceric	glĭ-sĕr'ĭk	
glycine	glī'sēn	glī-sēn' (*usage*)
glycolic	glī-kō'lĭk	glī-kŏl'ĭk (*usage*)
glycyl	glī'sĭl	
glycyrrhetic	glĭs'ĭ-rĕt'ĭk	
glyoxal	glī-ŏk'săl	glī'ŏk-săl' (*usage*)
glyoxyl	glī-ŏk'sĭl	
guaiacol	gwī'ȧ-kōl	
guanidine	gwä'nĭ-dēn	
guanine	gwä'nēn	
gulose	gū'lōs	
hafnium	hăf'nĭ-ŭm	
halide	hăl'īd	hā'lĭd (*usage*)
halogen	hăl'ō-jĕn	
haloid	hăl'oid	hā'loid
haloquinonoid	hăl'ō-kwĭn'ō-noid	hăl'ō-kwĭ-nō'noid
hematin	hĕm'ȧ-tĭn (*usage*)	hē'mȧ-tĭn
hemoglobin	hē'mō-glō'bĭn	hĕm'ō-glō'bĭn

heroine	hĕr′ō-ēn	hĕr′ō-ĭn (*usage*)
hydantoin	hī-dăn′tō-ĭn	
hydrazide	hī′dră-zīd	
hydrazine	hī′dră-zēn	
hydrazo	hī-drăz′ō	
hydrazoic	hī-dră-zō′ĭk	
hydriodic	hī′drĭ-ŏd′ĭk	
hydrofluoric	hī′drō-floo-ŏr′ĭk	
hydroquinone	hī′drō-kwĭ-nōn′	
hydrosol	hī′drō-sŏl	
hydroxylamine	hī-drŏk′sĭl-ă-mēn′	
hyenic	hī-ĕn′ĭk	
hypoiodous	hī′pō-ī-ō′dŭs	
iatrochemistry	ī-ăt′rō-kĕm′ĭs-trĭ	
idose	ī′dōs	
illinium	ĭ-lĭn′ĭ-ŭm	
imide	ĭm′īd	ĭm′ĭd (*usage*)
imido	ĭ-mē′dō	ĭm′ĭ-dō
imino	ĭ-mē′nō	ĭm′ĭ-nō
indigotin	ĭn-dĭg′ō-tĭn	ĭn′dĭ-gō tĭn
indoxyl	ĭn-dŏk′sĭl	
inositol	ĭn-ō′sĭ-tōl	
iodine	ī′ō-dēn	
iodoso	ī′ō-dō′sō	
iodous	ī-ō′dŭs	
ionone	ī′ō-nōn′ (*usage*)	
irone	ī-rōn′ (*usage*)	
isatide	ī′să-tīd	
isatin	ī′să-tĭn	
iso	ī′sō	
isotropic	ī′sō-trŏp′ĭk	ī′sō-trō′pĭk
itaconic	ĭt′ă-kŏn′ĭk	
labile	lā′bĭl	
lauronolic	lô′rō-nō′lĭk	
leucine	loo′sēn (*usage*)	lū′sēn
linaloöl	lĭn-ăl′ō-ōl	
linalyl	lĭn′ă-lĭl	
linoleic	lĭn′ō-lē′ĭk	
linolenic	lĭn′ō-lĕn′ĭk	lĭn′ō-lē′nĭk (*usage*)
lipase	lī′pās	
lipide	lī′pīd	lĭp′ĭd (*usage*)
lipoid	lī′poid	lĭp′oid (*usage*)
litharge	lĭth′ärj	
lutidine	loo′tĭ-dēn (*usage*)	lū′tĭ-dēn
maleic	mă-lē′ĭk	
malic	măl′ĭk	
malonic	mă-lŏn′ĭk	mă-lō′nĭk (*usage*)
malonyl	măl′ō-nĭl	

THE PRONUNCIATION OF CHEMICAL WORDS (Continued)

mandelic	măn-dĕl'ĭk	
manganese	măn'gă-nēs	
manganic	măn-găn'ĭk	
mannonic	mă-nŏn'ĭk	
margaric	mär-găr'ĭk	mär-gär'ĭk (*usage*)
meconic	mė-kŏn'ĭk	
melissyl	mė-lĭs'ĭl	
mellophanic	mĕl'ȯ-făn'ĭk	
menthol	mĕn'thōl	
mercaptal	mẽr-kăp'tăl	
mercaptan	mẽr-kăp'tăn	
mercuric	mẽr-kū'rĭk	
mercurous	mẽr-kū'rŭs	
mesaconic	mĕs'ă-kŏn'ĭk	
mesityl	mĕs'ĭ tĭl	
mesitylene	mė-sĭt'ĭl-ēn	
mesitylenic	mė-sĭt'ĭ-lē'nĭk	mė-sĭt'ĭ-lĕn'ĭk
mesotartaric	mĕs'ȯ-tar-tăr'ĭk	mĕs'ȯ-tar-tär'ĭk (*usage*)
mesothorium	mĕs'ȯ-thō'rĭ-ŭm	
mesoxalic	mĕs'ŏk-săl'ĭk	mĕz'ŏk-săl'ĭk (*usage*)
metarsenic	mĕt'är-sĕn'ĭk	
methanol	mĕth'ă-nōl	
methyl	mĕth'ĭl	
methylal	mĕth'ĭl-ăl	mĕth'ĭl-ăl' (*usage*)
methylamine	mĕth'ĭl-ă-mēn'	
micro	mī'krȯ	
mole	mōl	
molecule	mŏl'ė-kūl	
monacetin	mŏn-ăs'ė-tĭn	mȯ-năs'ė-tĭn
mono	mŏn'ȯ	mō'nȯ
monoxide	mŏn-ŏk'sīd	mȯ-nŏk'sīd
morphine	môr'fēn	
naphthalide	năf'thă-līd	năf'thă-lĭd (*usage*)
naphthenic	năf-thē'nĭk	năf-thĕn'ĭk
naphthol	năf'thōl	
nascent	năs'ĕnt	nā'sĕnt
neurine	nōō'rēn (*usage*)	nū'rēn
niton	nī'tŏn	
nitrato	nī-trā'tȯ	
nitrile	nī'trĭl	nī'trĭl (*usage*)
nitro	nī'trȯ	
nitrosamine	nī'trȯ-să-mēn'	
nitrosyl	nī'trȯ-sĭl	nī-trō'sĭl (*usage*)
nitroxyl	nī-trŏk'sĭl	
nonane	nō'nān	
nucleic	nū-klē'ĭk	
nucleotide	nū'klė-ȯ-tīd	
oleic	ȯ-lē'ĭk	

orcinol	ôr'sĭ-nōl	
ortho	ôr'thŏ	
osazone	ō'să-zōn	ō'să-zōn' (*usage*)
osmium	ŏz'mĭ-ŭm	
oxalic	ŏk-săl'ĭk	
oxazine	ŏk'să-zēn	
oxide	ŏk'sīd	
oxime	ŏk'sēm	
oxindole	ŏk-sĭn'dōl	ŏk'sĭn-dōl
oxozonide	ŏk-sō'zŏ-nīd	
ozone	ō'zōn	
palladio	pă-lā'dĭ-ŏ	
pelargonic	pĕl'är-gŏn'ĭk	
pentitol	pĕn'tĭ-tōl	
peptide	pĕp'tīd	
periodic (acid)	pûr'ī-ŏd'ĭk	
permutite	pûr'mŭ-tīt	
peroxide	pĕr-ŏk'sīd	
phenate	fē'nāt	fĕn'āt
phenazine	fĕn'ă-zēn	
phenetidine	fĕn-ĕt'ĭ-dēn	
phenol	fē'nōl	
phenolic	fē-nō'lĭk	
phenolphthalein	fē'nōl-thăl'ē-ĭn	fē'nōl-thăl'ēn (*usage*)
pheophorbide	fē'ŏ-fôr'bīd	
phloretic	flŏ-rĕt'ĭk	
phlorizin	flôr'ĭ-zĭn	
phosphatide	fŏs'fă-tīd	
phosphorous	fŏs-fō'rŭs	fŏs'fŏ-rŭs (*usage*)
phthalein	thăl'ē-ĭn	thăl'ēn (*usage*)
phthalic	thăl'ĭk	
phthalide	thăl'īd	
phthalimide	thăl-ĭm'īd	thăl-ĭm'ĭd (*usage*)
phytol	fī'tōl	
phytosterol	fī-tŏs'tĕr-ōl	
picric	pĭk'rĭk	
pilocarpine	pī'lŏ-kär'pēn	
pimalic	pĭ-măl'ĭk	
pimaric	pĭ-măr'ĭk	
pimelic	pĭ-mĕl'ĭk	
pinacolone	pĭn-ăk'ŏ-lōn	
piperamide	pĭp'ĕr-ăm'īd	pĭp'ēr-ăm'ĭd (*usage*) pĭ-pĕr'ă-mīd
piperidine	pĭ-pĕr'ĭ-dēn	pĭp'ēr-ĭ-dēn
polymerism	pŏl'ĭ-mĕr-ĭz'm	pŏ-lĭm'ĕr-ĭz'm
polymerize	pŏl'ĭ-mĕr-īz	pŏ-lĭm'ĕr-īz
porphyrin	pôr'fĭ-rĭn	
praseodymium	prā'zē-ŏ-dĭm'ĭ-ŭm	

propiolic	prō′pĭ-ō′lĭk	
propionamide	prō′pĭ-ŏn-ăm′īd	prō′pĭ-ŏn-ăm′ĭd (*usage*)
propionic	prō′pĭ-ŏn′ĭk	
propionyl	prō′pĭ-ō-nĭl	
propyl	prō′pĭl	
propylidene	prō-pĭl′ĭ-dēn	prō′pĭl-ĭ-dēn
protein	prō′tē-ĭn	
ptomaine	tō′mān (*popular*)	tō′mā-ēn
pyrazoline	pĭr-ăz′ō-lēn	
pyrogallol	pī′rō-găl′ōl	
pyrrole	pĭr′ōl	pĭr-ōl′ (*usage*
pyrrolidine	pĭ-rō′lĭ-dēn	pĭ-rŏl′ĭ-dēn
pyruvic	pī-ro͞o′vĭk	
quadrivalent	kwŏd′rĭ-vā′lĕnt	
quinine	kwī′nīn (*popular*)	kwĭn′ēn
quinone	kwĭn-ōn′	
quinonoid	kwĭn′ō-noid	kwĭ-nō′noid
racemize	răs′ē-mīz	
resorufin	rĕz′ō-ro͞o′fĭn	
rhamnitol	răm′nĭ-tōl	
ribonic	rĭ-bŏn′ĭk	
ribose	rī′bōs	
ricin	rī′sĭn	
rosaniline	rōz-ăn′ĭ-lēn	rōz-ăn′ĭ-lĭn (*usage*)
rosolic	rōz-ō′lĭk	rōz-ŏl′ĭk (*usage*)
sabinene	săb′ĭ-nēn	
saccharic	să-kăr′ĭk	
saccharide	săk′ă-rīd	
salicylate	săl′ĭ-sĭl-āt	să-lĭs′ĭ-lāt
saligenin	să-lĭj′ē-nĭn	
samarium	să-măr′ĭ-ŭm	să-mā′rĭ-ŭm
santalic	săn-tăl′ĭk	
sebacic	sē-băs′ĭk	
selenate	sĕl′ē-nāt	
selenic	sē-lĕn′ĭk	sē-lē′nĭk (*usage*
selenide	sĕl′ē-nīd	
semicarbazide	sĕm′ĭ-kär′bă-zīd	sĕm′ī-kär′bă-zĭd
serine	sĕr′ēn	
skatole	skā′tōl	
solute	sŏl′ūt	
stannonic	stă-nŏn′ĭk	
stearic	stē-ăr′ĭk	
stearin	stē′ă rĭn	
stearolic	stē′-ă-rō′lĭk	
stibine	stĭb′ēn	
strontium	strŏn′shĭ-ŭm	
strychnine	strĭk′nēn	strĭk′nĭn (*usage*)
styrene	stī′rēn	

THE PRONUNCIATION OF CHEMICAL WORDS (Concluded)

sulfinic	sŭl-fĭn′ĭk	
sulfonal	sŭl′fō-năl	
sulfone	sŭl-fōn′	sŭl′fōn
sulfonic	sŭl-fŏn′ĭk	
sulfurous	sŭl-fū′rŭs	
sulfuryl	sŭl′fū-rĭl	
tartaric	tär-tăr′ĭk	tär-tär′ĭk (*usage*)
taurocholic	tô′rō-kō′lĭk	
terephthalic	tĕr′ĕf-thăl′ĭk	
tetrolic	tē-trō′lĭk	
thebaine	thē′bā-ēn	
theine	thē′ēn	
titanic	tī-tăn′ĭk	
titanium	tī-tā′nĭ-ŭm	
titanous	tī-tăn′ŭs	
titanyl	tī′tăn-ĭl	
titer	tī′tẽr	
titrate	tī′trāt	
trional	trī′ō-năl	
trivalent	trī-vā′lĕnt	
univalent	ū′nĭ-vā′lĕnt	
uranyl	ū′ră-nĭl	
urea	ū-rē′ā	
ureide	ū′rē-īd	
valeric	vă-lĕr′ĭk	
valine	văl′ēn	vā′lēn
vanadate	văn′ă-dāt	
vanillin	văn′ĭ-lĭn	
veratrole	vĕr′ă-trōl	
vinyl	vī′nĭl	
vitamin	vī′tă-mĭn	
vitellin	vī-tĕl′ĭn	
xenon	zē′nŏn	
xylitol	zī′lĭ-tōl	

GENERAL CHEMICAL TABLES

FLAME AND BEAD TESTS

Flame Colorations

VIOLET

Potassium compounds. Purple red through blue glass. Easily obscured by sodium flame. Bluish green through green glass. Rubidium and Caesium compounds impart same flame as potassium compounds.

BLUES

Azure.—Copper chloride. Copper bromide gives azure blue followed by green. Other copper compounds give same coloration when moistened with hydrochloric acid.

Light Blue.—Lead, Arsenic, Selenium.

GREENS

Emerald.—Copper compounds except the halides, and when not moistened with hydrochloric acid.

Pure Green.—Compounds of thallium and tellurium.

Yellowish.—Barium compounds. Some molybdenum compounds. Borates, especially when treated with sulphuric acid or when burned with alcohol.

Bluish.—Phosphates with sulphuric acid.

Feeble.—Antimony compounds. Ammonium compounds.

Whitish.—Zinc.

REDS

Carmine.—Lithium compounds. Violet through blue glass. Invisible through green glass. Masked by barium flame.

Scarlet.—Strontium compounds. Violet through blue glass. Yellowish through green glass. Masked by barium flame.

Yellowish.—Calcium compounds. Greenish through blue glass. Green through green glass. Masked by barium flame.

YELLOW

Yellow.—All sodium compounds. Invisible with blue glass.

Borax Beads

Abbreviations employed: s., saturated; s.s., supersaturated; n.s., not saturated; h , hot; c , cold.

Substance	Oxidizing flame	Reducing flame
Aluminum	Colorless (h.c , n.s.); opaque (s.s.)	Colorless; opaque (s.)
Antimony	Colorless; yellow or brownish (h., s s)	Gray and opaque
Barium	Colorless (n s.)	....
Bismuth	Colorless; yellow or brownish (h., s.s.)	Gray and opaque
Cadmium	Colorless	Gray and opaque
Calcium	Colorless (n s.)	....
Cerium	Red (h.)	Colorless (h.c.)
Chromium	Green (c.)	Green
Cobalt	Blue (h.c.)	Blue (h.c.)
Copper	Green (h); blue (c.)	Red (c): opaque (s.s.): colorless (h.)

FLAME AND BEAD TESTS (Continued)

Borax Beads (Continued)

Substance	Oxidizing flame	Reducing flame
Iron	Yellow or brownish red (h., n s.)	Green (s s)
Lead	Colorless; yellow or brownish (h , s s)	Gray and opaque
Magnesium	Colorless (n s.)	
Manganese	Violet (h c)	Colorless (h c)
Molybdenum	Colorless	Yellow or brown (h)
Nickel	Brown; red (c)	Gray and opaque
Silicon	Colorless (h c.); opaque (s s)	Colorless; opaque (s)
Silver	Colorless (n.s)	Gray and opaque
Strontium	Colorless (n s)	
Tin	Colorless (h c); opaque (s s.)	Colorless; opaque (s)
Titanium	Colorless	Yellow (h); violet (c)
Tungsten	Colorless	Brown
Uranium	Yellow or brownish (h , n s)	Green
Vanadium	Colorless	Green

Beads of Microcosmic Salt
$NaNH_4HPO_4$

Substance	Oxidizing flame	Reducing flame
Aluminum	Colorless; opaque (s)	Colorless; not clear (s s)
Antimony	Colorless (n s)	Gray and opaque
Barium	Colorless; opaque (s)	Colorless; not clear (s s)
Bismuth	Colorless (n s)	Gray and opaque
Cadmium	Colorless (n s)	Gray and opaque
Calcium	Colorless; opaque (s.)	Colorless; not clear (s s)
Cerium	Yellow or brownish red (h , s.)	Colorless
Chromium	Red (h , s); green (c)	Green (c)
Cobalt	Blue (h c)	Blue (h c)
Copper	Blue (c); green (h)	Red and opaque (c)
Iron	Yellow or brown (h , s)	Colorless; yellow or brownish (h)
Lead	Colorless (n s)	Gray and opaque
Magnesium	Colorless; opaque (s)	Colorless; not clear (s s)
Manganese	Violet (h c)	Colorless
Molybdenum	Colorless; green (h)	Green (h)
Nickel	Yellow (c); red (h , s)	Yellow (c); red (h); gray and opaque
Silicon	(Swims undissolved)	(Swims undissolved)
Silver		Gray and opaque
Strontium	Colorless; opaque (s)	Colorless; not clear (s.s)
Tin	Colorless; opaque (s.)	Colorless
Titanium	Colorless (n s)	Violet (c); yellow or brownish (h)
Uranium	Green; yellow or brownish (h , s)	Green (h)
Vanadium	Yellow	Green
Zinc	Colorless (n s.)	Gray and opaque

Sodium Carbonate Bead

Manganese	Green	Colorless

PREPARATION OF REAGENTS

The following pages present directions for the preparation of various reagents. The collection has been prepared with the active collaboration of W. D. Bonner, R. K. Carleton, L. L. Carrick, Giles B. Cooke, E. J. Cragoe, Thos. De Vries, James L. Kassner, Thos. W. Mason, F. C. Mathers, M. G. Mellon, W. C. Pierce, J. H. Reedy, Arthur A. Vernon and S. R. Wood. Many others have contributed valuable suggestions.

Volumes have been stated in milliliters (ml) and liters (l). One milliliter is equivalent to 1.000027 cubic centimeters (cm^3 or cc.). Masses are indicated in grams (g).

The relation to molar solution (*M*) or normal solution (*N*) is indicated in many cases.

Distilled water should be used.

LABORATORY REAGENTS FOR GENERAL USE

DILUTE ACIDS, 3 molar. Use the amount of concentrated acid indicated and dilute to one liter.

Acetic acid, 3 *N*. Use 172 ml of 17.4 *M* acid (99–100%).

Hydrochloric acid, 3 *N*. Use 258 ml of 11.6 *M* acid (36% HCl).

Nitric acid, 3 *N*. Use 195 ml of 15.4 *M* acid (69% HNO_3).

Phosphoric acid, 9 *N*. Use 205 ml of 14.6 *M* acid (85% H_3PO_4).

Sulfuric acid, 6 *N*. Use 168 ml of 17.8 *M* acid (95% H_2SO_4).

DILUTE BASES.

Ammonium hydroxide, 3 *M*, 3 *N*. Dilute 200 ml of concentrated solution (14.8 *M*, 28% NH_3) to 1 liter.

Barium hydroxide, 0.2 *M*, 0.4 *N*. Saturated solution, 63 g per liter of $Ba(OH)_2.8H_2O$. Use some excess, filter off $BaCO_3$ and protect from CO_2 of the air with soda lime or ascarite in a guard tube.

Calcium hydroxide, 0.02 *M*, 0.04 *N*. Saturated solution, 1.5 g per liter of $Ca(OH)_2$. Use some excess, filter off $CaCO_3$ and protect from CO_2 of the air.

Potassium hydroxide, 3 *M*, 3 *N*. Dissolve 176 g of the sticks (95%) in water and dilute to 1 liter.

Sodium hydroxide, 3 *M*, 3 *N*. Dissolve 126 g of the sticks (95%) in water and dilute to 1 liter.

GENERAL REAGENTS. (See also *Standard Solutions for Volumetric Analysis*, and *Decinormal Solutions of Salts and Other Reagents*.)

Aluminum chloride, 0.167 *M*, 0.5 *N*. Dissolve 22 g of $AlCl_3$ in 1 liter of water.

Aluminum nitrate, 0.167 *M*, 0.5 *N*. Dissolve 58 g of $Al(NO_3)_3.7.5H_2O$ in 1 liter of water.

Aluminum sulfate, 0.083 *M*, 0.5 *N*. Dissolve 56 g of $Al_2(SO_4)_3.18H_2O$ in 1 liter of water.

Ammonium acetate, 3 *M*, 3 *N*. Dissolve 230 g of $NH_4C_2H_3O_2$ in water and dilute to 1 liter.

Ammonium carbonate, 1.5 *M*. Dissolve 144 g of the commercial salt (mixture of $(NH_4)_2CO_3.H_2O$ and $NH_4CO_2NH_2$) in 500 ml of 3 *N* NH_4OH and dilute to 1 liter.

Ammonium chloride, 3 *M*, 3 *N*. Dissolve 160 g of NH_4Cl in water. Dilute to 1 liter.

Ammonium molybdate.

1. 0.5 *M*, 1 *N*. Mix well 72 g of pure MoO_3 (or 81 g of H_2MoO_4) with 200 ml of water, and add 60 ml of conc. ammonium hydroxide. When solution is complete, filter and pour filtrate, *very slowly* and with *rapid stirring*, into a mixture of 270 ml of conc. HNO_3 and 400 ml of water. Allow to stand over night, filter and dilute to 1 liter.

2. The reagent is prepared as two solutions which are mixed as needed, thus always providing fresh reagent of proper strength and composition. Since ammonium molybdate is an expensive reagent, and since an acid solution of this reagent as usually prepared keeps for only a few days, the method proposed will avoid loss of reagent and provide more certain results for quantitative work.

Solution 1. Dissolve 100 g of ammonium molybdate (C.P. grade) in 400 ml of water and 80 ml of 15 *M* NH_4OH. Filter if necessary, though this seldom has to be done.

Solution 2. Mix 400 ml of 16 *M* nitric acid with 600 ml of water.

For use, mix the calculated amount of solution 1 with twice its volume of solution 2, adding solution 1 to solution 2 slowly, with vigorous stirring. Thus, for amounts of phosphorus up to 20 mg, 10 ml of solution 1 to 20 ml of solution 2 is adequate. Increase amount as needed.

Ammonium nitrate, 1 *M*, 1 *N*. Dissolve 80 g of NH_4NO_3 in 1 liter of water.

Ammonium oxalate, 0.25 *M*, 0.5 *N*. Dissolve 35.5 g of $(NH_4)_2C_2O_4.H_2O$ in water. Dilute to 1 liter.

Ammonium sulfate, 0.25 *M*, 0.5 *N*. Dissolve 33 g of $(NH_4)_2SO_4$ in 1 liter of water.

Ammonium sulfide, colorless.

1. 3 *M*. Treat 200 ml of conc. NH_4OH with H_2S until saturated, keeping the solution cold. Add 200 ml of conc. NH_4OH and dilute of 1 liter.

2. 6 *N*. Saturate 6 *N* ammonium hydroxide (40 ml conc. ammonia solution + 60 ml H_2O) with washed H_2S gas. The ammonium hydroxide bottle must be completely full and must be kept surrounded by ice while being saturated (about 48 hours for two liters). The reagent is best preserved in brown, completely filled, glass-stoppered bottles.

Ammonium sulfide, yellow. Treat 150 ml of conc. NH_4OH with H_2S until saturated, keeping the solution cool. Add 250 ml of conc. NH_4OH and 10 g of powdered sulfur. Shake the mixture until the sulfur is dissolved and dilute to 1 liter with water. In the solution the concentration of $(NH_4)_2S_2$, $(NH_4)_2S$ and NH_4OH are 0.625, 0.4 and 1.5 normal respectively. On standing, the concentration of $(NH_4)_2S_2$ increases and that of $(NH_4)_2S$ and NH_4OH decreases.

Antimony pentachloride, 0.1 *M*, 0.5 *N*. Dissolve 30 g of $SbCl_5$ in 1 liter of water.

Antimony trichloride, 0.167 *M*, 0.5 *N*. Dissolve 38 g of $SbCl_3$ in 1 liter of water.

Aqua regia. Mix 1 part concentrated HNO_3 with 3 parts of concentrated HCl. This formula should include one volume of water if the aqua regia is to be stored for any length of time. Without water, objectionable quantities of chlorine and other gases are evolved.

Barium chloride, 0.25 *M*, 0.5 *N*. Dissolve 61 g of $BaCl_2.2H_2O$ in water. Dilute to 1 liter.

Barium hydroxide, saturated solution, 0.1 *M*, about 0.2 *N*. Dissolve 32 g of $Ba(OH)_2.8H_2O$ in 1 liter of water.

Barium nitrate, 0.25 *M*, 0.5 *N*. Dissolve 65 g of $Ba(NO_3)_2$ in 1 liter of water.

Bismuth chloride, 0.167 *M*, 0.5 *N*. Dissolve 53 g of $BiCl_3$ in 1 liter of dilute HCl. Use 1 part HCl to 5 parts water.

Bismuth nitrate, 0.083 *M*, 0.25 *N*. Dissolve 40 g of $Bi(NO_3)_3.5H_2O$ in 1 liter of dilute HNO_3. Use 1 part of HNO_3 to 5 parts of water.

Cadmium chloride, 0.25 *M*, 0.5 *N*. Dissolve 46 g of $CdCl_2$ in 1 liter of water.

Cadmium nitrate, 0.25 *M*, 0.5 *N*. Dissolve 77 g of $Cd(NO_3)_2.4H_2O$ in 1 liter of water.

Cadmium sulfate, 0.25 *M*, 0.5 *N*. Dissolve 70 g of $CdSO_4.4H_2O$ in 1 liter of water.

Calcium chloride, 0.25 *M*, 0.5 *N*. Dissolve 55 g of $CaCl_2.6H_2O$ in water. Dilute to 1 liter.

Calcium nitrate, 0.25 *M*, 0.5 *N*. Dissolve 41 g of $Ca(NO_3)_2$ in 1 liter of water.

Chloroplatinic acid.

1. 0.0512 *M*, 0.102 *N*. Dissolve 26.53 g of $H_2PtCl_6.6H_2O$ in water. Dilute to 100 ml. Contains 0.100 g Pt per ml.

2. Make a 10% solution by dissolving 1 g of $H_2PtCl_6.6H_2O$ in 9 ml of water. Shake thoroughly to insure complete mixing. Keep in a dropping bottle.

Chromic chloride, 0.167 *M*, 0.5 *N*. Dissolve 26 g of $CrCl_3$ in 1 liter of water.

Chromic nitrate, 0.167 *M*, 0.5 *N*. Dissolve 40 g of $Cr(NO_3)_3$ in 1 liter of water.

Chromic sulfate, 0.083 *M*, 0.5 *N*. Dissolve 60 g of $Cr_2(SO_4)_3.18H_2O$ in 1 liter of water.

Cobaltous nitrate, 0.25 *M*, 0.5 *N*. Dissolve 73 g of $Co(NO_3)_2.6H_2O$ in 1 liter of water.

Cobaltous sulfate, 0.25 *M*, 0.5 *N*. Dissolve 70 g of $CoSO_4.7H_2O$ in 1 liter of water.

Cupric chloride, 0.25 *M*, 0.5 *N*. Dissolve 43 g of $CuCl_2.$-$2H_2O$ in 1 liter of water.

Cupric nitrate, 0.25 *M*, 0.5 *N*. Dissolve 74 g of $Cu(NO_3)_2.$-$6H_2O$ in 1 liter of water.

Cupric sulfate, 0.5 *M*, 1 *N*. Dissolve 124.8 g of $CuSO_4.$-$5H_2O$ in water to which 5 ml of H_2SO_4 has been added. Dilute to 1 liter.

Ferric chloride, 0.5 *M*, 1.5 *N*. Dissolve 135.2 g of $FeCl_3.$-$6H_2O$ in water containing 20 ml of conc. HCl. Dilute to 1 liter.

Ferric nitrate, 0.167 *M*, 0.5 *N*. Dissolve 67 g of $Fe(NO_3)_3.$-$9H_2O$ in 1 liter of water.

Ferric sulfate, 0.25 *M*, 0.5 *N*. Dissolve 140.5 g of Fe_2-$(SO_4)_3.9H_2O$ in water containing 100 ml of conc. H_2SO_4. Dilute to 1 liter.

Ferrous ammonium sulfate, 0.5 *M*, 1 *N*. Dissolve 196 g of $Fe(NH_4SO_4)_2.6H_2O$ in water containing 10 ml of conc. H_2SO_4. Dilute to 1 liter. Prepare fresh solutions for best results.

Ferrous sulfate, 0.5 *M*, 1 *N*. Dissolve 139 g of $FeSO_4.7H_2O$ in water containing 10 ml of conc. H_2SO_4. Dilute to 1 liter. Solution does not keep well.

Lead acetate, 0.5 *M*, 1 *N*. Dissolve 190 g of $Pb(C_2H_3O_2)_2.$-$3H_2O$ in water. Dilute to 1 liter.

Lead nitrate, 0.25 *M*, 0.5 *N*. Dissolve 83 g of $Pb(NO_3)_2$ in 1 liter of water.

Lime water. See *Calcium hydroxide*.

Magnesium chloride, 0.25 *M*, 0.5 *N*. Dissolve 51 g of $MgCl_2.6H_2O$ in 1 liter of water.

Magnesium chloride reagent. Dissolve 50 g of $MgCl_2.$-$6H_2O$ and 100 g of NH_4Cl in 500 ml of water. Add 10 ml of conc. NH_4OH, allow to stand over night and filter if a precipitate has formed. Make acid to methyl red with dilute HCl. Dilute to 1 liter. Solution contains 0.25 *M* $MgCl_2$ and 2 *M* NH_4Cl. Solution may also be diluted with 133 ml of conc. NH_4OH and water to make 1 liter. Such a solution will contain 2 *M* NH_4OH.

Magnesium nitrate, 0.25 *M*, 0.5 *N*. Dissolve 64 g of $Mg(NO_3)_2.6H_2O$ in 1 liter of water.

Magnesium sulfate, 0.25 *M*, 0.5 *N*. Dissolve 62 g of $MgSO_4.7H_2O$ in 1 liter of water.

Manganous chloride, 0.25 *M*, 0.5 *N*. Dissolve 50 g of $MnCl_2.4H_2O$ in 1 liter of water.

Manganous nitrate, 0.25 *M*, 0.5 *N*. Dissolve 72 g of $Mn(NO_3)_2.6H_2O$ in 1 liter of water.

Manganous sulfate, 0.25 *M*, 0.5 *N*. Dissolve 69 g of $MnSO_4.7H_2O$ in 1 liter of water.

Mercuric chloride, 0.25 *M*, 0.5 *N*. Dissolve 68 g of $HgCl_2$ in water. Dilute to 1 liter.

Mercuric nitrate, 0.25 *M*, 0.5 *N*. Dissolve 81 g of $Hg(NO_3)_2$ in 1 liter of water.

Mercuric sulfate, 0.25 *M*, 0.5 *N*. Dissolve 74 g of $HgSO_4$ in 1 liter of water.

Mercurous nitrate. Use 1 part $HgNO_3$, 20 parts water and 1 part HNO_3.

Nickel chloride, 0.25 *M*, 0.5 *N*. Dissolve 59 g of $NiCl_2 \cdot 6H_2O$ in 1 liter of water.

Nickel nitrate, 0.25 *M*, 0.5 *N*. Dissolve 73 g of $Ni(NO_3)_2 \cdot 6H_2O$ in 1 liter of water.

Nickel sulfate, 0.25 *M*, 0.5 *N*. Dissolve 66 g of $NiSO_4.6H_2O$ in 1 liter of water.

Potassium bromide, 0.5 *M*, 0.5 *N*. Dissolve 60 g of KBr in 1 liter of water.

Potassium carbonate, 1.5 *M*, 3 *N*. Dissolve 207 g of K_2CO_3 in 1 liter of water.

Potassium chloride, 0.5 *M*, 0.5 *N*. Dissolve 37 g of KCl in 1 liter of water.

Potassium chromate, 0.25 *M*, 0.5 *N*. Dissolve 49 g of K_2CrO_4 in 1 liter of water.

Potassium cyanide, 0.5 *M*, 0.5 *N*. Dissolve 33 g of KCN in 1 liter of water.

Potassium dichromate, 0.125 *M*. Dissolve 37 g of $K_2Cr_2O_7$ in 1 liter of water.

Potassium ferricyanide, 0.167 *M*, 0.5 *N*. Dissolve 55 g of $K_3Fe(CN)_6$ in 1 liter of water.

Potassium ferrocyanide, 0.5 *M*, 2 *N*. Dissolve 211 g of $K_4Fe(CN)_6.3H_2O$ in water. Dilute to 1 liter.

Potassium iodide, 0.5 *M*, 0.5 *N*. Dissolve 83 g of KI in 1 liter of water.

Potassium nitrate, 0.5 *M*, 0.5 *N*. Dissolve 51 g of KNO_3 in 1 liter of water.

Potassium sulfate, 0.25 *M*, 0.5 *N*. Dissolve 44 g of K_2SO_4 in 1 liter of water.

Silver nitrate, 0.5 *M*, 0.5 *N*. Dissolve 85 g of $AgNO_3$ in water. Dilute to 1 liter.

Sodium acetate, 3 *M*, 3 *N*. Dissolve 408 g of $NaC_2H_3O_2 \cdot 3H_2O$ in water. Dilute to 1 liter.

Sodium carbonate, 1.5 *M*, 3 *N*. Dissolve 159 g of Na_2CO_3, or 430 g of $Na_2CO_3.10H_2O$ in water. Dilute to 1 liter.

Sodium chloride, 0.5 *M*, 0.5 *N*. Dissolve 29 g of NaCl in 1 liter of water.

Sodium cobaltinitrite, 0.08 *M* (reagent for potassium). Dissolve 25 g of $NaNO_2$ in 75 ml of water, add 2 ml of glacial acetic acid and then 2.5 g of $Co(NO_3)_2.6H_2O$. Allow to stand for several days, filter and dilute to 100 ml. Reagent is somewhat unstable.

Sodium hydrogen phosphate, 0.167 *M*, 0.5 *N*. Dissolve 60 g of $Na_2HPO_4.12H_2O$ in 1 liter of water.

Sodium nitrate, 0.5 *M*, 0.5 *N*. Dissolve 43 g of $NaNO_2$ in 1 liter of water.

Sodium sulfate, 0.25 *M*, 0.5 *N*. Dissolve 36 g of Na_2SO_4 in 1 liter of water.

Sodium sulfide, 0.5 *M*, 1 *N*. Dissolve 120 g of $Na_2S.9H_2O$ in water and dilute to 1 liter. Or, saturate 500 ml of 1 *M* NaOH (21 g of 95% NaOH sticks) with H_2S, keeping the solution cool, and dilute with 500 ml of 1 *M* NaOH.

Stannic chloride, 0.125 *M*, 0.5 *N*. Dissolve 33 g of $SnCl_4$ in 1 liter of water.

Stannous chloride, 0.5 *M*, 1 *N*. Dissolve 113 g of $SnCl_2.2H_2O$ in 170 ml of conc. HCl, using heat if necessary. Dilute with water to 1 liter. Add a few pieces of tin foil. Prepare solution fresh at frequent intervals.

Stannous chloride (for Bettendorf test). Dissolve 113 g of $SnCl_2.2H_2O$ in 75 ml of conc. HCl. Add a few pieces of tin foil.

Strontium chloride, 0.25 *M*, 0.5 *N*. Dissolve 67 g of $SrCl_2.6H_2O$ in 1 liter of water.

Zinc nitrate, 0.25 *M*, 0.5 *N*. Dissolve 74 g of $Zn(NO_3)_2.6H_2O$ in 1 liter of water.

Zinc sulfate, 0.25 *M*, 0.5 *N*. Dissolve 72 g of $ZnSO_4.7H_2O$ in 1 liter of water.

SPECIAL SOLUTIONS AND REAGENTS

Aluminon (qualitative test for aluminum). Aluminon is a trade name for the ammonium salt of aurin tricarboxylic acid. Dissolve 1 g of the salt in 1 liter of distilled water. Shake the solution well to insure thorough mixing.

Bang's reagent (for glucose estimation). Dissolve 100 g of K_2CO_3, 66 g of KCl and 160 g of $KHCO_3$ in the order given in about 700 ml of water at 30° C. Add 4.4 g of $CuSO_4$ and dilute to 1 liter after the CO_2 is evolved. This solution should be shaken only in such a manner as not to allow entry of air. After 24 hours 300 ml are diluted to 1 liter with saturated KCl solution, shaken gently and used after 24 hours; 50 ml equivalent to 10 mg glucose.

Barfoed's reagent (test for glucose). See *Cupric acetate*.

Baudisch's reagent. See *Cupferron*.

Benedict's solution (qualitative reagent for glucose). With the aid of heat, dissolve 173 g of sodium citrate and 100 g of Na_2CO_3 in 800 ml of water. Filter, if necessary, and dilute to 850 ml. Dissolve 17.3 g of $CuSO_4.5H_2O$ in 100 ml of water. Pour the latter solution, with constant stirring, into the carbonate-citrate solution, and make up to 1 liter.

Benzidine hydrochloride solution (for sulfate determination). Make a paste of 8 g of benzidine hydrochloride ($C_{12}H_8(NH_2)_2.2HCl$) and 20 ml of water, add 20 ml of HCl (sp. gr. 1.12) and dilute to 1 liter with water. Each ml of this solution is equivalent to 0.00357 g of H_2SO_4.

Bertrand's reagent (glucose estimation). Consists of the following solutions:

(a) Dissolve 200 g of Rochelle salts and 150 g of NaOH in sufficient water to make 1 liter of solution.

(b) Dissolve 40 g of $CuSO_4$ in enough water to make 1 liter of solution.

(c) Dissolve 50 g of $Fe_2(SO_4)_3$ and 200 g of H_2SO_4 (sp. gr. 1.84) in sufficient water to make 1 liter of solution.

(d) Dissolve 5 g of $KMnO_4$ in sufficient water to make 1 liter of solution.

Bial's reagent (for pentose). Dissolve 1 g of orcinol ($CH_3.C_6H_3(OH)_2$) in 500 ml of 30% HCl to which 30 drops of a 10% solution of $FeCl_3$ has been added.

Boutron-Boudet soap solution.

(a) Dissolve 100 g of pure castile soap in about 2500 ml of 56% ethyl alcohol.

(b) Dissolve 0.59 g of $Ba(NO_3)_2$ in 1 liter of water.

Adjust the castile soap solution so that 2.4 ml of it will give a permanent lather with 40 ml of solution (b). When adjusted, 2.4 ml of soap solution is equivalent to 220 parts per million of hardness (as $CaCO_3$) for a 40 ml sample.

See also *Soap solution*.

Brucke's reagent (protein precipitation). See *Potassium iodide-mercuric iodide*.

Clarke's soap solution (or A.P.H.A. standard method). Estimation of hardness in water.

(a) Dissolve 100 g of pure powdered castile soap in 1 liter of 80% ethyl alcohol and allow to stand over night.

(b) Prepare a standard solution of $CaCl_2$ by dissolving 0.5 g of $CaCO_3$ in HCl (sp. gr. 1.19), neutralize with NH_4OH and make slightly alkaline to litmus, and dilute to 500 ml. One ml is equivalent to 1 mg of $CaCO_3$.

Titrate (a) against (b) and dilute (a) with 80% ethyl alcohol until 1 ml of the resulting solution is equivalent to 1 ml of (b) after making allowance for the lather factor (the amount of standard soap solution required to produce a permanent lather in 50 ml of distilled water). One ml of the adjusted solution after subtracting the lather factor is equivalent to 1 mg of $CaCO_3$.

See also *Soap solution*.

Cobalticyanide paper (Rinnmann's test for Zn). Dissolve 4 g of $K_3Co(CN)_6$ and 1 g of $KClO_3$ in 100 ml of water. Soak filter paper in solution and dry at 100° C. Apply drop of zinc solution and burn in an evaporating dish. A green disk is obtained if zinc is present.

Cochineal. Extract 1 g of cochineal for four days with 20 ml of alcohol and 60 ml of distilled water. Filter.

Congo red. Dissolve 0.5 g of congo red in 90 ml of distilled water and 10 ml of alcohol.

Cupferron (Baudisch's reagent for iron analysis). Dissolve 6 g of the ammonium salt of nitroso-phenyl-hydroxylamine (cupferron) in 100 ml of H_2O. Reagent good for one week only and must be kept in the dark.

Cupric acetate (Barfoed's reagent for reducing monosaccharides). Dissolve 66 g of cupric acetate and 10 ml of glacial acetic acid in water and dilute to 1 liter.

Cupric oxide, ammoniacal; Schweitzer's reagent (dissolves cotton, linen and silk, but not wool).

1. Dissolve 5 g of cupric sulfate in 100 ml of boiling water, and add sodium hydroxide until precipitation is complete. Wash the precipitate well, and dissolve it in a minimum quantity of ammonium hydroxide.

2. Bubble a slow stream of air through 300 ml of strong ammonium hydroxide containing 50 g of fine copper turnings. Continue for one hour.

Cupric sulfate in glycerin-potassium hydroxide (reagent for silk). Dissolve 10 g of cupric sulfate, $CuSO_4.5H_2O$, in 100 ml of water and add 5 g of glycerin. Add KOH solution slowly until a deep blue solution is obtained.

Cupron (benzoin oxime). Dissolve 5 g in 100 ml of 95% alcohol.

Cuprous chloride, acidic (reagent for CO in gas analysis).

1. Cover the bottom of a two-liter flask with a layer of cupric oxide about one-half inch deep, suspend a bunch of copper wire so as to reach from the bottom to the top of the solution, and fill the flask with hydrochloric acid (sp. gr. 1.10). Shake occasionally. When the solution becomes nearly colorless, transfer to reagent bottles, which should also contain copper wire. The stock bottle may be refilled with dilute hydrochloric acid until either the cupric oxide or the copper wire is used up.

Copper sulfate may be substituted for copper oxide in the above procedure.

2. Dissolve 340 g of $CuCl_2.2H_2O$ in 600 ml of conc. HCl and reduce the cupric chloride by adding 190 ml of a saturated solution of stannous chloride or until the solution is colorless. The stannous chloride is prepared by treating 300 g of metallic tin in a 500 ml flask with conc. HCl until no more tin goes into solution.

3. (Winkler method). Add a mixture of 86 g of CuO and 17 g of finely divided metallic Cu, made by the reduction of CuO with hydrogen, to a solution of HCl, made by diluting 650 ml of conc. HCl with 325 ml of water. After the mixture has been added slowly and with frequent stirring, a spiral of copper wire is suspended in the bottle, reaching all the way to the bottom. Shake occasionally, and when the solution becomes colorless, it is ready for use.

Cuprous chloride, ammoniacal (reagent for CO in gas analysis).

1. The acid solution of cuprous chloride as prepared above is neutralized with ammonium hydroxide until an ammonia odor persists. An excess of metallic copper must be kept in the solution.

2. Pour 800 ml of acidic cuprous chloride, prepared by the Winkler method, into about 4 liters of water. Transfer the

precipitate to a 250 ml graduate. After several hours, siphon off the liquid above the 50 ml mark and refill with 7.5 % NH_4OH solution which may be prepared by diluting 50 ml of conc. NH_4OH with 150 ml of water. The solution is well shaken and allowed to stand for several hours. It should have a faint odor of ammonia.

Dichlorofluorescein indicator. Dissolve 1 g in 1 liter of 70 % alcohol or 1 g of the sodium salt in 1 liter of water.

Dimethylglyoxime (diacetyl dioxime), 0.01 *N*. Dissolve 0.6 g of dimethylglyoxime, $(CH_3CNOH)_2$, in 500 ml of 95 % ethyl alcohol. This is an especially sensitive test for nickel, a very definite crimson color being produced.

Diphenylamine (reagent for rayon). Dissolve 0.2 g in 100 ml of concentrated sulfuric acid.

Diphenylamine sulfonate (for titration of iron with $K_2Cr_2O_7$). Dissolve 0.32 g of the barium salt of diphenylamine sulfonic acid in 100 ml of water, add 0.5 g of sodium sulfate and filter off the precipitate of $BaSO_4$.

Diphenylcarbazide. Dissolve 0.2 g of diphenylcarbazide in 10 ml of glacial acetic acid and dilute to 100 ml with 95 % ethyl alcohol.

Esbach's reagent (estimation of protein). To a water solution of 10 g of picric acid and 20 g of citric acid, add sufficient water to make one liter of solution.

Eschka's compound. Two parts of calcined ("light") magnesia are thoroughly mixed with one part of anhydrous sodium carbonate.

Fehling's solution (reagent for reducing sugars).

(a) Copper sulfate solution. Dissolve 34.66 g of $CuSO_4.5H_2O$ in water and dilute to 500 ml.

(b) Alkaline tartrate solution. Dissolve 173 g of potassium sodium tartrate (Rochelle salts, $KNaC_4H_4O_6.4H_2O$) and 50 g of NaOH in water and dilute when cold to 500 ml.

For use, mix equal volumes of the two solutions at the time of using.

Ferric-alum indicator. Dissolve 140 g of ferric-ammonium sulfate crystals in 400 ml of hot water. When cool, filter, and make up to a volume of 500 ml with dilute (6 *N*) nitric acid.

Folin's mixture (for uric acid). To 650 ml of water add 500 g of $(NH_4)_2SO_4$, 5 g of uranium acetate and 6 g of glacial acetic acid. Dilute to 1 liter.

Formaldehyde-sulfuric acid (Marquis' reagent for alkaloids). Add 10 ml of formaldehyde solution to 50 ml of sulfuric acid.

Froehde's reagent. See *Sulfomolybdic acid.*

Fuchsin (reagent for linen). Dissolve 1 g of fuchsin in 100 ml of alcohol.

Fuchsin-sulfurous acid (Schiff's reagent for aldehydes). Dissolve 0.5 g of fuchsin and 9 g of sodium bisulfite in 500 ml of water, and add 10 ml of HCl. Keep in well-stoppered bottles and protect from light.

Gunzberg's reagent (detection of HCl in gastric juice). Prepare as needed a solution containing 4 g of phloroglucinol and 2 g of vanillin in 100 ml of absolute ethyl alcohol.

Hager's reagent. See *Picric acid.*

Hanus solution (for iodine number). Dissolve 13.2 g of resublimed iodine in one liter of glacial acetic acid which will pass the dichromate test for reducible matter. Add sufficient bromine to double the halogen content, determined by titration (3 ml is about the proper amount). The iodine may be dissolved by the aid of heat, but the solution should be cold when the bromine is added.

Iodine, tincture of. To 50 ml of water add 70 g of I_2 and 50 g of KI. Dilute to 1 liter with alcohol.

Iodo-potassium iodide (Wagner's reagent for alkaloids). Dissolve 2 g of iodine and 6 g of KI in 100 ml of water.

Litmus (indicator). Extract litmus powder three times with boiling alcohol, each treatment consuming an hour. Reject the alcoholic extract. Treat residue with an equal weight of cold water and filter; then exhaust with five times its weight of boiling water, cool and filter. Combine the aqueous extracts.

Magnesia mixture (reagent for phosphates and arsenates). Dissolve 55 g of magnesium chloride and 105 g of ammonium chloride in water, barely acidify with hydrochloric acid, and dilute to 1 liter. The ammonium hydroxide may be omitted until just previous to use. The reagent, if completely mixed and stored for any period of time, becomes turbid.

Magnesium reagent. See *S and O reagent.*

Magnesium uranyl acetate. Dissolve 100 g of $UO_2(C_2H_3O_2)_2.2H_2O$ in 60 ml of glacial acetic acid and dilute to 500 ml. Dissolve 330 g of $Mg(C_2H_3O_2)_2.4H_2O$ in 60 ml of glacial acetic acid and dilute to 200 ml. Heat solutions to the boiling point until clear, pour the magnesium solution into the uranyl solution, cool and dilute to 1 liter. Let stand over night and filter if necessary.

Marme's reagent. See *Potassium-cadmium iodide.*

Marquis' reagent. See *Formaldehyde-sulfuric acid.*

Mayer's reagent (white precipitate with most alkaloids in slightly acid solutions). Dissolve 1.358 g of $HgCl_2$ in 60 ml of water and pour into a solution of 5 g of KI in 10 ml of H_2O. Add sufficient water to make 100 ml.

Methyl orange indicator. Dissolve 1 g of methyl orange in 1 liter of water. Filter, if necessary.

Methyl orange, modified. Dissolve 2 g of methyl orange and 2.8 g of xylene cyanole FF in 1 liter of 50% alcohol.

Methyl red indicator. Dissolve 1 g of methyl red in 600 ml of alcohol and dilute with 400 ml of water.

Methyl red, modified. Dissolve 0.50 g of methyl red and 1.25 g of xylene cyanole FF in 1 liter of 90% alcohol. Or, dissolve 1.25 g of methyl red and 0.825 g of methylene blue in 1 liter of 90% alcohol.

Millon's reagent (for albumins and phenols). Dissolve 1 part of mercury in 1 part of cold fuming nitric acid. Dilute with twice the volume of water and decant the clear solution after several hours.

Mixed indicator. Prepared by adding about 1.4 g of xylene cyanole FF to 1 g of methyl orange. The dye is seldom pure enough for these proportions to be satisfactory. Each new lot of dye should be tested by adding additional amounts of the dye until a test portion gives the proper color change. The acid color of this indicator is like that of permanganate; the neutral color is gray; and the alkaline color is green. Described by Hickman and Linstead, J. Chem. Soc. (Lon.), **121,** 2502 (1922).

Molisch's reagent. See *α-Naphthol.*

α-Naphthol (Molisch's reagent for wool). Dissolve 15 g of α-naphthol in 100 ml of alcohol or chloroform.

Nessler's reagent (for ammonia). Dissolve 50 g of KI in the smallest possible quantity of cold water (50 ml). Add a saturated solution of mercuric chloride (about 22 g in 350 ml of water will be needed) until an excess is indicated by the formation of a precipitate. Then add 200 ml of 5 *N* NaOH and dilute to 1 liter. Let settle, and draw off the clear liquid.

Nickel oxide, ammoniacal (reagent for silk). Dissolve 5 g of nickel sulfate in 100 ml of water, and add sodium hydroxide solution until nickel hydroxide is completely precipitated. Wash the precipitate well and dissolve in 25 ml of concentrated ammonium hydroxide and 25 ml of water.

***p*-Nitrobenzene-azo-resorcinol** (reagent for magnesium). Dissolve 1 g of the dye in 10 ml of *N* NaOH and dilute to 1 liter.

Nitron (detection of nitrate radical). Dissolve 10 g of nitron ($C_{20}H_{16}N_4$, 4, 5-dihydro-1, 4-diphenyl-3, 5-phenylimino-1, 2, 4-triazole) in 5 ml of glacial acetic acid and 95 ml of water. The solution may be filtered with slight suction through an alundum crucible and kept in a dark bottle.

α-Nitroso-β-naphthol. Make a saturated solution in 50% acetic acid (1 part of glacial acetic acid with 1 part of water). Does not keep well.

Nylander's solution (carbohydrates). Dissolve 20 g of bismuth subnitrate and 40 g of Rochelle salts in 1 liter of 8% NaOH solution. Cool and filter.

Obermayer's reagent (for indoxyl in urine). Dissolve 4 g of $FeCl_3$ in one liter of HCl (sp. gr. 1.19).

Oxine. Dissolve 14 g of HC_9H_6ON in 30 ml of glacial acetic acid. Warm slightly, if necessary. Dilute to 1 liter.

Oxygen absorbent. Dissolve 300 g of ammonium chloride in one liter of water and add one liter of concentrated ammonium hydroxide solution. Shake the solution thoroughly. For use as an oxygen absorbent, a bottle half full of copper turnings is filled nearly full with the NH_4Cl-NH_4OH solution and the gas passed through.

Pasteur's salt solution. To one liter of distilled water add 2.5 g of potassium phosphate, 0.25 g of calcium phosphate, 0.25 g of magnesium sulfate and 12.00 g of ammonium tartrate.

Pavy's solution (glucose reagent). To 120 ml of Fehling's solution, add 300 ml of NH_4OH (sp. gr. 0.88) and dilute to 1 liter with water.

Phenanthroline ferrous ion indicator. Dissolve 1.485 g of phenanthroline monohydrate in 100 ml of 0.025 *M* ferrous sulfate solution.

Phenolphthalein. Dissolve 1 g of phenolphthalein in 50 ml of alcohol and add 50 ml of water.

Phenolsulfonic acid (determination of nitrogen as nitrate). Dissolve 25 g of phenol in 150 ml of conc. H_2SO_4, add 75 ml of fuming H_2SO_4 (15% SO_3), stir well and heat for two hours at 100° C.

Phloroglucinol solution (pentosans). Make a 3% phloroglucinol solution in alcohol. Keep in a dark bottle.

Phosphomolybdic acid (Sonnenschein's reagent for alkaloids).

1. Prepare ammonium phosphomolybdate and after washing with water, boil with nitric acid and expel NH_3; evaporate to dryness and dissolve in 2 *N* nitric acid.

2. Dissolve ammonium molybdate in HNO_3 and treat with phosphoric acid. Filter, wash the precipitate, and boil with aqua regia until the ammonium salt is decomposed. Evaporate to dryness. The residue dissolved in 10% HNO_3 constitutes Sonnenschein's reagent.

Phosphoric acid—sulfuric acid mixture. Dilute 150 ml of conc. H_2SO_4 and 100 ml of conc. H_3PO_4 (85%) with water to a volume of 1 liter.

Phosphotungstic acid (Scheibler's reagent for alkaloids).

1. Dissolve 20 g of sodium tungstate and 15 g of sodium phosphate in 100 ml of water containing a little nitric acid.

2. The reagent is a 10% solution of phosphotungstic acid in water. The phosphotungstic acid is prepared by evaporating a mixture of 10 g of sodium tungstate dissolved in 5 g of phosphoric acid (sp. gr. 1.13) and enough boiling water to effect solution. Crystals of phosphotungstic acid separate.

Picric acid (Hager's reagent for alkaloids, wool and silk). Dissolve 1 g of picric acid in 100 ml of water.

Potassium antimonate (reagent for sodium). Boil 22 g of potassium antimonate with 1 liter of water until nearly all of the salt has dissolved, cool quickly, and add 35 ml of 10% potassium hydroxide. Filter after standing over night.

Potassium-cadmium iodide (Marme's reagent for alkaloids). Add 2 g of CdI_2 to a boiling solution of 4 g of KI in 12 ml of water, and then mix with 12 ml of saturated KI solution.

Potassium hydroxide (for CO_2 absorption). Dissolve 360 g of KOH in water and dilute to 1 liter.

Potassium iodide-mercuric iodide (Brucke's reagent for proteins). Dissolve 50 g of KI in 500 ml of water, and saturate with mercuric iodide (about 120 g). Dilute to 1 liter.

Potassium pyrogallate (for oxygen absorption). For mixtures of gases containing less than 28% oxygen, add 100 ml of KOH solution (50 g of KOH to 100 ml of water) to 5 g of pyrogallol. For mixtures containing more than 28% oxygen the KOH solution should contain 120 g of KOH to 100 ml of water.

Pyrogallol, alkaline.

(a) Dissolve 75 g of pyrogallic acid in 75 ml of water.

(b) Dissolve 500 g of KOH in 250 ml of water. When cool, adjust until sp. gr. is 1.55.

For use, add 270 ml of solution (b) to 30 ml of solution (a).

Rosolic acid (indicator). Dissolve 1 g of rosolic acid in 10 ml of alcohol and add 100 ml of water.

S and O reagent (Suitsu and Okuma's test for Mg). Dissolve 0.5 g of the dye (*o*-*p*-dihydroxy-monazo-*p*-nitrobenzene) in 100 ml of 0.25 N NaOH.

Scheibler's reagent. See *Phosphotungstic acid.*

Schiff's reagent. See *Fuchsin-sulfurous acid.*

Schweitzer's reagent. See *Cupric oxide, ammoniacal.*

Soap solution (reagent for hardness in water). Dissolve 100 g of dry castile soap in 1 liter of 80% alcohol (5 parts alcohol to 1 part water). Allow to stand several days and dilute with 70% to 80% alcohol until 6.4 ml produces a permanent lather with 20 ml of standard calcium solution. The latter solution is made by dissolving 0.2 g of $CaCO_3$ in a small amount of dilute HCl, evaporating to dryness and making up to 1 liter.

Sodium bismuthate (oxidation of manganese). Heat 20 parts of NaOH nearly to redness in an iron or nickel crucible and add slowly 10 parts of basic bismuth nitrate which has been previously dried. Add two parts of sodium peroxide, and pour the brownish-yellow fused mass on an iron plate to cool. When cold, break up in a mortar, extract with water, and collect on an asbestos filter.

Sodium hydroxide (for CO_2 absorption). Dissolve 330 g of NaOH in water and dilute to 1 liter.

Sodium nitroprusside (reagent for hydrogen sulfide and wool). Use a freshly prepared solution of 1 g of sodium nitroprusside in 10 ml of water.

Sodium oxalate, according to Sörensen (primary standard). Dissolve 30 g of the commercial salt in 1 liter of water, make slightly alkaline with sodium hydroxide, and let stand until perfectly clear. Filter and evaporate the filtrate to 100 ml. Cool and filter. Pulverize the residue and wash it several times with small volumes of water. The procedure is repeated until the mother liquor is free from sulfate and is neutral to phenolphthalein.

Sodium plumbite (reagent for wool). Dissolve 5 g of sodium hydroxide in 100 ml of water. Add 5 g of litharge and boil until dissolved.

Sodium polysulfide. Dissolve 480 g of $Na_2S.9H_2O$ in 500 ml of water, add 40 g of NaOH and 18 g of sulfur. Stir thoroughly and dilute to 1 liter with water.

Sonnenschein's reagent. See *Phosphomolybdic acid.*

Starch solution.

1. Make a paste with 2 g of soluble starch and 0.01 g of HgI_2 with a small amount of water. Add the mixture slowly to 1 liter of boiling water and boil for a few minutes. Keep in a glass stoppered bottle. If other than soluble starch is used, the solution will not clear on boiling; it should be allowed to stand and the clear liquid decanted.

2. A solution of starch which keeps indefinitely is made as follows: Mix 500 ml of saturated NaCl solution (filtered), 80 ml of glacial acetic acid, 20 ml of water and 3 g of starch. Bring slowly to a boil and boil for two minutes.

3. Make a paste with 1 g of soluble starch and 5 mg of HgI_2, using as little cold water as possible. Then pour about 200 ml of boiling water on the paste and stir immediately. This will give a clear solution if the paste is prepared correctly and the water actually boiling. Cool and add 4 g of KI. Starch solution decomposes on standing due to bacterial action, but this solution will keep a long time if stored under a layer of toluene.

Stoke's reagent. Dissolve 30 g of $FeSO_4$ and 20 g of tartaric acid in water and dilute to 1 liter. Just before using, add concentrated NH_4OH until the precipitate first formed is redissolved.

Sulfanilic acid (reagent for nitrites). Dissolve 0.5 g of sulfanilic acid in a mixture of 15 ml of glacial acetic acid and 135 ml of recently boiled water.

Sulfomolybdic acid (Froehde's reagent for alkaloids and glucosides). Dissolve 10 g of molybdic acid or sodium molybdate in 100 ml of conc. H_2SO_4.

Tannic acid (reagent for albumen, alkaloids and gelatin). Dissolve 10 g of tannic acid in 10 ml of alcohol and dilute with water to 100 ml.

Titration mixture. See *Zimmermann-Reinhardt reagent.*

***o*-Tolidine solution** (residual chlorine in water analysis). Prepare 1 liter of dilute HCl (100 ml of HCl (sp. gr. 1.19) in sufficient water to make 1 liter). Dissolve 1 g of *o*-tolidine in 100 ml of the dilute HCl and dilute to 1 liter with dilute HCl solution.

Trinitrophenol solution. See *Picric acid.*

Turmeric paper. Impregnate white, unsized paper with the tincture, and dry.

Turmeric tincture (reagent for borates). Digest ground turmeric root with several quantities of water which are discarded. Dry the residue and digest it several days with six times its weight of alcohol. Filter.

Uffelmann's reagent (turns yellow in presence of a lactic acid). To a 2% solution of pure phenol in water, add a water solution of $FeCl_3$ until the phenol solution becomes violet in color.

Wagner's reagent. See *Iodo-potassium iodide.*

Wagner's solution (used in phosphate rock analysis to prevent precipitation of iron and aluminum). Dissolve 25 g of citric acid and 1 g of salicylic acid in water and dilute to 1 liter. Use 50 ml of the reagent.

Wij's iodine monochloride solution (for iodine number). Dissolve 13 g of resublimed iodine in 1 liter of glacial acetic acid which will pass the dichromate test for reducible matter. Set aside 25 ml of this solution. Pass into the remainder of the solution dry chlorine gas (dried and washed by passing through H_2SO_4 (sp. gr. 1.84)) until the characteristic color of free iodine has been discharged. Now add the iodine solution which was reserved, until all free chlorine has been destroyed. A slight excess of iodine does little or no harm, but an excess of chlorine must be avoided. Preserve in well stoppered, amber colored bottles. Avoid use of solutions which have been prepared for more than 30 days.

Wij's special solution (for iodine number—Analyst **58,** 523–7, 1933). To 200 ml of glacial acetic acid that will pass the dichromate test for reducible matter, add 12 g of dichloroamine T (paratoluene-sulfonedichloroamide), and 16.6 g of dry KI (in small quantities with continual shaking until all the KI has dissolved). Make up to 1 liter with the same quality of acetic acid used above and preserve in a dark colored bottle.

Zimmermann-Reinhardt reagent (determination of iron). Dissolve 70 g of $MnSO_4.4H_2O$ in 500 ml of water, add 125 ml of conc. H_2SO_4 and 125 ml of 85% H_3PO_4, and dilute to 1 liter.

Zinc chloride solution, basic (reagent for silk). Dissolve 1000 g of zinc chloride in 850 ml of water, and add 40 g of zinc oxide. Heat until solution is complete.

Zinc uranyl acetate (reagent for sodium). Dissolve 10 g of $UO_2(C_2H_3O_2)_2.2H_2O$ in 6 g of 30% acetic acid with heat, if necessary, and dilute to 50 ml. Dissolve 30 g of $Zn(C_2H_3O_2)_2.$-$2H_2O$ in 3 g of 30% acetic acid and dilute to 50 ml. Mix the two solutions, add 50 mg of NaCl, allow to stand over night and filter.

STANDARD SOLUTIONS FOR VOLUMETRIC ANALYSIS

Acids

Hydrochloric acid, normal. (36.465 g per liter) (a) 180.15 g of constant boiling point (760 mm) acid diluted to 1 liter gives an exactly normal solution. (b) Concentrated HCl diluted to d 1.020 is approximately normal. (c) Concentrated HCl contains about one-third of its weight of HCl and 120 g diluted with water to 1 liter will give an acid slightly greater than normal. Solutions prepared as in (b) or (c) are most accurately standardized by precipitation as AgCl.

Hydrochloric acid solutions, standard, by the method of G. A. Hulett and W. D. Bonner. *Jour. Am. Chem. Soc.* **31,** 390 (1909). Standard HCl is easily prepared by starting with HCl of about d 1.10, made up with an ordinary hydrometer, distilling off and discarding the first three-fourths of the liquid taken; the distillate which is then collected does not differ by more than one part in 10,000 from the values in the table below. This constant boiling acid is not hygroscopic or noticeably volatile and is easily weighed in a small flask. By the use of a capillary pipette, to adjust the last amount of acid, it is a very simple matter to weigh out 180.15 g to less than 10 mg and this furnishes sufficient acid to make a liter of normal solution with an accuracy that is seldom attained even with very elaborate precautions.

Constant Boiling Hydrochloric Acid

Bonner-Titus, J.A C S , **52,** 633, 1930; Bonner-Wallace, J A C.S , **52,** 1747

Pressure	B.P.	Density	% HCl	Pressure	B.P.	Density	% HCl	g for 1 l of N sol.
100	62 4	1 1095	22 97	600	102 209	1 0980	20 638	176 52
200	75 9	1 1058	22 202	700	106 424	1 0966	20 360	178 93
300	84 9	1 1031	21 660	760	108 584	1 0959	20 222	180 15
400	92 080	1 1010	21 235	800	110 007	1 0955	20 155	180 74
500	97.578	1.0993	20 916	1000	116 185	1 0933	19 734	
				1200	122 38	1 0917	19 42	

Slightly different figures are given for a range near atmospheric pressure by Hollingsworth and Foulk.

Bar. pressure	% HCl by weight	Wt HCl sol. for 1 mole HCl
770	20 197	180 407
760	20 221	180 193
750	20.245	179 979
740	20 269	179 766
730	20.293	179.555

SOLUTIONS FOR VOLUMETRIC ANALYSIS (Continued)

Nitric acid, normal. (63.016 g per liter) Use a colorless acid, d 1.3 ±, free from chlorine and nitrous acid; a yellow color due to lower oxides of nitrogen is removed by adding about 2 volumes of water, boiling, cooling and then diluting to volume. 65 ml or 93 g of acid, d 1.42 diluted to 1 liter gives an acid slightly greater than normal. Standardize by titration with standard alkali.

Oxalic acid, normal. $H_2C_2O_4$ (63.023 g of $H_2C_2O_4.2H_2O$ or 45.008 g of $H_2C_2O_4$ per liter) Because of the uncertainty in the amount of water of crystallization, standards in dry climates cannot be prepared directly by dissolving a weighed quantity of acid. However, in a humid atmosphere finely ground oxalic acid crystals may be exposed to the air for a few hours, and brought to the proper composition. Unless this is done it is necessary to standardize the solution against alkali of known concentration using phenolphthalein as an indicator. Decinormal or less concentrated solutions are unstable and should be prepared fresh when needed; more concentrated solutions may deposit some of the acid when cooled to low temperatures but they are fairly stable at room temperature when protected from light.

Potassium acid phthalate, decinormal. ($KHC_8H_4O_4$, 10.207 g per 500 ml) This monobasic acid is recommended for the preparation of standard acid solutions, since it has a high equivalent weight, is anhydrous, stable, non-hygroscopic, and can be purchased with a purity factor of 99.95 %. Spread 10–11 g of the salt in a thin layer on a watch glass and dry at 110–120° C in an electric oven for 2-3 hours. Cool in a desiccator and weigh to the nearest milligram. Transfer the salt to a 500 ml volumetric flask, with aid of a funnel, and reweigh the watch glass with any adhering powder. Dissolve the salt in the flask, dilute to volume, and mix thoroughly. Compute the normality of the solution by the equation

$$\text{Normality} = \frac{\text{Weight of salt} \times \text{purity}}{102.07}$$

Potassium acid phthalate is suitable for the titration of carbonate-free strong bases, using phenolphthalein indicator, but is not suitable for titration of ammonium hydroxide.

Succinic acid, decinormal. $H_2C_4H_4O_4$ (5.9023 g per liter) Dry 5–6 g of pure succinic acid in an open weighing bottle at 105° for about 10 hours; cool in a desiccator. Weigh out accurately 2.9512 g, brush into a 400 ml beaker and dissolve in 150–200 ml of water; pour the solution into a 500 ml graduated flask, rinsing out the beaker several times to insure complete transference of the acid. Dilute to exactly 500 ml and mix thoroughly. This prepares an exact decinormal solution.

Sulfuric acid, normal. (49.04 g per liter) Take 30 ml of pure, concentrated H_2SO_4, d 1.84 and pour it cautiously and slowly into about 3–4 volumes of water, cool, mix thoroughly and dilute to 1 liter. Standardize by titration with standard

NaOH or KOH solutions with phenolphthalein as indicator. For a decinormal solution use 3 ml H_2SO_4 per liter and proceed as above. Sulfuric acid is obtained easily in a pure form; the normal acid solution is not affected by boiling (advantage over similar HNO_3 or HCl solutions); when used with lime or similar compounds, it gives precipitates and for such cases HCl is preferable.

Bases

For the titration of weak acids, bases should be made free of carbonate and used with phenolphthalein indicator. Such solutions should be stored in siphon-equipped bottles and protected from carbon dioxide by a soda-lime tube on the air inlet. The burette used for the titration should be capped by a one-hole stopper bearing a small tube of soda lime. If a base is to be used only for the titration of strong acids, it is unnecessary to remove carbonate or to protect the solution from carbon dioxide, since absorption of the latter does not change the alkaline value of the solution. Bases containing carbonate should be used with methyl orange indicator.

Potassium hydroxide, normal. (56.108 g per liter) Dissolve 64 g of potassium hydroxide, of assay value 85 % or better, in water and dilute to 1 liter. Standardize as directed for sodium hydroxide.

Sodium hydroxide, decinormal. Carbonate free. Prepare the carbonate free solution by one of the following methods:

1. Dissolve 6 g of sodium hydroxide in 200 ml of water. heat to boiling, and slowly add to the boiling solution 5 ml of 5 % barium chloride solution. Allow the precipitate to settle, add a few drops of barium chloride solution and notice whether a fresh precipitate forms. If more precipitate is formed, add another 5 ml of the reagent, and again test for completeness of precipitation of carbonate. Continue in this manner until no further precipitate forms. Allow the precipitate to settle, decant off two-thirds of the clear solution, and dilute to 1 liter with freshly boiled water. Standardize by titrating weighed 0.6–0.8 g portions of dry potassium acid phthalate, dissolved in 100 ml of water. Use phenolphthalein indicator.

2. (Recommended method) Dissolve 7 g of sodium hydroxide in 7 ml of water and filter the viscous liquid through an asbestos mat in a Gooch crucible, with aid of suction. Catch the filtrate in a small dry test tube. Do not wash the residue. Pour off two-thirds of the clear filtrate and dilute to 1 liter with freshly boiled water.

3. Place within an empty vacuum desiccator a beaker of water and a dry beaker containing 2.3 g of sodium metal, cut into thin shavings. The sodium must be clean and free of oil. Connect the desiccator to a water aspirator pump and evacuate. In the atmosphere of water vapor thus formed, the sodium metal quickly reacts to form sodium hydroxide. Continue to evacuate the desiccator until all the metal has dissolved and a

clear solution remains in the beaker. Dilute all this solution to 1 liter with freshly boiled water.

Sodium hydroxide, normal. (40.005 g per liter) Dissolve 42 g of sodium hydroxide sticks or pellets, of assay value 95% or better, in water and dilute to 1 liter. Standardize with normal hydrochloric acid or sulfuric acid, using methyl orange indicator.

Oxidizing and Reducing Solutions

Arsenite, alkaline, decinormal. $As^{III} \rightarrow As^{V}$ (4.9465 g As_2O_3 per liter; equivalent to 0.0126932 g I or 0.0035457 g Cl per ml) Dissolve 4.9465 g of pure sublimed As_2O_3 in a concentrated solution of 4 g of NaOH, add 100 ml of a saturated $NaHCO_3$ solution and dilute to 1 liter. Do not warm the solution above 60° C when dissolving the As_2O_3. Standardize against standard iodine solution with a starch indicator.

Ceric sulfate (oxidizing agent). Ceric sulfate is a strong oxidizing agent in acid solutions, is stable over a long period, can be used to titrate reducing agents in the presence of HCl and has only one valence change from 4 to 3. It can be used as a volumetric reagent in acid medium only since perceric compounds are formed in an alkaline medium. It cannot be used as its own indicator if the solution is colored.

1. The solution is made up for use by adding 64–66 g of ceric ammonium sulfate, $Ce(SO_4)_2.2(NH_4)_2SO_4.2H_2O$ or 35–40 g of ceric sulfate, $Ce(SO_4)_2$, to a solution of 500 ml of H_2O and 28 ml of concentrated H_2SO_4. The solution should be stirred until all is dissolved and 500 ml more of distilled water added.

2. Alternative method. To 35 g of ceric oxide in a 600 ml beaker, add 46 ml of concentrated H_2SO_4. Carefully add 50 ml of water and heat at boiling for five minutes. Cool somewhat and add, carefully, 450 ml of water. Digest until solution is complete. Filter, if necessary, dilute to 1000 ml and standardize.

The solution can be standardized against arsenious oxide dissolved in NaOH and acidified with H_2SO_4; against sodium oxalate or electrolytic iron by the Zimmermann-Reinhardt Method, using sodium diphenylamine sulfonate as indicator. The indicator acid is tri-ortho-phenanthroline ferrous sulfate, $(C_{12}H_8N_2.H_2O)FeSO_4$. The reaction involved in the standardization with sodium oxalate is $H_2C_2O_4 + 2Ce(SO_4)_2 = 2CO_2 + Ce_2(SO_4)_3 + H_2SO_4$.

An amount of sodium oxalate is weighed out which will require 25–35 ml of 0.1 N ceric sulfate solution for titration. To this is added 10–20 ml of concentrated HCl, 5 ml of 0.005 M iodine chloride and enough water to make a volume of 100 ml. The solution should be heated to 50° C, 1 drop of indicator added, and the solution titrated with ceric sulfate until the solution becomes pale blue in color and there is no return of any pink color after one minute. The temperature should not fall below 45° C.

Ceric sulfate may be used to titrate ferrous chloride according

to the reaction: $2FeCl_2 + 2Ce(SO_4)_2 + 2HCl = 2FeCl_3 + Ce_2(SO_4)_3 + H_2SO_4$.

Calcium may be precipitated as the oxalate, dissolved in dilute HCl and titrated with ceric sulfate. Chromium, arsenic, ferrocyanide and hydrogen peroxide may be titrated with ceric sulfate.

Iodine, decinormal. $I_2 \rightarrow 2HI$ (12.6932 g per liter) Dissolve about 13.5 g of pure sublimed iodine in a solution of 24 g of KI in 200 ml of H_2O and dilute to 1 liter. The solution is standardized by adding the iodine to a known volume of standard thiosulfate with a few drops of starch solution for the indicator.

Potassium dichromate, decinormal. $Cr^{vi} \rightarrow Cr^{iii}$ (4.904 g per liter) Grind about 5 g of potassium dichromate, of the purest grade obtainable, spread in a thin layer on a watch glass, and dry in an electric oven at 120–140° C for 2–4 hours. Cool in a desiccator and weigh to the nearest milligram. Transfer the powder to a 1 liter volumetric flask, with the aid of a funnel, and reweigh the watch glass with any adhering powder. Add water to the flask, shake until the sample is dissolved, dilute to volume and mix thoroughly. Compute the normality from the equation

$$\text{Normality} = \frac{\text{Weight potassium dichromate}}{49.04}$$

If pure dichromate is not available the solution may be standardized by iron wire or against an iron ore of known analysis. Weigh out three 0.2 g samples of clean, bright iron wire (prepared "for standardization", with purity factor of 99.8%) and transfer each to a 500 ml Erlenmeyer flask. Dissolve the wire in 10 ml of concentrated hydrochloric acid, keeping the flask covered with a small watch glass until solution is complete. Disregard a small residue of carbon which may remain in the solution as black particles. Rinse off the watch glass, heat the solution nearly to boiling and add stannous chloride solution (5 g of salt dissolved in 10 ml of concentrated hydrochloric acid, and diluted to 100 ml) a drop at a time until the solution is colorless. *Avoid an excess of over one drop of stannous chloride.* Cool completely and pour in 10 ml of saturated mercuric chloride solution. Allow to stand 2 minutes, then add a well cooled solution of 5 ml of 85% phosphoric acid in 200 ml of 3 *N* sulfuric acid (8:100). Add 6–8 drops of an indicator solution (containing 3 g of the sodium or barium salt of diphenylamine sulfonic acid per liter) and titrate with dichromate solution to the first appearance of a purple or violet tinge. The titration should be made slowly, since the reaction proceeds rather slowly. Run a blank. From the net volume of dichromate, compute the normality by the equation

$$\text{Normality} = \frac{\text{Weight of iron wire} \times \text{purity of iron}}{\text{Volume of dichromate} \times 0.05584}$$

Potassium permanganate, decinormal. $Mn^{vii} \rightarrow Mn^{ii}$ (3.1606 g per liter) Dissolve 3.3 g of dry $KMnO_4$ in 1 liter of

distilled water and allow to stand at least 24 hours in a clean glass-stoppered bottle. The reasons for not using the freshly prepared solution are: 1st, the reducing agents in the water (dust, etc.) are thus all oxidized, and 2nd, any MnO_2 formed by this reduction is permitted to settle. The solution is then carefully siphoned through a clean glass tube into clean beakers, discarding the first 25 ml of solution and the last inch of the solution in the bottle which contains the precipitated MnO_2; the $KMnO_4$ solution should never be permitted to come in contact with rubber, filter paper or other organic matter. The solution in the beakers is now poured back into a clean bottle and standardized against sodium oxalate. Weigh out several 0.25–0.30 g samples of sodium oxalate having an assay value of 99.95 %, transfer each portion to a 600 ml beaker, and dissolve in 250 ml of dilute sulfuric acid (5:95). Stir until the oxalate has dissolved, then add rapidly* from a burette about 95 % of the amount of permanganate needed for complete oxidation of the sample (a preliminary titration is made with one sample to determine the approximate amount of permanganate needed). Allow the solution to stand until the permanganate is decolorized, then heat to 55–60° C and complete the titration at this temperature, stirring *gently* with a thermometer and allowing each drop to become decolorized before adding the next. The end point is shown by a faint pink tinge which persists for 30 seconds. Run a blank on 250 ml of dilute sulfuric acid, heated to 60° C. From the net volume of permanganate, compute the normality by the equation

$$\text{Normality} = \frac{\text{Weight sodium oxalate} \times \text{purity}}{\text{Volume permanganate} \times 0.067}$$

Sodium thiosulfate, decinormal. $2Na_2S_2O_3 \rightarrow Na_2S_4O_6$ (24.8192 g of $Na_2S_2O_3.5H_2O$ per liter) Do not dry the sodium thiosulfate in an oven as it can be obtained almost pure; weigh out 25.0 g and dilute to exactly 1 liter. After mixing thoroughly, the solution is allowed to stand two weeks. If free sulfur has separated, the clear liquid is siphoned off. The solution is standardized indirectly by titration with potassium dichromate (see above). Dissolve 5 g of KI and 4 g of $NaHCO_3$ in 300 ml of H_2O in a 500 ml Erlenmeyer flask at room temperature and then add HCl slowly, swirling the flask, until there is no more evolution of CO_2 and then add about 10 ml more acid; add 35 ml of 0.1 N $K_2Cr_2O_7$, mixing the solutions, rinse the sides of the flask with a few ml of water, allowing it to form a layer over the solution without mixing; stopper the flask and allow to stand about 10 minutes. Then with thorough mixing run in thiosulfate until the solution is a light yellow, add a few drops of starch solution and continue with a slow addition of thiosulfate until the bright blue color has disappeared and only the pale green color of $CrCl_3$ remains.

* The method given for standardization is based upon the directions of Fowler and Bright, Bur. Stand. J. Res., **15**, 493 (1935).

REAGENTS FOR SEMI-MICRO QUALITATIVE ANALYSIS

Compiled by D. W. Pearce

The following reagents have been found extremely sensitive as confirmatory tests for the ions indicated. In most cases separation from other ions by micro or semi-micro technique should precede the test. For interferences, references to original literature, and detailed procedures see Feigl, "Qualitativ Analyse mit Hilfe von Tupfelreactionen", or Engelder, Dunkelberger and Schiller, "Semi-Micro Qualitative Analysis". Also see table, *Organic Analytical Reagents*, for other reagents.

Ammonium molybdate. Dissolve 15 g of ammonium molybdate in 300 ml of water, add 100 ml of nitric acid (1:2) and saturate with ammonium nitrate. Fine yellow precipitate for $H_2PO_4^-$ (cold) or $H_2AsO_4^-$ (60° C) in nitric acid solution.

Aniline sulfate. Concentrated solution of aniline sulfate in concentrated sulfuric acid. Reagent gives instant blue color with ClO_3^-; other strong oxidants as NO_3^- give the blue color much more slowly.

Benzidine acetate—cupric acetate. (a) Dilute 47.5 ml of saturated benzidene acetate solution to 100 ml. (b) Dissolve 0.286 g of cupric acetate in 100 ml solution. Solution (a) + solution (b) on spot paper gives blue color with HCN vapors.

α-Benzoinoxime. 5% alcoholic solution. Green precipitate with Cu^{++} in slightly ammoniacal solution.

Bettendorf's reagent. Saturated solution of $SnCl_2$ in concentrated HCl. Brown color or black precipitate upon adding As^{+3} (immediate) or As^{+5} (on standing), to excess of the reagent.

Brucine reagent. 0.02 g of brucine dissolved in 100 ml of concentrated sulfuric acid. Test solution + concentrated sulfuric acid + brucine reagent gives fleeting red color with NO_3^-, NO_2^-, or ClO_3^-.

Cacothelin. Fresh, saturated aqueous solution of cacothelin. Use a drop of reagent on test paper, warm till only slightly damp; drop of Sn^{+2} (reduced by means of Mg powder) gives violet color. Antimony does not interfere.

Cinchonin—potassium iodide reagent. One gram of cinchonin is dissolved in 100 ml of water upon the addition of a few drops of HNO_3 and warming; add 2 g of KI. Bright red-orange precipitate with Bi^{+++}, brown with Cu^{++}, yellow with Pb^{++}, white with Cd^{++}, and cream with Hg^{++}, in slightly acid solution.

Cobalticyanide paper (Rinnmann's green test). Saturate quantitative filter paper in a solution of 4 g of $K_3Co(CN)_6$ and 1 g of $KClO_3$ in 100 ml of water. Dry. Add drop test solution and ash the paper in a crucible over flame. Green ash—presence of Zn^{++}.

***p*-Dimethylaminobenzylidenerhodanine.** Saturated solution of the crystals in acetone. (Dissolve equi-molecular

amounts of rhodamine and *p*-dimethylaminobenzaldehyde in glacial acetic acid, warm on steam bath. Product may be crystallized out on addition of water.) Reagent for detection of Ag^{+} (and Hg^{++}) in nitric acid solution. Red-violet precipitate.

Dimethylglyoxime. 1 g dissolved in 100 ml of alcohol. In presence of much Co^{++} first add slight excess NaCN, warm till decidedly orange, add reagent and $AgNO_3$. Pink to red precipitate—presence of Ni^{++}.

Diphenylcarbazide. 1% alcoholic solution, freshly prepared. Violet or blue precipitate in neutral or slightly acid solution of $Hg(NO_3)_2$.

α-Nitrobenzeneazoresorcinol. 0.001 g dissolved in 100 ml of 2 *N* NaOH. Sky blue precipitate with Mg^{++}.

Potassium thiocyanate. Saturated aqueous solution. With HCl solution of CO^{++} yields deep blue color; best observed when extracted with amyl alcohol-ether (1:6). Fe^{+++}, if present, to be reduced with crystal of $Na_2S_2O_3$.

Rhodamine B. Dissolve 0.01 g of tetraethylrhodamine in 100 ml of water. Violet color with Sb^{+5} (oxidized with KNO_2 crystal). Tin does not interfere.

Sodium nitroprusside. Freshly prepared 1% aqueous solution. Deep violet color with S^{--} (alkaline).

Sulfanilic acid—α-naphthylamine. (a) 0.4 g of sulfanilic acid in 100 ml of 10% acetic acid. (b) 0.5 g of α-naphthylamine boiled in 100 ml of water; filter. Acetic acid + solution (a) + solution (b) gives brilliant red color with NO_2^-.

Tetramethyldiaminodiphenylmethane. Acetic acid solution. Blue color as sensitive test for Pb^{++}. (Must be previously oxidized to PbO_2 in ammonia solution with H_2O_2 and the latter decomposed by warming or standing.)

Zinc uranyl acetate. Dissolve 10 g of uranyl acetate, with warming, in 6 g of 30% acetic acid; dilute to 50 ml. Treat 30 g of zinc acetate with 3 g of 30% acetic acid; dilute to 50 ml. Mix the two solutions, add a trace of NaCl, let stand 24 hours and filter out the precipitate. Yellowish-green crystalline precipitate with Na^{+}.

Zirconium alizarin sulfonate reagent. (a) Dissolve 0.05 g of zirconium nitrate in 50 ml of H_2O and 10 ml of concentrated HCl. (b) Dissolve 0.05 g of alizarin red S in 50 ml of H_2O. Mix (a) and (b) to make the reagent. Gives immediate yellow color with F^- (oxalates or phosphates interfere, giving yellow color slowly).

ACID DILUTION BY VOLUME

The volume of pure acid (or water) which must be added to 50 cm³ of water (or acid) to give solutions of specific gravity shown. Temperature 20°C. Taken from curves prepared by W. W. Stiles, based on experimental determinations. The values are approximate only.

Sulfuric Acid

Sp. gr.	Acid cm³
0 9982	0 0
1 01	0 2
1 02	0 5
1 03	0 9
1 04	1 3
1 05	1 7
1 06	2 2
1 07	2 7
1 08	3 2
1 09	3 7
1 10	4 3
1 11	4 9
1 12	5 5
1 13	6 2
1.14	6 9
1 15	7 6
1 16	8 3
1 17	9 0
1 18	9 7
1 19	10 5
1 20	11.3
1.21	12.1
1 22	12 9
1 23	13 7
1 24	14 5
1 25	15 3
1 26	16 1
1 27	16 9
1 28	17 8
1 29	18 7
1 30	19 6
1 31	20 6
1 32	21 6
1.33	22 7
1 34	23 8
1 35	25 0
1 36	26 2
1 37	27 4
1.38	28 6
1 39	29 8
1 40	31 1
1 41	32 5
1 42	33 9
1 43	35 4
1.44	36 8

Sulfuric Acid

Sp. gr.	Acid cm³
1 45	38 4
1 46	40 2
1 47	42 3
1 48	44 5
1 49	46 6
1 50	48 7
Sp. gr.	**Water cm³**
1 51	49 3
1 52	47 2
1 53	45 2
1 54	43 3
1 55	41 4
1 56	39 5
1 57	37 7
1 58	36 0
1 59	34 3
1 60	32.8
1 61	31 4
1 62	30 0
1 63	28 6
1 64	27 2
1 65	25 9
1 66	24 6
1 67	23 3
1 68	22 0
1 69	20 7
1 70	19 4
1 71	18 1
1 72	16 9
1 73	15 6
1 74	14 3
1 75	13 0
1 76	11 7
1 77	10 4
1 78	9 1
1 79	7 6
1 80	6 0
1 81	4 4
1 82	2 8
1 83	.5

Hydrochloric acid

Sp. gr.	Acid cm³
0 9982	0 0
1 000	0 4
1 005	1 4
1 010	2.7
1 015	4.1
1 020	5 6
1 025	7 1
1 030	8 6
1 035	10 2
1 040	11 8
1 045	13 8
1 050	15 9
1 055	18 4
1 060	21 1
1 065	24
1 070	26 8
1 075	30
1 080	33 7
1 085	37 9
1 090	42 2
1 095	47 0
1 100	47.8
Sp. gr.	**Water cm³**
1.105	42 2
1 110	37 6
1 115	33 7
1 120	30 0
1 125	26 4
1 130	23 2
1 135	20 0
1 140	17 2
1 145	14 8
1 150	12 4
1 155	10
1.160	8
1.165	5 9
1 170	3 9
1 175	2 1
1 180	0 6
1 185	0.0

Nitric acid

Sp. gr.	Acid cm³
0 9982	0 0
1 00	0.2
1 01	1 1
1 02	1 9
1 03	3.
1 04	4.1
1 05	5 2
1 06	6 4
1 07	7 7
1 08	9.1
1 09	10.6
1 10	12.
1 11	13 5
1 12	15 1
1 13	16 8
1 14	18 5
1 15	20 3
1 16	22 3
1 17	24 4
1 18	26 7
1 19	29 3
1 20	32 1
1 21	35 1
1 22	38 3
1 23	41 8
1 24	45 6
1 25	49 4
Sp. gr.	**Water cm³**
1 26	46 9
1 27	43 2
1 28	39 3
1 29	35 5
1 30	31 7
1 31	28 2
1 32	24 9
1 33	21 8
1 34	18 8
1 35	15 9
1 36	12 9
1 37	9 9
1 38	7 1
1 39	4 5
1 40	2 1
1.408	0.0

ORGANIC ANALYTICAL REAGENTS

Compiled by John H. Yoe

Determination	Reagent	Reference
Aldehydes....	Dimethyl-dihydro-resorcin (Dimedon)	Ind Eng Chem., Anal. Ed **3,** 365 (1931)
Aluminum	Alizarin S	J. Am. Chem. Soc. **50,** 748 (1928)
	Ammonium salt of aurin tricarboxylic acid ("Aluminon")	" **49,** 2395 (1927)
		" **55,** 2437 (1933)
	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Bull soc chim. Belg, **36,** 288 (1927)
	Eriochrome cyanine	Z anal Chem. **96,** 91 (1934)
	Hematoxylin	Ind. Eng Chem **16,** 233 (1924)
	8-Hydroxyquinoline	J Am. Chem. Soc. **50,** 1900 (1928)
	Quinalizarine	J. Am. Phar Assoc **17,** 260 (1928)
Ammonia	Tannin—$AgNO_3$	Snell, Vol I, p. 659 (7)
Antimony ...	Hexamethylene-tetramine	Z. anal. Chem. **67,** 298 (1925)
	Phenylthiohydantoic acid	Compt. rend. **176,** 1221 (1923)
	Pyridine	Analyst **53,** 373 (1928)
	Pyrogallol	Z anal. Chem **64, 44** (1924)
Arsenic	Cocaine-molybdate	Biochem Z. **185,** 14 (1927)
	Quinine arsenomolybdate	Analyst **47,** 317 (1922)
	Strychnine-molybdate	Ann. chim. applicata **23,** 517 (1933)
Beryllium	Curcumin	J Am. Chem Soc **50,** 393 (1928)
	8-Hydroxyquinoline	Bur Standards J. Research **3,** 91 (1929)
	1, 2, 5, 8-Tetrahydroxyanthraquinone (Quinalizarin)	Siemens-Konzerns, Beryllium, p. 25 (1932)
Bismuth	Cinchonine	Scott, p 77 (1)
	Dimethylglyoxime	Z. anal. Chem. **72,** 11 (1927)
	8-Hydroxyquinoline	" **72,** 177 (1927)
	Pyrogallol	" **65,** 448 (1925)
	Thiourea	" **94,** 161 (1933)
Boron	Curcumin	Chem. News **87,** 27 (1903)
	Mannitol	Scott, p. 90 (1)
	Methyl alcohol	J. Am Chem Soc. **50,** 1385 (1928)
	Turmeric	Ind Eng. Chem, Anal. Ed **4,** 180 (1932)
Bromine ...	Fluorescein	Snell, Vol. I, p. 548 (7)
	Fuchsin	" " p 546 (7)
	Phenol red	" " p. 549 (7)
Cadmium	Allylthiourea	Helvetica Chim. Acta, **12,** 718 (1929)
	Ethylenediamine	Z. anal. Chem. **77,** 340 (1929)
	Hexamethylenetetramine alliodide	C. A., **24,** 311 (1930)
	β-Naphthoquinoline	Analyst **58,** 667 (1933)
	Phenyl-trimethyl-ammonium iodide	" **58,** 667 (1933)
	Pyridine	Z anal. Chem. **73,** 279 (1928)
Calcium.....	Alizarin	Biochem. **J. 16,** 494 (1922); Yoe, Vol. I, p 139 (2)
	1-amino-2-naphthol-4-sulfonic acid	J. Biol Chem. **81,** 1 (1929)

Determination	Reagent	Reference
Calcium (Cont.)	Ammonium oxalate	Snell, Vol. I, p. 463 (7)
	Ammonium stearate	J Biol. Chem. **29,** 169 (1917); Yoe, Vol. II, p. 119 (3)
	Antipyrine	Snell, Vol. I, p 462 (7)
	Picrolonic acid	Biochem. Z. **265,** 85 (1933)
	Sodium sulforicinate	" **137,** 157 (1923); Yoe, Vol. II, p. 125 (3)
Cerium	Gallic acid	Snell, Vol. I, p. 366 (7)
Chlorate	Aniline hydrochloride	" " p. 588 (7)
Chlorine	Benzidine hydrochloride	Ind. Eng. Chem., Anal Ed **4,** 2 (1932)
	Dimethyl-*p*-phenylene-diamine	Chem. Weekblad. **23,** 203 (1926)
	Oleic acid	J. Soc. Chem. Ind. **42,** 427A (1923)
	Sodium sulforicinate	Biochem. Z., **137,** 157 (1923); Yoe, Vol II, p. 125 (3)
	Thymolphthalein	Ind. Eng. Chem. **19,** 112 (1927)
	o-Tolidine	Yoe, Vol I, p. 157 (2)
Chromium	1, 8-Dihydroxynaphthalene-3, 6-Disulfonate	Ind. Eng Chem. **5,** 298 (1913)
	s-Diphenylcarbazide	J. Am. Chem. Soc. **50,** 2363 (1928)
	Pyrogallol dimethyl ether	C. A **4,** 3178 (1910)
Cobalt	Cysteine hydrochloride	J. Biol. Chem. **83,** 367 (1929)
	Dimethylglyoxime	J Am. Chem. Soc. **43,** 482 (1921)
	3, 5-Dimethylpyrazole	Ind. Eng. Chem., Anal. Ed **2,** 38 (1930)
	Dinitrosoresorcinol	J Am Chem. Soc **45,** 1439 (1923)
	α-Nitroso-β-naphthol	Chem Zeit **46,** 430 (1922)
	Nitroso-R-salt	J. Am. Chem Soc **43,** 746 (1921)
	Phenylthiohydantoic acid	" **44,** 2219 (1922)
Columbium	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Hillebrand and Lundell, p. 109 (5)
Copper	*m*-Benzamino-semicarbazide	Snell, Vol. I, p 166 (7)
	Benzidine	Z anal Chem. **67,** 31 (1925)
	α-Benzionoxime (Cupron)	Ber **56,** 2083 (1923)
	Diacetyl-dioxime	Analyst **54,** 333 (1929)
	p-Dimethylamino-benzalrhodanine	J. Am. Chem. Soc **52,** 2222 (1930)
	Dinitrosoresorcinol	" **47,** 1268 (1925)
	s-Diphenylcarbazide	Chem. Weekblad. **21,** 20 (1924)
	Diphenylthiocarbazone	J Assoc Official Agr. Chem. **18,** 192 (1935)
	Hydroquinone	Bull. soc chim **31,** 1176 (1922)
	Isatin	Rec trav chim. **42,** 199 (1923)
	α-Naphthol	Bull soc. chim. **31,** 1176 (1922)
	β-Naphthol	Am J. Pharm. **105,** 62 (1933)
	Phenolphthalein	Compt. rend **173,** 1082 (1921)
	Phenylthiohydantoic acid	J. Am Chem. Soc **44,** 225 (1922)
	Piperidinium piperidyl-dithioformate	Analyst **56,** 736 (1931)

Determination	Reagent	Reference
Copper (Cont.)	Potassium ethyl xanthate	Yoe, Vol. I, p. 184 (2)
	Pyridine	Z. anal. Chem. **67,** 27 (1925)
	Salicylic acid	Yoe, Vol I, p. 183 (2)
	Sodium diethyldithiocarbamate	Analyst **54,** 650 (1929)
	o-Tolidine	Z. anal Chem. **67,** 31 (1925)
	Urobilin	Chem. Weekblad. **27,** 552 (1930)
Fluoride	Acetylacetone	Ind. Eng. Chem., Anal. Ed. **5,** 300 (1933)
	Alizarin sodium sulfonate—$Zr(NO_3)_4$	Ind. Eng. Chem., Anal. Ed. **7,** 23 (1935)
	Quinalizarine—$Zr(NO_3)_4$	Ind. Eng. Chem., Anal. Ed. **6,** 61 (1934)
Gold	Benzidine	Bull. Chim. Farm. **52,** 461 (1912)
	Formaldehyde	Bull. soc. chim. **31,** 717 (1922)
	m-Phenylenediamine sulfate	Chem. Zeit. **36,** 934 (1912)
	Phenylhydrazine	Ann. Chim. anal. **12,** 90 (1907)
	o-Tolidine	Analyst **44,** 94 (1919)
Hydrogen sulfide	*p*-phenylenedimethyldiamine sulfate	Yoe, Vol. I, p. 375 (2)
Iodine	*o*-Tolidine	J. Am. Chem. Soc. **47,** 1000 (1925)
Iridium	Benzidine	Snell, Vol. I, p. 425 (7)
Iron	Acetylacetone	J Am. Chem. Soc. **26,** 967 (1904)
	Alloxantin	Compt. rend. **180,** 519 (1925)
	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Ind. Eng. Chem. **3,** 629 (1911)
	Cysteine	Biochem. Z. **187,** 255 (1927)
	Dimethyl glyoxime	Z. anorg. Chemie **89,** 401 (1914)
	Dinitrosoresorcinol	J. Am. Chem. Soc. **47,** 1268 (1925)
	Diphenylamine	" **46,** 263 (1924)
	α, α'-Dipyridyl	Snell, Vol I, p. 310 (7)
	Hexamethylenetetramine	Bull. soc. chim. Rom. **2,** 89 (1921)
	7-Iodo-8-hydroxyquinoline-5-sulfonic acid	J. Am. Chem. Soc. **59,** 872 (1937)
	Isonitrosoacetophenone	Ber. **60,** 527 (1927)
	α-Nitroso-β-naphthol	Bull soc. chim. **35,** 641 (1924)
	o-Phenanthroline	Ind. Eng. Chem., Anal. Ed. **9,** 67 (1937)
	Pyramidone	Pharm. Weekblad. **63,** 1121 (1926)
	Pyrocatechol	Helv. chim. Acta **9,** 835 (1926)
	Salicylic acid	J. Chem. Soc. **93,** 93 (1908)
	Salicylsulfonic acid	Snell, Vol. I, p. 302 (7)
	Sulfosalicylic acid	Biochem. Z. **181,** 391 (1927)
	Thioglycollic acid	J. Am. Chem. Soc. **49,** 1916 (1927)
Lead	Ammonium thiocyanate and pyridine	Z. anal. Chem. **72,** 289 (1927)
	Aniline	Ind. Eng. Chem. **11,** 1055 (1919); Yoe, Vol. I, p. 257 (2)
	s-Diphenylcarbazide	Yoe, Vol. I, p. 255 (2)
	Diphenylthiocarbazone (Dithizone)	Snell, Vol. I, p. 202 (7)
	Hematein	Yoe, Vol. I, p. 257 (2)
	Tetramethyldiamidodiphenylmethane	Snell, Vol. I, p. 200 (7)

ORGANIC ANALYTICAL REAGENTS (Continued)

Determination	Reagent	Reference
Lithium	Ammonium stearate	J. Am. Chem. Soc. **52,** 2754(1930)
Magnesium	Curcumin	Ind. Eng. Chem., Anal. Ed. **4,** 426 (1932)
	Dimethylamine	Z anorg. Chem. **26,** 347 (1901)
	Hydroquinone	Yoe, Vol. I, p. 264 (2)
	8-Hydroxyquinoline	Z. anal. Chem. **71,** 122 (1927)
	p-Nitrobenzene-azoresorcinol	J. Am. Chem Soc **51,** 1456 (1929)
	Oleic acid	Yoe, Vol I, p. 270 (2)
	Titan yellow	C. A. **23,** 1838 (1929)
Manganese	Benzidine	Snell, Vol. I, p. 343 (7)
	o-Tolidine	" " p. 341 (7)
Mercury	*p*-Dimethylamino-benzalrhodamine	J. Am. Chem. Soc. **52,** 2222 (1930)
	s-Diphenylcarbazide	Z angew Chem **39,** 791 (1926)
	Potassium diphenyl-carbazone	Snell, Vol. I, p. 180 (7)
	Strychnine sulfate	" " p. 185 (7)
Molybdenum	*α*-Benzoin-oxime (Cupron)	B. S J. Research **9,** 1 (1932)
	Ethyl ether	Blair, 7th Ed , p 210 (4)
	Phenylhydrazine	Ber **36,** 512 (1903)
	Potassium ethyl xanthate and chloroform	J Am. Chem. Soc. **44,** 1462 (1922)
	Tannic acid	Chem. Eng. Mining Rev **11,** 258 (1919)
Nickel	*α*-Benzil-dioxime	Analyst **38,** 316 (1913)
	Dicyandiamidine sulfate	Chem. Zeit. **31,** 335, 911 (1907)
	Dimethylglyoxime	Chem Weekblad. **21,** 358 (1924)
	Formaldoxime	Snell, Vol. I, p. 319 (7)
	Potassium dithiooxalate	J. Am. Chem. Soc. **54,** 1866 (1932)
Nitrate	Brucine	Yoe, Vol. I, p. 318 (2)
	Diphenylamine sulfonic acid	J Am Chem. Soc. **55,** 1448 (1933)
	Diphenylbenzidine	Yoe, Vol. I, p. 316 (2)
	Diphenyl-endo-anilo-hydrotriazole ("Nitron")	Fales, Inorg. Quant. Anal p. 271 (1925)
	Phenoldisulfonic acid	Yoe, Vol. I, p. 313 (2)
	Pyrogallol	" p. 319 (2)
	Strychnine sulfate	" p 320 (2)
	2:4-Xylenol	J Assoc. Off. Agri Chem. **18,** 459 (1935)
Nitrite	Antipyrin	Yoe, Vol. I, p. 311 (2)
	Dimethylaniline	" p. 311 (2)
	Dimethyl-*α*-Naphthylamine	Ind. Eng Chem., Anal. Ed. **1,** 28 (1929)
	Diphenylamine sulfate	Yoe, Vol I, p. 654 (2)
	α-Naphthylamine and *β*-Naphthylamine-6, 8-Disulfonic acid	J. Pharmacol. **51,** 398 (1934)
	α-Naphthylamine hydrochloride	Yoe, Vol. I, p. 309 (2)
	m-Phenylenediamine	" p 310 (2)
	Sulfanilic acid and *α*-naphthylamine	" p. 308 (2)
Osmium	Thiourea	Compt. rend. **167,** 235 (1918)

Determination	Reagent	Reference
Oxygen	Indigo carmine	Snell, Vol. I, p. 137 (7)
	Pyrogallol	Dennis, Gas Analysis, p 174 (1929)
Phosphate	1, 2, 4-Aminonaphthosulfonic acid	Yoe, Vol. I, p. 348 (2)
	Hydroquinone	" pp. 346 and 353 (2)
	Quinine-molybdate	" p. 343 (2)
	Strychnine-molybdate	Yoe, Vol. II, p. 142 (3)
Phosphorus	Hydrazine sulfate	Yoe, Vol. I, p. 341 (2)
Potassium	6-Chloro-5-nitrotoluene-3-sulfonic acid	Mikrochem. **14,** 368 (1934)
	Dipicrylamine	Z. angew. Chem **49,** 827 (1936)
	Picric acid	J. Am. Chem. Soc **53,** 539 (1931)
Selenium . . .	Codeine phosphate	Arch. Pharm. **252,** 161 (1914)
	Hydroquinone	Am. J. Sci. **15,** 253 (1928)
	Hydroxylamine hydrochloride	J. Am. Chem. Soc. **47,** 2456 (1925)
	Pyrrol	Snell, Vol. I, p. 604 (7)
Silver .	Chromotropic acid	Helvetica Chim. Acta **12,** 714 (1929)
	Dichlorofluorescein	J. Am. Chem. Soc. **51,** 3273 (1929)
	p-Dimethylaminobenzalrhodanine	" **52,** 2222 (1930)
	Methylamine	Mikrochemie **7,** 233 (1929)
Sodium . . .	Dihydroxy-tartaric acid	J Russ Phys. Chem Soc **60,** 661 (1928)
	Uranyl zinc acetate	J Am Chem. Soc. **51,** 1664 (1929)
Sulfide	*p*-Aminodimethylaniline	Snell, Vol. I, p. 593 (7)
Sulfur	*p*-Phenylenedimethyldiamine hydrochloride	Yoe, Vol. I, p. 373 (2)
Tantalum . .	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Hillebrand and Lundell, p. 113 (5)
Tellurium .	Hydrazine hydrochloride	J. Am. Chem. Soc. **47,** 2456 (1925)
	Hydroquinone	Am J Sci **15,** 253 (1928)
Thorium .	Phenylarsonic acid	J. Am. Chem Soc **48,** 895 (1926)
Tin	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Hillebrand and Lundell, p. 113 (5)
	Cacotheline	Ind Eng Chem., Anal. Ed. **7,** 26 (1935)
Titanium	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Hillebrand and Lundell, p. 113 (5); Z. anal. Chem. **83,** 345 (1931)
	5, 7-Dibromo-8-hydroxyquinoline	Z. anorg. Chem. **204,** 215 (1932)
	Dihydroxymaleic acid	Snell, Vol I, p 365 (7)
	Gallic acid	" p 365 (7)
	8-Hydroxyquinoline	Z anal. Chem **81,** 1 (1930)
	Tannic acid	Analyst **55,** 605 (1930)
	Thymol	Yoe, Vol I, p. 381 (2)
Tungsten . .	Benzidine	Ber. **38,** 783 (1905)
	Cinchonine	Hillebrand and Lundell, p 553 (5)
	Hydroquinone	Z angew. Chem. **44,** 237 (1931)

ORGANIC ANALYTICAL REAGENTS (Continued)

Determination	Reagent	Reference
Tungsten (Cont.)	Phenylhydrazine hydrochloride	Bull soc. chim. Belg. **38**, 385 (1929)
	Rhodamine B	Snell, Vol. I, p 379 (7)
	Uric acid	Ann chim. anal. **9**, 371 (1904)
Uranium	o-Hydroxybenzoic acid	Snell, Vol. I, p. 394 (7)
	Sodium salicylate	Chem Zeit. **43**, 739 (1919)
Urea	Xanthydrol	Mikrochem **14**, 132 (1934)
Vanadium	Aniline	C. A **24**, 567 (1930)
	Diphenylamine	Yoe, Vol. I, p 715 (2)
	Diphenylbenzidine	Ind. Eng. Chem. **20**, 764 (1928)
	Safranine	Vol. Anal., Vol II, p. 326 (6)
	Strychnine	Yoe, Vol. I, p. 393 (2)
Zinc	Diphenylamine	J. Am. Chem. Soc. **49**, 2214 (1927)
	Diphenylbenzidine	" **49**, 356 (1927)
	Diphenylthiocarbazone (Dithizone)	Ind. Eng. Chem., Anal. Ed. **9**, 127 (1937)
	8-Hydroxyquinoline	Z. anal. Chem. **71**, 171 (1927)
	Pyridine	" **73**, 356 (1928)
	Resorcinol	Yoe, Vol I, p 396 (2)
	Urobilin	J Ind. Hyg **7**, 273 (1925)
Zirconium	Ammonium salt of nitrosophenyl hydroxylamine ("Cupferron")	Hillebrand and Lundell, p. 109 (5)
	Phenylarsonic acid	J. Am. Chem. Soc **48**, 895 (1926)

(1) Scott, Standard Methods of Analysis, 1927.
(2) Yoe, Photometric Chemical Analysis, Vol I, Colorimetry, 1928
(3) Yoe, Photometric Chemical Analysis, Vol. II, Nephelometry, 1929.
(4) Blair, Chemical Analysis of Iron.
(5) Hillebrand and Lundell, Applied Inorganic Analysis, 1929.
(6) Kolthoff and Furman, Volumetric Analysis, 1929.
(7) Snell and Snell, Colorimetric Methods of Analysis, Vol. I, Inorganic, 1936.

VOLUMETRIC PRIMARY STANDARDS

Compiled by John H. Yoe

The 1937 International atomic weights were used in computing the equivalent weights.

Primary standard	Formula	$\frac{\text{Eq wt}}{\text{mol. wt.}}$	Equivalent weight
A. Acidimetry			
s-Diphenylguanidine	$NH{\cdot}C[NHC_6H_5]_2$	1	211.25
Mercuric oxide	HgO	$\frac{1}{2}$	108.31
Potassium acid carbonate	$KHCO_3$	1	100.12
Potassium iodate	KIO_3	$\frac{1}{6}$	35.67
Sodium carbonate	Na_2CO_3	$\frac{1}{2}$	53.00
Sodium oxalate (1)	$Na_2C_2O_4$	$\frac{1}{2}$	67.01
Sodium tetraborate (borax)	$Na_2B_4O_7.10H_2O$	$\frac{1}{2}$	190.72
B. Alkalimetry			
Benzoic acid (1)	C_6H_5COOH	1	122.12
Hydrazine sulfate	$N_2H_4.H_2SO_4$	$\frac{1}{2}$	65.06
Oxalic acid (cryst.) (2)	$H_2C_2O_4.2H_2O$	$\frac{1}{2}$	63.03
Potassium acid oxalate	KHC_2O_4	1	128.12
Potassium acid phthalate (1)	$KHC_8H_4O_4$	1	204.22
Potassium acid tartrate	$KHC_4H_4O_6$	1	188.18
Potassium tetraoxalate	$KH_3(C_2O_4)_2.2H_2O$	$\frac{1}{3}$	84.73
Sodium tetraborate (borax)	$Na_2B_4O_7.10H_2O$	$\frac{1}{2}$	190.72
C. Oxidimetry			
Ferrous sulfate (3)	$FeSO_4.7H_2O$	1	278.01
Ferrous ammonium sulfate (3)	$FeSO_4.(NH_4)_2SO_4.6H_2O$	1	392.14
Iron wire (4)	Fe	1	55.84
Oxalic acid (cryst.) (2)	$H_2C_2O_4.2H_2O$	$\frac{1}{2}$	63.03
Potassium ferrocyanide	$K_4Fe(CN)_6.3H_2O$	1	422.38
Potassium iodate	KIO_3	$\frac{1}{2}$	107.01
Potassium iodide	KI	$\frac{1}{2}$	83.01
Silver	Ag	1	107.88
Sodium oxalate (1)	$Na_2C_2O_4$	$\frac{1}{2}$	67.01
D. Iodimetry			
Arsenious oxide (1)	As_2O_3	$\frac{1}{4}$	49.455
Copper	Cu	1	63.57
Hydrazine sulfate	$N_2H_4.H_2SO_4$	$\frac{1}{4}$	32.531
Iodine (resublimed) (5)	I	1	126.92
Iodine cyanide	ICN	$\frac{1}{2}$	76.464
Oxalic acid (cryst.) (2)	$H_2C_2O_4.2H_2O$	$\frac{1}{2}$	63.03
Potassium bromate	$KBrO_3$	$\frac{1}{6}$	27.835
Potassium biiodate	$KH(IO_3)_2$	$\frac{1}{12}$	32.496
Potassium dichromate	$K_2Cr_2O_7$	$\frac{1}{6}$	49.035
Potassium ferricyanide	$K_3Fe(CN)_6$	1	329.24
Potassium iodate	KIO_3	$\frac{1}{6}$	35.669
Sodium thiosulfate	$Na_2S_2O_3.5H_2O$	1	248.19

VOLUMETRIC PRIMARY STANDARDS (Continued)

Primary standard	Formula	$\frac{\text{Eq wt}}{\text{mol. wt.}}$	Equivalent weight
E. Silver Nitrate			
Potassium bromide	KBr	1	119.01
Potassium chloride	KCl	1	74 55
Sodium chloride	$NaCl$	1	58.45
F. Alkali Thiocyanates			
Mercury .	Hg	$\frac{1}{2}$	100 31
Mercuric oxide	HgO	$\frac{1}{2}$	108 31
Silver	Ag	1	107 88
Silver nitrate .	$AgNO_3$	1	169 89

G. Miscellaneous

For the determination of substances that must pass through complicated reactions, it is best to standardize against a standard sample of the substance that has been carried through all steps of the analysis. The U S Bureau of Standards can supply at a nominal fee a large number of standard samples of irons and steels (representing a wide range in composition), iron ores, manganese ore, zinc ore, etc.

(1) May be obtained from the U. S. Bureau of Standards.
(2) Difficult to obtain with exactly two molecules of water but a valuable primary standard when carefully prepared
(3) The pure salt is hard to obtain and to keep without slight oxidation or loss of water, hence other standards are recommended
(4) Possesses many disadvantages and is not recommended
(5) The last few drops of iodine are decolorized very slowly. Titrate till the pale yellow color persists at least two minutes. Starch retards the reaction and should be avoided.

CORRECTION FOR CAPILLARY DEPRESSION OF MERCURY IN A GLASS TUBE

Correction to be added.

Diam. of tube.	Height of meniscus in centimeters.							
	0 04	0.06	0.08	0.10	0.12	0.14	0.16	0.18
cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
0.4	0.083	0.122	0.154	0.198	0.237			
0.5	.047	.065	.086	.119	.145	0.180		
0.6	.027	.041	.056	.078	.098	.121	0.143	
0.7	.018	.028	.040	.053	.067	.082	.097	.113
0.8	....	.020	.029	.038	.046	.056	.065	0.077
0.9	....	0.015	0.021	0.028	0.033	0.040	0.046	0.052
1.0	....	.....	.015	.020	.025	.029	.033	.037
1.1	....	.....	.010	.014	.018	.021	.024	.027
1.2	....	.....	.007	.010	.013	.015	.018	.019
1.3	...	.....	.004	.007	.010	.012	.013	.014

TRUE CAPACITY OF GLASS VESSELS FROM THE WEIGHT OF THE CONTAINED WATER OR MERCURY WHEN WEIGHED IN AIR WITH BRASS WEIGHTS*

A glass vessel containing G grams of water at a temperature of t°C has, at the same temperature, a capacity $V = W_t \times G$ cubic centimeters. Similarly when filled with G grams of mercury at a temperature of t°C the capacity at the same temperature is given by $V = M_t \times G$ cubic centimeters.

A glass vessel containing G grams of water at a temperature of t°C has a capacity at a temperature of 18°C given by $V = W_{18°} \times G$ cubic centimeters. Similarly when filled with G grams of mercury at a temperature of t°C the capacity at a temperature of 18°C is given by $V = M_{18°} \times G$ cubic centimeters. The true volume at temperature of 25°C when the weighing is made at t° is similarly obtained by use of the values under $W_{25°}$ and $M_{25°}$ for water and mercury respectively

t°C.	W_t	M_t	$W_{18°}$	$M_{18°}$	$W_{25°}$	$M_{25°}$
0	1.001193	0.0735501	1.001643	0.0735832	1.001818	0.0735960
1	1.001133	0.0735636	1.001559	0.0735949	1.001734	0.0736077
2	1.001092	0.0735771	1.001492	0.0736066	1.001668	0.0736194
3	1.001068	0.0735907	1.001443	0.0736183	1.001618	0.0736311
4	1.001060	0.0736037	1.001410	0.0736294	1.001586	0.0736423
5	1.001068	0.0736172	1.001394	0.0736411	1.001569	0.0736540
6	1.001092	0.0736308	1.001392	0.0736529	1.001568	0.0736657
7	1.001131	0.0736492	1.001406	0.0736695	1.001581	0.0736824
8	1.001184	0.0736628	1.001435	0.0736812	1.001610	0.0736941
9	1.001252	0.0736763	1.001477	0.0736929	1.001652	0.0737058
10	1.001333	0.0736894	1.001534	0.0737042	1.001709	0.0737171
11	1.001428	0.0736975	1.001603	0.0737104	1.001779	0.0737233
12	1.001536	0.0737111	1.001686	0.0737222	1.001862	0.0737351
13	1.001657	0.0737241	1.001782	0.0737333	1.001957	0.0737463
14	1.001790	0.0737377	1.001890	0.0737451	1.002066	0.0737581
15	1.001935	0.0737513	1.002010	0.0737569	1.002186	0.0737698
16	1.002092	0.0737614	1.002143	0.0737681	1.002318	0.0737810
17	1.002261	0.0737780	1.002286	0.0737798	1.002462	0.0737927
18	1.002441	0.0737911	1.002441	0.0737911	1.002617	0.0738039
19	1.002633	0.0738047	1.002608	0.0738028	1.002783	0.0738157
20	1.002835	0.0738183	1.002785	0.0738146	1.002960	0.0738275
21	1.003047	0.0738314	1.002972	0.0738258	1.003148	0.0738398
22	1.003271	0.0738450	1.003170	0.0738376	1.003346	0.0738505
23	1.003504	0.0738581	1.003379	0.0738489	1.003554	0.0738618
24	1.003748	0.0738717	1.003597	0.0738607	1.003773	0.0738736
25	1.004001	0.0738848	1.003825	0.0738719	1.004001	0.0738848
26	1.004264	0.0738985	1.004063	0.0738837	1.004239	0.0738966
27	1.004537	0.0739116	1.004310	0.0738950	1.004486	0.0739079
28	1.004819	0.0739253	1.004567	0.0739068	1.004743	0.0739197
29	1.005110	0.0739384	1.004833	0.0739181	1.005009	0.0739310
30	1.005410	0.0739520	1.005109	0.0739299	1.005284	0.0739428

* Assuming 25×10^{-6} as the coefficient of cubic expansion for glass.

Reduction of Weighings to Vacuo

If the apparent mass of a body is m, its density d_m, the density of the weights d_w and the density of the air d_a the true mass in vacuo is,

$$M = m + md_a\left(\frac{1}{d_m} - \frac{1}{d_w}\right)$$

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS

The weight in grams of the compound in 1 c.c. of the following deci-normal solutions is found by dividing the H equivalent in the last column by 1000.

Name	Formula	At. or mol. wt	Hydrogen equivalent	One H equiv. in gms.
Acetic acid	$HC_2H_3O_2$	60 03	$HC_2H_3O_2$	6 003
Ammonia	NH_3	17 03	NH_3	1 703
Ammonium	NH_4	18 04	NH_4	1 804
Ammonium chloride	NH_4Cl	53 50	NH_4Cl	5 350
Ammonium sulfate	$(NH_4)_2SO_4$	132 14	$\frac{1}{2}(NH_4)_2SO_4$	6 607
Ammonium sulfocyanate	NH_4CNS	76 11	NH_4CNS	7 611
Barium	Ba	137.36	$\frac{1}{2}Ba$	6.868
Barium carbonate	$BaCO_3$	197 36	$\frac{1}{2}BaCO_3$	9 868
Barium chloride	$BaCl_2\ 2H_2O$	244 31	$\frac{1}{2}BaCl_2\ 2H_2O$	12 216
Barium hydroxide	$Ba(OH)_2$	171 38	$\frac{1}{2}Ba(OH)_2$	8 569
Barium oxide	BaO	153 36	$\frac{1}{2}BaO$	7 668
Bromine	Br	79 92	Br	7 992
Calcium	Ca	40 08	$\frac{1}{2}Ca$	2 004
Calcium carbonate	$CaCO_3$	100 08	$\frac{1}{2}CaCO_3$	5 004
Calcium chloride	$CaCl_2$	110 99	$\frac{1}{2}CaCl_2$	5 550
Calcium chloride	$CaCl_2.6H_2O$	219 09	$\frac{1}{2}CaCl_2.6H_2O$	10 954
Calcium hydroxide	$Ca(OH)_2$	74 10	$\frac{1}{2}Ca(OH)_2$	3 705
Calcium oxide	CaO	56 08	$\frac{1}{2}CaO$	2 804
Chlorine	Cl	35 46	Cl	3 546
Citric acid	$C_6H_8O_7.H_2O$	210 08	$\frac{1}{3}C_6H_8O_7.H_2O$	7 003
Cobalt	Co	58 94	$\frac{1}{2}Co$	2 948
Copper	Cu	63 57	$\frac{1}{2}Cu$	3 179
Copper Oxide	CuO	79 57	$\frac{1}{2}CuO$	3 979
Copper sulfate	$CuSO_4\ 5H_2O$	249 71	$\frac{1}{2}CuSO_4.5H_2O$	12 485
Cyanogen	CN	26 01	CN	2 601
Hydrochloric acid	HCl	36 47	HCl	3 647
Hydrocyanic acid	HCN	27 02	HCN	2 702
Iodine	I	126 93	I	12 693
Lactic acid	$C_3H_6O_3$	90 05	$C_3H_6O_3$	9 005
Malic acid	$C_4H_6O_5$	134 05	$\frac{1}{2}C_4H_6O_5$	6 702
Magnesium	Mg	24 32	$\frac{1}{2}Mg$	1 216
Magnesium carbonate	$MgCO_3$	84 32	$\frac{1}{2}MgCO_3$	4 216
Magnesium chloride	$MgCl_2$	95 23	$\frac{1}{2}MgCl_2$	4 762
Magnesium chloride	$MgCl_2\ 6H_2O$	203 33	$\frac{1}{2}MgCl_2.6H_2O$	10 167
Magnesium oxide	MgO	40 32	$\frac{1}{2}MgO$	2 016
Manganese	Mn	54 93	$\frac{1}{2}Mn$	2 747
Manganese sulfate	$MnSO_4$	150 99	$\frac{1}{2}MnSO_4$	7 550
Mercuric chloride	$HgCl_2$	271 52	$\frac{1}{2}HgCl_2$	13 576
Nickel	Ni	58 69	$\frac{1}{2}Ni$	2 935
Nitric acid	HNO_3	63 02	HNO_3	6 302
Nitrogen	N	14 01	N	1 401
Nitrogen pentoxide	N_2O_5	108 02	$\frac{1}{2}N_2O_5$	5 401
Oxalic acid	$H_2C_2O_4$	90 02	$\frac{1}{2}H_2C_2O_4$	4 501
Oxalic acid	$H_2C_2O_4.2H_2O$	126 05	$\frac{1}{2}H_2C_2O_4.2H_2O$	6 302
Oxalic anhydride	C_2O_3	72 00	$\frac{1}{2}C_2O_3$	3 600
Phosphoric acid	H_3PO_4	98 04	$\frac{1}{3}H_3PO_4$	3 268
Potassium	K	39 10	K	3 910
Potassium bicarbonate	$KHCO_3$	100 11	$KHCO_3$	10 011
Potassium carbonate	K_2CO_3	138 20	$\frac{1}{2}K_2CO_3$	6 910
Potassium chloride	KCl	74 56	KCl	7 456
Potassium cyanide	KCN	65 11	KCN	6 511
Potassium hydroxide	KOH	56 11	KOH	5 611
Potassium oxide	K_2O	94 20	$\frac{1}{2}K_2O$	4 710
Potassium permanganate for Co estimation	$KMnO_4$	158 03	$\frac{1}{6}KMnO_4$	2.634

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS (Continued.)

Name	Formula	At. or mol. wt.	Hydrogen equivalent	One H equiv. in gms.
Potassium permanganate for Mn estimation	$KMnO_4$	158 03	$\frac{1}{3}KMnO_4$	5.268
Potassium tartrate	$K_2H_4C_4O_6$	226 23	$\frac{1}{2}K_2H_4C_4O_6$	11 312
Silver	Ag	107 88	Ag	10 788
Silver nitrate	$AgNO_3$	169 89	$AgNO_3$	16 989
Sodium	Na	23 00	Na	2 300
Sodium bicarbonate	$NaHCO_3$	84 00	$NaHCO_3$	8 400
Sodium carbonate	Na_2CO_3	105 99	$\frac{1}{2}Na_2CO_3$	5 300
Sodium chloride	NaCl	58 45	NaCl	5 845
Sodium hydroxide	NaOH	40 00	NaOH	4 000
Sodium oxide	Na_2O	61 99	$\frac{1}{2}Na_2O$	3 100
Sodium sulfide	Na_2S	78 05	$\frac{1}{2}Na_2S$	3.903
Succinic acid	$H_2C_4H_4O_4$	118 05	$\frac{1}{2}H_2C_4H_4O_4$	5 902
Sulfuric acid	H_2SO_4	98 08	$\frac{1}{2}H_2SO_4$	4 904
Sulfur trioxide	SO_3	80 06	$\frac{1}{2}SO_3$	4 003
Tartaric acid	$C_4H_6O_6$	150 05	$\frac{1}{2}C_4H_6O_6$	7.502
Zinc	Zn	65 38	$\frac{1}{2}Zn$	3.269
Zinc sulfate	$ZnSO_4\ 7H_2O$	287 55	$\frac{1}{2}ZnSO_4.7H_2O$	14.377

REDUCTIONS OF WEIGHINGS IN AIR TO VACUO

When the weight M in grams of a body is determined in air, a correction is necessary for the buoyancy of the air. The following table is computed for an air density of 0.0012. The corrected weight = M + kM /1000 values of k being found in the table.

Density of body weighed	Correction factor, k.		
	Pt Ir weights	Brass weights	Quartz or Al weights
5	+2 34	+2 26	+1 95
6	+1.94	+1.86	+1 55
7	+1 66	+1 57	+1 26
75	+1 55	+1 46	+1 15
80	+1 44	+1 36	+1 05
85	+1 36	+1 27	+0 96
90	+1 28	+1 19	+ .88
95	+1 21	+1 12	+ .81
1 00	+1.14	+1 06	+ .75
1 1	+1 04	+0.95	+ .64
1 2	+0 94	+ .86	+ .55
1 3	+ 87	+ .78	+ .47
1 4	+ .80	+ .71	+ .40
1 5	+ .75	+ 66	+ 35
1 6	+ .69	+ .61	+ 30
1 7	+ 65	+ 56	+ 25
1 8	+ 62	+ .52	+ 21
1 9	+ 58	+ .49	+ .18
2 0	+ .54	+ 46	+ .15
2 5	+ 43	+ 34	+ 03
3 0	+ 34	+ .26	— 05
4 0	+ .24	+ 16	— 15
6 0	+ 14	+ 06	— 25
8 0	+ 09	+ 01	— 30
10 0	+ .06	— .02	— 33
15 0	+ 03	— 06	— 37
20 0	+ .004	— 08	— 39
22 0	— 001	— 09	— 40

DECI-NORMAL SOLUTIONS OF OXIDATION AND REDUCTION REAGENTS

Name	Formula	At. or mol. wt.	Hydrogen equivalent	One H equiv. in gms.
Antimony.	Sb..	121 76	$\frac{1}{2}$Sb	6 089
Arsenic	As..	74 93	$\frac{1}{2}$As	3 747
Arsenic trisulfide.	As_2S_3	246 04	$\frac{1}{4}As_2S_3$	6 151
Arsenous oxide	As_2O_3	197 86	$\frac{1}{4}As_2O_3$	4 947
Barium peroxide.	BaO_2	169 36	$\frac{1}{2}BaO_2$	8 468
Barium peroxide, hydrated	$BaO_2.8H_2O$	313 48	$\frac{1}{2}BaO_2.8H_2O$	15 674
Calcium..	Ca	40 08	$\frac{1}{2}$Ca	2 004
Calcium carbonate	$CaCO_3$.	100 08	$\frac{1}{2}CaCO_3$	5 004
Calcium hypochlorite..	$Ca(ClO)_2$	142 99	$\frac{1}{4}Ca(ClO)_2$	3 574
Calcium oxide	CaO.	56 08	$\frac{1}{2}$CaO	2 804
Chlorine	Cl ..	35 46	Cl	3 546
Chromium trioxide.	CrO_3	100 01	$\frac{1}{3}CrO_3$	3 334
Ferrous ammonium sulfate .	$FeSO_4(NH_4)_2SO_4.6H_2O$	392 13	$FeSO_4(NH_4)_2SO_4.6H_2O$	39 213
Hydroferrocyanic acid	$H_4Fe(CN)_6$	215 92	$H_4Fe(CN)_6$	21 592
Hydrogen peroxide...	H_2O_2	34 02	$\frac{1}{2}H_2O_2$	1 701
Hydrogen sulfide...	H_2S	34 08	$\frac{1}{2}H_2S$	1 704
Iodine.....	I ..	126 93	I	12 693
Iron..	Fe	55 84	Fe	5 584
Iron oxide, ferrous	FeO.	71 84	FeO	7 184
Iron oxide, ferric.	Fe_2O_3	159 68	$\frac{1}{2}Fe_2O_3$	7 984
Lead peroxide ..	PbO_2	239 22	$\frac{1}{2}PbO_2$	11 961
Manganese peroxide	MnO_2 .	86 93	$\frac{1}{2}MnO_2$	4 347
Nitric acid	HNO_3	63 02	$\frac{1}{3}HNO_3$	2 101
Nitrogen trioxide.	N_2O_3....	76 02	$\frac{1}{4}N_2O_3$	1 800
Nitrogen pentoxide.	N_2O_5 ..	108 02	$\frac{1}{6}N_2O_5$	1 800
Oxalic acid... ...	$C_2H_2O_4$	90 02	$\frac{1}{2}C_2H_2O_4$	4 501
Oxalic acid......	$C_2H_2O_4.2H_2O$	126 05	$\frac{1}{2}C_2H_2O_4.2H_2O$	6 302
Oxygen . ..	O. ...	16 00	$\frac{1}{2}$O	0 800
Potassium bichromate	$K_2Cr_2O_7$	294 22	$\frac{1}{6}K_2Cr_2O_7$	4 904
Potassium chlorate..	$KClO_3$.	122 56	$\frac{1}{6}KClO_3$	2 043
Potassium chromate	K_2CrO_4	194 21	$\frac{1}{3}K_2CrO_4$	6 474
Potassium ferrocyanide	$K_4Fe(CN)_6$	368 29	$K_4Fe(CN)_6$	36 829
Potassium ferrocyanide	$K_4Fe(CN)_6 3H_2O$	422 33	$K_4Fe(CN)_6.3H_2O$	42 233
Potassium iodide.... .	KI	166 03	KI	16 603
Potassium nitrate	KNO_3	101 11	$\frac{1}{3}KNO_3$	3 370
Potassium perchlorate	$KClO_4$	138 56	$\frac{1}{8}KClO_4$	1 732
Potassium permanganate	$KMnO_4$	158 03	$\frac{1}{5}KMnO_4$	3 161
Sodium chlorate	$NaClO_3$	106 45	$\frac{1}{6}NaClO_3$	1 774
Sodium nitrate	$NaNO_3$	85 01	$\frac{1}{3}NaNO_3$	2 834
Sodium thiosulfate	$Na_2S_2O_3.5H_2O$	248 19	$Na_2S_2O_3.5H_2O$	24 819
Stannous chloride	$SnCl_2$	189 61	$\frac{1}{2}SnCl_2$	9 481
Stannous oxide .	SnO	134 70	$\frac{1}{2}$SnO	6 735
Sulfur dioxide	SO_2	64 06	$\frac{1}{2}SO_2$	3 203
Tin . ..	Sn	118 70	$\frac{1}{2}$Sn	5 935

VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS

Aluminum

(1) $Al_2(SO_4)_3 + 6KOH = 2Al(OH)_3 + 3K_2SO_4$

$$KOH = \frac{Al_2(SO_4)_3}{6} = \frac{Al_2O_3}{6} = \frac{Al}{3}$$

Antimony

(2) $SbCl_5 + 2KI = SbCl_3 + 2KCl + I_2$

$$I = \frac{Sb}{2} = \frac{Sb_2O_5}{4}$$

(3) $Sb_2O_3 + 2I_2 + 2H_2O = Sb_2O_5 + 4HI$

$$I = \frac{Sb_2O_3}{4} = \frac{Sb}{2}$$

(4) (a) $Sb_2S_3 + 6HCl = 2SbCl_3 + 3H_2S$
(b) $3H_2S + 3I_2 = 6HI + 3S$

$$I = \frac{H_2S}{2} = \frac{Sb_2S_3}{6} = \frac{Sb}{3}$$

(5) $5Sb_2(SO_4)_3 + 4KMnO_4 + 24H_2O = 10H_3SbO_4 + 2K_2SO_4 + 4MnSO_4 + 9H_2SO_4$

$$\frac{4KMnO_4}{20} = \frac{Sb_2(SO_4)_3}{4} = \frac{Sb_2O_3}{4} = \frac{Sb}{2}$$

Arsenic

(6) $As_2O_3 + 2H_2O + 2I_2 = As_2O_5 + 4HI$

$$I = \frac{As_2O_3}{4} = \frac{As}{2}$$

(7) $AsCl_3 + I_2 + 2HCl = AsCl_5 + 2HI$

$$I = \frac{AsCl_3}{2} = \frac{As}{2}$$

(8) As_2S_3 same as reaction 4

Boron

(9) (a) $Na_2B_4O_7 + 2HCl + 5H_2O - 2NaCl + 4H_3BO_3$
(b) $H_3BO_3 + NaOH = NaBO_2 + 2H_2O$

$$NaOH = H_3BO_3 = B$$

Cadmium

(10) $CdS + 2HCl + I_2 = CdCl_2 + 2HI + S$

$$I = \frac{CdS}{2} = \frac{Cd}{2} = \frac{S}{2}$$

Calcium

(11) $5CaC_2O_4 + 2KMnO_4 + 8H_2SO_4 = 5CaSO_4 + K_2SO_4 + 2MnSO_4 + 8H_2O + 10CO_2$

$$\frac{2KMnO_4}{10} = \frac{CaC_2O_4}{2} = \frac{CaCO_3}{2} = \frac{CaO}{2}$$

(12) $CaCO_3 + 2HCl = CaCl_2 + CO_2 + H_2O$

$$HCl = \frac{CaCO_3}{2} = \frac{CaO}{2}$$

VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS (Continued)

Carbon

(13) $Na_2CO_3 + H_2SO_4 = Na_2SO_4 + H_2O + CO_2$

$$\frac{H_2SO_4}{2} = \frac{Na_2CO_3}{2}$$

(14) $2NaHCO_3 + H_2SO_4 = Na_2SO_4 + 2H_2O + 2CO_2$

$$\frac{H_2SO_4}{2} = \frac{NaHCO_3}{1}$$

(15) $KHC_2O_4 + KOH = K_2C_2O_4 + H_2O$

$$KOH = KHC_2O_4$$

(16) $H_2C_2O_4.2H_2O + 2NaOH = Na_2C_2O_4 + 4H_2O$

$$NaOH = \frac{H_2C_2O_4.2H_2O}{2}$$

(17) $C_6H_5COOH + NaOH = C_6H_5COONa + H_2O$

$$NaOH = C_6H_5COOH$$

(18) $5Na_2C_2O_4 + 2KMnO_4 + 8H_2SO_4 = 5Na_2SO_4 + K_2SO_4 + 2MnSO_4 + 10CO_2 + 8H_2O$

$$\frac{2KMnO_4}{10} = \frac{Na_2C_2O_4}{2}$$

Chlorine

(19) $NaCl + AgNO_3 = AgCl + NaNO_3$

$$NaCl = Cl$$

(20) (a) $Cl + KI = KCl + I$

(b) $I_2 + 2Na_2S_2O_3 = Na_2S_4O_6 + 2NaI$

$$I = Cl$$

(21) $CaOCl_2 + 2HCl = CaCl_2 + H_2O + Cl_2$

$$I = Cl = \frac{CaOCl_2}{2}$$

Chromium

(22) $K_2Cr_2O_7 + 6FeCl_2 + 14HCl = 6FeCl_3 + 2KCl + 2CrCl_3 + 7H_2O$

$$Fe = \frac{K_2Cr_2O_7}{6} = \frac{Cr_2O_3}{6} = \frac{Cr}{3}$$

(23) $K_2Cr_2O_7 + 6KI + 7H_2SO_4 = 4K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3I_2$

$$I = \frac{K_2Cr_2O_7}{6} = \frac{Cr_2O_3}{6} = \frac{Cr}{3}$$

Copper ($KMnO_4$ Method)

(24) (a) $2CuSO_4 + 2KCNS + H_2SO_3 + H_2O = 2CuCNS + K_2SO_4 + 2H_2SO_4$

(b) $CuCNS + NaOH = NaCNS + CuOH$

(c) $5NaCNS + 6KMnO_4 + 4H_2SO_4 = 3K_2SO_4 + 6MnSO_4 + 5NaCN + 4H_2O$

$$\frac{6KMnO_4}{30} = \frac{NaCNS}{6} = \frac{CuSO_4}{6} = \frac{Cu}{6}$$

VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS (Continued)

(25) (Iodide Method)

$$2CuSO_4 + 4KI = 2CuI + 2K_2SO_4 + I_2$$

$$I = CuSO_4 = Cu$$

(26) (KCN Method)

(a) $2CuSO_4 + 2NH_4OH = (NH_4)_2SO_4 + Cu_2SO_4(OH)_2$

(b) $Cu_2SO_4(OH)_2 + 6NH_3 + (NH_4)_2SO_4 = 2Cu(NH_3)_4SO_4.H_2O$

(c) $2Cu(NH_3)_4SO_4.H_2O + 7KCN = K_3NH_4Cu_2(CN)_6 + NH_4CNO + 2K_2SO_4 + 6NH_3 + H_2O$

$$\frac{KCN}{2} = \frac{Cu(NH_3)_4SO_4.H_2O}{7} = \frac{CuSO_4}{7} = \frac{Cu}{7}$$

Iodine

(27) $I_2 + 2Na_2S_2O_3 = Na_2S_4O_6 + 2NaI$

$$I = Na_2S_2O_3$$

(28) $KIO_3 + 5KI + 6HCl = 6KCl + 3H_2O + 3I_2$

$$I = \frac{KIO_3}{6} = \frac{5KI}{6}$$

(29) $10KI + 2KMnO_4 + 8H_2SO_4 = 6K_2SO_4 + 2MnSO_4 + 8H_2O + 5I_2$

$$\frac{2KMnO_4}{10} = I$$

Iron

(30) $6FeCl_2 + K_2Cr_2O_7 + 14HCl = 6FeCl_3 + 2KCl + 2CrCl_3 + 7H_2O$

$$\frac{K_2Cr_2O_7}{6} = \frac{6FeCl_2}{6} = \frac{Fe_2O_3}{2} = \frac{Fe}{1}$$

(31) $10FeSO_4 + 2KMnO_4 + 8H_2SO_4 = 5Fe_2(SO_4)_3 + K_2SO_4 + 2MnSO_4 + 8H_2O$

$$\frac{2KMnO_4}{10} = \frac{10FeSO_4}{10} = \frac{Fe_2O_3}{2} = \frac{Fe}{1}$$

(32) $2FeCl_3 + 2KI = 2KCl + 2FeCl_2 + I_2$

$$I = FeCl_3 = Fe = \frac{Fe_2O_3}{2}$$

Lead

(33) $2Pb(C_2H_3O_2)_2 + K_2Cr_2O_7 + H_2O = 2PbCrO_4 + 2KC_2H_3O_2 + 2HC_2H_3O_2$

$\frac{2Pb}{4} = \frac{K_2Cr_2O_7}{4}$ (as precipitating agent for lead)

(34) $2PbCrO_4 + 6KI + 16HCl = 2PbCl_2 + 6KCl + 2CrCl_3 + 8H_2O + 3I_2$

$$I = \frac{PbCrO_4}{3} = \frac{Pb}{3} = \frac{K_2Cr_2O_7}{6}$$

VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS (Continued)

Manganese

(35) $MnO_2 + H_2SO_4 + H_2C_2O_4 = MnSO_4 + 2CO_2 + 2H_2O$

$$\frac{2KMnO_4}{10} = \frac{C_2H_2O_4}{2} = \frac{MnO_2}{2} = \frac{Mn}{2}$$

(36) (Bismuthate Method)

(a) $2Mn(NO_3)_2 + 5NaBiO_3 + 16HNO_3 = 5NaNO_3 + 5Bi(NO_3)_3 + 7H_2O + 2HMnO_4$

(b) $2HMnO_4 + 5Na_3AsO_3 + 4HNO_3 = 5Na_3AsO_4 + 2Mn(NO_3)_2 + 3H_2O$

$$\frac{2HMnO_4}{10} = \frac{Na_3AsO_3}{2} = \frac{Mn}{5}$$

(37) (Persulfate Method)

(a) $2Mn(NO_3)_2 + 5(NH_4)_2S_2O_8 + 8H_2O = 5(NH_4)_2SO_4 + 4HNO_3 + 5H_2SO_4 + 2HMnO_4$

(b) $2HMnO_4 + 10FeSO_4 + 7H_2SO_4 = 5Fe_2(SO_4)_3 + 2MnSO_4 + 8H_2O$

$$\frac{2HMnO_4}{10} = \frac{10FeSO_4}{10} = \frac{Mn}{5}$$

(38) (Volhard's Method)

$3MnSO_4 + 2KMnO_4 + 2H_2O = 5MnO_2 + K_2SO_4 + 2H_2SO_4$ *or*

$6MnSO_4 + 5ZnSO_4 + 4KMnO_4 + 14H_2O = 4KHSO_4 + 7H_2SO_4 + 5Zn(OH)_2.2MnO_2$

$$\frac{2KMnO_4}{10} = \frac{3MnSO_4}{10} = \frac{3Mn}{10}$$

(39) (Ford Williams Method)

$MnO_2 + 2FeSO_4 + 2H_2SO_4 = MnSO_4 + Fe_2(SO_4)_3 + 2H_2O$

$$\frac{2FeSO_4}{2} = \frac{MnO_2}{2} = \frac{Mn}{2}$$

Molybdenum

(40) (a) $2MoO_3 + 3Zn = Mo_2O_3 + 3ZnO$

(b) $5Mo_2O_3 + 6KMnO_4 + 9H_2SO_4 = 10MoO_3 + 3K_2SO_4 + 6MnSO_4 + 9H_2O$

$$\frac{6KMnO_4}{30} = \frac{Mo_2O_3}{6} = \frac{MoO_3}{3} = \frac{Mo}{3}$$

Nickel (KCN Method).

(41) (a) $2NiSO_4 + 12NH_4OH = 2Ni(NH_3)_6SO_4 + 12H_2O$

(b) $Ni(NH_3)_6SO_4 + 4KCN = K_2Ni(CN)_4 + K_2SO_4 + 6NH_3$

$$\frac{4KCN}{8} = \frac{Ni(NH_3)_6SO_4}{8} = \frac{Ni}{8}$$

Oxygen

(42) $5H_2O_2 + 2KMnO_4 + 4H_2SO_4 = 2KHSO_4 + 2MnSO_4 + 8H_2O + 5O_2$

$$\frac{2KMnO_4}{10} = \frac{H_2O_2}{2}$$

Phosphorus

(43) (a) $H_3PO_4 + 12(NH_4)_2MoO_4 + 21HNO_3 = (NH_4)_3PO_4.12MoO_3 + 21NH_4NO_3 + 12H_2O$

(b) $2(NH_4)_3PO_4.12MoO_3 + 46NaOH + H_2O = 2(NH_4)_2HPO_4 + (NH_4)_2MoO_4 + 23Na_2MoO_4 + 23H_2O$

$$\frac{NaOH}{1} = \frac{2(NH_4)_3PO_4.12MoO_3}{46} = \frac{P_2O_5}{46} = \frac{P}{23}$$

(44) (a) $2(NH_4)_3PO_4.12MoO_3 + 46NH_4OH + H_2O = 24(NH_4)_2MoO_4 + 2(NH_4)_2HPO_4 + 23H_2O$

(b) $(NH_4)_2MoO_4 + H_2SO_4 = (NH_4)_2SO_4 + H_2MoO_4$

(c) $2MoO_3 + 3Zn + 3H_2SO_4 = 3ZnSO_4 + 3H_2O + Mo_2O_3$

(d) $5Mo_2O_3 + 6KMnO_4 + 9H_2SO_4 = 10MoO_3 + 3K_2SO_4 + 6MnSO_4 + 9H_2O$

$$\frac{6KMnO_4}{30} = \frac{Mo_2O_3}{6} = \frac{(NH_4)_3PO_4.12MoO_3}{36} = \frac{P}{36} = \frac{P_2O_5}{72}$$

(45) (No ferric alum present)

(a-b-c) as in Reaction 44

(d) $12Mo_2O_3 + O = Mo_{24}O_{37}$

(e) $Mo_{24}O_{37} + 14KMnO_4 + 21H_2SO_4 = 24MoO_3 + 7K_2SO_4 + 14MnSO_4 + 21H_2O$

$$\frac{14KMnO_4}{70} = \frac{Mo_{24}O_{37}}{70} = \frac{(NH_4)_3PO_4.12MoO_3}{35} = \frac{P}{35} = \frac{P_2O_5}{70}$$

Sulfur

(46) $H_2S + I_2 = 2HI + S$

$$I = \frac{H_2S}{2} = \frac{S}{2}$$

(47) $H_2SO_4 + 2NaOH = Na_2SO_4 + 2H_2O$

$$NaOH = \frac{Na_2SO_4}{2}$$

(48) $NaHSO_4 + NaOH = Na_2SO_4 + H_2O$

$NaOH = NaHSO_4$

(49) $Na_2SO_3 + I_2 + H_2O = Na_2SO_4 + 2HI$

$$I = \frac{Na_2SO_3}{2} = \frac{SO_2}{2} = \frac{S}{2}$$

(50) $2Na_2S_2O_3 + I_2 = Na_2S_4O_6 + 2NaI$

$I = Na_2S_2O_3$

VOLUMETRIC QUANTITATIVE REACTIONS WITH GRAM EQUIVALENTS (Continued)

Tin

(51) $SnCl_2 + I_2 + 2HCl = SnCl_4 + 2HI$

$$I = \frac{SnCl_2}{2} = \frac{Sn}{2}$$

Titanium

(52) (a) $Ti_2(SO_4)_3 + Fe_2(SO_4)_3 = 2Ti(SO_4)_2 + 2FeSO_4$

(b) $10FeSO_4 + 2KMnO_4 + 8H_2SO_4 = 5Fe_2(SO_4)_3 + K_2SO_4 + 2MnSO_4 + 8H_2O$

$$\frac{2KMnO_4}{10} = \frac{FeSO_4}{1} = \frac{Ti_2(SO_4)_3}{2} = \frac{Ti}{1}$$

Tungsten

(53) $WO_3 + 2NaOH = Na_2WO_4 + H_2O$

$$\frac{NaOH}{1} = \frac{WO_3}{2} = \frac{W}{2}$$

Uranium

(54) (a) $U_3O_8 + 4H_2SO_4 = 2UO_2SO_4 + U(SO_4)_2 + 4H_2O$

(b) $5U(SO_4)_2 + 2KMnO_4 + 2H_2O = 2KHSO_4 + 2MnSO_4 + H_2SO_4 + 5UO_2SO_4$

$$\frac{2KMnO_4}{10} = \frac{U(SO_4)_2}{2} = \frac{UO_2}{2} = \frac{U}{2}$$

(c) $U_3O_8 = 2UO_3 + UO_2$

$$\frac{2KMnO_4}{10} = \frac{U_3O_8}{2} = \frac{3U}{2}$$

Vanadium

(55) (a) $V_2O_5 + SO_2 \rightleftarrows V_2O_4 + SO_3$

(b) $5V_2O_4 + 2KMnO_4 + 3H_2SO_4 = 5V_2O_5 + K_2SO_4 + 2MnSO_4 + 3H_2O$

$$\frac{2KMnO_4}{10} = \frac{V_2O_4}{2} = \frac{V_2O_5}{2} = \frac{V}{1}$$

(56) (a) $V_2O_5 + 3Zn + 3H_2SO_4 = V_2O_2 + 3H_2O + 3ZnSO_4$

(b) $V_2O_2 + 3Fe_2O_3 = 6FeO + V_2O_5$

(c) $10FeSO_4 + 2KMnO_4 + 8H_2SO_4 = 5Fe_2(SO_4)_3 + K_2SO_4 + 2MnSO_4 + 8H_2O$

$$\frac{2KMnO_4}{10} = \frac{FeSO_4}{1} = \frac{V_2O_5}{6} = \frac{V}{3}$$

57) (a) As in Reaction 56

(b) $5V_2O_2 + 6KMnO_4 + 9H_2SO_4 = 5V_2O_5 + 3K_2SO_4 + 6MnSO_4 + 9H_2O$

$$\frac{6KMnO_4}{30} = \frac{V_2O_5}{6} = \frac{V_2O_2}{6} = \frac{V}{3}$$

(58) $V_2O_5 + 2KI + 2HCl = V_2O_4 + 2KCl + H_2O + I_2$

$$I = \frac{V_2O_5}{2} = \frac{V}{1}$$

Zinc

(59) (a) $Fe_2(SO_4)_3 + Zn = ZnSO_4 + 2FeSO_4$

(b) $10FeSO_4 + 2KMnO_4 + 8H_2SO_4 = 5Fe_2(SO_4)_3 + K_2SO_4 + 2MnSO_4 + 8H_2O$

$$\frac{2KMnO_4}{10} = \frac{FeSO_4}{1} = \frac{Zn}{2}$$

(60) $3ZnCl_2 + 2K_4Fe(CN)_6 = K_2Zn_3(Fe(CN)_6)_2 + 6KCl$

$$\frac{K_4Fe(CN)_6}{3} = \frac{3ZnCl_2}{6} = \frac{Zn}{2}$$

EFFICIENCY OF DRYING AGENTS

Compiled by John H. Yoe

A Drying agents depending upon chemical action (absorption) for their efficiency:*

Substance	Weights of residual water vapor in dried air—mg per liter	Authority
P_2O_5.	Much less than 1 mg in 40,000 liters	Morley
$Mg(ClO_4)_2$ anh	Unweighable in 210 liters	Willard and Smith
$Mg(ClO_4)_2\,3H_2O$	Unweighable in 57 liters	Willard and Smith
BaO.	. .	Booth and McIntire
$CaSO_4\,\frac{1}{2}H_2O$.	. . . ..	Smith
KOH (fused)	0 002	Baxter and Starkweather
H_2SO_4	0 003	Baxter and Starkweather
MgO .	0 008	Dover and Marden
NaOH (fused)	0 16	Baxter and Starkweather
$CaBr_2$ . ..	0 2	Baxter and Warren
CaO... . ..	0 2	Dover and Marden
B_2O_3 .	.. ..	Walton and Rosenbaum
$Ba(ClO_4)_2$ anh	.	Smith
$CaCl_2$ (granular)	0 14 to 0 25	McPherson
$CaCl_2$ (fused)	0 36	Baxter and Starkweather
$ZnCl_2$	0 8	Baxter and Warren
$ZnBr_2$	1 1	Baxter and Warren
$CuSO_4$ anh	1 4	Dover and Marden

B Drying agents depending upon physical action (adsorption) for their efficiency *—Alumina (low temperature fired), asbestos, charcoal, clay and porcelain (low temperature fired), glass wool, kieselguhr, silica gel, refrigeration

* It should be noted that the efficiency of some drying agents (*e. g.* $Al_2O_3.xH_2O$ and anhydrous $CaCl_2$, and probably also BaO, anhydrous $Mg(ClO_4)_2$, $Mg(ClO_4)_2.3H_2O$, anhydrous $Ba(ClO_4)_2$, and $CaSO_4\,\frac{1}{2}H_2O$) depends upon both adsorption and absorption.

A METHOD OF BALANCING EQUATIONS FOR OXIDATION-REDUCTION REACTIONS

On the left-hand side of the equation write the formulae for all the compounds entering into the reaction. On the right-hand side write the formulae for all the compounds formed in the reaction.

Determine the L. C. M. (least common multiple) of the numbers representing the changes in valence per molecule of the oxidizing and reducing agents.

The quotient obtained in dividing the L. C. M. by the number representing the valence change per molecule is the number of molecules of that compound required, or formed.

The reaction between $FeSO_4$, $KMnO_4$, and H_2SO_4 serves to illustrate. Following the rule as given above we write, $KMnO_4 + FeSO_4 + H_2SO_4 \rightarrow K_2SO_4 + MnSO_4 + Fe_2(SO_4)_3 + H_2O$.

The valence change of manganese is five, that of iron is two per molecule of $Fe_2(SO_4)_3$. The L. C. M. of these two numbers is ten.

The quotient obtained by dividing the L. C. M. by the valence change of manganese is two. Therefore two molecules of $KMnO_4$ are required. The quotient obtained by dividing the L. C. M. by the valence change of iron per molecule of $Fe_2(SO_4)_3$ is five. Five molecules of $Fe_2(SO_4)_3$ are formed. Ten molecules of $FeSO_4$ are needed. From the two molecules of $KMnO_4$ used one molecule of K_2SO_4 is formed, as well as two molecules of $MnSO_4$.

Eighteen sulfate radicals are used in forming the salts; ten of these radicals are supplied by the $FeSO_4$ used, the other eight must be supplied by the free acid. The sixteen hydrogens form eight molecules of water.

The complete equation is, therefore,

$$2KMnO_4 + 10FeSO_4 + 8H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O.$$

SOLUBILITY CHART

Abbreviations: W, soluble in water; A, insoluble in water but soluble in acids; w, sparingly
I, insoluble in both water and acids; d, decomposes in water * Certain salts occur in two

No.		Al	NH_4	Sb	Ba	Bi	Cd	Ca
1	Acetates $-(C_2H_3O_2)$	W $Al(-)_3$	W $NH_4(-)$	. . .	W $Ba(-)_2$	W $Bi(-)_3$	W $Cd(-)_2$	W $Ca(-)_2$
2	Arsenate $-(AsO_4)$	a $Al(-)$	W $(NH_4)_3(-)$	A $Sb(-)$	w $Ba_3(-)_2$	A $Bi(-)$	A $Cd_3(-)_2$	w $Ca_3(-)_2$
3	Arsenite $-(AsO_3)$	. . .	W NH_4AsO_2	A $Sb(-)$	. . . . .	. .	. .	w $Ca_3(-)_2$
4	Benzoate $-(C_7H_5O_2)$		W $NH_4(-)$		W $Ba(-)_2$	A $Bi(-)_3$	W $Cd(-)_2$	W $Ca(-)_2$
5	Bromide	W $AlBr_3$	W NH_4Br	d $SbBr_3$	W $BaBr_2$	d $BiBr_3$	W $CdBr_2$	W $CaBr_2$
6	Carbonate		W $(NH_4)_2CO_3$	. .	w $BaCO_3$	.	A $CdCO_3$	w $CaCO_3$
7	Chlorate $-(ClO_3)$	W $Al(-)_3$	W $NH_4(-)$		W $Ba(-)_2$	W $Bi(-)_3$	W $Cd(-)_2$	W $Ca(-)_2$
8	Chloride	W $AlCl_3$	W NH_4Cl	W $SbCl_3$	W $BaCl_2$	d $BiCl_3$	W $CdCl_2$	W $CaCl_2$
9	Chromate $-(CrO_4)$		W $(NH_4)_2(-)$	.	A $Ba(-)$		A $Cd(-)$	W $Ca(-)$
10	Citrate $-(C_6H_5O_7)$	W $Al(-)$	W $(NH_4)_3(-)$		w $Ba_3(-)_2$	A $Bi(-)$	A $Cd_3(-)_2$	w $Ca_3(-)_2$
11	Cyanide	.	W NH_4CN		W $Ba(CN)_2$	w $Bi(CN)_3$	W $Cd(CN)_2$	W $Ca(CN)_2$
12	Ferricy'de $-(Fe(CN)_6)$		W $(NH_4)_3(-)$		w $Ba_3(-)_2$	. .	A $Cd_3(-)_2$	W $Ca_3(-)_2$
13	Ferrocy'de $-(Fe(CN)_6)$	w $Al_4(-)_3$	W $(NH_4)_4(-)$		W $Ba_2(-)$		A $Cd_2(-)$	W $Ca_2(-)$
14	Fluoride	W AlF_3	W NH_4F	W SbF_3	w BaF_2	W BiF_3	W CdF_2	w CaF_2
15	Formate $-(CHO_2)$	W $Al(-)_3$	W $NH_4(-)$		W $Ba(-)_2$	W $Bi(-)_3$	W $Cd(-)_2$	W $Ca(-)_2$
16	Hydroxide	A $Al(OH)_3$	W NH_4OH		W $Ba(OH)_2$	A $Bi(OH)_3$	A $Cd(OH)_2$	W $Ca(OH)_2$
17	Iodide	W AlI_3	W NH_4I	d SbI_3	W BaI_2	A BiI_3	W CdI_2	W CaI_2
18	Nitrate	W $Al(NO_3)_3$	W NH_4NO_3		W $Ba(NO_3)_2$	d $Bi(NO_3)_3$	W $Cd(NO_3)_2$	W $Ca(NO_3)_2$
19	Oxalate $-(C_2O_4)$	A $Al_2(-)_3$	W $(NH_4)_2(-)$		w $Ba(-)$	A $Bi_2(-)_3$	w $Cd(-)$	A $Ca(-)$
20	Oxide	a Al_2O_3	. . . .	w Sb_2O_3	W BaO	A Bi_2O_3	A CdO	w CaO
21	Phosphate	A $AlPO_4$	W $NH_4H_2PO_4$		A $Ba_3(PO_4)_2$	A $BiPO_4$	A $Cd_3(PO_4)_2$	w $Ca_3(PO_4)_2$
22	Silicate, $-(SiO_3)$	I $Al_2(-)_3$	. .		W $Ba(-)$	.	A $Cd(-)$	w $Ca(-)$
23	Sulfate	W $Al_2(SO_4)_3$	W $(NH_4)_2SO_4$	A $Sb_2(SO_4)_3$	a $BaSO_4$	d $Bi_2(SO_4)_3$	W $CdSO_4$	w $CaSO_4$
24	Sulfide	d Al_2S_3	W $(NH_4)_2S$	A Sb_2S_3	d BaS	A Bi_2S_3	A CdS	w CaS
25	Tartrate $-(C_4H_4O_6)$	w $Al_2(-)_3$	W $(NH_4)_2(-)$	W $Sb_2(-)_3$	w $Ba(-)$	A $Bi_2(-)_3$	A $Cd(-)$	W $Ca(-)$
26	Thiocy'te	. .	W NH_4CNS		W $Ba(CNS)_2$			W $Ca(CNS)_2$

CHART

soluble in water but soluble in acids; a, insoluble in water and only sparingly soluble in acids; modifications.

No.	Cr	Co	Cu	Au′	Au‴	H	Fe″	Fe‴
1	W $Cr(-)_3$	W $Co(-)_2$	W $Cu(-)_2$	. . . .		W $C_2H_4O_2$	W $Fe(-)_2$	W $Fe_2(-)_6$
2	. . .	A $Co_3(-)_2$	A $Cu_3(-)_2$	.		W H_3AsO_4	A $Fe_3(-)_2$	A $Fe(-)$
3	. . .	A $Co_3H_6(-)_4$	A $CuH(-)$	.	.	. . .	. . . . .	. . . . . .
4	.	W $Co(-)_2$	w $Cu(-)_2$	.		W $C_7H_6O_2$	W $Fe(-)_2$	A $Fe_2(-)_6$
5	W(I)* $CrBr_3$	W $CoBr_2$	W $CuBr_2$	w $AuBr$	W $AuBr_3$	W HBr	W $FeBr_2$	W $FeBr_3$
6	W $CrCO_3$	A $CoCO_3$		.		. .	w $FeCO_3$	. . .
7		W $Co(-)_2$	W $Cu(\ )_6$	. . .		W $HClO_3$	W $Fe(-)_2$	W $Fe(-)_3$
8	I $CrCl_3$	W $CoCl_2$	W $CuCl_2$	w $AuCl$	W $AuCl_3$	W HCl	W $FeCl_2$	W $FeCl_3$
9	.	A $Co(-)$	. . . . .		. .	.	.	A $Fe_2(-)_3$
10	.	w $Co_3(-)_2$		. .		W $C_6H_8O_7$	. .	W $Fe(-)$
11	A $Cr(CN)_2$	A $Co(CN)_2$	A $Cu(CN)_2$	w $AuCN$	W $Au(CN)_3$	W HCN	a $Fe(CN)_2$	. . .
12		I $Co_3(-)_2$	I $Cu_3(-)_2$			W $H_3(-)$	I $Fe_3(-)_2$	. . .
13	. .	I $Co_2(-)$	I $Cu_2(-)$			W $H_4(-)$	I $Fe_2(-)$	a $Fe_4(-)_3$
14	W(a)* CrF_3	W CoF_2	w CuF_2			W HF	w FeF_2	w FeF_3
15	.	W $Co(-)_2$	W $Cu(-)_2$	. . .		W CH_2O_2	W $Fe(-)_2$	W $Fe(-)_3$
16	A $Cr(OH)_3$	A $Co(OH)_2$	A $Cu(OH)_2$	W $AuOH$	A $Au(OH)_3$	.	A $Fe(OH)_2$	A $Fe(OH)_3$
17	W CrI_2	W CoI_2	a CuI	a AuI	a AuI_3	W HI	W FeI_2	W FeI_3
18	W $Cr(NO_3)_3$	W $Co(NO_3)_2$	W $Cu(NO_3)_2$	.		W HNO_3	W $Fe(NO_3)_2$	W $Fe(NO_3)_3$
19	W $Cr(-)$	A $Co(-)$	A $Cu(-)$			W $C_2H_2O_4$	A $Fe(-)$	W $Fe_2(-)_3$
20	a Cr_2O_3	A CoO	A CuO	Au_2O	A Au_2O_3	W H_2O_2	A FeO	A Fe_2O_3
21	w $Cr_2(PO_4)_2$	A $Co_3(PO_4)_2$	A $Cu_3(PO_4)_2$		. .	W H_3PO_4	A $Fe_3(PO_4)_2$	w $FePO_4$
22	. . . . . .	A Co_2SiO_4	A $Cu(-)$			I H_2SiO_3	. . . . .	. . . . . .
23	W(I)* $Cr_2(SO_4)_3$	W $CoSO_4$	W $CuSO_4$			W H_2SO_4	W $FeSO_4$	w $Fe_2(SO_4)_3$
24	d Cr_2S_3	A CoS	A CuS	I Au_2S	I Au_2S_3	W H_2S	A FeS	d Fe_2S_3
25		w $Co(-)$	w $Cu(-)$	.	. .	W $C_4H_6O_6$	w $Fe(-)$	W $Fe_2(-)_3$
26	.	W $Co(CNS)_2$	d $CuCNS$	. . . .	. . .	W $CNSH$	W $Fe(CNS)_2$	W $Fe(CNS)_3$

No.		Pb	Mg	Mn	Hg′	Hg″	Ni	K
1	Acetate —($C_2H_3O_2$)	W $Pb(-)_2$	W $Mg(-)_2$	W $Mn(-)_2$	w $Hg(-)$	W $Hg(-)_2$	W $Ni(-)_2$	W $K(-)$
2	Arsenate —(AsO_4)	A $PbH(-)$	A $Mg_3(-)$	w $MnH(-)$	A $Hg_3(-)$	w $Hg_3(-)_2$	A $Ni_3(-)_2$	W $K_3(-)$
3	Arsenite —(AsO_3)		W $Mg_3(-)_2$	A $Mn_3H_6(-)_4$	A $Hg_3(-)$	A $Hg_3(-)$	A $Ni_3H_6(-)_4$	W K_3AsO_3
4	Benzoate —($C_7H_5O_2$)	w $Pb(-)_2$	W $Mg(-)_2$	W $Mn(-)_2$	A $Hg_2(-)_2$	w $Hg(-)_2$	w $Ni(-)_2$	W $K(-)$
5	Bromide	W $PbBr_2$	W $MgBr_2$	W $MnBr_2$	A $HgBr$	W $HgBr_2$	W $NiBr_2$	W KBr
6	Carbonate	A $PbCO_3$	w $MgCO_3$	w $MnCO_3$	A Hg_2CO_3	..	w $NiCO_3$	W K_2CO_3
7	Chlorate —(ClO_3)	W $Pb(-)_2$	W $Mg(-)_2$	W $Mn(-)_2$	W $Hg(-)$	W $Hg(-)_2$	W $Ni(-)_2$	W $K(-)$
8	Chloride	W $PbCl_2$	W $MgCl_2$	W $MnCl_2$	a $HgCl$	W $HgCl_2$	W $NiCl_2$	W KCl
9	Chromate —(CrO_4)	A $Pb(-)$	W $Mg(-)$		w $Hg_2(-)$	w $Hg(-)$	A $Ni(-)$	W $K_2(-)$
10	Citrate —($C_6H_5O_7$)	W $Pb_3(-)_2$	W $Mg_3(-)_2$	w $MnH(-)$	w $Hg_3(-)$	.	W $Ni_3(-)_2$	W $K_3(-)$
11	Cyanide	w $Pb(CN)_2$	W $Mg(CN)_2$		A $HgCN$	W $Hg(CN)_2$	a $Ni(CN)_2$	W KCN
12	Ferricy'de —$Fe(CN)_6$	w $Pb_3(-)_2$	W $Mg_3(-)_2$			A $Hg_3(-)_2$	I $Ni_3(-)_2$	W $K_3(-)$
13	Ferrocy'de —$Fe(CN)_6$	a $Pb_2(-)$	W $Mg_2(-)$	A $Mn_2(-)$		I $Hg_2(-)$	I $Ni_2(-)$	W $K_4(-)$
14	Fluoride	w PbF_2	w MgF_2	A MnF_2	d HgF	d HgF_2	w NiF_2	W KF
15	Formate —(CHO_2)	W $Pb(-)_2$	W $Mg(-)_2$	W $Mn(-)_2$	w $Hg(-)$	W $Hg(-)_2$	W $Ni(-)_2$	W $K(-)$
16	Hydroxide	w $Pb(OH)_2$	A $Mg(OH)_2$	A $Mn(OH)_2$		A $Hg(OH)_2$	w $Ni(OH)_2$	W KOH
17	Iodide	w PbI_2	W MgI_2	W MnI_2	A HgI	w HgI_2	W NiI_2	W KI
18	Nitrate	W $Pb(NO_3)_2$	W $Mg(NO_3)_2$	W $Mn(NO_3)_2$	W $HgNO_3$	W $Hg(NO_3)_2$	W $Ni(NO_3)_2$	W KNO_3
19	Oxalate —(C_2O_4)	A $Pb(-)$	w $Mg(-)$	w $Mn(-)$	a $Hg_2(-)$	A $Hg(-)$	A $Ni(-)$	W $K_2(-)$
20	Oxide	w PbO	A MgO	A MnO	A Hg_2O	w HgO	A NiO	W K_2O
21	Phosphate	A $Pb_3(PO_4)_2$	w $Mg_3(PO_4)_2$	w $Mn_3(PO_4)_2$	A Hg_3PO_4	A $Hg_3(PO_4)_2$	A $Ni_3(PO_4)_2$	W K_3PO_4
22	Silicate —(SiO_3)	A $Pb(-)$	A $Mg(-)$	I $Mn(-)$				W $K_2(-)$
23	Sulfate	w $PbSO_4$	W $MgSO_4$	W $MnSO_4$	w Hg_2SO_4	d $HgSO_4$	W $NiSO_4$	W K_2SO_4
24	Sulfide	A PbS	d MgS	A MnS	I Hg_2S	I HgS	A NiS	W K_2S
25	Tartrate —($C_4H_4O_6$)	A $Pb(-)$	w $Mg(-)$	w $Mn(-)$	I $Hg_2(-)$		A $Ni(-)$	W $K_2(-)$
26	Thiocy'te	w $Pb(CNS)_2$	W $Mg(CNS)_2$	W $Mn(CNS)_2$	A $HgCNS$	w $Hg(CNS)_2$	.	W $KCNS$

CHART (Continued)

No.	Ag	Na	Sn''''	Sn''	Sr	Zn	Pt
1	**w** $Ag(-)$	**W** $Na(-)$	**W** $Sn(-)_4$	**d** $Sn(-)_2$	**W** $Sr(-)_2$	**W** $Zn(-)_2$	. . .
2	**A** $Ag_2(-)$	**W** $Na_3(-)$			**w** $SrH(-)$	**A** $Zn_3(-)_2$	.
3	**A** $Ag_3(-)$	**W** $Na_2H(-)$		**A** $Sn_3(-)_2$	**w** $Sr_3(-)_2$		. . . .
4	**w** $Ag(-)$	**W** $Na(-)$	.			**W** $Zn(-)_2$	. . .
5	**a** $AgBr$	**W** $NaBr$	**W** $SnBr_4$	**W** $SnBr_2$	**W** $SrBr_2$	**W** $ZnBr_2$	**w** $PtBr_4$
6	**A** Ag_2CO_3	**W** Na_2CO_3			**w** $SrCO_3$	**w** $ZnCO_3$	. .
7	**W** $Ag(-)$	**W** $Na(-)$		**W** $Sn(-)_2$	**W** $Sr(-)_2$	**W** $Zn(-)_2$	. . . . .
8	**a** $AgCl$	**W** $NaCl$	**W** $SnCl_4$	**W** $SnCl_2$	**W** $SrCl_2$	**W** $ZnCl_2$	**W** $PtCl_4$
9	**w** $Ag_2(-)$	**W** $Na_2(-)$	**W** $Sn(-)_2$	**A** $Sn(-)$	**w** $Sr(-)$	**w** $Zn(-)$	. . . .
10	**w** $Ag_3(-)$	**W** $Na_3(-)$	.		**A** $SrH(-)$	**w** $Zn_3(-)_2$	. . .
11	**a** $AgCN$	**W** $NaCN$		.	**W** $Sr(CN)_2$	**A** $Zn(CN)_2$	**I** $Pt(CN)_2$
12	**I** $Ag_3(-)$	**W** $Na_3(-)$	.	**A** $Sn_3(-)_2$	**W** $Sr_3(-)_2$	**A** $Zn_3(-)_2$	. . . . .
13	**I** $Ag_4(-)$	**W** $Na_4(-)$		**a** $Sn_2(-)$	**W** $Sr_2(-)$	**I** $Zn_2(-)$	
14	**W** AgF	**W** NaF	**W** SnF_4	**W** SnF_2	**w** SrF_2	**w** ZnF_2	**W** PtF_4
15	**W** $Ag(-)$	**W** $Na(-)$			**W** $Sr(-)_2$	**W** $Zn(-)_2$	. .
16		**W** $NaOH$	**w** $Sn(OH)_4$	**A** $Sn(OH)_2$	**W** $Sr(OH)_2$	**A** $Zn(OH)_2$	**A** $Pt(OH)_4$
17	**I** AgI	**W** NaI	**d** SnI_4	**W** SnI_2	**W** SrI_2	**W** ZnI_2	**I** PtI_2
18	**W** $AgNO_3$	**W** $NaNO_3$	.	**d** $Sn(NO_3)_2$	**W** $Sr(NO_3)_2$	**W** $Zn(NO_3)_2$	**W** $Pt(NO_3)_4$
19	**a** $Ag_2(-)$	**W** $Na_2(-)$	. .	**A** $Sn(-)$	**w** $Sr(-)$	**A** $Zn(-)$	.
20	**w** Ag_2O	**d** Na_2O	**A** SnO_2	**A** SnO	**W** SrO	**w** ZnO	**A** PtO
21	**A** Ag_3PO_4	**W** Na_3PO_4		**A** $Sn_3(PO_4)_2$	**A** $Sr_3(PO_4)_2$	**A** $Zn_3(PO_4)_2$	.
22		**W** $Na_2(-)$	.	.	**A** $Sr(-)$	**A** $Zn(-)$	. . . . .
23	**w** Ag_2SO_4	**W** Na_2SO_4	**W** $Sn(SO_4)_2$	**W** $SnSO_4$	**w** $SrSO_4$	**W** $ZnSO_4$	**W** $Pt(SO_4)_2$
24	**A** Ag_2S	**W** Na_2S	**A** SnS_2	**A** SnS	**W** SrS	**A** ZnS	**I** PtS
25	**w** $Ag_2(-)$	**W** $Na_2(-)$		**W** $Sn(-)$	**w** $Sr(-)$	**w** $Zn(-)$	. . .
26	**I** $AgCNS$	**W** $NaCNS$	. .	. . . .	**W** $Sr(CNS)_2$	**W** $Zn(CNS)_2$	. . . .

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER

The table shows the number of grams of the anhydrous substance indicated in the first column which can be dissolved in 100 grams of water at the temperature in degrees Centigrade given at the top. When the formula is preceded by a * the solubility is stated in grams of anhydrous substance in 100 grams of saturated solution; when preceded by ** the solubility is stated in grams of anhydrous substance in 100 c.c. of the saturated solution. The column headed with S. P. shows the solid phase hydrated form in equilibrium with the saturated solution.

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
Ag_3AsO_3				1.15×10^{-3}								
Ag_3AsO_4				8.5×10^{-4}								
$AgBr$				8.4×10^{-6}								
$AgC_2H_3O_2$		0 72	0 88	1 04	1 21	1 41	1 64	1 89	2 18	2 52		
$AgCl$			8.9×10^{-5}	$1\ 5\times10^{-4}$			5.23×10^{-4}					2.1×10^{-3}
$AgCN$				$2\ 2\times10^{-5}$								
Ag_2CO_3				$3\ 2\times10^{-3}$								5×10^{-2}
Ag_2CrO_4		1.4×10^{-3}			3.6×10^{-3}		5.3×10^{-3}		8×10^{-3}			
$Ag_3Fe(CN)_6$				$6\ 6\times10^{-5}$								
AgI					3×10^{-7}			3×10^{-6}				
$AgIO_3$			3×10^{-3}	4×10^{-3}				$1\ 9\times10^{-2}$				
$AgNO_2$		$1\ 55\times10^{-1}$	2.20×10^{-1}	3.40×10^{-1}	5×10^{-1}	$7\ 15\times10^{-1}$	$9\ 95\times10^{-1}$	13.63×10^{-1}				
$AgNO_3$		122	170	222	300	376	455	525		669		952
Ag_2S				1.4×10^{-5}								
*Ag_2SO_4		5.7×10^{-1}	6.9×10^{-1}	7.9×10^{-1}	$8\ 8\times10^{-1}$	$9\ 7\times10^{-1}$	10.7×10^{-1}	11.4×10^{-1}	$12\ 1\times10^{-1}$	12.8×10^{-1}	13.4×10^{-1}	$13\ 9\times10^{-1}$
*$AlCl_3$			$41.13^{15°}$									
*$Al_2(SO_4)_3$	$18H_2O$	23 8	25.1	26.7	28 8	31 4	34.3	37.2	39 8	42.2	44.7	47.1
*As_2O_5		37.3	38.3	39 7	41	41.6		42.2		42.9		43.4
As_2S_3				5.17×10^{-5}	at 18°							
B_2O_3		1 1	1.5	2 2		4 0		6.2		9 5		15 7
$BaBr_2$		98	101	104	109	114	118	123	128	135		149
*$Ba(BrO_3)_2$		$2\ 86\times10^{-1}$	4.39×10^{-1}	$6\ 52\times10^{-1}$	$9\ 5\times10^{-1}$	$13\ 1\times10^{-1}$	$17\ 2\times10^{-1}$	$22\ 71\times10^{-1}$	29.22×10^{-1}	35.21×10^{-1}	42.6×10^{-1}	54×10^{-1}
$Ba(C_2H_3O_2)_2$	$3H_2O$	59	63	71								
$Ba(C_2H_3O_2)_2$	$1H_2O$				75	79	77	74	74			75
$BaCl_2$		31.6	33 3	35.7	38 2	40 7	43.6	46.4	49.4	52.4		58.8
*$Ba(ClO_3)_2$		16.90	21.23	25.26	29.43	33 16		40.05		45.90		51.2

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
*$Ba(ClO_4)_2$		67.3		74.3		78.2		81		83.2		84.9
$BaCO_3$		1.6×10^{-3}	at 8°; 2 2×	10^{-3} at 18°;	2.4×10^{-3} a	t 24.2°						
*BaC_2O_4		$5\ 8\times10^{-3}$	$8\ 2\times10^{-3}$		17×10^{-3}							
$BaCrO_4$		2×10^{-4}	$2\ 8\times10^{-4}$	3.7×10^{-4}	4.6×10^{-4}							
BaI_2	$6H_2O$	170 2	185 7	203.1	219 6							
BaI_2	$2H_2O$					231 9		247 3		261 0		271 7
*$Ba(IO_3)_2$		8×10^{-3}	$1\ 4\times10^{-2}$	2.2×10^{-2}	$3\ 1\times10^{-2}$	4.1×10^{-2}	5.6×10^{-2}	7.4×10^{-2}	9.3×10^{-2}	11.5×10^{-2}	14.1×10^{-2}	19.7×10^{-2}
$BaMoO_4$			5.8×10^{-3}	at 23°								
*$Ba(NO_2)_2$	$1H_2O$			40 3						67 3		75
$Ba(NO_3)_2$		5 0	7 0	9 2	11 6	14 2	17.1	20 3		27 0		34 2
$Ba(OH)_2$		1 67	2 48	3 89	5 59	8 22	13.12	20.94		101 40		
$BaSO_4$		1.15×10^{-4}	$2\ 0\times10^{-4}$	2.4×10^{-4}	2.85×10^{-4}							
$BeKF_3$				2 0								5 2
$BeNaF_3$				1 4								2.8
$BeSO_4$	$6H_2O$				52		60 67					
$BeSO_4$	$4H_2O$				43 78	46 74			62		83	100
$BeSO_4$	$2H_2O$									84 76	98	110
Br_2		4 22	3 4	3 20	3 13							
Bi_2S_3			1.8×10^{-5}	at 18°								
$CaBr_2$	$6H_2O$	125	132	143								
$CaBr_2$	$4H_2O$					68 1		73 5		74 7		
$Ca(C_2H_3O_2)_2$	$2H_2O$	37 4	36 0	34 7	33 8	33 2		32.7		33 5		
$Ca(C_2H_3O_2)_2$	H_2O										31 1	29 7
$CaCl_2$	$6H_2O$	59 5	65 0	74 5	102							
$CaCl_2$	$2H_2O$							136 8	141 7	147.0	152 7	159
CaC_2O_4		6.7×10^{-4}	at 13°; 6.8	$\times10^{-4}$ at 2	5°; 9.5×10	$^{-4}$ at 50°; 1	4.0×10^{-4} a	t 95°				
CaF_2		1.6×10^{-3}	at 18°; 1.7	$\times10^{-3}$ at 2	6°							
$Ca(HCO_3)_2$		16 15		16.60		17 05		17 50		17 95		18 40
*CaI_2		64 6	66 0	67 6	69	70 8		74		78		81
*$Ca(IO_3)_2$	$6H_2O$	0 10	0 17		0 42	0 61	0 89	1 36				
*$Ca(IO_3)_2$	$1H_2O$					0 52	0 59	0 65		0 79		0 94

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
*$Ca(NO_2)_2$	$4H_2O$	38 3		43 4								
*$Ca(NO_2)_2$	$2H_2O$							57	60 3		71	
*$Ca(NO_3)_2$	$4H_2O$	50 50	53 55	56 39	60 41	66 21						
*$Ca(NO_3)_2$	$3H_2O$					70 37	73 79					
*$Ca(NO_3)_2$										78 2		78 43
$Ca(OH)_2$		1.85×10^{-1}	1.76×10^{-1}	1.65×10^{-1}	1.53×10^{-1}	1.41×10^{-1}	1.28×10^{-1}	1.16×10^{-1}	1.06×10^{-1}	9.4×10^{-2}	8.5×10^{-2}	7.7×10^{-2}
$CaSO_4$		1.759×10^{-1}	1.928×10^{-1}		2.09×10^{-1}		2.097×10^{-1}	2.047×10^{-1}	1.974×10^{-1}		...	1.619×10^{-1}
*$CdBr_2$	....	37 92			56 90	60 65		61 10		62 29		
*$CdCl_2$	$4H_2O$	49 39	55 58									
*$CdCl_2$	$2\frac{1}{2}H_2O$	47 37			56 91							
*$CdCl_2$	H_2O		57 47	57 35		57 51		57 71		58 41		59 52
$Cd(CN)_2$			1 7 at 15°									
CdI_2		79 8	83 2	86 2	89 7	93 8	97 4					127 6
$Cd(OH)_2$	...		2.6×10^{-4}	at 25°								
CdS			9×10^{-7}	at 18°								
*$Ce_2(SO_4)_3$	$9H_2O$	17 35		9 16	6 36		4 465	3 73				
*$Ce_2(SO_4)_3$	$8H_2O$	15 95		8 69		5 613		3 88				
*$Ce_2(SO_4)_3$	$5H_2O$							3 145		1 19		0 46
*$Ce_2(SO_4)_3$	$4H_2O$					5 71	3 31	2 3		1 0		0 42
Cl_2 760mm.		1 46	0 980	0 716	0 562	0 451	0 386	0 324	0 274	0 219	0 125	0
CO 760mm.	....	4.4×10^{-3}	3.5×10^{-3}	2.8×10^{-3}	2.4×10^{-3}	2.1×10^{-3}	1.8×10^{-3}	1.5×10^{-3}	1.3×10^{-3}	1.0×10^{-3}	6×10^{-4}	0
CO_2 760mm.	...	0 3346	0 2318	0 1688	0 1257	0 0973	0.0761	0 0576				
*$CoCl_2$	$6H_2O$	29 5	31 5	33 5	35 5							
*$CoCl_2$	H_2O					41 0	47 0	47.5		49 5		51 0
*CoI_2		58 0	61 5	65 2	79 0	75 0	79 0			80 0		
*$Co(NO_3)_2$	$6H_2O$	45 66		50		55 9						
*$Co(NO_3)_2$	$3H_2O$							62	64 89	68	77	
CoS		3.79×10^{-4}	at 18°									
$CoSO_4$		25 55	30 55	36 21	42 26	48 85	55 2	60 4	65 7	70		83
*CrO_3		62 24				63 50	64 55				68 5	67 4
CsCl		161 4	174 7	186 5	197 3	208 0	218 5	229 7	239 5	250 0	260 1	270 5

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$CsClO_3$	.	2.46	3.8	6.2	9.5	13.8	19.4	26.2	34.7	45.0	58.0	79.0
$CsClO_4$	..	0.8	1.0	1.6	2.6	4.0	5.4	7.3	9.8	14.4	20.5	30.0
CsF ..	$1\frac{1}{2}H_2O$	.		$366.6^{18°}$								..
$CsIO_3$		.		$2.6^{21°}$				.				.
$CsIO_4$	..			$2.15^{15°}$								
$CsNO_3$...		9.33	14.9	23.0	33.9	47.2	64.4	83.8	107.0	134.0	163.0	197.0
*$CsOH$ ..				$79.41^{15°}$								
Cs_2SO_4		167.1	173.1	178.7	184.1	189.9	194.9	199.9	205.0	210.3	214.9	220.3
$CuCl$.	..			$1.52^{25°}$								
*$CuCl_2$	...	41.4	42.45	43.5	44.55	45.6	46.65	47.7		49.8	.	51.9
CuI_2				1.107								
*$Cu(NO_3)_2$	$6H_2O$	45	48.79	55.58								.
*$Cu(NO_3)_2$	$3H_2O$					61.51		64.17		67.51		...
CuS ..			3.3×10^{-5}	at 18°								
$CuSO_4$ ..	..	14.3	17.4	20.7	25	28.5	33.3	40		55		75.4
*$FeBr_2$		50.5		53.5	55.0	56.2		59.0		61.5		64.0
*$FeCl_2$.	$4H_2O$		39.2		42.2	43.6	45.2	47.0		50.0		
*$FeCl_2$.	H_2O										51.3	51.4
$FeCl_3$.		74.4	81.9	91.8	.		315.1			525.8		535.7
*$Fe(NO_3)_2$	$6H_2O$	41.53	...	45.6				62.5				
FeS	..	6.16×10^{-4}	at 18°									...
$FeSO_4$.	$7H_2O$	15.65	20.51	26.5	32.9	40.2	48.6					.....
$FeSO_4$ ..	H_2O								50.9	43.6	37.3	...
*H_3BO_3 ...		2.59	3.45	4.8	6.30	8.02	10.35	12.90	15.70	19.11	23.30	28.7
HBr 760mm.	.	221.2	210.3	198			171.5				..	130
HCl 760mm.		82.3			67.3	63.3	59.6	56.1				
*H_2SeO_3 .		47.4	55	62.5	70.2	77.5	79.2	79.3	79.3	79.3	79.4	..
H_2SeO_4 ..	H_2O	81	...	85								.....
H_2SeO_4 .					93	94.5	96.5	100		.. ..		....
*H_2TeO_4 .	$6H_2O$	13.92	26.21									
*H_2TeO_4 ...	$2H_2O$	....	25.29	...	33.36	36.38	.. ...	43.67	.	51.55	...	60.84

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$HgBr$	...	...	3.9×10^{-6}	at 25°	...				...	...	...	...
$HgBr_2$	...	...	...	0.5					...			25
*$HgCl$	...	1.4×10^{-4}	...	2×10^{-4}	7×10^{-4}				...			...
*$HgCl_2$	...	3.5	4.6	6.1	7.7	9.3	...	14		23.1		38
$Hg(CN)_2$	...		$9.3^{13.5°}$;	$53.85^{101.1°}$		...						...
HgI	...	...	2×10^{-8}	at 25°		...			...	...		...
HgI_2	...	...	5.91×10^{-3}	at 25°						...	...	...
I_2	...	...		2.9×10^{-2}	4.0×10^{-2}	5.6×10^{-2}	7.8×10^{-2}			...	...	...
KBr	...	53.5	59.5	65.2	70.6	75.5	80.2	85.5	90.0	95.0	99.2	104.0
$KBrO_3$	...	3.1	4.8	6.9	9.5	13.2	17.5	22.7		34.0		50.0
$KC_2H_3O_2$	$1\tfrac{1}{2}H_2O$	216.7	233.9	255.6	283.8	323.3						...
$KC_2H_3O_2$	$\tfrac{1}{2}H_2O$						337.3	350	364.8	380.1	396.3	...
KCl		27.6	31.0	34.0	37.0	40.0	42.6	45.5	48.3	51.1	54.0	56.7
$KClO_3$	...	3.3	5	7.4	10.5	14	19.3	24.5		38.5		57
$KClO_4$	...	0.75	1.05	1.80	2.6	4.4	6.5	9	11.8	14.8	18	21.8
*$KCNS$	...	63.9	...	68.5								
*K_2CO_3	$2H_2O$	51.3	52	52.5	53.2	53.9	54.8	55.9	57.1	58.3	59.6	60.9
K_2CrO_4	...	58.2	60.0	61.7	63.4	65.2	66.8	68.6	70.4	72.1	73.9	75.6
$K_2Cr_2O_7$	...	5	8.5	13.1		29.2		50.5	...	73.0	...	102.0
*$KHC_4H_4O_6$	...	0.32	0.40	0.53	0.9	1.3	1.8	2.4	...	4.4	...	6.5
*$KHCO_3$	...	18.3	21.7	24.9	28.1	31.2		37.5				...
$KHSO_4$		36.3		51.4		67.3						121.6
KI		127.5	136	144	152	160	168	176	184	192	200	208
KIO_3		4.73	...	8.13	11.73	12.8		18.5		24.8		32.2
$KMnO_4$		2.83	4.4	6.4	9.0	12.56	16.89	22.2				...
*KNO_2		73.6		74.9		77						80.5
KNO_3		13.3	20.9	31.6	45.8	63.9	85.5	110.0	138	169	202	246
KOH	$2H_2O$	97	103	112	126							...
KOH	H_2O						140					178
K_2PtCl_6		0.74	0.90	1.12	1.41	1.76	2.17	2.64	3.19	3.79	4.45	5.18
K_2SO_4		7.35	9.22	11.11	12.97	14.76	16.50	18.17	19.75	21.4	22.8	24.1

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
**$K_2S_2O_8$		1 62	2 60	4 49	7 19	9 89						
$K_2SO_4.Al_2(SO_4)_3$	$24H_2O$	3 0	4 0	5 9	8 39	11 70	17 00	24 75	40 0	71 0	109 0	
$La_2(SO_4)_3$		3			1 9		1 5					0 69
LiBr	H_2O						214	224		245		266
LiBr	$2H_2O$	143	166	177	191	205						
LiCl		67	72	78 5	84 5	90 5	97	103		115		127 5
Li_2CO_3		1 54	1 43	1 33	1 25	1 17	1 08	1 01		0 85		0 72
LiI	$3H_2O$	151	157	165	171	179	187	202	230			
LiI	H_2O									435		481
*$LiNO_3$	$3H_2O$	34 8	37.9		57							
*$LiNO_3$	$1\frac{1}{2}H_2O$						61	63 6				
*$LiNO_3$									66			
LiOH		12 7	12 7	12 8	12 9	13	13 3	13 8		15 3		17.5
*Li_2SO_4		26 1	25 9	25 5	25 1	24 7	24 5	24 2		23 5		23
$MgBr_2$	$6H_2O$	91 0	94 5	96 5	99 2	101 6	104 1	107 5		113 7		120.2
$MgCl_2$	$6H_2O$	52 8	53 5	54 5		57 5		61 0		66 0		73.0
*MgI_2	$8H_2O$	54 7		58 3		63 4						
*$Mg(NO_3)_2$	$6H_2O$										65	
$Mg(OH)_2$		9×10^{-4} at 18°										
*$MgSO_4$	$7H_2O$		23 6	26 2	29	31 3						
*$MgSO_4$	$6H_2O$	29	29 7	30 8	31 2		33 5	35 5	37 3	39 1	40 8	42 5
*$MgSO_4$	H_2O									38 6		40.6
*$MnBr_2$	$4H_2O$	56 0	57 6	59 5	61 1	62 8	64 5	66 3	68 0			
*$MnBr_2$	$2H_2O$									69 2	69 3	69 5
$MnCl_2$	$4H_2O$	63 4	68 1	73 9	80 71	88 59	98 15					
$MnCl_2$	$2H_2O$							108 6	110 6	112 7	114 1	115 3
*$Mn(NO_3)_2$	$6H_2O$	50 49	54 1	58 8								
*$Mn(NO_3)_2$	$3H_2O$				67.38							
MnS			6.23×10^{-4} at 18°									
$MnSO_4$	$7H_2O$	53 23	60 01									

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$MnSO_4$	$5H_2O$		59.5	62.9	67.76							
$MnSO_4$	$4H_2O$			64.5	66.44	68.8	72.6					
$MnSO_4$	H_2O						58.17	55.0	52.0	48.0	42.5	34.0
MoO_3				0.138	0.264	0.476	0.687	1.206	2.055	2.106		
N_2O			0.1705	0.1211								
NH_4Br		60.6	68	75.5	83.2	91.1	99.2	107.8	116.8	126	135.6	145.6
*NH_4CNS		54.5	59	63	67.5							
*$(NH_4)_2C_2O_4$		2.1	3	4.2	5.6	7.4	9.3					
$(NH_4)_2Cd(SO_4)_2$				72.3^{25°								
NH_4Cl		29.4	33.3	37.2	41.4	45.8	50.4	55.2	60.2	65.6	71.3	77.3
**NH_4ClO_4		11.56		20.85		30.58		39.05		48.19		57.01
$(NH_4)_2CoSO_4$		6.0	9.5	13.0	17.0	22.0	27.0	33.5	40.0	49.0		
*$(NH_4)_2CrO_4$					28.8							
*$(NH_4)_2Cr_2O_7$					32.05							
$(NH_4)_2Cr_2(SO_4)_4$				10.78^{25°								
$(NH_4)_2Fe(SO_4)_2$		12.5	17.2			33.0	40		52			
$(NH_4)_2Fe_2(SO_4)_4$				44.15^{25°								
NH_4HCO_3		11.9	15.8	21	27							
$NH_4H_2PO_3$		171	$190^{14.5^\circ}$	260^{31°								
$(NH_4)_2HPO_4$			131^{15°									
NH_4I		154.2	163.2	172.3	181.4	190.5	199.6	208.9	218.7	228.8		250.3
*NH_4LiSO_4			35.58		35.87		36.00		36.18			
NH_4MgPO_4		0.023		0.052		0.036	0.030	0.040	0.016	0.019		
NH_4MnPO_4				0		0		0	0.005	0.007		
NH_4NO_3		118.3		192	241.8	297.0	344.0	421.0	499.0	580.0	740.0	871.0
$(NH_4)_2PtCl_6$			0.7									1.25
$(NH_4)_2SO_4$		70.6	73.0	75.4	78.0	81.0		88.0		95.3		103.3

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$(NH_4)_2SO_4.Al_2(SO_4)_3$	$24H_2O$	2 10	4.99	7 74	10 94	14 88	20.10	26.70	...	...	...	...
$(NH_4)_2S_2O_8$	...	58.2	...	...	...	...	...	...	...	...	...	...
*$(NH_4)_3SbS_4$	...	41.6	...	47.7	54.5	...	...	...	...	...	...	...
$(NH_4)_2SeO_4$	...	...	1.22[12°]	...	...	...	...	...	...	...	...	...
NH_4VO_3	...	...	...	4 8	8 4	13 2	17.8	...	30 5	...	...	...
NO 760mm.	...	$9\ 84\times10^{-3}$	7.57×10^{-3}	6.18×10^{-3}	5.17×10^{-3}	4.40×10^{-3}	3.76×10^{-3}	3.24×10^{-3}	2.67×10^{-3}	1.99×10^{-3}	1.14×10^{-3}	0
N_2O 760mm.	...	...	0.171	0.121	...	...	...	...	...	...	...	...
*NaBr	$2H_2O$	44.3	...	47.5	49 4	51.4	53.7	...	...	...	...	...
*NaBr	...	...	...	...	...	...	...	...	...	54 2	...	54.8
$Na_2B_4O_7$	$10H_2O$	1.3	1 6	2.7	3.9	...	10.5	20.3	...	...	...	...
$Na_2B_4O_7$	$5H_2O$	...	...	...	...	...	...	...	24.4	31 5	41	52.5
$NaBrO_3$	...	27 5	...	34 5	...	50.2	...	62 5	...	75.7	...	90.9
$NaC_2H_3O_2$	$3H_2O$	36 3	40 8	46.5	54.5	65.5	83	139	...	...	...	...
$NaC_2H_3O_2$	...	119	121	123 5	126	129.5	134	139.5	146	153	161	170
$Na_2C_2O_4$	...	...	...	3 7	...	...	...	...	...	...	...	6 33
NaCl	...	35.7	35.8	36.0	36.3	36.6	37.0	37.3	37.8	38.4	39.0	39.8
$NaClO_3$	...	79	89	101	113	126	140	155	172	189	...	230
Na_2CO_3	$10H_2O$	7	12.5	21.5	38.8	...	...	...	...	...	...	...
Na_2CO_3	H_2O	...	...	...	50.5	48.5	...	46.4	...	45.8	...	45.5
*Na_2CrO_4	$10H_2O$	24.07	33 41	47	...	...	...	...	...	...	...	...
*Na_2CrO_4	$4H_2O$	...	...	...	47	48.97	51	53.4	...	...	...	...
*Na_2CrO_4	...	...	...	...	...	...	...	...	55.15	55.53	...	55.74
*$Na_2Cr_2O_7$	$2H_2O$	61.98	...	64	...	...	71	...	76	79	...	...
$Na_2Cr_2O_7$	...	...	...	...	...	...	...	...	...	...	...	81
$Na_4Fe(CN)_6$	...	...	...	17 9	...	30	...	...	...	59	...	63
$NaHCO_3$	...	6 9	8 15	9.6	11 1	12.7	14.45	16.4	...	...	...	...
NaH_2PO_4	$2H_2O$	57.9	69 9	85.2	106.5	138.2	...	...	...	...	...	...
NaH_2PO_4	H_2O	...	...	...	...	...	158.6	...	...	...	...	...
NaH_2PO_4	...	...	...	...	...	...	...	179.3	190 3	207.3	225.3	246.6
Na_2HAsO_4	...	7.3	15.5	26.5	37	47	...	65	...	85	...	...

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
Na_2HPO_4	$12H_2O$	1 67	3 6	7 7	20 8						...	....
Na_2HPO_4	$7H_2O$					51 8						...
Na_2HPO_4 ...	$2H_2O$						80 2	82 9	88 1	92 4	102 9	
Na_2HPO_4 ...												102 2
NaI									294	296		302
NaI	$2H_2O$	158 7	168 6	178 7	190 3	205 0	227 8	256.8				
$NaIO_3$		2 5		9		15		21		27		34
*$NaNO_2$		41 9	43 8	45 8	47 8	49 6	51			57		62
$NaNO_3$		73	80	88	96	104	114	124		148		180
NaOH	$4H_2O$	42										
NaOH	$3\frac{1}{2}H_2O$		51 5									
NaOH	H_2O			109	119	129	145	174				
NaOH											313	347
Na_3PO_4	$12H_2O$	1 5	4 1	11	20	31	43	55		81		108
$Na_4P_2O_7$	$10H_2O$	3 16	3 95	6 23	9 95	13 50	17 45	21 83		30 04		40 26
*Na_2S	$9H_2O$		13 36	15 8	18 4	22 2						
*Na_2S	$5\frac{1}{2}H_2O$						28 48	29 92	31 38	33 95	37 20	
*Na_2S	$6H_2O$						26 7	28 1	30 22	32.95	36 42	
Na_2SO_3	$7H_2O$	13 9	20	26 9	36							
Na_2SO_3						28 0	28 2	28 8		28 3		
Na_2SO_4	$10H_2O$	5 0	9 0	19 4	40 8							
Na_2SO_4	$7H_2O$	19 5	30	44								
Na_2SO_4						48 8	46 7	45 3		43 7		42 5
$Na_2S_2O_3$		52 5	61 0	70 0	84 7	102 6	169 7	206 7		248 8	254 2	266 0
*Na_2SeO_4	$10H_2O$	11 74			44 05							
*Na_2SeO_4							44 49					42 14
$NaVO_3$	$2H_2O$					30 2		68 4				
$NaVO_3$						26 23		32 97	36 9			
*Na_2WO_4	$10H_2O$	36 54										
*Na_2WO_4 ..	$2H_2O$	41 73		42						47 7		49 3
$Nd_2(SO_4)_3$		9 5			5		3 7			2 7		

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
*$NiBr_2$		53	55	56 7	58	59.1	60	60 4		60 6		60 8
$NiCO_3$			9 25×	10^{-3} at 25°								
*$NiCl_2$		35	37 3	39 1	40 8	42 3	43 9	45 1	46			46 7
*NiI_2		55 4	57 5	59 7	61 7	63 5	64 7	64 8	65	65.2	65 3	
*$Ni(NO_3)_2$	$6H_2O$	44 32		49 06		55						
*$Ni(NO_3)_2$	$3H_2O$							61 99	63 95		70 16	
NiS			3 6 ×	10^{-4} at 18°								
$NiSO_4$	$7H_2O$	27.22	32		42 46							
$NiSO_4$	$6H_2O$						50 15	54 80	59.44	63 17		76.7
O_3		3 9×10^{-3}	2.9×10^{-3}	2 1×10^{-3}	7×10^{-4}	4×10^{-4}	1×10^{-4}	0				
$PbBr_2$		0 4554		0 85	1 15	1 53	1 94	2 36		3 34		4.75
$Pb(C_2H_3O_2)_2$				55.04[25°]								
$PbCO_3$				1.1×10^{-4}								
$PbCl_2$		0 6728		0 99	1 20	1 45	1 70	1 98		2 62		3 34
$PbCrO_4$				7×10^{-6}								
PbF_2			0 06	0 064	0 068							
PbI_2		0 0442		0 068	0 090	0 125	0 164	0 197		0 302		0 436
$Pb(NO_3)_2$		38.8	48 3	56 5	66	75	85	95		115		138 8
PbS				8.6×10^{-5}	at 18°							
$PbSO_4$		0 0028	0 0035	0 0041	0 0049	0 0056						
RbCl		77	84 4	91 1	97 6	103 5	109 3	115 5	121 4	127 2	133 1	138.9
$RbClO_3$		2 14		5 4	8		15 98					62 8
$RbClO_4$		0 5	0 6	1 0	1.5	2 3	3 5	4 85	6 72	9 2	12 7	18
$RbNO_3$		19 5	33 0	53 3	81.3	116 7	155 6	200	251	309	375	452
Rb_2SO_4		36 4	42 6	48 2	53 5	58 5	63 1	67 4	71 4	75 0	78 7	81 8
SO_2 760mm		22 83	16.21	11 29	7 81	5 41	4 5					
$SbCl_3$		601 6		931.5	1068 0	1368 0	1917 0	4531 0		∞		
SbF_3		384 7		444 7	563 6							
Sb_2S_3			1 75×	10^{-4} at 18°								
$SnCl_2$		83.9	269.8[15°]									
SnI_2				1 0	1 2	1 4	1 7	2 1	2 5	3 0	3.4	4 0

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$SnSO_4$				19								18
$SrBr_2$		85 2	93	102 4	111 9	123 2	135 8	150		181 8		222 5
$Sr(C_2H_3O_2)_2$	$4H_2O$	36 9	43 61									
$Sr(C_2H_3O_2)_2$	$\frac{1}{2}H_2O$		42.95	41 6	39 5		37 35		36.24	36 10	36 24	36 4
SrC_2O_4		0 0033	0.0044	0 0046	0 0057							
$SrCl_2$	$6H_2O$	43.5	47.7	52.9	58 7	65.3	72 4	81 8				
$SrCl_2$	$2H_2O$								85.9	90 5		100.8
SrI_2	$6H_2O$	165.3		177 8		191 5		217 5		270 4		
SrI_2	$2H_2O$										365 2	383 1
*$Sr(NO_2)_2$	H_2O	34 5		39			45 6	49 3			56 6	58 1
$Sr(NO_3)_2$	$4H_2O$	40.1		70.5								
$Sr(NO_3)_2$					88 6	90 1		93 8	96	98	100	
$SrSO_4$		0 0113		0 0114	0 0114							
$Th(SO_4)_2$	$9H_2O$	0 74	0 98	1 38	1 995	2 998	5 22					
$Th(SO_4)_2$	$8H_2O$	1 0	1 25	1 62								
$Th(SO_4)_2$	$6H_2O$	1 50		1 90	2 45			6 64				
$Th(SO_4)_2$	$4H_2O$					4 04	2 54	1 63	1 09			
$Th(SeO_4)_2$		0 498										
$TlBr$		0 024	0 029	0 042								
$TlBrO_3$				0 346		0 736						
$TlCl$		0 21	0 25	0 33	0 42	0 52	0 63	0 8		1 2		1 8
$TlClO_3$		2		3 92			12 67			36 65		57 31
$TlClO_4$		6	8 04		19 72		39 62		65 32	81 49		166 6
TlI			0 0036	0 006	0 008	0 015		0 035		0 070		0.120
$TlIO_3$				0 058								
$TlNO_3$		3 91	6 22	9 55	14 3	20 9	30 4	46 2	69 5	111.0	200 0	414.0
$TlOH$		25.44			39 9	49.5		73 8		106	126 1	148.3
Tl_2S				0 022								
Tl_2SO_4		2.70	3 70	4 87	6 16		9 21	10 92	12.74	14 61	16 53	18.45
Tl_2SeO_4			2 13	2 8								
*$UO_2(NO_3)_2$	$6H_2O$	49 5	52	55 7			67					

SOLUBILITY OF INORGANIC COMPOUNDS IN WATER (Continued)

Substance	S. P.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$Yb_2(SO_4)_3$		44 2		38 4		21 0		10 4	7 22	6 92	5 83	4 67
*$ZnBr_2$	$2H_2O$	79 55		81 7	84.08							
*$ZnBr_2$						85 53		86 08		86 57		87 05
*$Zn(ClO_3)_2$	$6H_2O$	59.19	60 4									
*$Zn(ClO_3)_2$	$4H_2O$			66 7	67 66	69 06	73.2					
*ZnI_2	$2H_2O$	81 16	82 06	82.9								
*ZnI_2		81 11				81 66		82.37		83.05		83 62
*$Zn(NO_3)_2$	$6H_2O$	48.66		54.2								
*$Zn(NO_3)_2$	$3H_2O$					67 42						
$ZnSO_4$	$7H_2O$	41 9	47	54.4								
$ZnSO_4$	$6H_2O$					41.2	43 5					
$ZnSO_4$										46.4	45 5	44 7

α, the absorption coefficient, is the volume of gas when reduced to 0° and 760 mm., absorbed by one volume of water when the pressure of the gas itself, without the aqueous tension, amounts to 760 mm.

q is the weight of gas in grams dissolved in 100 grams of water when the total pressure (i.e., the sum of the partial pressure of the gas plus the aqueous tension at the given temperature) is 760 mm.

Temp.° C	Nitrogen*		Oxygen		Hydrogen		Carbon Dioxide	
	α	q	α	q	α	q	α	q
0	0.02354	0.002942	0.04889	0.006945	0.02148	0.0001922	1.713	0.3346
1	0.02297	0.002869	0.04758	0.006756	0.02126	0.0001901	1.646	0.3213
2	0.02241	0.002798	0.04633	0.006574	0.02105	0.0001881	1.584	0.3091
3	0.02187	0.002730	0.04512	0.006400	0.02084	0.0001862	1.527	0.2978
4	0.02135	0.002663	0.04397	0.006232	0.02064	0.0001843	1.473	0.2871
5	0.02086	0.002600	0.04287	0.006072	0.02044	0.0001824	1.424	0.2774
6	0.02037	0.002537	0.04180	0.005918	0.02025	0.0001806	1.377	0.2681
7	0.01990	0.002477	0.04080	0.005773	0.02007	0.0001789	1.331	0.2589
8	0.01945	0.002419	0.03983	0.005632	0.01989	0.0001772	1.282	0.2492
9	0.01902	0.002365	0.03891	0.005498	0.01972	0.0001756	1.237	0.2403
10	0.01861	0.002312	0.03802	0.005368	0.01955	0.0001740	1.194	0.2318
11	0.01823	0.002263	0.03718	0.005246	0.01940	0.0001725	1.154	0.2239
12	0.01786	0.002216	0.03637	0.005128	0.01925	0.0001710	1.117	0.2165
13	0.01750	0.002170	0.03559	0.005014	0.01911	0.0001696	1.083	0.2098
14	0.01717	0.002126	0.03486	0.004906	0.01897	0.0001682	1.050	0.2032
15	0.01685	0.002085	0.03415	0.004802	0.01883	0.0001668	1.019	0.1970
16	0.01654	0.002045	0.03348	0.004703	0.01869	0.0001654	0.985	0.1903
17	0.01625	0.002006	0.03283	0.004606	0.01856	0.0001641	0.956	0.1845
18	0.01597	0.001970	0.03220	0.004514	0.01844	0.0001628	0.928	0.1789
19	0.01570	0.001935	0.03161	0.004426	0.01831	0.0001616	0.902	0.1737
20	0.01545	0.001901	0.03102	0.004339	0.01819	0.0001603	0.878	0.1688
21	0.01522	0.001869	0.03044	0.004252	0.01805	0.0001588	0.854	0.1640
22	0.01498	0.001838	0.02988	0.004169	0.01792	0.0001575	0.829	0.1590
23	0.01475	0.001809	0.02934	0.004087	0.01779	0.0001561	0.804	0.1540
24	0.01454	0.001780	0.02881	0.004007	0.01766	0.0001548	0.781	0.1493
25	0.01434	0.001751	0.02831	0.003931	0.01754	0.0001535	0.759	0.1449
26	0.01413	0.001724	0.02783	0.003857	0.01742	0.0001522	0.738	0.1406
27	0.01394	0.001698	0.02736	0.003787	0.01731	0.0001509	0.718	0.1366
28	0.01376	0.001672	0.02691	0.003718	0.01720	0.0001496	0.699	0.1327
29	0.01358	0.001647	0.02649	0.003651	0.01709	0.0001481	0.682	0.1292
30	0.01342	0.001624	0.02608	0.003588	0.01699	0.0001474	0.665	0.1257
35	0.01256	0.001501	0.02440	0.003315	0.01666	0.0001425	0.592	0.1105
40	0.01184	0.001391	0.02306	0.003082	0.01644	0.0001384	0.530	0.0973
45	0.01130	0.001300	0.02187	0.002858	0.01624	0.0001341	0.479	0.0860
50	0.01088	0.001216	0.02090	0.002657	0.01608	0.0001287	0.436	0.0761
60	0.01023	0.001052	0.01946	0.002274	0.01600	0.0001178	0.359	0.0576
70	0.00977	0.000851	0.01833	0.001856	0.0160	0.000102	—	—
80	0.00958	0.000660	0.01761	0.001381	0.0160	0.000079	—	—
90	0.0095	0.00038	0.0172	0.00079	0.0160	0.000046	—	—
100	0.0095	0.00000	0.0170	0.00000	0.0160	0.000000	—	—

* Atmospheric Nitrogen 98.815% Vol. N_2 + 1.185% Vol. A

GASES IN WATER

l is the volume of gas in c.c. dissolved by one volume of water when the total pressure (i.e., the sum of the partial pressure of the gas plus the aqueous tension at the given temperature) is 760 mm.

	Carbon Monoxide		Hydrogen Sulfide		Sulfur Dioxide		Nitric Oxide		Air**	
	α	q	α	q	l	q	α	q	cc/1000cc	% O_2 in dissolved air
0	0.03537	0 004397	4 670	0.7066	79.789	22.83	0.07381	0.009833	29.18	34.91
1	0.03455	0 004293	4.522	0 6839	77.210	22.09	0.07184	0 009564	28.42	34.87
2	0.03375	0.004191	4.379	0.6619	74.691	21.37	0.06993	0.009305	27.69	34.82
3	0.03297	0 004092	4 241	0.6407	72.230	20.66	0.06809	0.009057	26.99	34.78
4	0.03222	0 003996	4.107	0.6201	69.828	19.98	0.06632	0.008816	26.32	34.74
5	0.03149	0.003903	3.977	0.6001	67.485	19.31	0.06461	0.008584	25.68	34.69
6	0.03078	0.003813	3.852	0.5809	65.200	18.65	0.06298	0.008361	25.06	34.65
7	0.03009	0.003725	3 732	0.5624	62.973	18.02	0.06140	0.008147	24.47	34.60
8	0.02942	0.003640	3.616	0.5446	60.805	17.40	0.05990	0.007943	23.90	34.56
9	0.02878	0.003559	3.505	0.5276	58.697	16.80	0.05846	0.007747	23.36	34.52
10	0.02816	0 003479	3 399	0.5112	56.647	16.21	0.05709	0.007560	22.84	34.47
11	0.02757	0.003405	3.300	0.4960	54.655	15.64	0.05587	0.007393	22.34	34.43
12	0.02701	0.003332	3.206	0.4814	52.723	15.09	0.05470	0.007233	21.87	34.38
13	0.02646	0.003261	3 115	0.4674	50.849	14.56	0.05357	0.007078	21.41	34.34
14	0.02593	0.003194	3.028	0.4540	49.033	14.04	0.05250	0.006930	20.97	34.30
15	0.02543	0.003130	2.945	0.4411	47.276	13.54	0.05147	0.006788	20.55	34.25
16	0.02494	0.003066	2.865	0.4287	45.578	13.05	0.05049	0.006652	20.14	34.21
17	0 02448	0.003007	2.789	0.4169	43.939	12.59	0.04956	0.006524	19.75	34.17
18	0 02402	0.002947	2.717	0.4056	42.360	12.14	0.04868	0.006400	19.38	34.12
19	0.02360	0.002891	2.647	0.3948	40.838	11.70	0.04785	0.006283	19.02	34.08
20	0.02319	0.002838	2.582	0.3846	39.374	11.28	0.04706	0.006173	18.68	34.03
21	0.02281	0.002789	2.517	0.3745	37.970	10.88	0.04625	0.006059	18.34	33.99
22	0.02244	0.002739	2.456	0.3648	36.617	10.50	0.04545	0.005947	18.01	33.95
23	0.02208	0.002691	2.396	0.3554	35.302	10.12	0.04469	0.005838	17.69	33.90
24	0.02174	0 002646	2 338	0 3463	34.026	9.76	0.04395	0 005733	17.38	33.86
25	0.02142	0.002603	2.282	0.3375	32.786	9.41	0.04323	0.005630	17.08	33.82
26	0.02110	0.002560	2 229	0 3290	31.584	9.06	0.04254	0.005530	16.79	33.77
27	0.02080	0 002519	2 177	0 3208	30.422	8.73	0.04188	0.005435	16.50	33.73
28	0.02051	0.002479	2.128	0 3130	29.314	8.42	0.04124	0.005342	16.21	33.68
29	0.02024	0.002442	2.081	0 3055	28.210	8.10	0.04063	0.005252	15.92	33 64
30	0.01998	0.002405	2.037	0.2983	27.161	7.80	0.04004	0.005165	15.64	33.60
35	0.01877	0.002231	1.831	0.2648	22.489	6.47	0.03734	0.004757		
40	0.01775	0 002075	1.660	0.2361	18.766	5.41	0.03507	0.004394		
45	0.01690	0.001933	1.516	0.2110	—	—	0.03311	0.004059		
50	0.01615	0 001797	1.392	0.1883	—	—	0.03152	0.003758		
60	0.01488	0.001522	1.190	0.1480	—	—	0.02954	0.003237		
70	0.01440	0.001276	1.022	0.1101	—	—	0.02810	0.002668		
80	0.01430	0.000980	0.917	0.0765	—	—	0 02700	0.001984		
90	0.0142	0.00057	0.84	0.041	—	—	0.0265	0.00113		
100	0.0141	0.00000	0.81	0.000	—	—	0.0263	0.00000		

** Cubic centimeters of air (free from CO_2 and NH_3) dissd. in 1000 c.c. H_2O with barometer at 760 mm. (total pressure).

SOLUBILITY OF AMMONIA IN WATER

Press. NH_3, mm	0°C g/g	0°C cm³/cm³	20°C g/g	20°C cm³/cm³	40°C g/g	40°C cm³/cm³
700	.....	....	0.497	652.9	.....	......
800	.....	....	0.544	714 6	0.329	429.6
900	0.997	1312	0.588	772.4	....	......
1000	1 094	1440	0 629	826 2	0.386	504.0
1100	1 192	1569	0.669	878 8	....	......
1200	1 288	1695	0 707	928 8	0 433	565.4
1300	1.388	1827	0.745	978 7	.....	......
1400	1 488	1958	0 781	1025 9	0.472	616.3
1500	1.588	2090	0 815	1070 6	....	......
1600	1.688	2221	0.847	1112 6	0.508	663.3
1700	1 778	2340	0 877	1152.1	.....	......
1800	1.847	2431	0 906	1190 1	0.543	709.0
1900	.....	....	0.934	1226.9	.....	......
2000	.....	....	0 959	1259.7	0.577	753.4
2100	.....	....	0.984	1292.6	.....	......
2200	.....	....	1.007	1322 8	0.611	797.8
2300	....	....	1.029	1351.7	.....	......
2400	.....	....	1.052	1381.8	0.644	840.9
2500	.....	....	1 074	1410 8	.....	......
2600	.....	....	1.096	1439 6	0.676	882.7
2700	.....	....	1.117	1467 3	.....	......
2800	..	....	1.140	1497.4	0.706	921.7
2900	...	....	1.162	1526 4	.....	......
3000	....	....	1.185	1556.6	0.732	955.8
3100	.....	....	1.207	1585.5	.....	......
3200	...	...	1.230	1615.7	0.758	989.8
3300	....	...	.....	......	.....	......
3400	....	...	....	.....	0.784	1023.7

SOLUBILITIES OF VARIOUS GASES IN WATER

Henry's Law Constant K

Compiled by Hardin B. Jones, PhD.

$K \times 10^{-7}$ $\quad K = P/X \quad$ P = partial pressure mm. of Hg, X = mole fraction

Gas / References	$t = 0°$	10°	20°	30°	38°	40°	50°	60°	70°	80°
Argon 1, 8, 14, 15, 17	1.65	2.18	2.58	3.02	3.41	3.49	3.76	3.92	4.12	4 25
Carbon dioxide 6, 7, 9, 12	.0555	.0788	.108	.139	.168	.173	.217	.258		
Helium 1, 3, 8, 12, 14, 15, 18, 21	10.0	10.5	10.9	11.1	11.0	10.9	10.5	10.3	9.88	
Hydrogen 6, 12	4.42	4 82	5 20	5.51	5 72	5.78	5.82	5.80	5 77	5 73
Krypton 2, 14, 15	0.853	1.20	1.52	1.85	2.13	2.18	2 43	2.66	2 83	2 94
Neon (2), 8	7.68	8.49	9.14	9.45	9.76	9 80	10 0			
Nitrogen 12, 16, 20, 22, 23, 24	4.09	4 87	5 75	6 68	7.51	7 60	8.20	8.70	9.20	
Oxygen 6, 10, 12, 13	1.91	2.48	2.95	3.52	4.04	4 14	4.50	4.84	5 13	5.28

SOLUBILITIES OF VARIOUS GASES IN WATER (Continued)

Gas / References	$K \times 10^{-7}$ $K = P/X$ P = partial pressure mm. of Hg X = mole fraction $t = 0°$	10°	20°	30°	38°	40°	50°	60°	70°	80°
Radon 2, 14, 15	.186	.286	.391	.529	.651	.683	.839	.976	1.07	
Xenon 2, 14, 15	.392	.555	.742	.945	1.12	1.16	1.31	1.46	1.59	1.66
Nitrous oxide 6, 9, 10, 12	.074	.108	.155	.210	.242	.246	.279			
Acetylene 5, 25	.0555	0716	.0900	.112	.131	.133				
Ethylene 5, 10	.370	.552	.753	1 00	1 21	1.23				

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INDICATORS

R. T. Thomson's table, showing the hydrogen atoms replaced by NaOH or KOH when a compound neutral to the indicator is formed. The blank spaces indicate that the end-reaction is obscure.

(From Cohn's Indicators and Test-papers, John Wiley and Sons, publishers, by permission.)

Acid	Formula	Methyl-orange	Phenolphthalein		Litmus	
		Cold	Cold	Boiling	Cold	Boiling
Sulphuric.......	H_2SO_4	2	2	2	2	2
Hydrochloric ...	HCl	1	1	1	1	1
Nitric..........	HNO_3	1	1	1	1	1
Thiosulphuric...	$H_2S_2O_3$	2	2	2	2	2
Carbonic.......	H_2CO_3	0	1 dilute	0	..	0
Sulphurous.....	H_2SO_3	1	2	.	..	..
Hydrosulphuric.	H_2S	0	1 dilute	0	..	0
Phosphoric.....	H_3PO_4	1	2	..	..	..
Arsenic........	H_3AsO_4	1	2	..	..	..
Arsenous......	H_3AsO_3	4	..		0	0
Nitrous.......	HNO_2	indicator destroyed	1	..	1	..
Silicic	H_4SiO_4	0	..	..	0	0
Boric.........	H_3BO_3	0	..		..	..
Chromic...	H_2CrO_4	1	2	2	..	..
Oxalic..........	$H_2C_2O_4$	..	2	2	2	2
Acetic..........	$HC_2H_3O_2$	..	1	.. 1	nearly	..
Butyric.......	$HC_4H_7O_2$	..	1	.. 1	nearly	..
Succinic.......	$H_2C_4H_4O_4$	..	2	.. 2	nearly	..
Lactic..........	$HC_3H_5O_3$	..	1	.	1	.
Tartaric.... ...	$H_2C_4H_4O_6$	..	2	..	2	.
Citric.........	$H_3C_6H_5O_7$	..	3	..	..	

TABLE OF INDICATORS

Due to hydrolysis of the salt formed, the composition of a weak acid solution titrated against a strong base is basic (when equivalent amounts of acid and base are present) and of a weak base against a strong acid is acid. A truly neutral titrated solution has the same concentration of hydrogen ions $[H^+]$ and hydroxyl ions $[OH^-]$ as water. Water has a concentration of $[H^+]$ ion of 10^{-7} and of $[OH^-]$ ion of 10^{-7} at 25°C. As an index of the acid intensity the expression pH is employed and is equal to the logarithm of the reciprocal of the hydrogen ion concentration; i. e., $pH = \log \frac{1}{[H^+]}$ per liter. From this it follows that the pH of a neutral solution is the same as that of water; viz., 7; an acid solution has a pH less than 7 and a basic solution has a pH greater than 7. Those indicators in the table below with a * are the Sörensen selected indicators; those with a # are the Clark and Lubs selected indicators; those with the ## are Cohen's supplement to the Clark and Lubs selection; those with the *E* are the Eastman indicators.

TABLE OF INDICATORS (Continued)

Indicator	Synonym	pH Range	Observer
Mauveine	...	0.1–2.9 *	
a-Naphtholbenzein	...	0–1 } E 8–9 } E	
Methyl Red (para)	...	0–2 E	
Methyl Violet	...	0–2 E 0 1–3.1 *	
Iodeosin	Tetraiodofluorescein	0.3–0 } E 4–5 } E	
Benzoyl Auramine	...	0.1–1 E	
Quinaldine Red	...	1.2 E	
Diphenylamino-azo-benzene	...	1.2–2.1 *	
Tropeolin 00	Orange IV; diphenylamino azo-p-benzene sulfonic acid	1.4–2.6 * 1–3 E	
Metanil Yellow	Diphenylamino-azo-m-benzene sulfonic acid	1.2–2 3 *E	
Meta Cresol Purple	...	1.2–2.8 } ## 7.4–9.0 } ##	
Thymol Blue	Thymolsulfonphthalein	1.2–2.8 # 8 0–9.6	
Benzylaniline-azo-benzene sulfonic acid	...	1.9–3.3 *	
Ethyl Orange	Diethylaniline orange; sodium (or ammonium) diethylaniline-azo-benzene sulfonate	2–4 E	
Benzopurpurin 4B	...	2-4 E	
Benzylaniline-azo-benzene		2.3–3.3 *	
Red Cabbage Extract	Wild cabbage; sea cabbage; *Brassica oleracea*	2.4–4 5	Walbum
m-Chloro-diethyl aniline-azo-p-benzene sulfonic acid	...	2.6–4.0 *	
p-Dimethylamino-azo-benzene	Butter yellow; benzene-azo-dimethylaniline	2.9–4.0 * 3–4 E	
Congo Red	Sodium tetrazodiphenyl-naphthionate	3–5 E	Prideaux
2, 5-Dinitrohydro-quinone	...	3–9	Henderson and Forbes
Bromophenol Blue	Tetrabromophenolsulfon-phthalein	3.0–3.6 #E	
Methyl Orange[1]	Tropeolin D; orange III; Helianthine; Lunge's Indicator	2.9–4.0 E 3.1–4.4 *	
a-Naphthylamino-azo-p-benzene sulfonic acid	...	3.5–5.7 *	
a-Naphthylamino-azo-benzene	...	3.7–5.0 *	
Brom Cresol Green	...	3 8–5.4##	
p-Sulfo-o-methoxy-benzene-azo-dimethyl-a-napthylamine	...	4 0–4.6 E	
Iodeosin	*See iodeosin above*	4–5 } E 0.3–0 } E	

[1] Methyl Orange may be used in the presence of carbon dioxide or hydrogen sulfide.

TABLE OF INDICATORS (Continued)

Indicator	Synonym	pH Range	Observer
Dinitrohydroquinone Acetate		4–5, 9–10 E	
Sodium Alizarinsulfonate		4–5, 5–6 E	
Dichlorofluorescein		4–6 E	Hottinger
Lacmosol		4.4–5.5	
Methyl Red		4.4–6.0 # 4.2–6.3 E	
Lacmoid		4 4–6.2	Sörensen
Tetrabromo-m-cresol-sulfonphthalein		4.5–5.5 E	
Azolitmin (Litmus)		4.5–8.3	Sörensen
Cochineal	Dried female insect, *Coccus cacti* Lin.; carminic acid	4.7–6.2	Sorensen
Chlor Phenol Red		4.8–6.4##	
Propyl Red		4.8–6.4 E	Lubs and Clark
Hematoxylin	From logwood, *Haematoxylon campechia* L.	5–6 E	
p-Nitrophenol		5.0–7.0 * 5–6 E	
Sodium Alizarinsulfonate		4–5 5–6 E	
Brom Phenol Red		5 2–6.8 ##	
Bromocresol Purple	Dibromo-o-cresolsulfonphthalein	5.2–6.8 #E	
Alizarin	Roots of madder; *Rubia tinctorum*, Lin. Dihydroxyanthraquinone; Schaal's Indicator.	5 5–6 8 10.1–12.1	Sörensen
Dinitrobenzoyleneurea		7–8 E 6–8	Bogart and Scatchard
Bromothymol Blue	Dibromothymolsulfonphthalein	6.0–7.6 #E	
Anisolesulfonphthalein		6–8 E	
Curcumin	Turmeric Yellow; curcummin; roots of *Curcuma longa* L.	6.8 E	
Brilliant Yellow		6–8 E	
Neutral Red	Toluylene Red	6.8–8.0 *E	
Phenol Red	Phenolsulfonphthalein	6 8–8.4 #E	
Rosolic acid	Aurin; aurin red; corallin; p-rosolic acid	6.9–8.0 *E	
Cyanin	Quinoline Blue; diamylcyanine iodide	7–8	Prideaux
β-Naphtholphthalein		7.2–8.6	Sörensen and Palitzsch
Cresol Red	o-Cresolsulfonphthalein	7–9 E 7.2–8.8 #E	
Meta Cresol Purple		7.4–9.0 1.2–2.8 ##	
Tropeolin 000	Orange I; Orange B; sodium-naphthol-azo-benzene sulfonate; von Muller's indicator	7.6–8.9 *	

TABLE OF INDICATORS (Continued)

Indicator	Synonym	pH Range	Observer
Thymol Blue........	*See thymol blue above*.......	8.0–9.6 1.2–2.8 ‡E	
α-Naphtholbenzein..	....	8.9 E	
Cresolphthalein.....	o-Cresolphthalein	8.2–9.8 ‡ 8–10 E	
Phenolphthalein[2]....	Dihydroxyphthalophenone; Luck's indicator	8.3–10 *E	
Dinitrohydro-quinone Acetate	....	9–10 E	
Alizarin Yellow R...	Sodium p-nitrobenzene-azo-salicylate	9–10 E	
Tetranitrophenol-sulfonphthalein	....	9–10 E	
Thymolphthalein.....	....	9.3–10.5 * 10–11 E	
Alizarin Yellow G....	p-nitrobenzene-azo-salicylic acid	10.1–12.1 *	
Alizarin Blue S......	....	11–13	Prideaux
Poirrier's Blue.......	....	11–13	Prideaux
Tropeolin O..........	Resorcine-azo-benzene-sulfonic acid	11.1–12.7 *E	
Sodium Indigodisulfonate...........	....	12–14 E	
1,3,5-Trinitrobenzene	....	14–14.3 E	

[2] Phenolphthalein may be used in the presence of weak acids.

PREPARATION OF CLARK AND LUBS INDICATOR SOLUTIONS

To prepare a 0.04% indicator reagent, 0.1 gram of the dry indicator is mixed in a mortar with the number of cubic centimeters of 0.01 *N* sodium hydroxide as given in the table below and the mixture diluted to 250 cc with water. Such solutions give satisfactory results when five drops of indicator are added to 10 cc of the solution to be tested.

Indicator	0.01 *N* NaOH cc	Indicator	0.01 *N* NaOH cc
Brom cresol green	14.3	Chlor phenol red	23.6
Brom cresol purple	18.5	Cresol red	26.2
Brom phenol blue	14.9	Meta cresol purple	26.2
Brom phenol red	19.5	Phenol red	28.2
Brom thymol blue	16.0	Thymol blue	21.5

CONVERSION FACTORS—pH TO E. M. F.

When the half-cell:

KCl (saturated)|KCl (0.1*N*), HgCl (s)|Hg is used as a standard of reference and it is assumed, arbitrarily that in the cell:

$$\underset{A}{\text{Pt, } H_2 \text{ (1 atmosphere)}|}H^+ \text{ (unknown activity)}\underset{B}{|}\text{KCl (saturated)}\underset{C}{|}\text{KCl (0.1}N\text{), HgCl (s)}\underset{D}{|}\text{Hg}$$

the potential difference at **B** remains constant with variations of "H (unknown activity)" and that the sum of the potential differences at **B, C** and **D** is Σ as follows: (cf. Clark: *Determination of Hydrogen Ions*, 3d Ed., 1928).

t°C	18	20	25	30
Potential difference (Σ) volts	0 3380	0 3379	0.3376	0.3371

t°C	35	38	40
Potential difference (Σ) volts	0.3365	0.3361	0.3358

then,

$$\text{pH} = \frac{\text{E. M. F.} - \Sigma}{0.00019832 \times T}$$ where T is the absolute temperature.

CONVERSION FACTORS—pH TO E.M.F. (Continued)

Calomel Electrode

The voltage of the calomel electrode at 25°C. is for the half-cell:

$$Hg|HgCl,\ (N)\ KCl|| = +0.2822$$
$$Hg|HgCl,\ (0.1N\ KCl)|| = +0.3376$$
$$Hg|HgCl,\ (saturated)\ KCl|| = +0.2458$$

From this the relation of the E. M. F. and pH (of a cell composed of a hydrogen electrode and one of the calomel electrodes) is given by:

$$pH = \frac{E.\ M.\ F. - \Sigma}{0.0591}\ (at\ 25°C.)$$

Quinhydrone Electrode

The normal electrode potential (E_h) of the quinhydrone electrode referred to the normal hydrogen electrode at t°C. is given by the expression:

$$E_h = 0.7177 - 0.00074t$$

McILVAINE'S STANDARD BUFFER SOLUTIONS

Stock solution A: 0.1 molar citric acid ($C_6H_8O_7$) solution.
Stock solution B: 0.2 molar disodium phosphate (Na_2HPO_4) solution.

pH	Soln. A cc	Soln. B cc	pH	Soln. A cc	Soln. B cc
2 2	19.60	0.40	5.2	9.28	10.72
2.4	18.76	1.24	5.4	8.85	11.15
2.6	17.82	2.18	5.6	8.40	11.60
2.8	16.83	3.17	5.8	7.91	12 09
3.0	15.89	4 11	6.0	7.37	12.63
3.2	15.06	4.94	6.2	6.78	13.22
3.4	14.30	5.70	6.4	6.15	13.85
3.6	13.56	6.44	6.6	5.45	14.55
3.8	12.90	7.10	6.8	4.55	15.45
4.0	12.29	7.71	7.0	3.53	16.47
4.2	11.72	8.28	7.2	2.61	17.39
4.4	11.18	8.82	7.4	1.83	18.17
4.6	10.65	9.35	7.6	1.27	18.73
4.8	10.14	9.86	7.8	0.85	19.15
5.0	9.70	10.30	8.0	0.55	19.45

pH VALUES FOR POTENTIOMETER READINGS

Harold V. Gaskill

The following table presents pH values for various potentiometer readings using the quinhydrone half-cell and saturated calomel half-cell at 25°C. The argument is potential in millivolts and the table entries are in terms of pH. The table was constructed upon the following formula:

$$\text{pH} = \frac{0.4538 - E_q}{0.0591}$$

in which E_q is the observed potential in volts.[1]

The temperature factor is 0.77 millivolts per degree, to be added above 25°C and subtracted below 25°C.

Polarity is reversed above 7.68 pH.

Millivolts	.0	1	.2	3	4	.5	6	7	8	.9
0	7 6785	7 6768	7 6751	7 6734	7 6717	7 6700	7 6683	7 6667	7 6650	7 6633
1	7 6616	7.6599	7.6582	7.6565	7 6548	7 6531	7 6514	7 6497	7 6480	7 6464
2	7.6447	7.6430	7.6413	7 6396	7 6379	7 6362	7 6345	7.6328	7 6311	7.6294
3	7 6277	7.6260	7.6244	7 6227	7 6210	7 6193	7 6176	7.6159	7 6142	7 6125
4	7.6108	7.6091	7.6074	7.6057	7.6040	7.6024	7 6007	7.5990	7 5973	7 5956
5	7 5939	7 5922	7 5905	7 5888	7 5871	7.5854	7 5837	7 5821	7 5804	7 5787
6	7 5770	7.5753	7 5736	7.5719	7 5702	7 5685	7 5668	7 5651	7 5634	7 5617
7	7 5601	7 5584	7 5567	7.5550	7.5533	7 5516	7 5499	7 5482	7 5465	7 5448
8	7 5431	7.5414	7 5398	7 5381	7 5364	7 5347	7 5330	7 5313	7 5296	7 5279
9	7.5262	7.5245	7.5228	7.5211	7.5194	7.5178	7.5161	7.5144	7.5127	7 5110
10	7 5093	7.5076	7 5059	7 5042	7 5025	7 5008	7 4991	7 4975	7 4958	7.4941
11	7 4924	7.4907	7.4890	7.4873	7 4856	7 4839	7 4822	7 4805	7.4788	7 4771
12	7 4755	7.4738	7.4721	7.4704	7 4687	7 4671	7 4653	7 4636	7 4619	7.4602
13	7 4585	7.4568	7.4551	7 4535	7 4518	7 4501	7 4484	7 4467	7 4450	7.4433
14	7 4416	7 4399	7 4382	7 4365	7 4348	7 4332	7 4315	7 4298	7.4281	7 4264
15	7 4247	7.4230	7.4213	7.4196	7.4179	7 4162	7 4145	7.4128	7 4112	7 4095
16	7 4078	7.4061	7 4044	7 4027	7 4010	7 3993	7.3976	7 3959	7.3942	7 3925
17	7 3909	7 3892	7 3875	7 3858	7 3841	7 3824	7 3807	7 3790	7 3773	7 3756
18	7 3739	7.3722	7.3705	7.3689	7.3672	7 3655	7.3638	7 3621	7 3604	7 3587
19	7.3570	7 3553	7 3536	7.3519	7 3502	7 3486	7 3469	7 3452	7.3435	7 3418
20	7 3401	7.3384	7 3367	7 3350	7.3333	7 3316	7 3299	7.3282	7 3266	7 3249
21	7 3232	7 3215	7.3198	7 3181	7 3164	7 3147	7 3130	7 3113	7 3096	7 3079
22	7 3062	7.3046	7.3029	7 3012	7 2995	7 2978	7 2961	7 2944	7 2927	7 2910
23	7 2893	7 2876	7 2859	7 2843	7 2826	7.2809	7 2792	7 2775	7 2758	7.2741
24	7.2724	7 2707	7.2690	7.2673	7 2656	7.2639	7 2623	7 2606	7 2589	7 2572
25	7 2565	7 2538	7 2521	7 2504	7 2487	7 2470	7 2453	7.2436	7 2420	7 2403
26	7 2386	7 2369	7 2352	7.2335	7 2318	7.2301	7 2284	7.2267	7 2250	7 2233
27	7 2216	7.2200	7 2183	7 2166	7 2149	7.2132	7 2115	7 2098	7 2081	7.2064
28	7 2047	7 2030	7.2013	7.1997	7 1980	7.1963	7 1946	7 1929	7 1912	7 1895
29	7.1878	7.1861	7.1844	7.1827	7.1810	7.1793	7.1777	7 1760	7 1743	7.1726
30	7 1709	7.1692	7.1675	7 1658	7.1641	7 1624	7 1607	7 1590	7.1573	7 1557
31	7 1540	7 1523	7.1506	7 1489	7 1472	7 1455	7 1438	7 1421	7 1404	7 1387
32	7 1370	7.1354	7.1337	7.1320	7.1303	7.1286	7 1269	7 1252	7 1235	7 1218
33	7 1201	7.1184	7 1167	7 1150	7 1134	7 1117	7 1100	7 1083	7 1066	7 1049
34	7 1032	7 1015	7.0998	7 0981	7 0964	7 0947	7.0931	7 0914	7 0897	7 0880

[1] From formula number 1, p. 405, Clark, W. M., The determination of hydrogen ions, Baltimore, 1928; and, Baver, L. D., Soil Science, 1926, **21**, 3, 167–180.

pH VALUES FOR POTENTIOMETER READINGS (Continued)

Milli-volts	0	.1	2	3	.4	5	6	.7	.8	.9
35	7.0863	7.0846	7.0829	7 0812	7 0795	7 0778	7.0761	7.0744	7.0727	7.0711
36	7 0694	7.0677	7.0660	7 0643	7.0626	7 0609	7.0592	7.0575	7.0558	7.0541
37	7 0524	7.0508	7 0491	7.0474	7.0457	7 0440	7.0423	7.0406	7.0389	7.0372
38	7 0355	7 0338	7.0321	7.0304	7.0288	7 0271	7.0254	7.0237	7.0220	7.0203
39	7 0186	7.0169	7.0152	7.0135	7.0118	7 0101	7.0084	7.0068	7.0051	7.0034
40	7.0017	7 0000	6.9983	6 9966	6 9949	6.9932	6.9915	6.9898	6.9881	6.9865
41	6 9848	6 9831	6.9814	6 9797	6 9780	6 9763	6 9746	6.9729	6.9712	6.9695
42	6 9678	6 9661	6 9645	6 9628	6 9611	6 9594	6 9577	6.9560	6 9543	6.9526
43	6.9509	6 9492	6.9475	6 9458	6.9442	6 9425	6 9408	6.9391	6.9374	6.9357
44	6 9340	6.9323	6.9306	6.9289	6.9272	6.9255	6.9238	6.9222	6.9205	6.9188
45	6.9171	6.9154	6.9137	6 9120	6 9103	6 9086	6 9069	6 9052	6 9035	6.9019
46	6 9002	6 8985	6.8968	6 8951	6.8934	6 8917	6 8900	6.8883	6.8866	6.8849
47	6.8832	6 8815	6.8799	6 8782	6 8765	6 8748	6.8731	6 8714	6 8697	6.8680
48	6 8663	6.8646	6 8629	6.8612	6 8595	6 8579	6.8562	6 8545	6 8528	6.8511
49	6 8494	6 8477	6 8460	6.8443	6.8426	6 8409	6.8392	6.8376	6.8359	6.8342
50	6 8325	6 8308	6 8291	6 8274	6 8257	6 8240	6 8223	6.8206	6 8189	6.8172
51	6 8156	6 8139	6 8122	6.8105	6 8088	6 8071	6 8054	6.8037	6.8020	6.8003
52	6 7986	6 7969	6 7953	6.7936	6 7919	6 7902	6.7885	6 7868	6.7851	6 7834
53	6 7817	6 7800	6.7783	6 7766	6.7749	6 7733	6.7716	6 7699	6.7682	6 7665
54	6 7648	6.7631	6.7614	6.7597	6 7580	6.7563	6.7546	6.7530	6.7513	6.7496
55	6 7479	6 7462	6.7445	6.7428	6 7411	6 7394	6.7377	6.7360	6.7343	6.7326
56	6 7310	6 7293	6 7276	6.7259	6 7242	6 7225	6 7208	6 7191	6.7174	6.7157
57	6 7140	6 7123	6 7106	6 7090	6.7073	6 7056	6.7039	6.7022	6 7005	6 6988
58	6 6971	6 6954	6 6937	6 6920	6 6903	6 6887	6.6870	6.6853	6.6836	6 6819
59	6.6802	6 6785	6.6768	6 6751	6.6734	6 6717	6.6700	6.6683	6.6667	6.6650
60	6 6633	6 6616	6 6599	6.6582	6 6565	6 6548	6.6531	6 6514	6 6497	6.6480
61	6 6464	6.6447	6.6430	6 6413	6 6396	6 6379	6 6362	6 6345	6 6328	6.6311
62	6 6294	6 6277	6 6260	6 6244	6 6227	6 6210	6 6193	6.6176	6.6159	6 6142
63	6 6125	6 6108	6 6091	6 6074	6 6057	6 6040	6 6024	6.6007	6 5990	6.5973
64	6 5956	6 5939	6.5922	6.5905	6.5888	6 5871	6 5854	6.5837	6.5821	6.5804
65	6 5787	6 5770	6 5753	6 5736	6 5719	6 5702	6 5685	6.5668	6.5651	6 5634
66	6 5617	6.5601	6 5584	6 5567	6 5550	6 5533	6 5516	6 5499	6 5482	6 5465
67	6 5448	6 5431	6 5414	6 5398	6.5381	6 5364	6 5347	6 5330	6 5313	6.5296
68	6 5279	6 5262	6 5245	6 5228	6.5211	6 5194	6 5178	6 5161	6 5144	6.5127
69	6 5110	6.5093	6.5076	6.5059	6 5042	6 5025	6 5008	6.4991	6.4975	6.4958
70	6 4941	6.4924	6.4907	6 4890	6.4873	6 4856	6 4839	6.4822	6 4805	6.4788
71	6 4771	6.4755	6.4738	6 4721	6 4704	6 4687	6 4670	6 4653	6 4636	6.4619
72	6 4602	6.4585	6.4568	6 4551	6 4535	6 4518	6 4501	6 4484	6.4467	6.4450
73	6 4433	6.4416	6 4399	6 4382	6 4365	6 4348	6 4332	6.4315	6 4298	6.4281
74	6.4264	6.4247	6.4230	6.4213	6.4196	6.4179	6.4162	6.4145	6.4128	6.4112
75	6.4095	6 4078	6 4061	6 4044	6 4027	6 4010	6.3993	6.3976	6 3959	6.3942
76	6 3925	6 3909	6.3892	6 3875	6.3858	6.3841	6 3824	6.3807	6.3790	6.3773
77	6 3756	6.3739	6.3722	6 3705	6 3689	6 3672	6 3655	6.3638	6 3621	6.3604
78	6 3587	6 3570	6.3553	6 3536	6.3519	6 3502	6.3486	6.3469	6.3452	6 3435
79	6.3418	6.3401	6.3384	6 3367	6 3350	6 3333	6.3316	6.3299	6.3282	6.3266
80	6 3249	6 3232	6 3215	6 3198	6.3181	6 3164	6.3147	6.3130	6.3113	6.3096
81	6.3079	6 3062	6.3046	6 3029	6.3012	6.2995	6.2978	6.2961	6 2944	6 2927
82	6.2910	6.2893	6.2876	6.2859	6.2843	6.2826	6.2809	6.2792	6 2775	6 2758
83	6.2741	6.2724	6 2707	6.2690	6.2673	6.2656	6.2639	6.2623	6.2606	6.2589
84	6.2572	6.2555	6 2538	6.2521	6.2504	6.2487	6.2470	6.2453	6.2436	6.2420

pH VALUES FOR POTENTIOMETER READINGS (Continued)

Millivolts	0	1	2	3	.4	5	6	7	.8	9
85	6.2403	6.2386	6 2369	6 2352	6 2335	6 2318	6 2301	6 2284	6 2267	6.2250
86	6.2233	6 2216	6 2200	6 2183	6 2166	6 2149	6 2132	6 2115	6 2098	6.2081
87	6.2064	6 2047	6 2030	6 2013	6.1997	6 1980	6 1963	6 1946	6 1929	6 1912
88	6.1895	6.1878	6 1861	6 1844	6 1827	6 1810	6 1793	6 1777	6 1760	6.1743
89	6.1726	6.1709	6.1692	6.1675	6.1658	6 1641	6.1624	6.1607	6 1590	6.1573
90	6.1557	6 1540	6 1523	6 1506	6 1489	6.1472	6.1455	6 1438	6 1421	6.1404
91	6 1387	6 1370	6 1354	6 1337	6 1320	6 1303	6 1286	6 1269	6 1252	6.1235
92	6 1218	6 1201	6 1184	6 1167	6 1150	6 1134	6 1117	6 1100	6 1083	6.1066
93	6 1049	6 1032	6.1015	6 0998	6 0981	6 0964	6 0947	6 0931	6 0914	6 0897
94	6.0880	6 0863	6.0846	6.0829	6 0812	6 0795	6 0778	6.0761	6 0744	6.0727
95	6 0711	6 0694	6 0677	6 0660	6.0643	6 0626	6 0609	6 0592	6 0575	6 0558
96	6 0541	6 0524	6 0508	6 0491	6.0474	6 0457	6 0440	6 0423	6 0406	6.0389
97	6 0372	6 0355	6 0338	6 0321	6 0304	6 0288	6 0271	6 0254	6 0237	6.0220
98	6 0203	6 0186	6 0169	6 0152	6 0135	6 0118	6 0101	6 0084	6 0068	6 0051
99	6.0034	6 0017	6 0000	5 9983	5.9966	5 9949	5 9932	5.9915	5 9898	5 9881
100	5 9865	5 9848	5 9831	5 9814	5 9797	5 9780	5 9763	5 9746	5 9729	5 9712
101	5 9695	5 9678	5 9661	5 9645	5 9628	5 9611	5 9594	5 9577	5 9560	5.9543
102	5 9526	5 9509	5 9492	5 9475	5 9458	5 9442	5 9425	5 9408	5 9391	5 9374
103	5 9357	5 9340	5 9323	5 9306	5 9289	5 9272	5 9255	5 9238	5 9222	5 9205
104	5 9188	5 9171	5 9154	5 9137	5.9120	5 9103	5 9086	5 9069	5.9052	5.9035
105	5 9019	5 9002	5.8985	5 8968	5 8951	5 8934	5 8917	5 8900	5 8883	5 8866
106	5 8849	5 8832	5.8815	5 8799	5 8782	5 8765	5 8748	5 8731	5 8714	5 8697
107	5 8680	5 8663	5.8646	5 8629	5 8612	5 8595	5 8579	5 8562	5 8545	5 8528
108	5.8511	5 8494	5.8477	5 8460	5 8443	5 8426	5 8409	5 8392	5 8376	5 8359
109	5.8342	5 8325	5.8308	5 8291	5.8274	5 8257	5 8240	5.8223	5 8206	5 8189
110	5 8172	5 8156	5 8139	5 8122	5 8105	5 8088	5 8071	5 8054	5 8037	5 8020
111	5 8003	5 7986	5 7969	5 7953	5 7936	5 7919	5 7902	5 7885	5 7868	5 7851
112	5 7834	5 7817	5.7800	5 7783	5 7766	5 7749	5 7733	5.7716	5 7699	5 7682
113	5 7665	5 7648	5.7631	5 7614	5 7597	5 7580	5.7563	5 7546	5 7530	5 7513
114	5 7496	5.7479	5.7462	5 7445	5.7428	5.7411	5 7394	5 7377	5.7360	5 7343
115	5 7326	5 7310	5 7293	5 7276	5 7259	5 7242	5 7225	5.7208	5 7191	5 7174
116	5 7157	5 7140	5.7123	5 7106	5 7090	5 7073	5 7056	5 7039	5.7022	5 7005
117	5 6988	5 6971	5.6954	5 6937	5 6920	5 6903	5 6887	5 6870	5 6853	5 6836
118	5 6819	5 6802	5 6785	5 6768	5 6751	5 6734	5 6717	5 6700	5 6683	5.6667
119	5 6650	5 6633	5 6616	5.6599	5 6582	5.6565	5.6548	5 6531	5 6514	5 6497
120	5 6480	5 6464	5 6447	5 6430	5 6413	5 6396	5 6379	5 6362	5 6345	5 6328
121	5 6311	5 6294	5.6277	5 6260	5.6244	5 6227	5.6210	5 6193	5 6176	5.6159
122	5 6142	5 6125	5 6108	5 6091	5.6074	5 6057	5 6040	5 6024	5 6007	5 5990
123	5 5973	5 5956	5 5939	5 5922	5 5905	5 5888	5 5871	5 5854	5 5837	5 5821
124	5 5804	5 5787	5 5770	5 5753	5.5736	5.5719	5.5702	5.5685	5 5668	5.5651
125	5 5634	5 5617	5 5601	5 5584	5 5567	5 5550	5.5533	5 5516	5 5499	5 5482
126	5 5465	5 5448	5 5431	5 5414	5 5398	5 5381	5 5364	5 5347	5 5330	5 5313
127	5 5296	5 5279	5 5262	5 5245	5.5228	5 5211	5 5194	5 5178	5 5161	5 5144
128	5.5127	5 5110	5 5093	5 5076	5 5059	5 5042	5 5025	5 5008	5 4991	5 4975
129	5 4958	5 4941	5 4924	5 4907	5 4890	5 4873	5 4856	5.4839	5.4822	5.4805
130	5 4788	5 4771	5 4755	5 4738	5 4721	5 4704	5 4687	5 4670	5 4653	5.4636
131	5 4619	5 4602	5 4585	5 4568	5.4551	5 4535	5 4518	5 4501	5 4484	5.4467
132	5 4450	5 4433	5.4416	5.4399	5.4382	5 4365	5 4348	5.4332	5 4315	5 4298
133	5 4281	5 4264	5 4247	5 4230	5.4213	5 4196	5 4179	5.4162	5.4145	5 4128
134	5 4112	5 4095	5 4078	5 4061	5.4044	5 4027	5.4010	5.3993	5.3976	5.3959

pH VALUES FOR POTENTIOMETER READINGS (Continued)

Millivolts	0	.1	2	3	4	5	6	7	8	.9
135	5 3942	5 3925	5 3909	5 3892	5 3875	5 3858	5 3841	5 3824	5 3807	5 3790
136	5 3773	5 3756	5 3739	5 3722	5 3705	5 3689	5 3672	5 3655	5 3638	5 3621
137	5 3604	5 3587	5 3570	5 3553	5 3536	5 3519	5 3502	5 3486	5 3469	5 3452
138	5 3435	5 3418	5 3401	5 3384	5 3367	5.3350	5 3333	5 3316	5 3299	5 3282
139	5 3266	5 3249	5 3232	5 3215	5 3198	5 3181	5.3164	5.3147	5 3130	5 3113
140	5 3096	5 3079	5 3062	5 3046	5 3029	5.3012	5.2995	5 2978	5 2961	5 2944
141	5 2927	5 2910	5 2893	5 2876	5 2859	5 2843	5 2826	5 2809	5.2792	5 2775
142	5 2758	5 2741	5 2724	5 2707	5 2690	5 2673	5 2656	5 2639	5 2623	5 2606
143	5 2589	5 2572	5 2555	5 2538	5 2521	5 2504	5 2487	5 2470	5 2453	5 2436
144	5.2420	5 2403	5.2386	5 2369	5 2352	5 2335	5.2318	5 2301	5.2284	5 2267
145	5 2250	5 2233	5 2216	5 2200	5 2183	5 2166	5 2149	5 2132	5 2115	5.2098
146	5 2081	5 2064	5 2047	5 2030	5 2013	5 1997	5.1980	5.1963	5 1946	5.1929
147	5 1912	5 1895	5.1878	5 1861	5 1844	5.1827	5 1810	5 1793	5 1777	5 1760
148	5 1743	5 1726	5 1709	5 1692	5 1675	5 1658	5 1641	5 1624	5 1607	5 1590
149	5 1573	5 1557	5 1540	5 1523	5 1506	5 1489	5 1472	5 1455	5 1438	5 1421
150	5 1404	5 1387	5 1370	5 1354	5 1337	5 1320	5 1303	5 1286	5 1269	5 1252
151	5 1235	5 1218	5 1201	5 1184	5 1167	5 1150	5 1134	5 1117	5 1100	5 1083
152	5 1066	5 1049	5 1032	5 1015	5 0998	5 0981	5 0964	5 0947	5 0931	5 0914
153	5 0897	5 0880	5 0863	5 0846	5 0829	5 0812	5 0795	5 0778	5 0761	5 0744
154	5 0727	5 0711	5 0694	5.0677	5 0660	5.0643	5 0626	5 0609	5 0592	5 0575
155	5 0558	5 0541	5 0524	5 0508	5 0491	5 0474	5 0457	5 0440	5 0423	5 0406
156	5.0389	5.0372	5 0355	5 0338	5 0321	5.0304	5 0288	5 0271	5 0254	5 0237
157	5.0220	5 0203	5 0186	5 0169	5 0152	5.0135	5 0118	5 0101	5 0084	5 0068
158	5 0051	5 0034	5 0017	5 0000	4 9983	4 9966	4 9949	4 9932	4 9915	4 9898
159	4 9881	4 9865	4 9848	4 9831	4 9814	4 9797	4 9780	4 9763	4 9746	4 9729
160	4 9712	4 9695	4 9678	4 9661	4 9645	4 9628	4 9611	4 9594	4 9577	4 9560
161	4 9543	4 9526	4 9509	4 9492	4 9475	4 9458	4 9442	4 9425	4 9408	4 9391
162	4 9374	4 9357	4.9340	4 9323	4 9306	4 9289	4 9272	4 9255	4 9238	4 9222
163	4 9205	4 9188	4 9171	4 9154	4 9137	4 9120	4 9103	4 9086	4 9069	4 9052
164	4 9035	4 9019	4 9002	4 8985	4 8968	4 8951	4 8934	4 8917	4 8900	4 8883
165	4 8866	4 8849	4 8832	4 8815	4 8799	4.8782	4 8765	4 8748	4 8731	4.8714
166	4 8697	4 8680	4 8663	4 8646	4 8629	4 8612	4 8595	4 8579	4 8562	4 8545
167	4 8528	4 8511	4 8494	4 8477	4 8460	4 8443	4 8426	4.8409	4 8392	4 8376
168	4 8359	4 8342	4 8325	4 8308	4 8291	4 8274	4.8257	4 8240	4.8223	4.8206
169	4 8189	4 8172	4 8156	4 8139	4 8122	4 8105	4 8088	4 8071	4 8054	4 8037
170	4.8020	4 8003	4 7986	4 7969	4 7953	4 7936	4.7919	4.7902	4 7885	4 7868
171	4.7851	4 7834	4 7817	4 7800	4 7783	4 7766	4.7749	4 7733	4 7716	4 7699
172	4.7682	4 7665	4 7648	4 7631	4 7614	4 7597	4 7580	4 7563	4 7546	4 7530
173	4 7513	4 7496	4 7479	4 7462	4 7445	4 7428	4 7411	4 7394	4 7377	4 7360
174	4 7343	4 7326	4 7310	4 7293	4 7276	4 7259	4 7242	4 7225	4 7208	4 7191
175	4 7174	4 7157	4 7140	4 7123	4.7106	4 7090	4 7073	4 7056	4 7039	4.7022
176	4 7005	4 6988	4 6971	4 6954	4 6937	4 6920	4 6903	4 6887	4 6870	4.6853
177	4 6836	4 6819	4 6802	4 6785	4.6768	4 6751	4 6734	4 6717	4 6700	4.6683
178	4 6667	4 6650	4 6633	4 6616	4 6599	4.6582	4 6565	4 6548	4.6531	4.6514
179	4 6497	4 6480	4 6464	4 6447	4 6430	4 6413	4 6396	4 6379	4 6362	4 6345
180	4 6328	4 6311	4 6294	4 6277	4 6260	4 6244	4 6227	4 6210	4 6193	4 6176
181	4 6159	4 6142	4 6125	4 6108	4 6091	4 6074	4 6057	4 6040	4 6024	4 6007
182	4 5990	4 5973	4.5956	4 5939	4 5922	4 5905	4 5888	4 5871	4 5854	4.5837
183	4.5821	4 5804	4 5787	4 5770	4.5753	4.5736	4 5719	4 5702	4 5685	4.5668
184	4 5651	4 5634	4 5617	4 5601	4 5584	4 5567	4 5550	4 5533	4 5516	4 5499

pH VALUES FOR POTENTIOMETER READINGS (Continued)

Milli-volts	0	1	2	3	.4	5	6	7	.8	.9
185	4 5482	4 5465	4.5448	4.5431	4.5414	4 5398	4 5381	4.5364	4.5347	4.5330
186	4 5313	4.5296	4 5279	4 5262	4.5245	4.5228	4.5211	4 5194	4.5178	4.5161
187	4.5144	4 5127	4.5110	4.5093	4 5076	4 5059	4 5042	4 5025	4.5008	4.4991
188	4 4975	4 4958	4.4941	4 4924	4.4907	4 4890	4.4873	4 4856	4 4839	4 4822
189	4.4805	4.4788	4 4771	4 4755	4 4738	4 4721	4 4704	4.4687	4.4670	4 4653
190	4.4636	4.4619	4.4602	4.4585	4.4568	4.4551	4.4535	4.4518	4.4501	4.4484
191	4.4467	4.4450	4.4433	4.4416	4 4399	4.4382	4 4365	4.4348	4 4332	4.4315
192	4 4298	4.4281	4.4264	4 4247	4 4230	4.4213	4.4196	4.4179	4 4162	4.4145
193	4 4128	4.4112	4.4095	4.4078	4.4061	4.4044	4.4027	4.4010	4 3993	4.3976
194	4.3959	4.3942	4.3925	4.3909	4.3892	4.3875	4.3858	4 3841	4.3824	4.3807
195	4 3790	4.3773	4.3756	4.3739	4 3722	4.3705	4 3689	4.3672	4 3655	4.3638
196	4.3621	4.3604	4.3587	4.3570	4 3553	4.3536	4 3519	4 3502	4.3486	4.3469
197	4.3452	4.3435	4.3418	4.3401	4 3384	4.3367	4 3350	4 3333	4 3316	4 3299
198	4.3282	4.3266	4.3249	4 3232	4 3215	4.3198	4.3181	4.3164	4 3147	4 3130
199	4.3113	4.3096	4.3079	4 3062	4.3046	4.3029	4 3012	4.2995	4 2978	4.2961

POLARITY REVERSED

Milli-volts	0	1	2	3	.4	5	6	7	.8	.9
0	7 6785	7.6802	7 6819	7 6836	7 6853	7 6870	7 6887	7 6903	7 6920	7 6937
1	7 6954	7 6971	7.6988	7 7005	7.7022	7 7039	7 7056	7 7073	7 7090	7 7106
2	7 7123	7 7140	7.7157	7 7174	7 7191	7 7208	7.7225	7 7242	7.7259	7 7276
3	7 7293	7.7310	7 7326	7 7343	7 7360	7 7377	7 7394	7 7411	7.7428	7 7445
4	7 7462	7.7479	7.7496	7.7513	7.7530	7.7546	7.7563	7.7580	7 7597	7 7614
5	7 7631	7 7648	7 7665	7.7682	7 7699	7 7716	7 7733	7.7749	7 7763	7 7783
6	7 7800	7.7817	7.7834	7 7851	7.7868	7.7885	7.7902	7.7919	7 7936	7 7953
7	7.7969	7.7986	7.8003	7 8020	7 8037	7 8054	7 8071	7 8088	7 8105	7.8122
8	7.8139	7.8156	7.8172	7.8189	7.8206	7 8223	7.8240	7 8257	7.8274	7 8291
9	7 8308	7 8325	7.8342	7.8359	7 8376	7.8392	7.8409	7.8426	7.8443	7 8460
10	7 8477	7 8494	7.8511	7 8528	7 8545	7.8562	7 8579	7.8595	7 8612	7.8629
11	7 8646	7 8663	7 8680	7 8697	7 8714	7 8731	7 8748	7 8765	7 8782	7.8799
12	7 8815	7 8832	7 8849	7 8866	7 8883	7 8900	7.8917	7 8934	7.8951	7.8968
13	7 8985	7 9002	7 9019	7 9035	7.9052	7 9069	7.9086	7.9103	7 9120	7 9137
14	7.9154	7 9171	7.9188	7.9205	7.9222	7 9238	7 9255	7.9272	7 9289	7.9306
15	7 9323	7 9340	7 9357	7 9374	7 9391	7 9408	7 9425	7 9442	7.9458	7 9475
16	7.9492	7.9509	7 9526	7.9543	7 9560	7 9577	7 9594	7 9611	7.9628	7.9645
17	7.9661	7.9678	7 9695	7 9712	7.9729	7 9746	7 9763	7 9780	7.9797	7 9814
18	7.9831	7.9848	7.9865	7 9881	7 9898	7 9915	7.9932	7.9949	7.9966	7.9983
19	8.0000	8.0017	8 0034	8.0051	8.0068	8 0084	8.0101	8.0118	8.0135	8.0152
20	8 0169	8 0186	8 0203	8 0220	8.0237	8 0254	8 0271	8 0288	8 0304	8 0321
21	8 0338	8.0355	8 0372	8.0389	8.0406	8 0423	8 0440	8 0457	8 0474	8 0491
22	8 0508	8 0524	8.0541	8.0558	8.0575	8 0592	8 0609	8.0626	8 0643	8.0660
23	8 0677	8 0694	8 0711	8.0727	8 0744	8 0761	8 0778	8 0795	8 0812	8 0829
24	8.0846	8.0862	8 0880	8.0897	8.0914	8 0931	8 0947	8 0964	8 0981	8 0998
25	8 1015	8 1032	8 1049	8 1066	8.1083	8.1100	8.1117	8.1134	8.1150	8.1167
26	8.1184	8 1201	8.1218	8 1235	8.1252	8 1269	8 1286	8.1303	8.1320	8.1337
27	8.1354	8 1370	8 1387	8 1404	8.1421	8.1438	8.1455	8.1472	8 1489	8.1506
28	8.1523	8.1540	8.1557	8.1573	8 1590	8.1607	8 1624	8.1641	8.1658	8 1675
29	8.1692	8.1709	8.1726	8 1743	8 1760	8.1777	8.1793	8.1810	8.1827	8.1844

APPROXIMATE pH VALUES

The following tables give approximate pH values for a number of substances such as acids, bases, foods, biological fluids, etc. All values are rounded off to the nearest tenth and are based on measurements made at 25° C. A few buffer systems with their pH values are also given.

From Modern pH and Chlorine Control, W. A. Taylor & Co., by permission

ACIDS

Hydrochloric, N.	0.1	Formic, 0.1N	2.3
Hydrochloric, 0.1N	1.1	Lactic, 0.1N	2.4
Hydrochloric, 0.01N	2.0	Acetic, N	2.4
Sulfuric, N	0.3	Acetic, 0.1N	2.9
Sulfuric, 0.1N	1.2	Acetic, 0.01N	3.4
Sulfuric, 0.01N	2.1	Benzoic, 0.01N	3.1
Orthophosphoric, 0.1N	1.5	Alum, 0.1N	3.2
Sulfurous, 0.1N	1.5	Carbonic (saturated)	3.8
Oxalic, 0.1N	1.6	Hydrogen sulfide, 0.1N	4.1
Tartaric, 0.1N	2.2	Arsenious (saturated)	5.0
Malic, 0.1N	2.2	Hydrocyanic, 0.1N	5.1
Citric, 0.1N	2.2	Boric, 0.1N	5.2

BASES

Sodium hydroxide, N	14.0	Ammonia, N	11.6
Sodium hydroxide, 0.1N	13.0	Ammonia, 0.1N	11.1
Sodium hydroxide, 0.01N	12.0	Ammonia, 0.01N	10.6
Potassium hydroxide, N	14.0	Potassium cyanide, 0.1N	11.0
Potassium hydroxide, 0.1N	13.0	Magnesia (saturated)	10.5
Potassium hydroxide, 0.01N	12.0	Sodium sesquicarbonate, 0.1M	10.1
Sodium metasilicate, 0.1N	12.6	Ferrous hydroxide (saturated)	9.5
Lime (saturated)	12.4	Calcium carbonate (saturated)	9.4
Trisodium phosphate, 0.1N	12.0	Borax, 0.1N	9.2
Sodium carbonate, 0.1N	11.6	Sodium bicarbonate, 0.1N	8.4

BIOLOGIC MATERIALS

Blood, plasma, human	7.3–7.5	Duodenal contents, human	4.8–8.2
Spinal fluid, human	7.3–7.5	Feces, human	4.6–8.4
Blood, whole, dog	6.9–7.2	Urine, human	4.8–8.4
Saliva, human	6.5–7.5	Milk, human	6.6–7.6
Gastric contents, human	1.0–3.0	Bile, human	6.8–7.0

FOODS

Apples	2.9–3.3	Milk, cows	6.3–6.6
Apricots	3.6–4.0	Olives	3.6–3.8
Asparagus	5.4–5.8	Oranges	3.0–4.0
Bananas	4.5–4.7	Oysters	6.1–6.6
Beans	5.0–6.0	Peaches	3.4–3.6
Beers	4.0–5.0	Pears	3.6–4.0
Beets	4.9–5.5	Peas	5.8–6.4
Blackberries	3.2–3.6	Pickles, dill	3.2–3.6
Bread, white	5.0–6.0	Pickles, sour	3.0–3.4
Butter	6.1–6.4	Pimento	4.6–5.2
Cabbage	5.2–5.4	Plums	2.8–3.0
Carrots	4.9–5.3	Potatoes	5.6–6.0
Cheese	4.8–6.4	Pumpkin	4.8–5.2
Cherries	3.2–4.0	Raspberries	3.2–3.6
Cider	2.9–3.3	Rhubarb	3.1–3.2
Corn	6.0–6.5	Salmon	6.1–6.3
Crackers	6.5–8.5	Sauerkraut	3.4–3.6
Dates	6.2–6.4	Shrimp	6.8–7.0
Eggs, fresh white	7.6–8.0	Soft drinks	2.0–4.0
Flour, wheat	5.5–6.5	Spinach	5.1–5.7
Gooseberries	2.8–3.0	Squash	5.0–5.4
Grapefruit	3.0–3.3	Strawberries	3.0–3.5
Grapes	3.5–4.5	Sweet potatoes	5.3–5.6
Hominy (lye)	6.8–8.0	Tomatoes	4.0–4.4
Jams, fruit	3.5–4.0	Tuna	5.9–6.1
Jellies, fruit	2.8–3.4	Turnips	5.2–5.6
Lemons	2.2–2.4	Vinegar	2.4–3.4
Limes	1.8–2.0	Water, drinking	6.5–8.0
Maple syrup	6.5–7.0	Wines	2.8–3.8

APPROXIMATE pH VALUES (Continued)

BUFFER SYSTEMS

The following table gives some common buffer systems and the approximate pH of maximum buffer capacity. The zone of effective buffer action will vary with concentration but, for concentrations approximately 0.1 molar, the general average will be ± 1.0 pH from the value given.

Glycocoll-sodium chloride-hydrochloric acid	2.0
Potassium acid phthalate-hydrochloric acid	2.8
Primary potassium citrate	3.7
Acetic acid-sodium acetate	4.6
Potassium acid phthalate-sodium hydroxide	5.0
Secondary sodium citrate	5.0
Potassium acid phosphate-disodium phosphate	6.8
Potassium acid phosphate-sodium hydroxide	6.8
Boric acid-borax	8.5
Borax	9.2
Boric acid-sodium hydroxide	9.2
Sodium bicarbonate-sodium carbonate	10.2
Disodium phosphate-sodium hydroxide	11.5

POLAROGRAPHIC ANALYSIS

Courtesy E. H. Sargent and Co., 155–165 East Superior Street, Chicago, Illinois.

All values in the following tables are volts referred to the normal calomel electrode.

Table I
Cathodic Reduction Potentials of Metals (Half Wave)

Name	Valence	Neutral or acid	Alkali	Ammonia-Ammonium Chloride	Cyanide	Citrate or Tartrate	Thiocyanate	Ammonium-Carbonate	Pyridine
Aluminum	3	−1 7							
Ammonium	1	−2 09							
Antimony.	3	−0 2	−1 8		−1 13				
Barium	2	−1 94							
Bismuth	3	−0 1				−0 35			
Cadmium	2	−0 68	−0 80	−0 85	−1 13	−0 80			
Calcium	2	−2 23							
Cesium	1	−2 1							
Chromium	2	−1 42	−2 0	−1 74					
Chromium	3	−0 7		−1 46					
Chromium	6		−0 36	−0 36					
Cobalt	2	−1 23	−1 44	−1 32	−1 23		−1 07		−1 11
Cobalt	3	−0 4		−0 4					
Copper	2	−0 03		−0 27		−0 14			
Copper	1	−0 03		−0 54		−0 14			
Gallium	3	−1 23							
Gold	1		−1 2		−1 5				
Gold	3		−0 55						
Hydrogen	1	−1 60							
Indium	3	−0 63	−1 2						
Iron	2	−1 33	−1 56	−1 52					
Iron	3	−0 1(?)							
Lead	2	−0 46	−0 81		−0 73	−0 6			
Lithium	1	−2 31	−2 31						
Manganese	2	−1 53	−1 7	−1 69	−1 36		−1 58		
Manganese	3		−1 3						
Manganese.	4					−1 1			
Manganese.	6		−0 2						
Nickel	2	−1 09		−1 13	−1 43		−0 74		−0 82
Potassium	1	−2 17	−2 17						
Radium	2	−1 88							
Rhenium	7	−1 2	−1 2	−1 2					
Rubidium	1	−2 07	−2 07						
Selenium	4			−1 6		−1 6			
Sodium	1	−2 15	−2 15						
Strontium	2	−2 13	−2 13						
Tellurium	4		−0 7	−0 75		−0 9			
Thallium	1	−0 50	−0 50	−0 50	−0 50	−0 50			
Tin	2	−0 47	−1 1						
Titanium	4	−0 98							
Uranium	4							−1 45	
Uranium	6	−0 14	−0 9					−0 83	
Vanadium	5			−1 23					
Zinc	2	−1 06	−1 41	−1 38					

POLAROGRAPHIC ANALYSIS (Continued)

Table II
Cathodic Reduction Potentials of Anions (Half Wave)

Bromate (alkaline)	−1 7
Bromate (acid)	−0.17
Iodate (alkaline)	−1 1
Iodate (neutral)	−1 1
Nitrate (in N/10 lanthanum chloride)	−1 3
Nitrite (in N/10 lanthanum chloride)	−1 3
Sulfite (acid)	−0 2

Table III
Anodic Oxidation Potentials of Metals (Half Wave)

Metal	Valence	Normal Alkali	Normal Ammonia with Ammonium Chloride	Molar Citrate or Tartrate
Iron	2	....	+0.1	....
Manganese	2	....	.	−0 4
Tin	2	−0 6	.....	−0.5

Table IV
Reversible Redox Potentials of Metals

Metal	Valence	Neutral or Acid	Normal Alkali	Normal Ammonia with Ammonium Chloride	Molar Citrate or Tartrate
Copper	1, 2	−0 06	....	−0 25	−0 21
Iron	2, 3	. .	−0.9	. .	−0 49
Titanium	3, 4		. . .		−0.48

Table V
Anodic Depolarization Potentials of Anions (Half Wave)

Bromide	+0 09	Sulfide	−0 63
Chloride	+0 22	Sulfite	−0 04
Cyanide	−0 37	Thiocyanate	+0 15
Hydroxide	+0 05	Thiosulfate	−0 27
Iodide	−0 09		

Table VI
Reduction Potentials of Dissolved Gases (Half Wave)

Oxygen	−0.3 to −0.4
Sulfur dioxide	−0.3
Hydrogen peroxide	−1.1

Table VII
Tangent Potentials of Organic Substances
(Concentrations, 10^{-4} N)

	pH	Volts		pH	Volts
Acetaldehyde	3.9	−1.61	Fumaric acid	3.9	−1.70
"	7	−1.83	Furfurol	3.9	−1.23
Acetoin	2	−1.14	Glyceric aldehyde	3.9	−1.45
Acetone	2	−1.28	Hematin	3.9	−1.37
Acetophenone	2	−1.12	Hymetomelanic acid	13	−1.4
"	3.9	−1.32	Hydroxybenzaldehyde (*o*)	3.9	−1.26
Acetylacetone	2	−1.20	Hydroxybenzophenone (*p*)	3.9	−1.2
"	3.9	−1.24	Isovaleric aldehyde	3.9	−1.61
Acetylene dicarboxylic acid	1	−0.45	Maleic acid	1	−0.54
Acetylene dicarboxylic acid	7	−1.90	" "	7	−1.90
Acotinic acid	1	−0.66	Mesaconic acid	1	−0.66
" "	7	−2.1	" "	7	−1.8
Albumin in ammonium ion	4	−1.60	Methemoglobin	3.9	−1.26
Aminoazobenzene (*p*)	7	−0.48	Methylene blue	3.9	−0.11 & −1.2
Azobenzene	3.9	−0.18	Nicotinic acid	3.9	−1.03
Benzaldehyde	3.9	−1.26	* " "	7	−1.74
Benzil	2	−0.20	Nitraniline (*o*)	1	−0.193
Benzilidene acetone	3.9	−1.06	" (*m*)	1	−0.112
Benzoin	2	−0.95	" (*p*)	1	−0.183
"	3.9	−1.19	Nitrobenzene	3.9	−0.35
Benzophenone	3.9	−0.90	Nitrophenol (*o*)	3.9	−0.32
"	2	−1.01	" (*m*)	3.9	−0.33
Benzoylacetone	2	−0.95	" (*p*)	3.9	−0.40
Butyraldehyde	7	−1.7	Oxalic acid	1	−1.2
Cinnamic acid	1.5	−1.10	Oxyhemaglobin	3.9	−0.06
" "	7	−1.8	Propionic aldehyde	3.9	−1.61
Citraconic acid	1	−0.66	Pyridine	3.9	−1.30
Crotonaldehyde	3.9	−1.34	Pyroracemic acid	1	−0.39
Cystine	1	−0.4	" "	7	−1.4
"	7	−0.8	Pyruvic acid	1	−0.4
Diacetyl	2	−0.40	" "	7	−1.4
Dibenzoylmethane	2	−0.82	Quinhydrone	3.9	−0.02
Dimethylaminoazobenzene	7	−0.56	Quinine	13	−1.5
Dinitrobenzene (*o*)	3.9	−0.15 & −0.31	Quinoline	4	−1.07
" (*m*)	3.9	−0.20 & −0.33	* Riboflavin	7	−0.39
" (*p*)	3.9	−0.18 & −0.35	Saccharin	1	−1.0
Dinitrophenol:			"	7	−1.8
2:4:1	3.9	−0.13 & −0.31	Sorbinic acid	7	−1.90
2:5:1	3.9	−0.19	Sorbose	7	−1.80
2:6:1	3.9	−0.12 & −0.23	* Thiamine	7	−1.29
Diphenyl triketone	2	−0.25	Trimethyl azonium iodide	12.5	−1.7
Formaldehyde	3.9	−1.50	Vitamin C	7	−1.80
"	7	−1.64	Tetramethyl and tetraethyl ammonium ions, half wave potential −2.8		
Fructose	7	−1.80			
Fumaric acid	1	−0.54			

* Half wave.

Table VIII
Anode Potentials in the Presence of Stated Anions At Normal Concentration

Chloride	0.0	Sulfite	−0.25
Bromide	−0.12	Iodide	−0.30
Sulfate	+0.20	Cyanide	−0.58
Nitrate	+0.30	Sulfide	−0.90
Hydroxide	−0.16		

STANDARD OXIDATION-REDUCTION POTENTIALS

VALUES, IN VOLTS, REFERRED TO THE HYDROGEN-HYDROGEN ION COUPLE AS ZERO, ARE FOR UNIT ACTIVITIES AND TEMPERATURE OF 25° C.

(From Latimer and Hildebrand, Reference Book of Inorganic Chemistry, The Macmillan Co., Publishers, by permission.)

Reaction	E_0
$Li = Li^+ + E^-$	+2.957
$Rb = Rb^+ + E^-$	+2.924
$K = K^+ + E^-$	+2.922
$Sr = Sr^{++} + 2E^-$	+2.92
$Ba = Ba^{++} + 2E^-$	+2.90
$Ca = Ca^{++} + 2E^-$	+2.87
$Na = Na^+ + E^-$	+2.712
$Mg = Mg^{++} + 2E^-$	+2.40
$Al = Al^{+++} + 3E^-$	+1.7
$Be = Be^{++} + 2E^-$	+1.69
$U = U^{+4} + 4E^-$	+1.4
$Mn = Mn^{++} + 2E^-$	+1.1
$CN^- + 2OH^- = CNO^- + H_2O + 2E^-$	+0.97
$Fe + 2OH^- = Fe(OH)_2 + 2E^-$	+0.86
$\frac{1}{2}H_2 + OH^- = H_2O + E^-$	+0.828
$Tl + I^- = TlI + E^-$	+0.77
$Hg + HS^- + OH^- = HgS + H_2O + 2E^-$	+0.77
$Zn = Zn^{++} + 2E^-$	+0.758
$Zn + 3OH^- = HZnO_2^- + H_2O + 2E^-$	+0.72
$H_2Te = Te + 2H^+ + 2E^-$	ca +0.7
$Fe(OH)_2 + OH^- = Fe(OH)_3 + E^-$	+0.65
$Cr = Cr^{++} + 2E^-$	+0.6
$Pb + 2OH^- = PbO + H_2O + 2E^-$	+0.58
$S^{--} = S + 2E^-$	+0.51
$H_2Se = Se + 2H^+ + 2E^-$	ca +0.5
$Ga = Ga^{+++} + 3E^-$	+0.5
$Ag + 2CN^- = Ag(CN)_2^- + E^-$	+0.5
$Fe = Fe^{++} + 2E^-$	+0.44
$Cr^{++} = Cr^{+++} + E^-$	+0.4
$H_2 = 2H^+(10^{-7}M) + 2E^-$	+0.414
$Cd = Cd^{++} + 2E^-$	+0.397
$In = In^{+++} + 3E^-$	+0.38
$Ti^{++} = Ti^{+++} + E^-$	+0.37
$2Cu + 2OH^- = Cu_2O + H_2O + 2E^-$	+0.34
$Tl = Tl^+ + E^-$	+0.336
$Pb + SO_4^{--} = PbSO_4 + 2E^-$	+0.31
$P + 4H_2O = H_3PO_4 + 5H^+ + 5E^-$	+0.3
$Co(CN)_6^{----} = Co(CN)_6^{---} + E^-$	+0.3
$Co = Co^{++} + 2E^-$	+0.29
$Ni = Ni^{++} + 2E^-$	+0.22
$V^{++} = V^{+++} + E^-$	+0.2
$Cu + I^- = CuI + E^-$	+0.17
$Ag + I^- = AgI + E^-$	+0.15
$Cu_2O + 2OH^- = 2CuO + H_2O + 2E^-$	+0.15
$Sn = Sn^{++} + 2E^-$	+0.13
$Pb = Pb^{++} + 2E^-$	+0.12
$9OH^- + NH_3 = NO_2^- + 6H_2O + 8E^-$	+0.12
$2Hg + 2I^- = Hg_2I_2 + 2E^-$	+0.04
$2Ag + H_2S = Ag_2S + 2H^+ + 2E^-$	+0.036
$Cu + H_2S = CuS + 2H^+ + 2E^-$	+0.02

Reaction	E_0
$H_2 = 2H^+ + 2E^-$	0.000
$2OH^- + NO_2^- = NO_3^- + H_2O + 2E^-$	0.0
$HCN + H_2O = HCNO + 2H^+ + 2E^-$	0.0
$Sb + 3H_2O = H_3SbO_3 + 3H^+ + 3E^-$	ca 0.0
$W + 3H_2O = WO_3 + 6H^+ + 6E^-$	ca 0.0
$WO^{+++} + 2H_2O = WO_3 + 4H^+ + E^-$	ca 0.0
$Ti^{+++} + H_2O = TiO^{++} + 2H^+ + E^-$	−0.04
$Hg + 2OH^- = HgO + H_2O + 2E^-$	−0.099
$Ag + Br^- = AgBr + E^-$	−0.10
$2Hg + 2Br^- = Hg_2Br_2 + 2E^-$	−0.13
$Sn^{++} = Sn^{++++} + 2E^-$	−0.13
$H_2O + H_2SO_3 = SO_4^{--} + 4H^+ + 2E^-$	−0.14
$Cu^+ = Cu^{++} + E^-$	−0.17
$H_2S = S + 2H^+ + 2E^-$	−0.17
$Bi = Bi^{+++} + 3E^-$	−0.2
$2Ta + 5H_2O = Ta_2O_5 + 10H^+ + 10E^-$	ca −0.2
$Pt + 4Cl^- = PtCl_4^{--} + 2E^-$	ca −0.2
$Ag + Cl^- = AgCl + E^-$	−0.223
$As + 3H_2O = H_3AsO_3 + 3H^+ + 3E^-$	−0.24
$Mo + 3H_2O = MoO_3 + 6H^+ + 6E^-$	−0.25
$2Hg + 2Cl^- = Hg_2Cl_2 + 2E^-$	−0.270
$PbO + 2OH^- = PbO_2 + H_2O + 2E^-$	−0.3
$V + H_2O = VO^{++} + 2H^+ + 4E^-$	−0.3
$Cu = Cu^{++} + 2E^-$	−0.344
$V^{+++} + H_2O = VO^{++} + 2H^+ + E^-$	−0.4
$4OH^- = O_2 + 2H_2O + 4E^-$	−0.40
$PtCl_4^{--} + 2Cl^- = PtCl_6^{--} + 2E^-$	ca −0.40
$U^{+4} + 2H_2O = UO_2^{++} + 4H^+ + 2E^-$	−0.41
$S + 3H_2O = H_2SO_3 + 4H^+ + 4E^-$	−0.47
$Fe(CN)_6^{----} = Fe(CN)_6^{---} + E^-$	−0.49
$H_3AsO_3 + H_2O = H_3AsO_4 + 2H^+ + 2E^-$	−0.49
$Ni(OH)_2 + 2OH^- = NiO_2 \cdot 2H_2O + 2E^-$	−0.49
$2Ag + CO_3^{--} = Ag_2CO_3 + 2E^-$	−0.50
$MoO^{+++} + 2H_2O = MoO_3 + 4H^+ + E^-$	−0.5
$Cu = Cu^+ + E^-$	−0.51
$2I^- = I_2 + 2E^-$	−0.535
$3I^- = I_3^- + 2E^-$	−0.54
$Hg_2Cl_2 + 2Cl^- = 2HgCl_2 + 2E^-$	−0.63
$MnO_4^{--} = MnO_4^- + E^-$	−0.66
$H_2O_2 = O_2 + 2H^+ + 2E^-$	−0.68
$Ag + BrO_3^- = AgBrO_3 + E^-$	−0.68
$C_6H_4(OH)_2 = C_6H_4O_2$ (quinone) $+ 2H^+ + 2E^-$	−0.70
$MnO_2 + 4OH^- = MnO_4^{--} + 2H_2O + 2E^-$	−0.71
$Fe^{++} = Fe^{+++} + E^-$	−0.74
$Se + 3H_2O = H_2SeO_3 + 4H^+ + 4E^-$	−0.74

STANDARD OXIDATION-REDUCTION POTENTIALS

(Continued)

Reaction	E_0	Reaction	E_0
$H_3SbO_3+H_2O=H_3SbO_4+2H^++2E^-$	-0.75	$Mn^{++}+2H_2O=MnO_2+4H^++2E^-$	-1.33
$2Hg=Hg_2^{++}+2E^-$	-0.798	$Cl^-+4H_2O=ClO_4^-+8H^++8E^-$	-1.35
$Ag=Ag^++E^-$	-0.799	$2Cl^-=Cl_2+2E^-$	-1.359
$CuI=Cu^{++}+I^-+E^-$	-0.85	$2Au+3H_2O=Au_2O_3+6H^++6E^-$	-1.362
$Hg=Hg^{++}+2E^-$	-0.86	$I^-+4H_2O=IO_4^-+8H^++8E^-$	-1.4
$2H_2O+NH_4^+=HNO_2+7H^++6E^-$	-0.86	$Br^-+3H_2O=BrO_3^-+6H^++6E^-$	-1.42
$3OH^-=HO_2^-+H_2O+2E^-$	-0.87	$Pb^{++}+2H_2O=PbO_2+4H^++2E^-$	-1.44
$CoO+2OH^-=CoO_2+H_2O+2E^-$	-0.9	$Cl^-+3H_2O=ClO_3^-+6H^++6E^-$	-1.45
$Hg_2^{++}=2Hg^{++}+2E^-$	-0.92	$Cl^-+H_2O=HClO+H^++2E^-$	-1.50
$Cl^-+2OH^-=ClO^-+H_2O+2E^-$	-0.94	$Mn^{++}=Mn^{+++}+E^-$	ca -1.5
$NO+2H_2O=NO_3^-+4H^++3E^-$	-0.94	$Au=Au^++E^-$	ca -1.5
$HNO_2+H_2O=NO_3^-+3H^++2E^-$	-0.95	$2SO_4^{--}+2H^+=H_2S_2O_8+2E^-$	ca -1.5
$NO+H_2O=HNO_2+H^++E^-$	-0.98	$Ce^{+++}+2H_2O=CeO_2+4H^++E^-$	-1.5
$I^-+H_2O=HIO+H^++2E^-$	-0.99	$Mn^{++}+4H_2O=MnO_4^-+8H^++5E^-$	-1.52
$OsO_2Cl_4^{--}+2H_2O=OsO_4+4H^++4Cl^-+2E^-$	ca -1.0	$MnO_2+2H_2O=MnO_4^-+4H^++3E^-$	-1.63
$2Br^-=Br_2+2E^-$	-1.065	$Fe^{+++}+4H_2O=FeO_4^{--}+8H^++3E^-$	ca -1.7
$I^-+3H_2O=IO_3^-+6H^++6E^-$	-1.09	$Bi^{+++}+6H_2O=HBiO_3+5H^++2E^-$	ca -1.7
$VO^{++}+2H_2O=HVO_3+3H^++E^-$	-1.1	$PbSO_4+2H_2O=PbO_2+4H^++SO_4^{--}+2E^-$	-1.7
$Tl^+=Tl^{+++}+2E^-$	-1.2	$2H_2O=H_2O_2+2H^++2E^-$	-1.78
$H_2SeO_3+H_2O=H_2SeO_4+2H^++2E^-$	ca -1.2	$Co^{++}=Co^{+++}+E^-$	-1.8
$2H_2O=O_2+4H^++4E^-$	-1.23	$Ni^{++}+4H_2O=NiO_2\cdot 2H_2O+4H^++2E^-$	-1.8
$PdCl_4^{--}+2Cl^-=PdCl_6^{--}+2E^-$	-1.3	$O_2+H_2O=O_3+2H^++2E^-$	-1.9
$Cr^{+++}+4H_2O=HCrO_4^-+7H^++3E^-$	-1.3	$2F^-=F_2+2E^-$	-2.8
$Br^-+H_2O=HBrO+H^++2E^-$	-1.33		

SOLUBILITY OF CANE SUGAR IN WATER

Grams of sugar in 100 grams of water, temperature in degrees Centigrade.

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$C_{12}H_{22}O_{11}$.... ..	179.2	190.5	203.9	219.5	238.1	260.4	287.3	320.5	362.1	415.7	487.2

The values below give the per cent by weight of sugar in the final solution:

Temp., °C.	Per cent sugar	Temp., °C.	Per cent sugar	Temp., °C.	Per cent sugar
0	64.18	35	69.55	70	76.22
5	64.87	40	70.42	75	77.27
10	65.58	45	71.32	80	78.36
15	66.53	50	72.25	85	79.46
20	67.09	55	73.20	90	80.61
25	67.89	60	74.18	95	81.77
30	68.80	65	75.88	100	82.97

POTENTIALS OF ELECTROCHEMICAL REACTIONS AT 25° C

Compiled by Thos. DeVries

The reactions are classified according to the main element or radical entering into the reaction. Radicals are found under the name of the parent element. The sign of the potential is the sign on the electrode, according to the "European system".

Reaction	Potential, volts
$Ag(s) = Ag^{+} + e$	+0 7996
$Ag^{+} = Ag^{++} + e$	+1 914
$Ag(s) + Br^{-} = AgBr(s) + e$	+0 0713
$Ag(s) + BrO_3^{-} = AgBrO_3(s) + e$	+0 680
$Ag(s) + Cl^{-} = AgCl(s) + e$	+0 2221
$Ag(s) + 2CN^{-} = Ag(CN)_2^{-} + e$	−0 5
$2Ag(s) + CO_3^{--} = Ag_2CO_3(s) + 2e$	+0 500
$2Ag^{+} + CrO_4^{--} = Ag_2CrO_4(s) + 2e$	+0 4463
$2Ag(s) + H_2S(g) = Ag_2S(s) + 2H^{+} + 2e$	−0 0366
$Ag(s) + I^{-} = AgI(s) + e$	−0 1523
$Al(s) = Al^{+++} + 3e$	−1 7
$Al\text{-}Hg + 3OH^{-} = Al(OH)_3(s) + 3e$	−1 62
$As(s) + 2H_2O(l) = HAsO_2 + 3H^{+} + 3e$	+0 2375
$As(s) + 3H_2O = H_3AsO_3 + 3H^{+} + 3e$	+0 24
$H_3AsO_3 + H_2O = H_3AsO_4 + 2H^{+} + 2e$	+0 49
$Au(s) = Au^{+} + e$	+1 5(?)
$Au(s) = Au^{+++} + 3e$	+1 36
$2Au(s) + 3H_2O(l) = Au_2O_3(s) + 6H^{+} + 6e$	+1 363
$Ba(s) = Ba^{++} + 2e$	−2 90
$Ba\text{-}Hg = Ba^{++} + 2e$	−1 5700
$Be(s) = Be^{++} + 2e$	−1 69
$Bi(s) = Bi^{+++} + 3e$	+0 277
$Bi(s) + Cl^{-} + H_2O(l) = BiOCl(s) + 2H^{+} + 3e$	+0 1588
$Bi(s) + 4Cl^{-} = BiCl_4^{-} + 3e$	+0 1678
$Bi^{+++} + 6H_2O = HBiO_3 + 5H^{+} + 2e$	+1.7(?)
$Br^{-} = \frac{1}{2}Br_2(l) + e$	+1 0648
$Br^{-} + 3H_2O = BrO_3^{-} + 6H^{+} + 6e$	+1 42
$Br^{-} + H_2O = HBrO + H^{+} + 2e$	+1 33
$\frac{1}{2}Br_2(l) + 3H_2O(l) = BrO_3^{-} + 6H^{+} + 5e$	+1 491
$C_6H_4(OH)_2 = C_6H_4O_2 + 2H^{+} + 2e$	+0 6992
$Ca(s) = Ca^{++} + 2e$	−2 763
Calomel electrode, sat. KCl	+0.2446
Calomel electrode, normal KCl	+0 2809
Calomel electrode, molal KCl.	+0 2816
Calomel electrode, decinormal KCl	+0 3334
$Cd(s) = Cd^{++} + 2e$	−0.4024
$Cd\text{-}Hg = Cd^{++} + 2e$	−0 3519
$Cd\text{-}Hg + (2Br^{-}$ in $CdBr_2.4H_2O$ sat.$) = CdBr_2.4H_2O + 2e$	−0.4182
$Cd\text{-}Hg + (2Cl^{-}$ in $CdCl_2$ sat.$) = CdCl_2(s) + 2e$	−0.4034
$Cd\text{-}Hg + (2I^{-}$ in CdI_2 sat.$) = CdI_2(s) + 2e$	−0 4588
$Cd\text{-}Hg + 2OH^{-} = CdO(s) + H_2O(l) + 2e$	−0 726
$Cd\text{-}Hg + 2OH^{-} = Cd(OH)_2(s) + 2e$	−0.761
$Cd\text{-}Hg + (SO_4^{--}$ in $CdSO_4.8/3H_2O$ sat.$) = CdSO_4.8/3H_2O + 2e$	−0 4346
$Ce^{+++} = Ce^{++++} + e(H_2SO_4$ soln.$)$	+1 44
$Ce^{+++} = Ce^{++++} + e(HNO_3$ soln.$)$	+1 6095
$Ce^{+++} + 2H_2O = CeO_2 + 4H^{+} + e$	+1 5
$Cl^{-} = \frac{1}{2}Cl_2 + e$	+1 3583
$Cl^{-} + H_2O = HClO + H^{+} + 2e$	+1 50
$Cl^{-} + 3H_2O = ClO_3^{-} + 6H^{+} + 6e$	+1 45
$Cl^{-} + 4H_2O = ClO_4^{-} + 8H^{+} + 8e$	+1.35
$Cl^{-} + 2OH^{-} = ClO^{-} + H_2O + 2e$	+0 94
$CN^{-} + 2OH^{-} = CNO^{-} + H_2O + 2e$	−0 97
$HCN + H_2O = HCNO + 2H^{+} + 2e$	0 0
$Co(s) = CO^{++} + 2e$	−0 29
$Co^{++} = Co^{+++} + e$	+1 817
$Co(CN)_6^{----} = Co(CN)_6^{---} + e$	−0 3
$CoO(s) + 2OH^{-} = CoO_2(s) + H_2O + 2e$	+0 9
$Cr(s) = Cr^{++} + 2e$	−0 557
$Cr^{++} = Cr^{+++} + e$	−0 400
$Cr^{+++} + 4H_2O = HCrO_4^{-} + 7H^{+} + 3e$	+1 3
$Cu(s) = Cu^{+} + e$	+0 51
$Cu(s) = Cu^{++} + 2e$	+0 3452
Cu(sat. amalgam)$ = Cu^{++} + 2e$	+0 3495
$Cu^{+} = Cu^{++} + e$	+0 17
$Cu(s) + Cl^{-} = CuCl(s) + e$	+0 1287
$Cu(s) + H_2S(g) = CuS(s) + 2H^{+} + 2e$	−0 259
$Cu(s) + I^{-} = CuI(s) + e$	−0.17
$2Cu(s) + 2OH^{-} = Cu_2O(s) + H_2O(l) + 2e$	−0 344
$CuCl_2^{-} = Cu^{++} + 2Cl^{-} + e$	+0 455
$Cu\text{-}Hg + (SO_4^{--}$ in $CuSO_4.5H_2O$ sat.$) = CuSO_4.5H_2O(s) + 2e$	+0 2684
$CuI(s) = Cu^{++} + I^{-} + e$	+0 85
$Cu_2O(s) + 2OH^{-} = 2CuO(s$, aged$) + H_2O(l) + 2e$	−0 154
$Cu_2O(s) + 2OH^{-} + H_2O(l) = 2Cu(OH)_2(s) + 2e$	−0 082
$2F^{-} = F_2 + 2e$	+2 88
$Fe(s) = Fe^{++} + 2e$	−0 441
$Fe^{++} = Fe^{+++} + e$	+0 782
$Fe^{+++} + 4H_2O = FeO_4^{--} + 8H^{+} + 3e$	+1 7(?)
$Fe(s) + 2OH^{-} = Fe(OH)_2(s) + 2e$	−0 86
$Fe(CN)_6^{----} = Fe(CN)_6^{---} + e$	+0 36
$Fe(OH)_2(s) + OH^{-} = Fe(OH)_3(s) + e$	−0 65
$K_4Fe(CN)_6 = K_3Fe(CN)_6 + K^{+} + e$	+0.4866
$Ga(s) = Ga^{+++} + 3e$	−0 5
$\frac{1}{2}H_2(g) = H^{+} + e$	0 0000
$H_2(g) = 2H^{+}(10^{-7}M) + 2e$	−0 4141
$\frac{1}{2}H_2(g) + OH^{-} = H_2O(l) + e$	−0 8295
$2H_2O = H_2O_2 + 2H^{+} + 2e$	+1 78
$2H_2O = O_2(g) + 4H^{+} + 4e$	+1 23

POTENTIALS OF ELECTROCHEMICAL REACTIONS AT 25° C (Continued)

Reaction	Potential, volts
$H_2O(l) = O(g) + 2H^+ + 2e$	+2.419
$H_2O_2 = O_2(g) + 2H^+ + 2e$	+0.68
$2Hg(l) = Hg_2^{++} + 2e$	+0.7986
$Hg^{++} = \frac{1}{2}Hg_2^{++} + e$	+0.9011
$2Hg(l) + 2Br^- = Hg_2Br_2(s) + 2e$	+0.1385
$2Hg(l) + 2Cl^- = Hg_2Cl_2(s) + 2e$	+0.2676
$Hg(l) + HS^- + OH^- = HgS(s) + H_2O + 2e$	−0.77
$2Hg(l) + 2I^- = Hg_2I_2(s) + 2e$	−0.0416
$Hg_2Cl_2(s) + 2Cl^- = 2HgCl_2 + 2e$	+0.63
$Hg(l) + 2OH^- = HgO(s, red) + H_2O(l) + 2e$	+0.0969
$Hg(l) + 2OH^- = HgO(s, yellow) + H_2O(l) + 2e$	+0.0976
$2Hg(l) + SO_4^{--} = Hg_2SO_4(s) + 2e$	+0.6141
$Hg(l)$, $HgO(s)$, $Ba(OH)_2(s)$, H_2O	+0.1462
$Hg(l)$, $HgO(s)$, $Ca(OH)_2(s)$, H_2O	+0.192
$I^- = \frac{1}{2}I_2(s) + e$	+0.5356
$3I^- = I_3^- + 2e$	+0.54
$I^- + H_2O = HIO + H^+ + 2e$	+0.99
$I^- + 3H_2O = IO_3^- + 6H^+ + 6e$	+1.09
$I^- + 4H_2O = IO_4^- + 8H^+ + 8e$	+1.4
$\frac{1}{2}I_2(s) + 3H_2O = IO_3^- + 6H^+ + 5e$	+1.195
$In(s) = In^{+++} + 3e$	−0.340
$IrCl_6^{---} = IrCl_6^{--} + e$	+0.97
$K(s) = K^+ + e$	−2.9241
$Li(s) = Li^+ + e$	−2.9595
$Mg(s) = Mg^{++} + 2e$	−2.40
$Mn(s) = Mn^{++} + 2e$	−1.1
$Mn^{++} = Mn^{+++} + e$	+1.5(?)
$Mn^{++} + 2H_2O = MnO_2(s) + 4H^+ + 2e$	+1.236
$Mn^{++} + 4H_2O = MnO_4^- + 8H^+ + 5e$	+1.509
$MnO_2(s) + 2H_2O = MnO_4^- + 4H^+ + 3e$	+1.691
$MnO_2(s) + 4OH^- = MnO_4^{--} + 2H_2O + 2e$	+0.71
$MnO_4^{--} = MnO_4^- + e$	+0.664
$Mo(s) + 3H_2O = MoO_3(s) + 6H^+ + 6e$	+0.25
$Mo(CN)_8^{----} = Mo(CN)_8^{---} + e$	+0.7260
$MoO^{+++} + 2H_2O = MoO_3(s) + 4H^+ + e$	+0.5
$Na(s) = Na^+ + e$	−2.7146
$Na\text{-}Hg + (Cl^-$ in NaCl sat.$) = NaCl(s) + e$	−1.8378
$NH_3 + 9OH^- = NO_3^- + 6H_2O + 8e$	−0.12
$NH_4^+ + 2H_2O = HNO_2 + 7H^+ + 6e$	+0.86
$NO + H_2O = HNO_2 + H^+ + e$	+0.98
$NO + 2H_2O = NO_3^- + 4H^+ + 3e$	+0.94
$NO_2^- + 2OH^- = NO_3^- + H_2O + 2e$	0.0
$HNO_2 + H_2O = NO_3^- + 3H^+ + 2e$	+0.95
$Ni(s) = Ni^{++} + 2e$	−0.227
$Ni^{++} + 4H_2O = NiO_2.2H_2O + 4H^+ + 2e$	+1.8
$Ni(OH)_2(s) + 2OH^- = NiO_2.2H_2O + 2e$	+0.49
$O_2(g) + H_2O = O_3(g) + 2H^+ + 2e$	+2.07
$3OH^- = HO_2^- + H_2O + 2e$	+0.87

Reaction	Potential, volts
$4OH^- = O_2 + 2H_2O + 4e$	+0.40
$OsO_2Cl_4^{--} + 2H_2O = OsO_4 + 4H^+ + 4Cl^- + 2e$	+1.0(?)
$P(s) + 4H_2O = H_3PO_4 + 5H^+ + 5e$	−0.3
$Pb(s) = Pb^{++} + 2e$	−0.126
$Pb\text{-}Hg + 2Cl^- = PbCl_2(s) + 2e$	−0.2623
$Pb\text{-}Hg + 2I^- = PbI_2(s) + 2e$	−0.3580
$Pb(s) + 2OH^- = PbO(s, red) + H_2O(l) + 2e$	−0.5786
$Pb(s) + 2OH^- = PbO(s, yellow) + H_2O(l) + 2e$	−0.575
$Pb(s) + 2OH^- = PbO(s) + H_2O(l) + 2e$	−0.576
$Pb\text{-}Hg + 2OH^- = Pb(OH)_2(s) + 2e$	−0.568
$Pb(s) + H_2S(g) = PbS(s) + 2H^+ + 2e$	+0.070
$Pb(s) + SO_4^{--} = PbSO_4(s) + 2e$	−0.3447
$Pb\text{-}Hg + SO_4^{--} = PbSO_4(s) + 2e$	−0.3505
$Pb^{++} + 2H_2O = PbO_2(s) + 4H^+ + 2e$	+1.467
$PbO(s) + 2OH^- = PbO_2(s) + H_2O(l) + 2e$	+0.27
$PbSO_4(s) + 2H_2O(l) = PbO_2(s) + 4H^+ + SO_4^{--} + 2e$	+1.6797
$PdCl_4^{--} + 2Cl^- = PdCl_6^{--} + 2e$	+1.3
$Pt(s) + 4Cl^- = PtCl_4^{--} + 2e$	+0.2(?)
$PtCl_4^{--} + 2Cl^- = PtCl_6^{--} + 2e$	+0.717
$[Pt(CN)_4]^{--} + 2Cl^- = [Pt(CN)_4Cl_2]^{--} + 2e$	+0.879
Quinhydrone electrode, $H^+(a = 1)$	+0.6992
$Rb(s) = Rb^+ + e$	−2.9259
$S^{--} = S(rhombic) + 2e$	−0.51
$S(rhombic) + 3H_2O = H_2SO_3 + 4H^+ + 4e$	+0.47
$H_2S = S(rhombic) + 2H^+ + 2e$	+0.17
$2SO_4^{--} + 2H^+ = H_2S_2O_8 + 2e$	+1.5(?)
$H_2SO_3 + H_2O = SO_4^{--} + 4H^+ + 2e$	+0.14
$Sb(s) + H_2O(l) = SbO^+ + 2H^+ + 3e$	−0.212
$Sb(s) + 3H_2O = H_3SbO_3 + 3H^+ + 3e$	0.0(?)
$2Sb(s) + 3H_2O(l) = Sb_2O_3(s) + 6H^+ + 6e$	+0.1445
$H_3SbO_3 + H_2O = H_3SbO_4 + 2H^+ + 2e$	+0.75
$Se(s) + 3H_2O = H_2SeO_3 + 4H^+ + 4e$	+0.74
$H_2Se = Se + 2H^+ + 2e$	−0.5(?)
$H_2SeO_3 + H_2O = H_2SeO_4 + 2H^+ + 2e$	+1.2(?)
$Sn(s) = Sn^{++} + 2e$	−0.136
$Sn^{++} = Sn^{++++} + 2e$(0.1 M HCl)	+0.070
$Sn^{++} = Sn^{++++} + 2e$(0.53 M HCl)	+0.144
$Sn^{++} = Sn^{++++} + 2e$(2.0 M HCl)	+0.133
$Sr\text{-}Hg = Sr^{++} + 2e$	−1.7932
$2Ta(s) + 5H_2O = Ta_2O_5 + 10H^+ + 10e$	+0.2(?)
$Te(s) = Te^{++++} + 4e$	−0.5682
$H_2Te = Te + 2H^+ + 2e$	−0.7(?)
$Ti^{++} = Ti^{+++} + e$	+0.37
$Ti^{+++} + H_2O = TiO^{++} + 2H^+ + e$	+0.04
$Ti^{+++} + 2SO_4^{--} = Ti(SO_4)_2 + e$	+0.04
$Tl(s) = Tl^+ + e$	−0.336
$Tl^+ = Tl^{+++} + 2e$	+1.2466
$Tl\text{-}Hg = Tl^+ + e$	−0.3360
$Tl(s) + I^- = TlI(s) + e$	−0.7715

POTENTIALS OF ELECTROCHEMICAL REACTIONS AT 25° C (Continued)

Reaction	Potential, volts	Reaction	Potential, volts
Tl-Hg+Cl^-=TlCl(s)+e	−0.5545	$\frac{1}{2}(VO)_2SO_4+\frac{1}{2}SO_4^{--}$=$VOSO_4$+e	+0.30
Tl-Hg+Br^-=TlBr(s)+e	−0.6058	$VSO_4+H_2O(l)=\frac{1}{2}(VO)_2SO_4+2H^+ +\frac{1}{2}SO_4^{--}$+e	−0.21
Tl-Hg+SO_4^{--}=Tl_2SO_4(s)+2c	−0.4360	W(s)+$3H_2O$=WO_3(s)+$6H^+$+6e	0.0(?)
U=U^{++++}+4e	−1.4	$W(CN)_8^{----}$=$W(CN)_8^{---}$+e	+0.485
$U^{++++}+2H_2O=UO_2^{++}+4H^+$+2c	+0.41	$WO^{+++}+2H_2O=WO_3+4H^+$+e	0.0(?)
$U(SO_4)_2+2H_2O(l)=UO_2SO_4+4H^++SO_4^{--}$+2e	+0.358	Zn(s)=Zn^{++}+2e	−0 7614
$V^{++}=V^{+++}$+e	−0 2	Zn-Hg=Zn^{++}+2e	−0.7614
$V^{+++}+H_2O=VO^{++}+2H^+$+e	+0 4	Zn(s)+$2OH^-$=ZnO(s)+H_2O(l)	−1.2483
V(s)+$H_2O=VO^{++}+2H^+$+4e	+0.3	Zn(s)+$3OH^-$=$HZnO_2^-+H_2O$+2e	−0.72
$VO^{++}+2H_2O=HVO_3+3H^+$+e	+1.1	Zn-Hg+(SO_4^{--} in $ZnSO_4.7H_2O$ sat.)=$ZnSO_4.7H_2O$(s)+2e	−0 7993
$VOSO_4+2H_2O(l)=HVO_3+H_2SO_4$+e	+0 92		

DEGREE OF IONIZATION

In Normal Solution at 18° Unless Indicated

Acids

Nitric acid	0.82
Hydrochloric acid	0.784
Sulfuric acid	0.510
Hydrofluoric acid	0 070
* Oxalic acid	0.500
* Tartaric acid	0.082
Acetic acid	0.004
* Carbonic acid	0.0017
* Hydrogen sulfide	0 0007
* Boric acid	0.0001
* Hydrocyanic acid	0.0001
† Permanganic acid	0.933
† Hydriodic acid	0.901
† Hydrobromic acid	0.899
† Perchloric acid	0 880
† Chloric acid	0.878
† Hydrochloric acid	0.876
† Phosphoric acid	0.170

* In 0.1 M. solution; primary ionization.
† In N/2 solution, at 25°.

Bases

Potassium hydroxide	0 77
Sodium hydroxide	0 73
Barium hydroxide	0 69
Lithium hydroxide	0.63
Ammonium hydroxide	0 004
Tetramethyl ammonium hydroxide	0.96
‡ Strontium hydroxide	0 93
‡ Barium hydroxide	0.92
‡ Calcium hydroxide	0.90

‡ In N/64 solution, at 25°.

Salts

Approximate degree of ionization for active salts in N/10 solution:

Type R^+R^- (e.g. KCl)	0.86
Type R^{++} $(R^-)_2$ (e.g. $BaCl_2$)	0.72
Type $(R^+)_2R^{--}$ (e.g. K_2SO_4)	0.72
Type R^{++} R^{--} (e.g. $CuSO_4$)	0.45

SOLUBILITY PRODUCT

The solubility product (or ion product constant) is the product of the concentrations of the ions in the saturated solution of a difficultly soluble salt. The concentrations are expressed as moles per liter of solution. The number of cations (or anions) resulting from the dissociation of one molecule of the salt, appears in the formula for calculations of the solubility product as the exponent of the concentration of the cation (or anion).

If two solutions, each containing one of the ions of a difficultly soluble salt, are mixed, no precipitation takes place unless the product of the ion concentrations in the mixture is greater than the solubility product.

In a solution containing two salts which yield a common ion the ratio of solubilities of the two salts is the ratio of the solubility products.

Substance	Solubility product at temperature noted	Substance	Solubility product at temperature noted
Aluminum hydroxide	4×10^{-13} (15°)	Calcium oxalate, $CaC_2O_4 \cdot H_2O$	1.78×10^{-9} (18°)
Aluminum hydroxide	1.1×10^{-15} (18°)	Calcium oxalate, $CaC_2O_4 \cdot H_2O$	2.57×10^{-9} (25°)
Aluminum hydroxide	3.7×10^{-15} (25°)	Calcium sulfate	6.1×10^{-5} (10°)
Barium carbonate	7×10^{-9} (16°)	Calcium tartrate, $CaC_4H_4O_6 \cdot 2H_2O$	0.77×10^{-6} (18°)
Barium carbonate	8.1×10^{-9} (25°)	Cobalt sulfide	3×10^{-26} (18°)
Barium chromate	1.6×10^{-10} (18°)	Cupric iodate	1.4×10^{-7} (25°)
Barium chromate	2.4×10^{-10} (28°)	Cupric oxalate	2.87×10^{-8} (25°)
Barium fluoride	1.6×10^{-6} (9.5°)	Cupric sulfide	8.5×10^{-45} (18°)
Barium fluoride	1.7×10^{-6} (18°)	Cuprous bromide	4.15×10^{-8} (18–20°)
Barium fluoride	1.73×10^{-6} (25.8°)	Cuprous chloride	1.02×10^{-6} (18–20°)
Barium iodate, $Ba(IO_3)_2 \cdot 2H_2O$	8.4×10^{-11} (10°)	Cuprous iodide	5.06×10^{-12} (18–20°)
Barium iodate, $Ba(IO_3)_2 \cdot 2H_2O$	6.5×10^{-10} (25°)	Cuprous sulfide	2×10^{-47} (16–18°)
Barium oxalate, $BaC_2O_4 \cdot 3\frac{1}{2}H_2O$	1.62×10^{-7} (18°)	Cuprous thiocyanate	1.6×10^{-11} (18°)
Barium oxalate, $BaC_2O_4 \cdot 2H_2O$	1.2×10^{-7} (18°)	Ferric hydroxide	1.1×10^{-36} (18°)
Barium oxalate, $BaC_2O_4 \cdot \frac{1}{2}H_2O$	2.18×10^{-7} (18°)	Ferrous hydroxide	1.64×10^{-14} (18°)
Barium sulfate	0.87×10^{-10} (18°)	Ferrous oxalate	2.1×10^{-7} (25°)
Barium sulfate	1.08×10^{-10} (25°)	Ferrous sulfide	3.7×10^{-19} (18°)
Barium sulfate	1.98×10^{-10} (50°)	Lead carbonate	3.3×10^{-14} (18°)
Cadmium oxalate $CdC_2O_4 \cdot 3H_2O$	1.53×10^{-8} (18°)	Lead chromate	1.77×10^{-14} (18°)
Cadmium sulfide	3.6×10^{-29} (18°)	Lead fluoride	2.7×10^{-8} (9°)
Calcium carbonate (calcite)	0.99×10^{-8} (15°)	Lead fluoride	3.2×10^{-8} (18°)
Calcium carbonate (calcite)	0.87×10^{-8} (25°)	Lead fluoride	3.7×10^{-8} (26.6°)
Calcium fluoride	3.4×10^{-11} (18°)	Lead iodate	5.3×10^{-14} (9.2°)
Calcium fluoride	3.95×10^{-11} (26°)	Lead iodate	1.2×10^{-13} (18°)
Calcium iodate, $Ca(IO_3)_2 \cdot 6H_2O$	22.2×10^{-8} (10°)	Lead iodate	2.6×10^{-13} (25.8°)
Calcium iodate, $Ca(IO_3)_2 \cdot 6H_2O$	64.4×10^{-8} (18°)	Lead iodide	7.47×10^{-9} (15°)
		Lead iodide	1.39×10^{-8} (25°)
		Lead oxalate	2.74×10^{-11} (18°)
		Lead sulfate	1.06×10^{-8} (18°)
		Lead sulfide	3.4×10^{-28} (18°)
		Lithium carbonate	1.7×10^{-3} (25°)
		Magnesium ammonium phosphate	2.5×10^{-13} (25°)

Substance	Solubility product at temperature noted	Substance	Solubility product at temperature noted
Magnesium carbonate	2.6×10^{-5} (12°)	Silver chloride .	0.21×10^{-10} (4.7°)
Magnesium fluoride	7.1×10^{-9} (18°)	Silver chloride .	0.37×10^{-10} (9.7°)
Magnesium fluoride	6.4×10^{-9} (27°)	Silver chloride .	1.56×10^{-10} (25°)
Magnesium hydroxide	1.2×10^{-11} (18°)	Silver chloride...	13.2×10^{-10} (50°)
Magnesium oxalate	8.57×10^{-5} (18°)	Silver chloride	21.5×10^{-10} (100°)
Manganese hydroxide	4×10^{-14} (18°)	Silver chromate.	1.2×10^{-12} (14.8°)
Manganese sulfide	1.4×10^{-15} (18°)	Silver chromate..	9×10^{-12} (25°)
Mercuric sulfide.	4×10^{-53} to 2×10^{-49} (18°)	Silver cyanide $[Ag^+][Ag(CN)^-_2]$	2.2×10^{-12} (20°)
Mercurous bromide	1.3×10^{-21} (25°)	Silver dichromate	2×10^{-7} (25°)
Mercurous chloride	2×10^{-18} (25°)	Silver hydroxide.	1.52×10^{-8} (20°)
Mercurous iodide	1.2×10^{-28} (25°)	Silver iodate..	0.92×10^{-8} (9.4°)
Nickel sulfide...	1.4×10^{-24} (18°)	Silver iodide....	0.32×10^{-16} (13°)
Potassium acid tartrate $[K^+][HC_4H_4O_6^-]$	$3\ 8 \times 10^{-4}$ (18°)	Silver iodide. .	1.5×10^{-16} (25°)
Silver bromate...	$3\ 97 \times 10^{-5}$ (20°)	Silver sulfide. .	1.6×10^{-49} (18°)
Silver bromate...	5.77×10^{-5} (25°)	Silver thiocyanate	0.49×10^{-12} (18°)
Silver bromide. .	4.1×10^{-13} (18°)	Silver thiocyanate	1.16×10^{-12} (25°)
Silver bromide	7.7×10^{-13} (25°)	Strontium carbonate	1.6×10^{-9} (25°)
Silver carbonate.	6.15×10^{-12} (25°)	Strontium fluoride	2.8×10^{-9} (18°)
		Strontium oxalate	5.61×10^{-8} (18°)
		Strontium sulfate	2.77×10^{-7} (2.9°)
		Strontium sulfate	3.81×10^{-7} (17.4°)
		Zinc hydroxide	1.8×10^{-14} (18–20°)
		Zinc oxalate, $ZnC_2O_4.2H_2O$	1.35×10^{-9} (18°)
		Zinc sulfide. ..	1.2×10^{-23} (18°)

TABLE FOR TRANSFORMING EXPRESSION OF RESULTS OF WATER ANALYSIS

Compiled by Dr. R. E. Brewer. (Based on Equivalents of $CaCO_3$)

	Parts per 1,000,000	Parts per 100,000	mg per l	g per l	Grains per U. S. gal.	Grains per Eng. gal.	English or Clark degrees	French degrees	German degrees
p.p.m... . .	1	0 10	1 0	0 001	0 0583*	0 07	0 07	0 10	0 056
mg / l	1	0 10	1 0	0 001	0 0583	0 07	0 07	0 10	0 056
p./100,000 .	10	1 00	10 0	0 010	0 583	0 70	0 70	1 00	0 560
French degrees .	10	1 00	10 0	0 010	0 583	0 70	0 70	1 00	0 560
g / l..	1000	100 0	1000 0	1 000	58 300	70 00	70 00	100 00	56 000
Gr. /U. S. gal.. .	17 1	1 71	17 1	0 0171	1 000	1 2	1 2	1 71	0 958
Gr. /Eng. gal.. ...	14 3	1 43	14 3	0 0143	0 829	1 00	1 00	1.43	0 80
Clark degrees.	14 3	1 43	14 3	0 0143	0 829	1 00	1 00	1 43	0 80
German degrees...	17 8	1 78	17 8	0 0178	1.044	1 24	1.24	1.78	1 00

*Variously reported

DISSOCIATION CONSTANTS OF BASES

Name	Formula	Constant for first OH	Temp. °C.	Constant for second OH	Temp. °C.
Acetamide	C_2H_5ON	3.1×10^{-15}	25		
Acetanilide	C_8H_9ON	4.1×10^{-14}	40		
α-Alanine	$C_3H_7O_2N$	5.1×10^{-12}	25		
o-Aminobenzoic	$C_7H_7O_2N$	1.4×10^{-12}	25		
Ammonium Hydroxide	NH_4OH	1.8×10^{-5}	25		
Aniline	C_6H_7N	4.6×10^{-10}	25		
Arsenious Oxide	As_2O_3	1×10^{-14}	25		
Beryllium Hydroxide	$Be(OH)_2$	..	....	5×10^{-11}	25
Brucine	$C_{23}H_{26}O_4N_2$	7.2×10^{-4}	25	2.5×10^{-11}	25
Butylamine (sec.)	$C_4H_{11}N$	4.4×10^{-4}	25		
Caffeine	$C_8H_{10}O_2N_4$	4.1×10^{-14}	40		
Cinchonine	$C_{19}H_{22}ON_2$	1.6×10^{-7}	15	3.3×10^{-10}	15
Cocaine	$C_{17}H_{21}O_4N$	4×10^{-7}	25		
Diethylbenzylamine	$C_{11}H_{17}N$	3.6×10^{-5}	25		
Diethylamine	$C_4H_{11}N$	1.26×10^{-3}	25		
Diisoamylamine	$C_{10}H_{23}N$	9.6×10^{-4}	25		
Diisobutylamine	$C_8H_{19}N$	4.8×10^{-4}	25		
Dimethylamine	C_2H_7N	5.2×10^{-4}	25		
Dimethylbenzylamine	$C_9H_{13}N$	1.05×10^{-5}	25		
Dipropylamine	$C_6H_{15}N$	1.02×10^{-3}	25		
Ethylamine	C_2H_7N	5.6×10^{-4}	25		
Ethylenediamine	$C_2H_8N_2$	8.5×10^{-5}	25		
Hydrazine	$N_2H_4.H_2O$	3×10^{-6}	25		
Isoamylamine	$C_5H_{13}N$	5×10^{-4}	25		
Isobutylamine	$C_4H_{11}N$	3.1×10^{-4}	25		
Isopropylamine	C_3H_9N	5.3×10^{-4}	25		
Lead Hydroxide	$Pb(OH)_2$	....	....	3×10^{-8}	25
Methylamine	CH_5N	5×10^{-4}	25		
Methyldiethylamine	$C_5H_{13}N$	2.7×10^{-4}	25		
α-Naphthylamine	$C_{10}H_9N$	9.9×10^{-11}	25		
β-Naphthylamine	$C_{10}H_9N$	2×10^{-10}	25		
o-Phenylenediamine	$C_6H_8N_2$	3.3×10^{-10}	25		
Phenylhydrazine	$C_6H_8N_2$	1.6×10^{-9}	40		
Piperidine	$C_5H_{11}N$	1.6×10^{-3}	25		
Propylamine (norm.)	C_3H_9N	4.7×10^{-4}	25		
Pyridine	C_5H_5N	2.3×10^{-9}	25		
Quinine	$C_{20}H_{24}O_2N_2$	2.2×10^{-7}	15	3.3×10^{-10}	15
Quinoline	C_9H_7N	1×10^{-9}	25		
Semicarbazide	CH_5ON_3	2.7×10^{-11}	40		
Silver Hydroxide	$AgOH$	1.1×10^{-4}	25		
Strychnine	$C_{21}H_{22}O_4N_2$	1×10^{-7}	15	6×10^{-11}	15
Tetramethylenediamine	$C_4H_{12}N_2$	5.1×10^{-4}	25		
Thiourea	CH_4N_2S	1.1×10^{-15}	25		
m-Toluidine	C_7H_9N	5.5×10^{-10}	25		
o-Toluidine	C_7H_9N	3.3×10^{-10}	25		
p-Toluidine	C_7H_9N	2×10^{-9}	25		
Triethylamine	$C_6H_{15}N$	6.4×10^{-4}	25		
Triisobutylamine	$C_{12}H_{27}N$	2.6×10^{-4}	25		
Trimethylamine	C_3H_9N	7.4×10^{-5}	25		
Trimethylenediamine	$C_3H_{10}N_2$	3.5×10^{-4}	25		
Tripropylamine	$C_9H_{21}N$	5.5×10^{-4}	25		
Urea	CH_4ON_2	1.5×10^{-14}	25		
Zinc Hydroxide	$Zn(OH)_2$	....	.....	1.5×10^{-9}	25

DISSOCIATION CONSTANTS OF ACIDS

Acid	Formula	Constant for the first hydrogen	Temp. °C.	Constant for the second hydrogen	Temp. °C.
Acetic	$C_2H_4O_2$	1.75×10^{-5}	25		
α-Alanine	$C_3H_7O_2N$	9×10^{-10}	25		
Arsenic	H_3AsO_4	5×10^{-3}	25	4×10^{-5}	25
				6×10^{-10} (3H)	25
Arsenious	$HAsO_2$	6×10^{-10}	25		
Barbituric	$C_4H_4O_3N$	1.05×10^{-4}	25		
Benzoic	$C_7H_6O_2$	6.3×10^{-5}	25		
Boric	H_3BO_3	6.4×10^{-10}	25		
Bromacetic	$C_2H_3O_2Br$	1.38×10^{-3}	25		
α-Brompropionic	$C_3H_5O_2Br$	1.08×10^{-3}	25		
β-Brompropionic	$C_3H_5O_2Br$	9.8×10^{-5}	25		
Butyric	$C_4H_8O_2$	1.48×10^{-5}	25		
Carbonic	H_2CO_3	3.5×10^{-7}	18	4.4×10^{-11}	25
Chloracetic	$C_2H_3O_2Cl$	1.4×10^{-3}	25		
α-Chlorpropionic	$C_3H_5O_2Cl$	1.47×10^{-3}	25		
β-Chlorpropionic	$C_3H_5O_2Cl$	8.59×10^{-5}	25		
Citric	$C_6H_8O_7$	8.4×10^{-4}	25	1.8×10^{-5}	
				4×10^{-6} (3H)	
Dichloracetic	$C_2H_2O_2Cl_2$	5×10^{-2}	25		
Formic	CH_2O_2	1.76×10^{-4}	25		
Fumaric	$C_4H_4O_4$	1×10^{-3}	25	3×10^{-5}	25
Hippuric	$C_9H_9O_3N$	2.3×10^{-4}	25		
Hydrocyanic	CHN	7.2×10^{-10}	25		
Hydroquinone	$C_6H_6O_2$	1.1×10^{-10}	18		
Hydrosulfuric	H_2S	9.1×10^{-8}	18	1.2×10^{-15}	
Hydrazoic	HN_3	1.9×10^{-5}	25		
Hypochlorous	$HOCl$	3.7×10^{-8}	17		
Iodic	HIO_3	1.9×10^{-1}	25		
Isobutyric	$C_4H_8O_2$	1.5×10^{-5}	25		
Isovaleric	$C_5H_{10}O_2$	1.7×10^{-5}	25		
Lactic	$C_3H_6O_3$	1.38×10^{-4}	25		
Maleic	$C_4H_4O_4$	1.5×10^{-2}	25	2.6×10^{-7}	25
Malic	$C_4H_6O_5$	4×10^{-4}	25	9×10^{-6}	25
Malonic	$C_3H_4O_4$	1.61×10^{-3}	25	2.1×10^{-6}	25
Mandelic	$C_8H_8O_3$	4.29×10^{-4}	25		
α-Naphthoic	$C_{11}H_8O_2$	2×10^{-4}	25		
β-Naphthoic	$C_{11}H_8O_2$	6.8×10^{-5}	25		
Nicotinic	$C_6H_5O_2N$	1.4×10^{-5}	25		
Nitrous	HNO_2	4×10^{-4}	18		
Oxalic	$H_2C_2O_4$	6.5×10^{-2}	25	6.1×10^{-5}	25
Periodic	HIO_4	2.3×10^{-2}	25		
Phenol	C_6H_6O	1.3×10^{-10}	25		
Phosphoric	H_3PO_4	1.1×10^{-2}	18	7.5×10^{-8}	18
				4.8×10^{-13}(3H)	18
Phosphorous	H_3PO_3	7×10^{-3}	25	2×10^{-5}	25
Phthalic	$C_8H_6O_4$	1.26×10^{-3}	25	3.1×10^{-6}	25
Picolinic	$C_6H_5O_2N$	3×10^{-6}	25		
Picric	$C_6H_3O_7N_3$	1.6×10^{-1}	18		
Propionic	$C_3H_6O_2$	1.4×10^{-5}	25		
Pyromucic	$C_5H_4O_3$	7.1×10^{-4}	25		
Pyrophosphoric	$H_4P_2O_7$	1.4×10^{-1}	18	1.1×10^{-2}	18
				2.9×10^{-7}(3H)	18
				3.6×10^{-9}(4H)	18
Pyrotartaric	$C_5H_8O_4$	8.7×10^{-5}	25		
Salicylic	$C_7H_6O_3$	1.06×10^{-3}	25	1×10^{-13}	20
Selenious	H_2SeO_3	3×10^{-3}	25	5×10^{-8}	25
Succinic	$C_4H_6O_4$	6.6×10^{-5}	25	2.8×10^{-6}	25
Sulfanilic	$C_6H_7O_3NS$	6.2×10^{-4}			
Sulfuric	H_2SO_4	....	......	2×10^{-2}	18

DISSOCIATION CONSTANTS OF ACIDS (Continued)

Acid	Formula	Constant for the first hydrogen	Temp. °C.	Constant for the second hydrogen	Temp. °C.
Sulfurous	H_2SO_3	1.7×10^{-2}	25	5×10^{-6}	25
Tartaric	$C_4H_6O_6$	1.1×10^{-3}	25	6.9×10^{-5}	25
Telluric	H_2TeO_4	6×10^{-7}	25	4×10^{-11}	25
Tellurous	H_2TeO_3	3×10^{-6}	25	2×10^{-8}	25
Trichloracetic	$C_2HO_2Cl_3$	2×10^{-1}	18		
Uric	$C_5H_4O_3N_4$	1.5×10^{-6}	25		
Valeric	$C_5H_{10}O_2$	1.6×10^{-5}	25		

PROPERTIES OF THE AMINO ACIDS

Compiled by M. S. Dunn
with the cooperation of Frank J. Ross and M. Palmer Stoddard

Data are given in the following tables for the *dl*, *d*(+), *d*(−), *l*(+), and *l*(−) forms of the amino acids which are considered to be constituents of native proteins. All of the naturally occurring forms of the amino acids have the "*l*" configuration around the alpha carbon atom. The symbols (+) and (−) refer to the direction of rotation in water at 25°C. The values quoted are those considered to be most reliable.

Composition of the Amino Acids

The molecular weights and percentage composition of the amino acids given in the following table were calculated from the 1939 International Atomic Weights.

Amino acid	Empirical formula	Molecular weight	Percentage Composition			
			Carbon	Hydrogen	Oxygen	Nitrogen
Alanine	$C_3H_7O_2N$	89.095	40.440	7.920	35.917	15.723
Arginine	$C_6H_{14}O_2N_4$	174.205	41.365	8.102	18.369	32.164
Aspartic acid	$C_4H_7O_4N$	133.105	36.092	5.302	48.082	10.524
Cystine[1]	$C_6H_{12}O_4N_2S_2$	240.29	29.989	5.034	26.634	11.659
Diiodotyrosine[2]	$C_9H_9O_3NI_2$	433.01	24.962	2.095	11.085	3.235
Glutamic acid	$C_5H_9O_4N$	147.131	40.814	6.167	43.499	9.521
Glycine	$C_2H_5O_2N$	75.068	31.998	6.715	42.628	18.660
Histidine	$C_6H_9O_2N_3$	155.157	46.443	5.848	20.624	27.085
Hydroxyglutamic acid	$C_5H_9O_5N$	163.131	36.811	5.562	49.040	8.587
Hydroxyproline	$C_5H_9O_3N$	131.131	45.794	6.919	36.605	10.682
Isoleucine	$C_6H_{13}O_2N$	131.173	54.935	9.991	24.395	10.679
Leucine	$C_6H_{13}O_2N$	131.173	54.935	9.991	24.395	10.679
Lysine	$C_6H_{14}O_2N_2$	146.189	49.292	9.654	21.889	19.164
Methionine[3]	$C_5H_{11}O_2NS$	149.21	40.245	7.432	21.446	9.388
Norleucine	$C_6H_{13}O_2N$	131.173	54.935	9.991	24.395	10.679
Phenylalanine	$C_9H_{11}O_2N$	165.187	65.435	6.713	19.372	8.480
Proline	$C_5H_9O_2N$	115.131	52.158	7.881	27.794	12.167
Serine	$C_3H_7O_3N$	105.095	34.283	6.715	45.673	13.329
Threonine	$C_4H_9O_3N$	119.121	40.329	7.617	40.295	11.759
Thyroxine[4]	$C_{15}H_{11}O_4NI_4$	776.927	23.188	1.427	8.238	1.803
Tryptophane	$C_{11}H_{12}O_2N_2$	204.223	64.689	5.926	15.669	13.718
Tyrosine	$C_9H_{11}O_3N$	181.187	59.657	6.120	26.492	7.731
Valine	$C_5H_{11}O_2N$	117.147	51.260	9.466	27.316	11.958

[1] 26.68 per cent sulfur. [2] 58.622 per cent iodine. [3] 21.486 per cent sulfur. [4] 65.345 per cent iodine.

IONIZATION CONSTANTS AND pH VALUES AT THE ISOELECTRIC POINTS OF THE AMINO ACIDS IN WATER AT 25°C

The majority of the recorded values are true thermodynamic constants calculated from electrometric force measurements of cells without liquid junctions. The values for the constants given in the table were derived from the classical, the zwitterionic (Bjerrum), and the acidic (Bronsted) formulations of ionization and the corresponding mass law expressions. pH values at the isoelectric points were calculated from the expression, $pI = \frac{1}{2}(pk_{a1} + pk_w - pk_{b1})$. The error is approximately 0.5 per cent when this expression is used to calculate pI values for cystine, tyrosine, and diiodotyrosine.

Amino acid	Classical				Zwitterionic				Acidic				pI	Ref. no.
	pk_{a1}	pk_{a2}	pk_{b1}	pk_{b2}	pK_{A1}	pK_{A2}	pK_{B1}	pK_{B2}	pK_1	pK_2	pK_3	pK_4		
dl-Alanine	9.866		11.649		2.348		4.131		2.348	9.866			6.107	1
l(+)-Arginine	12.48		4.96	11.99	2.01		1.52	4.96	2.01	9.04	12.48		10.76	2
l(+)-Aspartic acid	3.86	9.82	11.93		2.10	3.86	4.18		2.10	3.86	9.82		2.98	3
l(−)-Cystine	8.00	10.25	11.95	12.96	1.04	2.05	3.75	6.00	1.04	2.05	8.00	10.25	5.02	4
l(−)-Diiodotyrosine	6.48	7.82	11.88		2.12	6.48	6.18		2.12	6.48	7.82		4.29	5,6
l(+)-Glutamic acid	4.07	9.47	11.90		2.10	4.07	4.53		2.10	4.07	9.47		3.08	7
Glycine	9.778		11.647		2.350		4.219		2.350	9.778			6.064	8
l(−)-Histidine	9.18		7.90	12.23	1.77		4.82	7.90	1.77	6.10	9.18		7.64	3
l(+)-Hydroxyglutamic acid	4.24	9.56	11.67		2.33	4.24	4.44		2.33	4.24	9.56		3.28	9
l(−)-Hydroxyproline	9.73		12.08		1.92		4.27		1.92	9.73			5.82	9
dl-Isoleucine	9.758		11.679		2.318		4.239		2.318	9.758			6.038	1
dl-Leucine	9.744		11.669		2.328		4.253		2.328	9.744			6.036	1
l(+)-Lysine	10.53		5.05	11.82	2.18		3.47	5.05	2.18	8.95	10.53		9.47	2
dl-Methionine	9.21		11.72		2.28		4.79		2.28	9.21			5.74	10
dl-Norleucine	9.834		11.662		2.335		4.163		2.335	9.834			6.084	1
dl-Phenylalanine	9.24		11.42		2.58		4.76		2.58	9.24			5.91	11
l(−)-Proline	10.60		12.0		2.00		3.40		2.00	10.60			6.3	12
dl-Serine	9.15		11.79		2.21		4.85		2.21	9.15			5.68	9
l(−)-Tryptophane	9.39		11.62		2.38		4.61		2.38	9.39			5.88	13
l(−)-Tyrosine	9.11	10.07	11.80		2.20	9.11	3.93		2.20	9.11	10.07		5.63	6
dl-Valine	9.719		11.711		2.286		4.278		2.286	9.719			6.002	1

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Ionization Constants of the Amino Acids in Aqueous Ethanol Solutions

Amino acid	pK_1	pK_2	pK_3	Volume per cent ethanol	Temperature °C	Ref. No.
Alanine	3.55	10.02	. .	72	25	1
Arginine	3.34	9 40	14.1	72	25	1
Aspartic acid	2.85	5.20	10.51	72	25	1
Glutamic acid	3 16	5 63	10.75	72	25	2
Glycine	2 66	9.82	.....	10	19 5	2
	2 96	9 76	.	40	19 5	2
	3 46	9 82	..	72	25	1
	3 79	9.99	..	90	19 5	2
Histidine	3 00	5 85	9.45	72	25	1
Isoleucine	3 69	9.81	.	72	25	1
Lysine	2 75	8 95	10.53	48	25	1
	3.56	8.95	10.49	84	25	1
Proline	3 01	10.55	....	72	25	1
Valine	3 60	9.73	....	72	25	1

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Ionization Constants of the Amino Acids in Aqueous Formaldehyde Solution[a]

Amino acid	Mole per cent formaldehyde				
	0.99	3.95	5.60	10.0	17.9
dl-Alanine	8.36	7.42	6.96[b]	6.56	6.10
l(+)-Arginine	....	3.45[c]	3.40[d]	....	...
l(+)-Aspartic acid	....	. .	7.21[d]	$\gtreqless$3.8[e] 6.85[f]	....
l(+)-Glutamic acid	....	. ..	6 91[d]	$\gtreqless$4.2[e] 6.8[f]	. ..
Glycine	7.16	6.08	5.92[b]	5.34	5.04
l(−)-Histidine	....	7 90[c]	7.90[d]	....	.. .
l(−)-Hydroxyproline	....	...	7.19[d]	......	.
l(−)-Leucine	8.44	7.50	6.92[d]	6.62	6.20
dl-Leucine	8.44	7.48	. .	6.60	6.20
l(+)-Lysine	...	7.35[c]	7 15[d]	....	....
l(+)-Norleucine	8.42	7.48	...	6 61	..
dl-Norleucine	8.42	7.48	7.10[b]	6.61	6.21
l(−)-Phenylalanine		. .	6.62[d]	5.9[e]	
dl-Phenylalanine	8 09	7.16	6 80[b]	6.35	6 13
l(−)-Proline	....	....	7.78[d]	....	.
dl-Serine	6.66	5.74	5.63[b]	....	4.94
l(−)-Trytophane	....	...	6.88[d]	....	.
l(−)-Tyrosine	....	......	7.50[d]	6.2[e] >9[f]	..
dl-Valine	8.52	7.65	7.47[b]	. ..	6 52

[a] Dunn and Weiner (1), pK_2 at 22°.
[b] Dunn and Loshakoff (2), pK_2 at 22°.
[c] Levy (3) pK_2 at 30° for arginine and pK_3 at 30° for histidine and lysine.
[d] Levy and Silberman (4), pK_2 at 30°, pK_3 at 30° for histidine and lysine.
[e] Harris (5), pK_2 at 25° for aspartic acid, glutamic acid, phenylalanine and tyrosine.
[f] Harris (5), pK_3 at 30° for aspartic acid, glutamic acid, and tyrosine.

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Specific Rotations of the Amino Acids Using Sodium Light (5893 Å)

Abbreviations

c—grams of solute per 100 ml. of solution.
d—density of the solution.
p—grams of solute per 100 grams of solution.
l—length of the tube in decimeters.
α—observed rotation in angular degrees.
$[\alpha]$—specific rotation in angular degrees calculated from

$$[\alpha]_{\lambda}^{t} = \frac{\alpha \times 100}{c \times l} = \frac{\alpha \times 100}{p \times d \times l}$$ where t is temperature in °C and λ is wave length of the incident light in Ångstroms.

A—prepared from a protein or other naturally occurring material.
B—prepared by resolution of the inactive synthetic form.
C—prepared by resolution of the inactive racemized form.
D—prepared from the inactive synthetic form by a biological method.
E—prepared from the inactive racemized form by a biological method.
?—source not given.

Source	c	Solvent	d	p	Moles acid or base per mole amino acid	l	Temp. °C.	α	$[\alpha]$	Ref. No.
					$l(+)$-Alanine					
A	5 790	0 97 N HCl	1 033	5 605	1 5	2	15	+1 70	+14 7	1
A	10 3	Water	1 03	1 00	0	2	22	+0 55	+2 7	2
A	1 781	3 N NaOH			15	2	20		+3 0	3
					$d(-)$-Alanine					
B	1 344	6 N HCl	......	.	39 4	2	30 4	−0 392	−14 6	4
					$l(+)$-Arginine					
A	1 653	6 0 N HCl	.		63	4 001	23 4	+1 777	+26 9	5
A	3 48	Water	.		0	2	20	....	+12 5	6
A	0 87	0 50 N NaOH	.		10	2	20		+11 8	6
					$l(+)$-Aspartic acid					
A	2.002	6 0 N HCl		.	39	4.001	24 0	+1.972	+24 6	7
A	1 3300	Water		..	0	3	18	.	+4 7	3
A	1 3300	3 N NaOH			30	3	18	..	−1 7	3
					$d(-)$-Aspartic acid					
C	4 289	0.97 N HCl	1 032	4 156	3	1	20	−1 09	−25 5	8
					$l(-)$-Cystine					
A	0 9974	1 02 N HCl	1 0181	0.9797	24 6	2	24 35	−4 277	−214.40	9
A	0.400	0 20 N NaOH	.		12	2	18 5	. .	−70 0	3
					$d(+)$-Cystine					
C		1 N HCl	.	1	24		20	.	+223	10
					$l(-)$-Diiodotyrosine					
A	5 08	1 1 N HCl	1 05	4 84	9 4	1	20	+0 15	+2 89	11
A	4 41	13 4 N NH_4OH	0 9779	4 51	132	1	20	+0 10	+2 27	11
					$l(+)$-Glutamic acid					
A	1 002	6 0 N HCl			87	4 001	22 4	+1 25	+31 2	12
A	1 471	Water			0	2	18	.	+11 5	3
A	1 471	1 N NaOH			10	2	18	. . .	+10 96	3
					$d(-)$-Glutamic acid					
C	5 425	0 37 N HCl	1 0233	5 3011	1	1	20	−1 63	−30 05	8
					$l(-)$-Histidine					
A	1 480	6 0 N HCl	.		63	4 001	22.7	+0 766	+13 0	7
A	1 128	Water	1 0012	1.127	0	4	25 00	−1 714	−39 01	13
A	0.775	0 50 N NaOH	.		10	2	20	.	−10 9	6

Specific Rotations of the Amino Acids Using Sodium Light (5893 Å) (Continued)

Source	c	Solvent	d	p	Moles acid or base per mole amino acid	l	Temp. °C.	α	[α]	Ref. No.
					d(+)-Histidine					
?	4 000	1 0 *N* HCl			4	1	20	−0 407	−10 2	14
B	2 66	Water			0	2	23	+2 11	+39 8	14
					l(+)-Hydroxyglutamic acid					
A	1 33	6 0 *N* HCl			73	2 0	20	+0 47	+17 6	15
A	4 0	Water			0	2 0	20	+0 10	+1 2	15
					l(−)-Hydroxyproline (*a*)					
A	1 31	1 0 *N* HCl			10	2	20		−47 3	6
A	1 001	Water			0	4 001	22 5	−3 009	−75 2	7
A	0 655	0 50 *N* NaOH			10	2	20		−70 6	6
					d(+)-Hydroxyproline (*a*)					
B	4 48	Water	1 03	4 35	0	1	21	+3 37	+75 2	16
					(−)-Hydroxyproline (*b*)					
B	2 617	Water	1 014	2 581	0	1	18	−1 52	−58 1	16
					(+)-Hydroxyproline (*b*)					
B	2 530	Water	1 013	2 998	0	1	17	+1 48	+58 5	16
					l(+)-Isoleucine					
B	5 09	6 1 *N* HCl	1 098	4 64	15	1	20	+2 07	+40 61	17
B	3 10	Water	1 008	3 08	0	2	20	+0 70	+11 29	17
A	3 34	0 33 *N* NaOH	1 017	3 28	1 3	2	20	+0 74	+11 09	18
					d(−)-Isoleucine					
B	4 53	6 1 *N* HCl	1 083	4 18	17	1	20	−1 85	−40 86	17
B	3.12	Water	1 006	3 10	0	2	20	−0 66	−10 55	17
					d(−)-*allo*-Isoleucine					
D	5 14	6 0 *N* HCl	1 094	4 70	15 0	2	20	−3 80	−36 95	19
B	2 00	Water			0	1	20	−0 285	−14 2	20
					l(+)-*allo*-Isoleucine					
B	3 97	6 0 *N* HCl			20	1	20	+1 50	+38 1	20
B	2 00	Water			0	1	20	+0 28	+14 0	20
					l(−)-Leucine					
A	1 990	6 0 *N* HCl			38	4 001	25 9	+1 212	+15 1	5
A	2 001	Water			0	4 001	24 7	−0 863	−10 8	5
A	1 31	3 00 *N* NaOH			30	2	20		+7 6	3
					d(+)-Leucine					
?	4 0	6 0 *N* HCl	1 1	3 664	19	2	20	+1 26	−15 6	21
?		Water		2 08	0	2	20	+0 43	+10 34	38
					l(+)-Lysine					
A	2 00	6 0 *N* HCl			43	4	22 9	+1 652	+25 9	5
A	6 496	Water			0	2	20	+1 90	+14 6	22
					d(−)-Lysine					
B	2 00	0 27 *N* HCl			2	2	20	−0 939	−23 48	23
					l(−)-Methionine					
B	0.80	Water			0	2	25	−0.13	−8 11	24
					d(+)-Methionine					
B	0 80	0 2001 *N* HCl			4	2	25	−0 34	−21 18	24
B	0.80	Water			0	2	25	+0 13	+8 12	24
B	0.80	0 6 *N* $NaHCO_3$			11	2	25	−0 12	−7 47	24

Specific Rotations of the Amino Acids Using Sodium Light (5893 Å) (Continued)

Source	c	Solvent	d	p	Moles acid or base per mole amino acid	l	Temp. °C.	α	$[\alpha]$	Ref. No.
				$l(+)$-Norleucine						
B	4 25	6 0 *N* HCl	1 10	3 86	18	2	20	+1.81	+21 3	25
B	0 70	Water	.	0 733	0	2	20	+0 095	+6 26	26
				$d(-)$-Norleucine						
B	4 69	6 0 *N* HCl	1 10	4 26	16	2	20	−2.10	−22 4	25
B	0 96	Water	.	0 959	0	2	20	−0.087	−4 49	26
				$l(-)$-Phenylalanine						
B	1 936	Water	1 0040	1 928	0	2	20	−1 36	−35 14	27
				$d(+)$-Phenylalanine						
B	3 814	5 4 *N* HCl	1 0895	3 501	23	2	20	+0 54	+7 07	28
B	2 043	Water	1 0045	2 034	0	2	20	+1 43	+35 0	27
				$l(-)$-Proline						
A	0 575	0 50 *N* HCl		.	10	2	20	.	−52 6	6
A	1 001	Water			0	4 001	23.4	−3 402	−85 0	7
B	2 42	0 6 *N* KOH	1 031	2 35	3	1	20	−2.25	−93 0	29
				$d(+)$-Proline						
B	3 90	Water	1 01	3 865	0	1	20	+3 18	+81 5	29
				$l(-)$-Serine						
B	9 344	1 *N* HCl	1 0465	8 929	1	1	25	+1 35	+14 45	30
B	10 414	Water	1.0414	9 997	0	2	20	−1.42	−6 83	30
				$d(+)$-Serine						
B	9 359	1 *N* HCl	1 0465	8 943	1	1	25	−1 34	−14 32	30
B	10 412	Water	1 0414	9 998	0	2	20	+1.43	+6 87	30
				$d(-)$-Threonine						
B		Water	. .	1 092	0	2	26	−0 625	−28 3	31
				$l(+)$-Threonine						
B		Water	. . .	1 331	0	2	26	+0 780	+28.4	31
				$(-)$-*allo*-Threonine						
B		Water	.	1 634	0	2	26	−0 302	−9 1	31
				$(+)$-*allo*-Threonine						
B		Water	.	1 643	0	2	26	+0 320	+9 6	31
				$l(?)$-Thyroxine						
A		0 13 *N* NaOH in 70% EtOH by weight	. .	3	3	1	. .	−0.147	−4.4	32
				$l(-)$-Tryptophane						
A	1 02	0 50 *N* HCl			10	2	20		+2 4	6
A	1 004	Water			0	4 001	22 7	−1 266	−31 5	7
A	2 426	0 5 *N* NaOH	1 0243	2 368	4 2	1	20	+0 15	+6 17	33
				$d(+)$-Tryptophane						
C	0 5024	Water			0	2	25	+0 326	+32 45	34
				$l(-)$-Tyrosine						
B	4 40	6 3 *N* HCl	1 116	3 94	28	2	20	−0.76	−8.64	35
A	0 906	3 0 *N* NaOH			60	3	18		−13 2	3
				$d(+)$-Tyrosine						
B	5.1484	6 3 *N* HCl	1 1175	4 6071	24	2	20	+0 89	+8 64	35

Specific Rotations of the Amino Acids Using Sodium Light (5893 Å) (Continued)

Source	c	Solvent	d	p	Moles acid or base per mole amino acid	l	Temp. °C.	α	[α]	Ref. No.
					l(+)-Valine					
B	3 4	6 0 N HCl	1 1	3 05	20	2	20	+1 93	+28.8	36
B	3.58	Water	1.007	3 56	0	2	20	+0 46	+6 42	36
					d(−)-Valine					
B	3 2	6 0 N HCl	1 1	2 91	21	2	20	−1 86	−29 04	36
E	6 24	Water	1 00	6 24	0	1	20	−0 37	−6 06	37

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Solubilities of the Amino Acids in Grams per 100 Grams of Water

Amino acid	Temperature, °C.					Ref. No.
	0°	25°	50°	75°	100°	
dl-Alanine	12 11	16.72	23.09	31.89	44.04	1
l(+)-Alanine	12.73	16.65	21.79	28.51	37.30	1
dl-Aspartic acid	0.262	0 778	2.000	4.456	8.594	1
l(+)-Aspartic acid	0.209	0.500	1.199	2.875	6.893	1
l(−)-Cystine‡ × 10^2	0.502	1.096	2.394	5.229	11.42	2
dl-Diiodotyrosine × 10	0.149	0.340	0.773	......	......	3
l(−)-Diiodotyrosine × 10	0.204	0.617	1.862	5.62	17.00	1
dl-Glutamic acid	0.855	2 054	4.934	11.86	28.49	1
l(+)-Glutamic acid	0.341	0.864	2.186	5.532	14.00	1
Glycine	14.18	24.99	39.10	54.39	67.17	1
l(−)-Histidine	....	4.19	....	...	......	4
l(−)-Hydroxyproline (*a*)	28.86	36 11	45.18	51.67*	......	5
dl-Isoleucine	1.826	2.229	3.034	4.607	7.802	1
l(+)-Isoleucine	3.791	4.117	4.818	6.076	8.255	2
dl-Leucine	0 797	0.991	1.406	2.276	4 206	1
l(−)-Leucine	2.270	2.426†	2.887†	3.823	5.638	1
dl-Methionine	1.818	3 381	6.070	10.52	17.60	2
dl-Norleucine	0.843	1.149	1.727	2.861	5.229	1
dl-Phenylalanine	0.997	1.411	2.187	3.708	6.886	1
l(−)-Phenylalanine	1.983	2.965	4.431	6 624	9.900	2
l(−)-Proline × 10^{-1}	12.74	16.23	20.67	23.90*	...	3
dl-Serine	2.204	5.023	10.34	19.21	32.24	2
l(−)-Tryptophane	0 823	1.136	1.706	2 795	4.987	2
dl-Tyrosine × 10	0.147	0.351	0.836	....	....	3
l(−)-Tyrosine × 10	0.196	0.453	1.052	2.438	5.650	1
d(+)-Tyrosine × 10	0.196	0 453	1.052	....	...	3
dl-Valine	5.98	7.09	9.11	12.61	18 81	1
l(+)-Valine	8 34	8.85	9.62	10.24*	.	6

* Value at 65°.

† Dunn and Stoddard (7) report 2.19 g. at 25° for *l*(−)-leucine rendered methionine-free by repeated recrystallization from 6 *N* HCl. Hlynka (8) found 2.20 g. at 25° and 2.66 g. at 50° for *l*(−)-leucine rendered methionine-free [by S. W. Fox (9)] by fractional crystallization of the formyl derivative and identical values for *d*(+)-leucine obtained by resolution of the *dl*-form.

‡ The following values were found by Loring and du Vigneaud (10): *dl*-cystine (0.0049g), *d* (+)-cystine (0.0108 g), and *meso*-cystine (0.0056 g) at 25°.

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Solubilities of the Amino Acids in Grams per 100 Grams of Water-Ethanol Mixtures

Per cent ethanol by volume	Temp. °C	Grams amino acid per 100 grams solvent	Ref. No.
***dl*-Alanine**			
24.93	0.00	3.84	1
50.10	0.00	1.16	1
74.50	0.00	0.305	1
95.14	0.00	0.0167	1
10	25	12.25	2
24.93	24.97	7.09	1
50.10	24.97	2.52	1
74.20	24.97	0.573	1
95.14	25.09	0.0329	1
25.28	45.16	10.6	1
50.10	44.96	4.25	1
74.20	44.98	0.949	1
95.14	45.19	0.0545	1
24.93	64.96	15.9	1
50.10	64.94	6.68	1
74.20	64.94	1.48	1
95.09	65.15	0.0851	1
***dl*-Aspartic acid**			
24.93	0.03	0.0703	1
50.10	0.03	0.0267	1
74.20	0.02	0.0111	1
24.55	25.06	0.266	1
50.25	25.06	0.0992	1
74.28	25.14	0.317	1
95.14	25.07	0.0020	1
24.74	45.25	0.680	1
50.18	45.25	0.255	1
74.28	45.27	0.0608	1
95.14	45.21	0.0042	1
24.93	64.91	1.53	1
50.10	64.91	0.588	1
74.20	65.07	0.132	1
95.14	65.00	0.0129	1
***l*(+)-Aspartic acid**			
20	25	0.204	3
50	25	0.0633	3
70	25	0.0224	3
90	25	0.0034	3
***l*(+)-Glutamic acid**			
24.74	0.01	0.0855	1
50.18	0.01	0.0371	1
74.28	0.03	0.0163	1
24.56	25.05	0.292	1
50.25	25.08	0.131	1
74.35	25.07	0.0370	1
95.14	25.04	0.0044	1
24.55	45.01	0.811	1
50.18	45.27	0.378	1
74.35	44.93	0.0885	1
95.14	45.20	0.0127	1
Glycine			
24.93	0.02	3.95	1
50.10	0.02	1.03	1
74.50	0.02	0.200	1
95.09	0.01	0.0080	1
10	25	17.13	2
24.93	24.97	8.72	1
50.10	24.97	2.47	1
74.20	24.97	0.448	1
95.14	25.09	0.0172	1
24.93	44.98	15.0	1
50.10	44.98	4.62	1
74.20	44.97	0.756	1
95.14	45.19	0.0294	1
24.93	65.11	24.5	1
50.10	65.10	8.03	1
74.20	65.07	1.23	1
95.14	65.00	0.0488	1
***l*(+)-Isoleucine**			
80	20	0.46	4
80	78–80	1.16	4
***l*(+)-*allo*-Isoleucine**			
80	20	0.81	4
80	78–80	1.97	4
***dl*-Leucine**			
24.93	0.00	0.251	1
50.10	0.00	0.118	1
74.50	0.00	0.0693	1
95.14	0.00	0.0116	1
10	25	0.771	2
24.93	24.97	0.493	1
50.10	24.97	0.318	1
74.20	24.97	0.175	1
95.14	25.09	0.0258	1
24.93	45.24	0.853	1
50.10	45.24	0.633	1
74.50	45.18	0.323	1
95.14	45.18	0.0471	1
24.93	65.16	1.45	1
50.10	65.20	1.16	1
74.20	65.15	0.584	1
95.09	65.07	0.0844	1
***l*(−)-Leucine**			
20	25	1.33	2
60	25	0.641	2
90	25	0.123	2

Solubilities of the Amino Acids in Grams per 100 Grams of Water-Ethanol Mixtures (Continued)

Per cent ethanol by volume	Temp. °C	Grams amino acid per 100 grams solvent	Ref. No.
	dl-Norleucine		
24.93	0.00	0.275	1
50.10	0.00	0.147	1
74.50	0.00	0.0995	1
95.14	0.00	0.0192	1
24.93	25.69	0.625	1
50.10	25.69	0.453	1
74.20	24.97	0.266	1
95.14	25.09	0.0417	1
24.93	44.97	1.12	1
50.10	44.96	0.918	1
74.20	44.96	0.518	1
95.14	45.18	0.0759	1
24.93	65.17	2.02	1
50.10	65.17	1.76	1
74.20	65.17	0.944	1
95.14	65.01	0.134	1
	l(−)-Proline		
100	19	1.5	5
	dl-Serine		
24.93	0.00	0.1530	1
50.10	0.00	0.146	1
74.50	0.00	0.0304	1
95.14	0.00	0.0008	1
24.93	25.14	1.54	1
50.10	25.14	0.461	1
74.50	25.10	0.0840	1
95.14	25.09	0.0028	1
24.93	45.15	3.14	1
50.10	45.04	0.985	1
74.20	45.04	0.185	1
95.14	45.18	0.0058	1
24.93	65.26	5.99	1
50.10	65.25	1.88	1
74.50	65.24	0.318	1
95.14	65.01	0.0152	1
	dl-Threonine		
95	25	0.07*	6
	dl-*allo*-Threonine		
95	25	0.03*	6
	l(−)-Tyrosine		
95	17	0.10	7
	dl-Tyrosine		
95.09	0.00	0.0031	8
25.28	24.85	0.0285	8
50.99	24.75	0.0226	8
74.63	24.75	0.0117	8
95.09	25.24	0.0032	8
25.28	45.15	0.0630	8
50.99	45.16	0.0513	8
74.63	44.93	0.0230	8
95.09	44.98	0.0035	8
95.09	65.06	0.0067	8
	dl-Valine		
24.93	0.02	2.10	1
50.10	0.02	0.769	1
74.20	0.02	0.269	1
95.14	0.01	0.0277	1
10	25	5.50	2
25.28	24.85	3.30	1
50.99	24.85	1.53	1
74.35	24.93	0.570	1
95.14	25.04	0.0569	1
24.55	44.91	5.10	1
50.25	44.92	2.74	1
74.35	44.92	0.999	1
95.14	45.21	0.0979	1
24.55	65.07	7.44	1
50.10	64.94	4.49	1
74.20	64.34	1.62	1
95.09	65.15	0.167	1
	l(+)-Valine		
20	25	5.11	2
40	25	2.93	2
60	25	1.61	2
80	25	0.52	2

* Grams per 100 ml. of solution.

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Solubilities of the Amino Acids in Grams per 100 Grams of Organic Solvent

Solvent	Grams amino acid per 100 grams solvent	Temp. °C	Ref. No.
	dl-Alanine		
Ethanol	0.0087	25	1
	l(+)-Aspartic acid		
Ethanol	0.000196	25	2
	l(+)-Glutamic acid		
Ethanol	0.000347	25	2
Ethanol	0.0056	44.93	3
	Glycine		
Acetone	0.000291	25	4
Butanol	0.000892	25	4
Ethanol	0.0037	25	1
Formamide	0.558	25	4
Methanol	0.0407	25	4
	l(+)-Isoleucine		
Ethanol	0.09	20	5
Ethanol	0.13	78–80	5
	l(+)-*allo*-Isoleucine		
Ethanol	0.13	20	5
Ethanol	0.19	78–80	5
	l(−)-Leucine		
Ethanol	0.0217	25	1
	dl-Norleucine		
Acetone	0.00132	25	4
Butanol	0.00545	25	4
Ethanol	0.0173	25	1
Formamide	0.201	25	4
Methanol	0.142	25	4
	l(−)-Proline		
Ethanol	1.5	19	6
	dl-Valine		
Ethanol	0.0136	0.03	3
Ethanol	0.019	25	1

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Densities of Crystalline Amino Acids

Amino acid	Density	Ref. No.
dl-Alanine	1.424	1
l(+)-Alanine	1.401	2
dl-β-Alanine	1.404	1
dl-α-Amino-*n*-butyric acid	1.231	1
α-Aminoisobutyric acid	1 278	1
l(+)-Arginine	1.1	3
l(+)-Aspartic acid	1.66	3
dl-Glutamic acid	1.460	4
l(+)-Glutamic acid	1.538	4
Glycine*	1.601	3
	1 607	1
dl-Leucine	1.191	1
l(−)-Leucine	1.165	1
dl-Methionine	1.340	5
dl-Norleucine	1.169	5
	1 174	1
dl-Serine	1.537	5
l(−)-Tyrosine	1.456	1
dl-Valine	1.316	1
l(+)-Valine	1.230	1

* The density of glycine at 50° is 1.5753 according to Houck (6) who concluded that the figure 1.1607, reported by Curtius (7) and reproduced in chemical handbooks, is a typographical error.

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ELECTROMOTIVE FORCE SERIES OF ELEMENTS

Compiled by Giles B. Cooke

Standard Electrode Potentials at 25°C

Element	Ion	Electrode reaction	Electrode potential
Li	Li^+	$Li = Li^+ + e$	+2 9595
Rb	Rb^+	$Rb = Rb^+ + e$	2 9259
K	K^+	$K = K^+ + e$	2 9241
*Sr	Sr^{++}	$\frac{1}{2}Sr = \frac{1}{2}Sr^{++} + e$	2 92
*Ba	Ba^{++}	$\frac{1}{2}Ba = \frac{1}{2}Ba^{++} + e$	2 90
*Ca	Ca^{++}	$\frac{1}{2}Ca = \frac{1}{2}Ca^{++} + e$	2.87
Na	Na^+	$Na = Na^+ + e$	2 7146
*Mg	Mg^{++}	$\frac{1}{2}Mg = \frac{1}{2}Mg^{++} + e$	2 40
*Al	Al^{+++}	$\frac{1}{3}Al = \frac{1}{3}Al^{+++} + e$	1.70
*Be	Be^{++}	$\frac{1}{2}Be = \frac{1}{2}Be^{++} + e$	1.69
*U	U^{++++}	$\frac{1}{4}U = \frac{1}{4}U^{++++} + e$	1.40
*Mn	Mn^{++}	$\frac{1}{2}Mn = \frac{1}{2}Mn^{++} + e$	1 10
*Te	Te^-	$\frac{1}{2}Te^- = \frac{1}{2}Te + e$	0 827
Zn	Zn^{++}	$\frac{1}{2}Zn = \frac{1}{2}Zn^{++} + e$	0.7618
Cr	Cr^{++}	$\frac{1}{2}Cr = \frac{1}{2}Cr^{++} + e$	0 557
*S	S^-	$\frac{1}{2}S^- = \frac{1}{2}S + e$	0 51
*Ga	Ga^{+++}	$\frac{1}{3}Ga = \frac{1}{3}Ga^{+++} + e$	0 50
Fe	Fe^{++}	$\frac{1}{2}Fe = \frac{1}{2}Fe^{++} + e$	0.441
*Cd	Cd^{++}	$\frac{1}{2}Cd = \frac{1}{2}Cd^{++} + e$	0 401
*In	In^{+++}	$\frac{1}{3}In = \frac{1}{3}In^{+++} + e$	0 336
*Tl	Tl^+	$Tl = Tl^+ + e$	0.330
Co	Co^{++}	$\frac{1}{2}Co = \frac{1}{2}Co^{++} + e$	0.278
Ni	Ni^{++}	$\frac{1}{2}Ni = \frac{1}{2}Ni^{++} + e$	0.231
Sn	Sn^{++}	$\frac{1}{2}Sn = \frac{1}{2}Sn^{++} + e$	0 136
Pb	Pb^{++}	$\frac{1}{2}Pb = \frac{1}{2}Pb^{++} + e$	0 122
*Fe	Fe^{+++}	$\frac{1}{3}Fe = \frac{1}{3}Fe^{+++} + e$	0 045
H_2	H^+	$\frac{1}{2}H_2 = H^+ + e$	0 0000
*Sb	Sb^{+++}	$\frac{1}{3}Sb = \frac{1}{3}Sb^{+++} + e$	−0 10
*Bi	Bi^{+++}	$\frac{1}{3}Bi = \frac{1}{3}Bi^{+++} + e$	−0 226
*As	As^{+++}	$\frac{1}{3}As = \frac{1}{3}As^{+++} + e$	−0 30
Cu	Cu^{++}	$\frac{1}{2}Cu = \frac{1}{2}Cu^{++} + e$	−0 344
*O_2	OH^-	$OH^- = \frac{1}{4}O_2 + \frac{1}{2}H_2O + e$	−0 397
Po (18°C)	Po^{++++}	$\frac{1}{4}Po = \frac{1}{4}Po^{++++} + e$	−0 40
Cu	Cu^+	$Cu = Cu^+ + e$	−0 470
I_2	I^-	$I^- = \frac{1}{2}I_2 + e$	−0 5345
*Te	Te^{++++}	$\frac{1}{4}Te = \frac{1}{4}Te^{++++} + e$	−0.558
Ag	Ag^+	$Ag = Ag^+ + e$	−0 7978
Hg	Hg^{++}	$2Hg = Hg_2^{++} + 2e$	−0 7986
*Pb	Pb^{++++}	$\frac{1}{4}Pb = \frac{1}{4}Pb^{++++} + e$	−0 80
*Pd	Pd^{++}	$\frac{1}{2}Pd = \frac{1}{2}Pd^{++} + e$	−0 820
*Pt	Pt	$\frac{1}{4}Pt = \frac{1}{4}Pt^{++++} + e$	−0 863
Br_2	Br^-	$Br^- = \frac{1}{2}Br_2 + e$	−1 0648
Cl_2	Cl^-	$Cl^- = \frac{1}{2}Cl_2 + e$	−1.3583
*Au	Au^{+++}	$\frac{1}{3}Au = \frac{1}{3}Au^{+++} + e$	−1 360
*Au	Au^+	$Au = Au^+ + e$	−1.50
*F_2	F^-	$F^- = \frac{1}{2}F_2 + e$	−1 90

* These values are doubtful but they indicate the relative activity of the elements and are therefore included.

1. **Action of Metals on Salts.**—Any metal will replace any other metal *below* it in the series thus:

$$Mg + FeSO_4 \rightarrow MgSO_4 + Fe$$
$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$$
$$Sn + 2AgNO_3 \rightarrow Sn(NO_3)_2 + 2Ag$$
$$Cu + Hg(NO_3)_2 \rightarrow Cu(NO_3)_2 + Hg$$

This is the fundamental principle of the Daniell Cell. The voltage of such a cell depends upon the difference between the electrode potentials of the metals employed. Thus the Zn-Cu couple gives a greater E.M.F. than the Zn-Pb couple or the Fe-Cu couple.

ELECTROMOTIVE FORCE SERIES OF ELEMENTS (Continued)

2. **Action of Metals on Acids.**—Metals *above* H_2 react with HCl and dilute H_2SO_4, replacing the H_2

$$Zn + \text{dil. } H_2SO_4 \rightarrow ZnSO_4 + H_2$$
$$Sn + 2HCl \rightarrow SnCl_2 + H_2$$
$$Cu + \text{dil } H_2SO_4 \rightarrow \text{no reaction}$$

Metals above Pt react with HNO_3 and *hot conc* H_2SO_4

$$2Ag + 2 \text{ conc. } H_2SO_4 \rightarrow Ag_2SO_4 + SO_2 + 2H_2O$$
$$3Zn + 8 \text{ conc. } HNO_3 \rightarrow 3Zn(NO_3)_2 + 2NO + 4H_2O$$
$$3Cu + 8 \text{ dil. } HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$$

The acid first oxidizes the metal and the reaction may be explained as follows

Some of the acid takes on water and ionizes thus:

$$2HNO_3 + 4H_2O \rightleftarrows 10OH^- + 2N^{+++++}$$

Nitrogen gains 3 electrons and copper loses 2 electrons:

$$2(N^{+++++} + 3e) + 3(Cu - 2e) \rightarrow 3Cu^{++} + 2N^{++}$$

Some of the acid ionizes as follows·

$$6HNO_3 \leftrightarrows 6H^+ + 6NO_3^-$$
$$3Cu^{++} + 6NO_3^- \rightarrow 3Cu(NO_3)_2$$
$$10OH^- + 6H^+ + 2N^{++} \rightarrow 2NO + 8H_2O$$

added $\quad 3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$

3. **In Regard to Ease of Reduction of Oxides.**—The metallic oxides down to and including Mn can not be completely reduced to the metal state, even in a current of hydrogen. The oxides of Cd and succeeding metals are easily reduced, and far down the list, the oxides of silver, platinum, mercury, and gold are reduced (decomposed into metal and oxygen) even by heat alone

4. **In Regard to Ease of Rusting. (Oxidation in the Air.)**—The alkali and alkaline-earth metals rust very rapidly and with considerable evolution of heat All the metals down to copper rust with comparative ease. The metals below copper do not rust Assuming the electrolytic theory of the process of rusting to be true, these facts are just about what might have been predicted.

5. **In Regard to the Occurrence of the Metals in the Free State in Nature.**—Natural waters are frequently dilute solutions of carbonic, nitric, humic, etc , acids. As such they contain displaceable hydrogen. Metals *above* hydrogen in the E.M.F series scarcely, if ever, occur in the free state in nature, but are practically without exception found in the combined state, as sulfides, carbonates, etc. Metals *below* hydrogen are frequently found in the free state in nature. Thus gold is found in the form of nuggets of metallic gold However, metals below hydrogen are also found in the combined state, as cinnabar, HgS, etc

6 **In Regard to Action of the Metals on Water.**—The alkali and alkaline-earths metal displace hydrogen from water, even in the cold, and with evolution of much heat Mg and succeeding metals will displace hydrogen from steam. Metals at the bottom of the list will not displace hydrogen from steam.

7. **In Regard to the Solubility and Stability of Hydroxides.**—The alkali metal oxides have great avidity for water, forming hydroxides The alkaline-earth metal oxides react with less readiness, forming hydroxides. MgO reacts slowly and incompletely with water, forming the hydroxide All the other metallic oxides and hydroxides are insoluble in water and have no perceptible reaction therewith. When a solution of NaOH acts on solutions of salts of the metals, the alkali metal salts are not precipitated. The alkaline-earth metal salts are not precipitated unless in very concentrated solution. All the other metal solutions are acted upon, with precipitation of hydroxides, except in the case of copper which first gives copper hydroxide (blue), and which, on warming, changes to copper oxide (black). Also in the case of arsenic, no precipitate falls, sodium arsenite being formed. In the case of the last metals in the series, the *oxide* is precipitated, instead of the hydroxide, thus NaOH acting on salts of Sb, Hg, Ag, Pd, Pt, and Au, causes a precipitation of the *oxides* of these metals. Bismuth, as an exception, gives a normal hydroxide.

ELECTROMOTIVE FORCE SERIES OF ELEMENTS (Continued)

8. **In Regard to Carbonates.**—The alkali metals form normal stable, soluble carbonates, not easily decomposed on heating. The alkaline-earth metals form normal carbonates, which are insoluble in water, and which decompose upon heating, leaving the oxide, carbon dioxide being evolved. When sodium carbonate solution acts on solutions of all the other metals, as a rule, a basic carbonate is precipitated, being insoluble in water, and decomposed by heat into oxide and carbon dioxide. If the solution is cold, Ag, Hg, Cd, Fe, and Mn give normal carbonates. If the solution is warm, Sb, Hg, Ag, Pd, Pt, and Au give a precipitate of the *oxide*, instead of the carbonate, thus showing the instability of the carbonates of the lowest metals in the series.

9. **In Regard to Nitrates.**—The nitrates of the alkali metals decompose when strongly heated forming the *nitrite* and oxygen. The nitrates of the heavy metals, down to and including copper, decompose when heated forming the oxide of the metal, oxygen and nitrogen dioxide. Mercury nitrate when heated yields mercury, oxygen and nitrogen dioxide.

REDUCTION VALUES FOR GLUCOSE IN BLOOD

Amounts of Glucose Corresponding to Titration Values when 0.1 c.c. Blood is Used in the Method of Hagedorn and Jensen. Biochem. Zeit. 135, 46; 137, 92 (1923).

Milligrams of Glucose in 0.1 c.c. of Blood

c.c. of 0.005N $Na_2S_2O_3$	Hundredths of 1 c.c. of 0.005 N Sodium Thiosulfate, $Na_2S_2O_3$									
	0	1	2	3	4	5	6	7	8	9
0 0	0 385	0 382	0 379	0 376	0 373	0 370	0 367	0 364	0 361	0 358
0 1	0 355	0 352	0 350	0 348	0 345	0 343	0 341	0 338	0 336	0 333
0 2	0 331	0 329	0.327	0 325	0 323	0 321	0 318	0 316	0 314	0 312
0 3	0.310	0 308	0 306	0 304	0 302	0 300	0 298	0 296	0 294	0 292
0 4	0 290	0 288	0 286	0 284	0 282	0 280	0 278	0 276	0 274	0 272
0 5	0 270	0 268	0 266	0 264	0 262	0 260	0 259	0 257	0 255	0 253
0 6	0 251	0 249	0 247	0 245	0 243	0 241	0 240	0 238	0 236	0 234
0 7	0 232	0 230	0 228	0 226	0 224	0 222	0 221	0 219	0 217	0.215
0 8	0 213	0 211	0 209	0 208	0 206	0 204	0 202	0 200	0 199	0 197
0 9	0 195	0 193	0 191	0 190	0 188	0 186	0 184	0 182	0 181	0 179
1 0	0 177	0 175	0 173	0 172	0 170	0 168	0 166	0 164	0 163	0 161
1 1	0 159	0 157	0 155	0 154	0 152	0 150	0 148	0 146	0 145	0 143
1 2	0 141	0 139	0 138	0 136	0 134	0 132	0 131	0 129	0 127	0 125
1 3	0 124	0 122	0 120	0 119	0 117	0 115	0 113	0 111	0 110	0 108
1 4	0 106	0 104	0 102	0 101	0 099	0 097	0 095	0 093	0 092	0 090
1 5	0 088	0 086	0 084	0 083	0 081	0 079	0 077	0 075	0 074	0 072
1 6	0 070	0 068	0 066	0 065	0 063	0 061	0.059	0.057	0 056	0 054
1 7	0 052	0 050	0 048	0 047	0 045	0 043	0 041	0 039	0 038	0 036
1 8	0 034	0 032	0 031	0 029	0 027	0 025	0 024	0 022	0 020	0 019
1 9	0 017	0 015	0 014	0 012	0 010	0 008	0 007	0 005	0 003	0 002

Procedure

Into a test tube (15×150 mm.) pipette 1 c.c. 0.1 normal NaOH and 5 c.c. 0.45% zinc sulfate solution; 0.1 c.c. of blood from a capillary pipette is added being washed out with the mixture in the test tube; heat for 3 minutes in a boiling water bath; filter through cotton into a test tube (30×90 mm.) and wash the filter with two 3 c.c. portions of water. Add 2 c.c. of alkaline ferricyanide solution (1.65 g potassium ferricyanide, 10.6 g anhydrous sodium carbonate in 1000 c.c. of water) and heat in a boiling water bath for 15 minutes; cool and add 3 c.c. of the iodide-sulfate solution (5 g potassium iodide, 10 g zinc sulfate, 50 g sodium chloride and sufficient water to make 200 c.c.) and 2 c.c. of 3% acetic acid solution. Titrate with 0.005 normal sodium thiosulfate using starch indicator. The method is based upon the reduction of alkaline ferricyanide by glucose and the subsequent titration of the excess unreduced ferri cyanide according to the following equation: $2H_3Fe(CN)_6 + 2HI = 2H_4Fe(CN)_6 + I_2$

REDUCTION VALUES FOR GLUCOSE (Continued)

Amounts of Glucose Corresponding to Titration Values when 5 c.c. of 1:10 Blood Filtrate and 5 c.c. of Copper Reagent (Modified*) are Heated in a Water Bath for 15 Minutes. M. Somogyi, Jour. Biol. Chem. **70**, 599 (1926).

Milligrams of Glucose in 100 c.c. of Blood

c.c. of 0.005N $Na_2S_2O_3$	Tenths of 1 c.c. of 0.005 N Sodium Thiosulfate, $Na_2S_2O_3$									
	0	1	2	3	4	5	6	7	8	9
0			21	23	26	29	31	34	36	39
1	41	44	46	49	51	53	56	58	61	63
2	65	68	70	72	75	77	80	82	84	86
3	89	92	94	97	99	101	103	106	108	110
4	113	115	117	119	121	124	126	128	130	132
5	135	137	139	141	143	146	148	150	152	154
6	157	159	161	163	165	168	170	172	174	176
7	179	181	183	185	187	190	192	194	196	199
8	201	203	205	207	210	212	214	216	218	221
9	223	225	227	230	232	234	237	239	241	243
10	245	248	250	252	254	256	259	261	263	265
11	267	270	272	274	276	279	281	283	285	288
12	290	292	294	296	299	301	303	305	308	310
13	312	314	316	318	321	323	326	328	330	332
14	334	337	339	341	343	345	347	350	352	354
15	356	359	361	363	365	367	370	372	374	376
16	378	381	383	386	388	390	392	394	396	398
17	400	—	—	—	—	—	—	—	—	—

To 5 c.c. of the copper reagent in a test tube (250 × 25 mm) are added 5 c.c. of the sugar solution containing between 0.1 and 2.0 mg of glucose; mix; heat for 15 minutes in a boiling water bath; cool to 35°C; with mixing add 1 c.c. of 5N H_2SO_4 and 2 minutes later titrate with 0.005 normal $Na_2S_2O_3$. A blank titration using 5 c.c. of water in place of the blood is run at the same time.

Amounts of Glucose Corresponding to Titration Values when 2 c.c. of 1:15 Blood Filtrate and 2 c.c. of Copper Reagent (Modified*) are Heated in a Water Bath for 15 Minutes. M. Somogyi, Jour. Biol. Chem. **70**, 599 (1926).

Milligrams of Glucose in 100 c.c. of Blood

c.c. of 0.005N $Na_2S_2O_3$	Tenths of 1 c.c. of 0.005 N Sodium Thiosulfate, $Na_2S_2O_3$									
	0	1	2	3	4	5	6	7	8	9
0	—	—	42	53	63	74	83	91	100	108
1	117	125	134	142	150	159	168	176	185	193
2	202	210	219	227	236	245	253	262	270	279
3	288	296	305	313	322	330	339	347	355	364
4	373	381	390	399	407	416	424	433	441	450
5	458	—	—	—	—	—	—	—	—	—

To 2 c.c. of 0.0667 normal H_2SO_4 in a test tube add 0.2 c.c. of blood, rinsing the pipette several times with the liquid in the test tube; add exactly 0.8 c.c. of 2.5% sodium tungstate solution; centrifugate; fasten a small tuft of absorbent cotton over the end of a 2 c.c. pipette and with this pipette remove 2 c.c. of the blood filtrate in the test tube and deliver it into a 16 × 150 mm test tube; add exactly 2 c.c. of the sugar-copper reagent; mix; heat in a boiling water bath for 15 minutes; cool to 35°C; add 1 c.c. 2 normal H_2SO_4 and titrate with 0.005 normal $Na_2S_2O_3$. A blank using 0.2 c.c. of water in place of the blood is run at the same time.

* Modified tartrate-carbonate copper reagent.—Copper sulfate (crystalline) 6.5 g; Rochelle salt 12 g; sodium carbonate (anhydrous) 20 g; potassium iodide 10 g; potassium iodate 0.8 g; potassium oxalate 18 g; sodium bicarbonate 25 g; water sufficient to make one liter of solution.

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE

(Munson and Walker, Jour. Amer. Chem. Soc. 28, 663 (1906.)

Add exactly 25 c.c. of Fehling Solution A and 25 c.c. of Fehling Solution B (see under *Special Solutions and Reagents*) to 50 c.c. of reducing sugar solution (if a smaller volume of sugar solution is used, add sufficient water to make the final solution 100 c.c.); heat the solution at such a rate that boiling begins in four minutes and continue boiling for exactly 2 minutes, keeping the beaker covered with a watch glass; filter immediately on a Gooch crucible using suction; wash thoroughly with water at 60°C., then with 10 c.c. of alcohol and finally with 10 c.c. of ether; dry for 30 minutes in an oven at 100°C., cool in a desiccator and weigh as cuprous oxide.

(Expressed in Milligrams)

Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$	Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$
10	4.0	4.5	3.8	5.9	50	21.3	22.3	30.1	37.6
11	4.5	5.0	4.5	6.7	51	21.7	22.8	30.7	38.4
12	4.9	5.4	5.1	7.5	52	22.2	23.2	31.4	39.2
13	5.3	5.8	5.8	8.3	53	22.6	23.7	32.1	40.0
14	5.7	6.3	6.4	9.1	54	23.0	24.1	32.7	40.8
15	6.2	6.7	7.1	9.9	55	23.5	24.6	33.4	41.6
16	6.6	7.2	7.8	10.6	56	23.9	25.0	34.0	42.4
17	7.0	7.6	8.4	11.4	57	24.3	25.5	34.7	43.2
18	7.5	8.1	9.1	12.2	58	24.8	25.9	35.4	44.0
19	7.9	8.5	9.7	13.0	59	25.2	26.4	36.0	44.8
20	8.3	8.9	10.4	13.8	60	25.6	26.8	36.7	45.6
21	8.7	9.4	11.0	14.6	61	26.1	27.3	37.3	46.3
22	9.2	9.8	11.7	15.4	62	26.5	27.7	38.0	47.1
23	9.6	10.3	12.3	16.2	63	27.0	28.2	38.6	47.9
24	10.0	10.7	13.0	17.0	64	27.4	28.6	39.3	48.7
25	10.5	11.2	13.7	17.8	65	27.8	29.1	40.0	49.5
26	10.9	11.6	14.3	18.6	66	28.3	29.5	40.6	50.3
27	11.3	12.0	15.0	19.4	67	28.7	30.0	41.3	51.1
28	11.8	12.5	15.6	20.2	68	29.2	30.4	41.9	51.9
29	12.2	12.9	16.3	21.0	69	29.6	30.9	42.6	52.7
30	12.6	13.4	16.9	21.8	70	30.0	31.3	43.3	53.5
31	13.1	13.8	17.6	22.6	71	30.5	31.8	43.9	54.3
32	13.5	14.3	18.3	23.3	72	30.9	32.3	44.6	55.1
33	13.9	14.7	18.9	24.1	73	31.4	32.7	45.2	55.9
34	14.3	15.2	19.6	24.9	74	31.8	33.2	45.9	56.7
35	14.8	15.6	20.2	25.7	75	32.2	33.6	46.6	57.5
36	15.2	16.1	20.9	26.5	76	32.7	34.1	47.2	58.2
37	15.6	16.5	21.5	27.3	77	33.1	34.5	47.9	59.0
38	16.1	16.9	22.2	28.1	78	33.6	35.0	48.5	59.8
39	16.5	17.4	22.8	28.9	79	34.0	35.4	49.2	60.6
40	16.9	17.8	23.5	29.7	80	34.4	35.9	49.9	61.4
41	17.4	18.3	24.2	30.5	81	34.9	36.3	50.5	62.2
42	17.8	18.7	24.8	31.3	82	35.3	36.8	51.2	63.0
43	18.2	19.2	25.5	32.1	83	35.8	37.3	51.8	63.8
44	18.7	19.6	26.1	32.9	84	36.2	37.7	52.5	64.6
45	19.1	20.1	26.8	33.7	85	36.7	38.2	53.1	65.4
46	19.6	20.5	27.4	34.4	86	37.1	38.6	53.8	66.2
47	20.0	21.0	28.1	35.2	87	37.5	39.1	54.5	67.0
48	20.4	21.4	28.7	36.0	88	38.0	39.5	55.1	67.8
49	20.9	21.9	29.4	36.8	89	38.4	40.0	55.8	68.5

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE (Continued)

Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$	Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$
90	38.9	40.4	56.4	69.3	140	61.3	63.6	89.5	109.0
91	39.3	40.9	57.1	70.1	141	61.8	64.0	90.2	109.8
92	39.8	41.4	57.8	70.9	142	62.2	64.5	90.8	110.5
93	40.2	41.8	58.4	71.7	143	62.7	65.0	91.5	111.3
94	40.6	42.3	59.1	72.5	144	63.1	65.4	92.2	112.1
95	41.1	42.7	59.7	73.3	145	63.6	65.9	92.8	112.9
96	41.5	43 2	60.4	74.1	146	64.0	66.4	93.5	113.7
97	42.0	43.7	61.1	74.9	147	64.5	66.9	94.2	114.5
98	42.4	44.1	61.7	75.7	148	65.0	67.3	94.8	115.3
99	42.9	44.6	62.4	76.5	149	65.4	67.8	95.5	116.1
100	43.3	45.0	63.0	77.3	150	65.9	68.3	96.1	116.9
101	43.8	45 5	63.7	78.1	151	66.3	68.7	96 8	117.7
102	44.2	46.0	64.4	78.8	152	66.8	69.2	97.5	118.5
103	44.7	46.4	65.0	79.6	153	67.2	69.7	98.1	119.3
104	45.1	46.9	65.7	80.4	154	67.7	70.1	98.8	120.0
105	45.5	47.3	66.4	81.2	155	68.2	70.6	99.5	120.8
106	46.0	47.8	67.0	82.0	156	68.6	71.1	100 1	121.6
107	46.4	48.3	67.7	82.8	157	69.1	71.6	100.8	122.4
108	46.9	48.7	68.3	83.6	158	69.5	72.0	101.5	123.2
109	47.3	49.2	69.0	84.4	159	70.0	72.5	102.1	124.0
110	47.8	49.6	69.7	85.2	160	70.4	73.0	102.8	124.8
111	48.2	50.1	70.3	86.0	161	70.9	73.4	103.4	125.6
112	48.7	50.6	71.0	86.8	162	71.4	73.9	104.1	126.4
113	49.1	51.0	71.6	87.6	163	71.8	74.4	104.8	127.2
114	49.6	51.5	72.3	88.4	164	72.3	74.9	105.4	128.0
115	50.0	51.9	73.0	89.2	165	72.8	75.3	106.1	128.8
116	50.5	52.4	73.6	90.0	166	73.2	75.8	106.8	129.6
117	50.9	52.9	74.3	90.7	167	73.7	76.3	107.4	130.3
118	51.4	53.3	75.0	91.5	168	74.1	76.8	108.1	131.1
119	51.8	53.8	75.6	92.3	169	74.6	77.2	108.8	131.9
120	52.3	54.3	76.3	93.1	170	75.1	77.7	109.4	132.7
121	52.7	54.7	76.9	93.9	171	75.5	78.2	110.1	133.5
122	53.2	55.2	77.6	94.7	172	76.0	78.7	110.8	134.3
123	53.6	55.7	78.3	95.5	173	76.4	79.1	111.4	135.1
124	54.1	56.1	78.9	96.3	174	76.9	79.6	112 1	135.9
125	54.5	56.6	79.6	97.1	175	77.4	80.1	112.8	136.7
126	55.0	57.0	80.3	97.9	176	77.8	80.6	113.4	137.5
127	55.4	57.5	80.9	98.7	177	78.3	81.0	114 1	138.3
128	55.9	58.0	81.6	99.4	178	78.8	81.5	114.8	139.1
129	56.3	58.4	82.2	100 2	179	79.2	82.0	115.4	139.8
130	56.8	58.9	82.9	101.0	180	79.7	82.5	116.1	140.6
131	57.2	59.4	83.6	101.8	181	80.1	82.9	116.7	141.4
132	57.7	59.8	84.2	102 6	182	80 6	83.4	117.4	142.2
133	58.1	60.3	84.9	103.4	183	81.1	83.9	118.1	143.0
134	58.6	60.8	85.5	104.2	184	81.5	84.4	118.7	143.8
135	59.0	61.2	86.2	105.0	185	82.0	84.9	119.4	144.6
136	59.5	61.7	86.9	105.8	186	82.5	85.3	120.1	145.4
137	60.0	62.2	87 5	106.6	187	82.9	85.8	120.7	146.2
138	60.4	62.6	88.2	107.4	188	83.4	86.3	121.4	147.0
139	60.9	63.1	88.9	108.2	189	83.9	86.8	122.1	147.8

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE (Continued)

Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$	Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$
190	84.3	87.2	122.7	148.6	240	108.0	111.5	156.1	188.1
191	84.8	87.7	123.4	149.3	241	108.4	112.0	156.7	188.9
192	85.3	88.2	124.1	150.1	242	108.9	112.5	157.4	189.7
193	85.7	88.7	124.7	150.9	243	109.4	113.0	158.1	190.5
194	86.2	89.2	125.4	151.7	244	109.9	113.5	158.7	191.3
195	86.7	89.6	126.1	152.5	245	110.4	114.0	159.4	192.1
196	87.1	90.1	126.7	153.3	246	110.8	114.5	160.1	192.9
197	87.6	90.6	127.4	154.1	247	111.3	115.0	160.7	193.6
198	88.1	91.1	128.1	154.9	248	111.8	115.4	161.4	194.4
199	88.5	91.6	128.7	155.7	249	112.3	115.9	162.1	195.2
200	89.0	92.0	129.4	156.5	250	112.8	116.4	162.7	196.0
201	89.5	92.5	130.0	157.3	251	113.2	116.9	163.4	196.8
202	89.9	93.0	130.7	158.1	252	113.7	117.4	164.1	197.6
203	90.4	93.5	131.4	158.8	253	114.2	117.9	164.7	198.4
204	90.9	94.0	132.0	159.6	254	114.7	118.4	165.4	199.2
205	91.4	94.5	132.7	160.4	255	115.2	118.9	166.1	200.0
206	91.8	94.9	133.4	161.2	256	115.7	119.4	166.8	200.8
207	92.3	95.4	134.0	162.0	257	116.1	119.9	167.4	201.6
208	92.8	95.9	134.7	162.8	258	116.6	120.4	168.1	202.3
209	93.2	96.4	135.4	163.6	259	117.1	120.9	168.8	203.1
210	93.7	96.9	136.0	164.4	260	117.6	121.4	169.4	203.9
211	94.2	97.4	136.7	165.2	261	118.1	121.9	170.1	204.7
212	94.6	97.8	137.4	166.0	262	118.6	122.4	170.8	205.5
213	95.1	98.3	138.0	166.8	263	119.0	122.9	171.4	206.3
214	95.6	98.8	138.7	167.5	264	119.5	123.4	172.1	207.1
215	96.1	99.3	139.4	168.3	265	120.0	123.9	172.8	207.9
216	96.5	99.8	140.0	169.1	266	120.5	124.4	173.5	208.7
217	97.0	100.3	140.7	169.9	267	121.0	124.9	174.1	209.5
218	97.5	100.8	141.4	170.7	268	121.5	125.4	174.8	210.3
219	98.0	101.2	142.0	171.5	269	122.0	125.9	175.5	211.0
220	98.4	101.7	142.7	172.3	270	122.5	126.4	176.1	211.8
221	98.9	102.2	143.4	173.1	271	122.9	126.9	176.8	212.6
222	99.4	102.7	144.0	173.9	272	123.4	127.4	177.5	213.4
223	99.9	103.2	144.7	174.7	273	123.9	127.9	178.1	214.2
224	100.3	103.7	145.4	175.5	274	124.4	128.4	178.8	215.0
225	100.8	104.2	146.0	176.2	275	124.9	128.9	179.5	215.8
226	101.3	104.6	146.7	177.0	276	125.4	129.4	180.2	216.6
227	101.8	105.1	147.4	177.8	277	125.9	129.9	180.8	217.4
228	102.2	105.6	148.0	178.6	278	126.4	130.4	181.5	218.2
229	102.7	106.1	148.7	179.4	279	126.9	130.9	182.2	218.9
230	103.2	106.6	149.4	180.2	280	127.3	131.4	182.8	219.7
231	103.7	107.1	150.0	181.0	281	127.8	131.9	183.5	220.5
232	104.1	107.6	150.7	181.8	282	128.3	132.4	184.2	221.3
233	104.6	108.1	151.4	182.6	283	128.8	132.9	184.8	222.1
234	105.1	108.6	152.0	183.4	284	129.3	133.4	185.5	222.9
235	105.6	109.1	152.7	184.2	285	129.8	133.9	186.2	223.7
236	106.0	109.5	153.4	184.9	286	130.3	134.4	186.9	224.5
237	106.5	110.0	154.0	185.7	287	130.8	134.9	187.5	225.3
238	107.0	110.5	154.7	186.5	288	131.3	135.4	188.2	226.1
239	107.5	111.0	155.4	187.3	289	131.8	135.9	188.9	226.9

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE (Continued)

Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$	Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$
290	132.3	136.4	189.5	227.6	340	157.3	162.0	223.2	267.1
291	132.7	136.9	190.2	228.4	341	157.8	162.5	223.8	267.9
292	133.2	137.4	190.9	229.2	342	158.3	163.1	224.5	268.7
293	133 7	137.9	191.5	230.0	343	158.8	163.6	225.2	269.5
294	134.2	138.4	192.2	230.8	344	159.3	164.1	225.9	270.3
295	134.7	138.9	192.9	231.6	345	159.8	164.6	226.5	271.1
296	135.2	139.4	193.6	232.4	346	160.3	165.1	227.2	271.9
297	135.7	140.0	194.2	233.2	347	160.8	165.7	227.9	272.7
298	136.2	140.5	194.9	234.0	348	161.4	166.2	228 5	273.5
299	136.7	141.0	195.6	234.8	349	161.9	166.7	229.2	274.3
300	137.2	141.5	196.2	235.5	350	162.4	167.2	229.9	275.0
301	137.7	142.0	196.9	236.3	351	162.9	167.7	230.6	275.8
302	138.2	142.5	197.6	237.1	352	163.4	168.3	231.2	276.6
303	138.7	143.0	198.3	237.9	353	163.9	168.8	231.9	277.4
304	139.2	143.5	198 9	238.7	354	164.4	169.3	232.6	278.2
305	139.7	144.0	199.6	239.5	355	164.9	169.8	233.3	279.0
306	140.2	144.5	200.3	240.3	356	165.4	170.4	233.9	279.8
307	140.7	145.0	201.0	241.1	357	166.0	170 9	234.6	280.6
308	141.2	145.5	201.6	241.9	358	166 5	171 4	235.3	281.4
309	141.7	146.1	202.3	242.7	359	167.0	171.9	236.0	282.2
310	142.2	146.6	203.0	243.5	360	167.5	172.5	236.7	282.9
311	142.7	147.1	203.6	244.2	361	168.0	173.0	237.3	283.7
312	143.2	147.6	204 3	245.0	362	168.5	173.5	238 0	284.5
313	143.7	148.1	205.0	245.8	363	169.0	174.0	238.7	285.3
314	144.2	148.6	205.7	246.6	364	169.6	174.6	239.4	286.1
315	144.7	149.1	206.3	247.4	365	170.1	175.1	240.0	286.9
316	145.2	149.6	207.0	248 2	366	170.6	175.6	240.7	287.7
317	145.7	150.1	207.7	249.0	367	171.1	176.1	241.4	288.5
318	146 2	150.7	208.4	249.8	368	171.6	176.7	242.1	289.3
319	146.7	151.2	209.0	250.6	369	172.1	177.2	242.7	290.0
320	147.2	151.7	209.7	251.3	370	172.7	177.7	243.4	290.8
321	147 7	152 2	210.4	252.1	371	173 2	178 3	244.1	291.6
322	148 2	152.7	211.0	252.9	372	173.7	178.8	244.8	292.4
323	148.7	153.2	211.7	253.7	373	174.2	179.3	245.4	293.2
324	149.2	153.7	212.4	254.5	374	174.7	179.8	246.1	294.0
325	149.7	154.3	213.1	255 3	375	175.3	180.4	246.8	294.8
326	150.2	154.8	213.7	256.1	376	175.8	180.9	247.5	295.6
327	150.7	155.3	214.4	256.9	377	176.3	181.4	248.1	296.4
328	151.2	155.8	215.1	257.7	378	176.8	182.0	248.8	297.2
329	151.7	156.3	215 8	258 5	379	177.3	182.5	249.5	297.9
330	152.2	156.8	216.4	259.3	380	177.9	183.0	250.2	298.7
331	152.7	157.3	217.1	260.0	381	178 4	183.6	250.8	299.5
332	153.2	157.9	217 8	260.8	382	178 9	184.1	251.5	300.3
333	153.7	158.4	218.4	261.6	383	179.4	184.6	252.2	301.1
334	154.2	158.9	219 1	262.4	384	180.0	185.2	252.9	301.9
335	154.7	159.4	219.8	263.2	385	180.5	185.7	253.6	302.7
336	155.2	159.9	220.5	264.0	386	181.0	186.2	254.2	303.5
337	155.8	160.5	221.1	264.8	387	181.5	186.8	254.9	304.2
338	156.3	161.0	221.8	265.6	388	182.0	187.3	255.6	305.0
339	156.8	161.5	222.5	266.4	389	182.6	187.8	256.3	305.8

CUPROUS OXIDE EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE (Continued)

Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$	Cuprous Oxide Cu_2O	Dextrose $C_6H_{12}O_6$	Invert Sugar	Lactose $C_{12}H_{22}O_{11}$	Maltose $C_{12}H_{22}O_{11}$
390	183.1	188.4	256.9	306.6	440	209.8	215.5	290.9	346.1
391	183.6	188.9	257.6	307.4	441	210.3	216.1	291.5	346.8
392	184.1	189.4	258.3	308.2	442	210.9	216.6	292.2	347.6
393	184.7	190.0	259.0	309.0	443	211.4	217.2	292.9	348.4
394	185.2	190.5	259.6	309.8	444	212.0	217.8	293.6	349.2
395	185.7	191.0	260.3	310.6	445	212.5	218.3	294.2	350.0
396	186.2	191.6	261.0	311.4	446	213.1	218.9	294.9	350.8
397	186.8	192.1	261.7	312.1	447	213.6	219.4	295.6	351.6
398	187.3	192.7	262.3	312.9	448	214.1	220.0	296.3	352.4
399	187.8	193.2	263.0	313.7	449	214.7	220.5	297.0	353.2
400	188.4	193.7	263.7	314.5	450	215.2	221.1	297.6	353.9
401	188.9	194.3	264.4	315.3	451	215.8	221.6	298.3	354.7
402	189.4	194.8	265.0	316.1	452	216.3	222.2	299.0	355.5
403	189.9	195.4	265.7	316.9	453	216.9	222.8	299.7	356.3
404	190.5	195.9	266.4	317.7	454	217.4	223.3	300.4	357.1
405	191.0	196.4	267.1	318.5	455	218.0	223.9	301.1	357.9
406	191.5	197.0	267.8	319.2	456	218.5	224.4	301.7	358.7
407	192.1	197.5	268.4	320.0	457	219.1	225.0	302.4	359.5
408	192.6	198.1	269.1	320.8	458	219.6	225.5	303.1	360.3
409	193.1	198.6	269.8	321.6	459	220.2	226.1	303.8	361.0
410	193.7	199.1	270.5	322.4	460	220.7	226.7	304.5	361.8
411	194.2	199.7	271.2	323.2	461	221.3	227.2	305.1	362.6
412	194.7	200.2	271.8	324.0	462	221.8	227.8	305.8	363.4
413	195.2	200.8	272.5	324.8	463	222.4	228.3	306.5	364.2
414	195.8	201.3	273.2	325.6	464	222.9	228.9	307.2	365.0
415	196.3	201.8	273.9	326.3	465	223.5	229.5	307.9	365.8
416	196.8	202.4	274.6	327.1	466	224.0	230.0	308.6	366.6
417	197.4	202.9	275.2	327.9	467	224.6	230.6	309.2	367.3
418	197.9	203.5	275.9	328.7	468	225.1	231.2	309.9	368.1
419	198.4	204.0	276.6	329.5	469	225.7	231.7	310.6	368.9
420	199.0	204.6	277.3	330.3	470	226.2	232.3	311.3	369.7
421	199.5	205.1	277.9	331.1	471	226.8	232.8	312.0	370.5
422	200.1	205.7	278.6	331.9	472	227.4	233.4	312.6	371.3
423	200.6	206.2	279.3	332.7	473	227.9	234.0	313.3	372.1
424	201.1	206.7	280.0	333.4	474	228.5	234.5	314.0	372.9
425	201.7	207.3	280.7	334.2	475	229.0	235.1	314.7	373.7
426	202.2	207.8	281.3	335.0	476	229.6	235.7	315.4	374.4
427	202.8	208.4	282.0	335.8	477	230.1	236.2	316.1	375.2
428	203.3	208.9	282.7	336.6	478	230.7	236.8	316.7	376.0
429	203.8	209.5	283.4	337.4	479	231.3	237.4	317.4	376.8
430	204.4	210.0	284.1	338.2	480	231.8	237.9	318.1	377.6
431	204.9	210.6	284.7	339.0	481	232.4	238.5	318.8	378.4
432	205.5	211.1	285.4	339.7	482	232.9	239.1	319.5	379.2
433	206.0	211.7	286.1	340.5	483	233.5	239.6	320.1	380.0
434	206.5	212.2	286.8	341.3	484	234.1	240.2	320.8	380.7
435	207.1	212.8	287.5	342.1	485	234.6	240.8	321.5	381.5
436	207.6	213.3	288.1	342.9	486	235.2	241.4	322.2	382.3
437	208.2	213.9	288.8	343.7	487	235.7	241.9	322.9	383.1
438	208.7	214.4	289.5	344.5	488	236.3	242.5	323.6	383.9
439	209.2	215.0	290.2	345.3	489	236.9	243.1	324.2	384.7
					490	237.4	243.6	324.5	385.5

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Computed from the International atomic weights of 1936* by Eric A. Arnold.

To facilitate the use of the table the group of substances weighed given under each element as well as the substances sought under each substance weighed are arranged in the alphabetical order of their formulae.

Weighed	Sought	Factor	Logarithm
Aluminum: Al = 26.97			−10
Al	Al_2O_3	1.8899	10 27643
	$AlPO_4$	4 5217	10 65530
Al_4C_3	Al_2O_3	1 4167	10 15128
$AlCl_3$	Al_2O_3	0 38225	9 58235
AlF_3	CaF_2	1 3948	10 14451
Al_2O_3	Al	0 52913	9 72357
	Al_4C_3	0.70586	9 84872
	$AlCl_3$	2.6161	10 41765
	$AlPO_4$	2 3926	10 37887
	$Al_2(SO_4)_3$	3 3561	10 52583
	$Al_2(SO_4)_3$ $18H_2O$	6.5373	10.81540
	$K_2SO_4Al_2(SO_4)_3$ $24H_2O$	9 3071	10 96881
	$(NH_4)_2SO_4$ $Al_2(SO_4)_3$. $24H_2O$	8 8940	10 94909
$AlPO_4$	Al	0 22116	9.34470
	Al_2O_3	0.41796	9.62113
	P_2O_5	0 58204	9 76495
$Al_2(SO_4)_3$	Al_2O_3	0 29797	9.47417
$Al_2(SO_4)_3$ $18H_2O$	Al_2O_3	0.15297	9 18460
CaF_2	AlF_3	0.71696	9 85549
$K_2SO_4Al_2(SO_4)_3$ $24H_2O$	Al_2O_3	0.10745	9 03119
$(NH_4)_2SO_4Al_2(SO_4)_3$ $24H_2O$	Al_2O_3	0 11244	9 05091
P_2O_5	$AlPO_4$	1 7181	10 23505
Ammonium NH_4 = 18 0404			
Ag	NH_4Br	0.90801	9 95809
	NH_4Cl	0 49590	9 69539
	NH_4I	1 3437	10 12831
AgBr	NH_4Br	0 52161	9 71735
AgCl	NH_4Cl	0 37323	9 57197
AgI	NH_4I	0 61738	9 79055
$BaSO_4$	$(NH_4)_2SO_4$	0 56611	9 75290
Br	NH_4Br	1 2257	10 08840
Cl	NH_4	0 50880	9 70654
	NH_4Cl	1 5088	10 17863
HCl	NH_4Cl	1 4671	10 16646
I	NH_4I	1 1421	10.05772
$MgNH_4PO_4$. $6H_2O$	NH_3	0 069396	8 84133
	NH_4	0 073503	8 86631
	$(NH_4)_2O$	0 10610	9 02571
N	NH_3	1 2159	10 08490
	NH_4	1 2879	10 10987
Ammonium:			−10
N	NH_4Cl	3 8191	10 58196
	NH_4NO_3	5 7145	10 75698
	$(NH_4)_2O$	1 8590	10 26927
	$(NH_4)_2SO_4$	4 7166	10.67363
NH_3	$MgNH_4PO_4$. $6H_2O$.	14 410	11 15867
	N	0 82244	9 91510
	NH_4	1 0592	10 02497
	NH_4Cl	3 1409	10 49706
	$(NH_4)_2CO_3$	2 8208	10.45038
	NH_4HCO_3	4 6417	10 66668
	NH_4NO_3	4 6998	10 67208
	$(NH_4)_2O$	1 5289	10 18437
	NH_4OH	2 0578	10 31340
	$(NH_4)_2PtCl_6$	13 036	11 11513
	$(NH_4)_2SO_4$	3 8791	10 58873
	N_2O_5	3 1709	10 50118
	Pt	5 7312	10 75824
	SO_3	2 3502	10 37111
NH_4	Cl	1 9654	10 29346
	$MgNH_4PO_4$ $6H_2O$	13 605	11 13369
	N	0 77648	9 89013
	NH_3	0 94412	9 97503
	NH_4Cl	2 9654	10 47209
	$(NH_4)_2PtCl_6$	12 307	11 09016
	Pt	5 4109	10 73327
NH_4Br	Ag	1 1013	10 04191
	AgBr	1 9171	10.28265
	Br	0 81583	9 91160
NH_4Cl	Ag	2 0165	10 30461
	AgCl	2 6793	10 42803
	Cl	0 66278	9 82137
	HCl	0 68162	9 83354
	N	0 26184	9.41804
	NH_3	0 31838	9 50294
	NH_4	0 33722	9 52791
	$(NH_4)_2O$	0 48676	9.68731
	NH_4OH	0 65514	9.81634
	$(NH_4)_2Pt$. Cl_6	4.1502	10 61807
	Pt.	1.8247	10.26118
$(NH_4)_2$. CO_3	NH_3	0 35450	9.54962
NH_4. HCO_3	NH_3	0 21544	9 33332
NH_4I	Ag	0 74420	9 87169
	AgI	1.6198	10 20945
	I	0 87555	9 94228
NH_4NO_3	NH_3	0 21278	9 32792
	$(NH_4)_2PtCl_6$	2 7737	10 44305
	N_2O_5	0 67469	9 82911
	Pt	1 2194	10 08616

*Revised, atomic weights 1939.

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
			−10
Ammonium: $(NH_4)_2O$.	$MgNH_4PO_4 \cdot 6H_2O$	9.4253	10.97429
	N	0.53793	9.73073
	NH_3	0 65407	9 81563
	NH_4Cl	2.0544	10 31269
	$(NH_4)_2PtCl_6$	8.5262	10 93076
	N_2O_5	2 0740	10 31681
	Pt	3 7486	10 57387
NH_4OH	N	0.39967	9 60171
	NH_3	0 48596	9 68660
	NH_4	0 51473	9 71158
	NH_4Cl	1.5264	10 18366
	$(NH_4)_2PtCl_6$	6.3348	10 80174
	Pt	2.7851	10.44485
$(NH_4)_2PtCl_6$	NH_3	0 076713	8 88487
	NH_4	0 081253	8 90984
	NH_4Cl	0 24095	9 38193
	NH_4NO_3	0 36054	9 55695
	$(NH_4)_2O$	0 11729	9 06924
	NH_4OH	0 15786	9 19826
	$(NH_4)_2SO_4$	0 29758	9.47360
$(NH_4)_2SO_4$	$BaSO_4$	1 7664	10 24710
	H_2SO_4	0 74221	9 87053
	N	0 21202	9 32637
	NH_3	0 25779	9.41127
	$(NH_4)_2PtCl_6$	3 3605	10 52640
	Pt	1 4774	10 16951
	SO_3	0 60587	9 78238
N_2O_5	NH_3	0 31537	9 49882
	NH_4NO_3	1 4822	10.17089
	$(NH_4)_2O$	0 48216	9 68319
Pt	NH_3	0 17448	9 24176
	NH_4	0 18481	9 26673
	NH_4Cl	0 54804	9 73882
	NH_4NO_3	0 82004	9 91384
	$(NH_4)_2O$	0 26677	9 42613
	NH_4OH	0 35905	9 55515
	$(NH_4)_2SO_4$	0.67685	9 83049
SO_3	NH_3	0.42549	9 62889
	$(NH_4)_2SO_4$	1.6505	10.21762
Antimony: Sb= 121 76			
$KSbOC_4H_4O_6$ ½H_2O	Sb	0.36462	9.56184
	Sb_2O_3	0 43649	9 63997
	Sb_2O_4	0 46045	9.66318
	Sb_2S_3	0 50863	9.70640
Sb	$KSbOC_4H_4O_6$ ½H_2O	2.7426	10.43816
	Sb_2O_3	1.1971	10 07813
	Sb_2O_4	1.2628	10 10134
	Sb_2O_5	1 3235	10 12337

Weighed	Sought	Factor	Logarithm
			−10
Antimony: Sb	Sb_2S_3	1 3950	10 14456
	Sb_2S_5	1 6583	10 21965
Sb_2O_3	$KSbOC_4H_4O_6$ ½H_2O	2 2910	10 36003
	Sb	0 83535	9 92187
	Sb_2O_4	1 0549	10 02321
	Sb_2O_5	1 1098	10 04523
	Sb_2S_3	1 1653	10 06643
	Sb_2S_5	1 3852	10 14152
Sb_2O_4	$KSbOC_4H_4O_6$ ½H_2O	2 1718	10 33682
	Sb	0 79188	9 89866
	Sb_2O_3	0 94797	9 97679
	Sb_2O_5	1 0520	10 02203
	Sb_2S_3	1 1046	10 04322
	Sb_2S_5	1 3132	10 11831
Sb_2O_5	Sb	0 75272	9 87663
	Sb_2O_3	0 90109	9.95477
	Sb_2O_4	0 95054	9 97797
	Sb_2S_5	1.2482	10 09629
Sb_2S_3	$KSbOC_4H_4O_6$ ½H_2O	1.9661	10 29360
	Sb	0.71687	9 85544
	Sb_2O_3	0.85817	9 93357
	Sb_2O_4	0.90527	9 95678
	Sb_2O_5	0 95237	9 97881
Sb_2S_5	Sb	0 60304	9.78035
	Sb_2O_3	0 72191	9 85848
	Sb_2O_4	0 76153	9 88169
	Sb_2O_5	0.80115	9.90371
Arsenic: As=74.91			
As	As_2O_3	1 3204	10 12070
	As_2O_5	1 5340	10 18582
	As_2S_3	1 6420	10 21537
	As_2S_5	2 0700	10 31596
	$BaSO_4$	4 6740	10 66969
	$Mg_2As_2O_7$	2 0722	10 31644
	$MgNH_4AsO_4$ ½H_2O	2 5401	10 40485
AsO_3	$BaSO_4$	2 8487	10 45464
	$Mg_2As_2O_7$	1 2630	10 10139
	$MgNH_4AsO_4$ ½H_2O	1 5481	10 18980
AsO_4	$BaSO_4$	2 5206	10 40150
	$Mg_2As_2O_7$	1.1175	10 04824
	$MgNH_4AsO_4$ ½H_2O	1 3698	10.13666
As_2O_3	As	0 75736	9 87930
	As_2O_5	1 1618	10 06512
	As_2S_3	1 2436	10 09466
	As_2S_5	1 5677	10 19526
	$BaSO_4$	3.5399	10 54899
	$Mg_2As_2O_7$	1.5694	10.19574
	$MgNH_4AsO_4$ ½H_2O	1 9238	10 28415
As_2O_5	As	0 65190	9 81418
	As_2O_3	0 86076	9 93488

Weighed	Sought	Factor	Logarithm
Arsenic.			−10
As_2O_5	As_2S_3 .	1 0704	10 02955
	As_2S_5	1 3494	10 13014
	$BaSO_4$	3 0470	10 48387
	$Mg_2As_2O_7$	1.3509	10.13062
	$MgNH_4AsO_4.\frac{1}{2}H_2O$	1 6559	10.21903
As_2S_3	As	0 60902	9 78463
	As_2O_3	0 80415	9 90534
	As_2O_5	0 93423	9 97045
	As_2S_5	1 2607	10 10059
	$Mg_2As_2O_7$	1 2620	10 10107
As_2S_5	As	0 48310	9 68404
	As_2O_3	0 63788	9 80474
	As_2O_5	0.74107	9 86986
	As_2S_3	0 79324	9 89941
$BaSO_4$	As	0 21395	9 33031
	AsO_3	0 35104	9 54536
	AsO_4	0 39674	9 59850
	As_2O_3	0 28250	9 45101
	As_2O_5	0.32819	9 51613
$Mg_2As_2O_7$	As	0 48257	9 68356
	AsO_3	0 79179	9 89861
	AsO_4	0 89487	9 95176
	As_2O_3	0.63718	9 80426
	As_2O_5	0 74026	9 86938
	As_2S_3	0.79237	9 89893
$MgNH_4.AsO_4\ \frac{1}{2}H_2O$	As	0 39369	9 59515
	AsO_3.	0 64595	9 81020
	AsO_4	0 73004	9 86334
	As_2O_3	0 51982	9 71585
	As_2O_5	0.60390	9 78097
Barium: Ba= 137 36			
Ba	$BaCO_3$.	1 4369	10 15742
	$BaCrO_4$	1 8446	10.26589
	$BaSiF_6$	2 0342	10 30840
	$BaSO_4$	1 6993	10 23028
$BaCl_2$	$BaCO_3$....	0 94765	9 97665
	$BaCrO_4$	1 2165	10 08512
	$BaSO_4$	1 1207	10 04950
$BaCl_2\ 2H_2O$	$BaSO_4$	0 95544	9 98020
$BaCO_3$	Ba	0 69595	9 84258
	$BaCl_2$	1 0552	10 02335
	$BaCrO_4$	1 2837	10 10847
	$Ba(HCO_3)_2$	1 3143	10 11868
	BaO	0 77702	9 89043
	$BaSO_4$	1 1827	10 07286
	CO_2	0 22298	9.34827
$BaCrO_4$	Ba	0 54213	9 73411
	$BaCl_2$	0 82202	9 91488
	$BaCO_3$	0 77898	9 89153
	BaO	0 60528	9 78196
BaF_2 .	$BaSiF_6$	1.5934	10 20233
$Ba(HCO_3)_2$	$BaCO_3$	0 76088	9 88132
$Ba(NO_3)_2$	$BaSO_4$	0 89304	9 95087
BaO	$BaCO_3$	1 2870	10.10957

Weighed	Sought	Factor	Logarithm
Barium:			−10
BaO	$BaCrO_4$	1.6521	10 21804
	$BaSiF_6$	1.8220	10.26055
	$BaSO_4$	1.5220	10.18243
	CO_2	0.28697	9.45784
BaO_2.	$BaSO_4$	1.3782	10.13933
BaS.	$BaSO_4$.	1.3778	10 13917
$BaSiF_6$	Ba	0.49159	9.69160
	BaF_2	0.62759	9 79767
	BaO	0.54885	9 73945
$BaSO_4$	Ba	0.58847	9.76972
	$BaCl_2$	0 89227	9.95050
	$BaCl_2.2H_2O$.	1 0466	10.01980
	$BaCO_3$	0.84556	9.92714
	$Ba(NO_3)_2$	1 1198	10 04913
	BaO ...	0 65701	9.81757
	BaO_2 .	0 72556	9 86067
	BaS	0 72582	9 86083
CO_2.	$BaCO_3$	4.4847	10.65173
	BaO	3.4847	10.54216
Beryllium (glucinum) Be=9.02			
Be	BeO	2 7738	10 44308
$BeCl_2$	BeO	0 31301	9 49556
BeO	Be	0 36051	9.55692
	$BeCl_2$	3.1948	10.50444
	$BeSO_4.4H_2O$.	7 0801	10.85004
$BeSO_4\ 4H_2O$	BeO	0.14124	9.14996
Bismuth: Bi= 209 00			
Bi	$BiAsO_4$	1 6646	10 22132
	Bi_2O_3	1.1148	10 04721
	BiOCl .	1 2462	10 09559
	Bi_2S_3	1 2301	10.08994
$BiAsO_4$	Bi	0 60073	9.77868
	Bi_2O_3 .	0 66971	9.82589
$Bi(NO_3)_3\ 5H_2O$	Bi_2O_3	0 48031	9 68152
	BiOCl .	0 53691	9.72990
Bi_2O_3	Bi	0 89700	9 95279
	$BiAsO_4$	1.4932	10.17411
	$Bi(NO_3)_3.5H_2O$	2 0820	10 31848
	BiOCl	1 1178	10 04838
	$BiONO_3$	1 2318	10 09054
	Bi_2S_3	1 1034	10 04273
BiOCl.	Bi	0.80244	9 90441
	$Bi(NO_3)_3.5H_2O$.	1 8625	10 27010
	Bi_2O_3	0 89458	9 95162
	$BiONO_3$	1.1019	10 04216
$BiONO_3$..	Bi_2O_3	0 81182	9.90946
	BiOCl	0 90749	9 95784
Bi_2S_3...	Bi	0.81294	9 91006
	Bi_2O_3 .	0 90630	9.95727
Boron: B=10.82			
B .	B_2O_3.	3 2181	10 50760

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Boron:			−10
B	KBF_4	11.637	11.06585
BO_2	B_2O_3	0.81317	9.91018
BO_3	B_2O_3	0.59198	9.77230
B_2O_3	B	0.31074	9.49240
	BO_2	1.2298	10.08982
	BO_3	1.6893	10.22770
	B_4O_7	1.1149	10.04723
	H_3BO_3	1.7761	10.24947
	KBF_4	3.6162	10.55825
	$Na_2B_4O_7 \cdot 10H_2O$	2.7386	10.43753
B_4O_7	B_2O_3	0.89696	9.95277
H_3BO_3	B_2O_3	0.56303	9.75053
	KBF_4	2.0360	10.30878
KBF_4	B	0.085930	8.93415
	B_2O_3	0.27653	9.44175
	H_3BO_3	0.49116	9.69122
	$Na_2B_4O_7 \cdot 10H_2O$	0.75732	9.87928
$Na_2B_4O_7 \cdot 10H_2O$	B_2O_3	0.36515	9.56247
	KBF_4	1.3204	10.12072
Bromine: Br= 79.916			
Ag	Br	0.74079	9.86969
	BrO_3	1.1857	10.07398
	HBr	0.75013	9.87514
AgBr	Br	0.42555	9.62895
	BrO_3	0.68114	9.83324
	HBr	0.43091	9.63439
AgCl	Br	0.55754	9.74628
Br	Ag	1.3499	10.13031
	AgBr	2.3499	10.37105
	AgCl	1.7936	10.25372
	O	0.10011	9.00046
BrO_3	Ag	0.84337	9.92602
	AgBr	1.4681	10.16676
HBr	Ag	1.3331	10.12486
	AgBr	2.3206	10.36561
O	Br	9.9895	10.99954
Cadmium Cd= 112.41			
Cd	$CdCl_2$	1.6309	10.21241
	$Cd(NO_3)_2$	2.1032	10.32289
	CdO	1.1423	10.05779
	CdS	1.2852	10.10897
	$CdSO_4$	1.8546	10.26824
$CdCl_2$	Cd	0.61318	9.78759
	CdO	0.70045	9.84538
	CdS	0.78806	9.89656
	$CdSO_4$	1.1372	10.05582
$Cd(NO_3)_2$	Cd	0.47546	9.67711
	CdO	0.54313	9.73490
	CdS	0.61106	9.78608
	$CdSO_4$	0.88176	9.94535
CdO	Cd	0.87540	9.94221
	$CdCl_2$	1.4276	10.15462
	$Cd(NO_3)_2$	1.8412	10.26510
	CdS	1.1251	10.05118

Weighed	Sought	Factor	Logarithm
Cadmium:			−10
CdO	$CdSO_4$	1.6235	10.21044
CdS	Cd	0.77809	9.89103
	$CdCl_2$	1.2689	10.10344
	$Cd(NO_3)_2$	1.6365	10.21392
	CdO	0.88884	9.94882
	$CdSO_4$	1.4430	10.15927
$CdSO_4$	Cd	0.53921	9.73176
	$CdCl_2$	0.87938	9.94418
	$Cd(NO_3)_2$	1.1341	10.05465
	CdO	0.61596	9.78956
	CdS	0.69300	9.84073
Calcium: Ca=40.08			
$BaSO_4$	CaS	0.30906	9.49004
	$CaSO_4$	0.58324	9.76585
	$CaSO_4 \cdot 2H_2O$	0.73761	9.86783
Ca	$CaCl_2$	2.7693	10.44237
	$CaCO_3$	2.4973	10.39746
	CaF_2	1.9481	10.28961
	CaO	1.3992	10.14588
	$CaSO_4$	3.3967	10.53106
	Cl	1.7693	10.24780
$Ca_3(AsO_4)_2$	$Mg_2As_2O_7$	0.77993	9.89206
$CaCl_2$	Ca	0.36110	9.55763
	$CaCO_3$	0.90176	9.95509
	CaO	0.50525	9.70351
	$CaSO_4$	1.2266	10.08869
	Cl	0.63890	9.80543
$CaCO_3$	Ca	0.40044	9.60254
	$CaCl_2$	1.1089	10.04491
	$Ca(HCO_3)_2$	1.6197	10.20944
	CaO	0.56030	9.74842
	$CaSO_4$	1.3602	10.13360
	$CaSO_4 \cdot 2H_2O$	1.7202	10.23557
	CO_2	0.43970	9.64316
	HCl	0.72865	9.86252
CaF_2	Ca	0.51332	9.71039
	$CaSO_4$	1.7436	10.24145
$Ca(HCO_3)_2$	$CaCO_3$	0.61740	9.79056
	CaO	0.34592	9.53898
$Ca(NO_3)_2$	N_2O_5	0.65825	9.81839
CaO	Ca	0.71469	9.85412
	$CaCl_2$	1.9792	10.29649
	$CaCO_3$	1.7848	10.25158
	CaF_2	1.3923	10.14373
	$Ca(HCO_3)_2$	2.8908	10.46102
	$Ca_3(PO_4)_2$	1.8438	10.26571
	$CaSO_4$	2.4276	10.38518
	$CaSO_4 \cdot 2H_2O$	3.0701	10.48716
	Cl	1.2645	10.10192
	CO_2	0.78477	9.89474
	MgO	0.71897	9.85671
	SO_3	1.4276	10.15461
$Ca_3(PO_4)_2$	CaO	0.54236	9.73429
	$CaSO_4$	1.3166	10.11947
	$Mg_2P_2O_7$	0.71760	9.85588
	$(NH_4)_3PO_4 \cdot 12MoO_3$	12.099	11.08274
	P_2O_5	0.45764	9.66052

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Calcium:			−10
CaS	$BaSO_4$...	3.2357	10 50996
$CaSO_4$	$BaSO_4$..	1 7146	10 23415
	Ca	0 29440	9 46894
	$CaCl_2$	0 81529	9 91131
	$CaCO_3$.	0.73520	9 86640
	CaF_2 ..	0 57353	9 75855
	CaO .	0 41193	9 61482
	$Ca_3(PO_4)_2$.	0 75951	9 88053
	SO_3 ..	0 58807	9 76943
$CaSO_4$ $2H_2O$	$BaSO_4$...	1 3557	10 13217
	$CaCO_3$	0 58134	9.76443
	CaO....	0 32572	9 51284
	SO_3 ..	0 46500	9 66745
$CaWO_4$	WO_3 .	0 80528	9 90595
Cl .	Ca	0 56519	9 75220
	$CaCl_2$	1 5652	10 19457
	CaO .	0 79082	9 89808
CO_2 .	$CaCO_3$	2 2743	10 35684
	CaO .	1 2743	10 10526
HCl	$CaCO_3$	1 3724	10 13748
$Mg_2As_2O_7$	$Ca_3(AsO_4)_2$	1 2822	10 10794
MgO	CaO	1 3909	10 14329
$Mg_2P_2O_7$	$Ca_3(PO_4)_2$.	1 3935	10.14412
$(NH_4)_3$ PO_4. $12MoO_3$	$Ca_3(PO_4)_2$	0 082654	8 91726
N_2O_5	$Ca(NO_3)_2$	1 5192	10 18161
P_2O_5	$Ca_3(PO_4)_2$	2 1851	10 33948
SO_3.	CaO	0 70047	9 84539
	$CaSO_4$	1 7005	10 23057
	$CaSO_4.2H_2O$	2 1505	10 33255
WO_3	$CaWO_4$..	1.2418	10 09405
Carbon: C= 12.01			
Ag	CN	0 24118	9 38233
	HCN .	0 25052	9.39884
	KCN . .	0 60358	9 78073
AgCN	CN. .	0 19431	9 28850
	HCN..	0 20184	9 30501
	KCN.	0.48630	9 68690
AgCNS	CNS .	0 34996	9 54401
$BaCO_3$	C ...	0 060850	8 78426
	CO_2......	0 22298	9 34827
	CO_2 . ..	0.30405	9 48294
BaO .	CO_2 .	0 28697	9.45784
	CO_2, bicarbonate	0 57394	9 75887
$BaSO_4$	CNS . .	0 24881	9 39587
C	$BaCO_3$.	16 434	11 21574
	CO_2	3 6644	10 56401
$CaCO_3$	CO_2.....	0 43970	9 64316
Ca $(HCO_3)_2$	CO_2	0 54294	9 73475
CaO ..	CO_2 ..	0 78477	9 89474
	CO_2, bicarbonate	1 5695	10 19577
CN	Ag	4 1464	10 61767
	AgCN .	5.1464	10 71150
CNS .	AgCNS .	2.8575	10.45599
	$BaSO_4$.... ..	4.0191	10 60413

Weighed	Sought	Factor	Logarithm
Carbon:			−10
CNS... .	CuCNS	2 0946	10.32109
CO_2.	$BaCO_3$.	4 4847	10.65173
	$Ba(HCO_3)_2$	2 9470	10.46938
	BaO	3.4847	10 54216
	C	0.27289	9.43599
	$CaCO_3$	2 2743	10 35684
	$Ca(HCO_3)_2$	1 8418	10 26525
	CaO .	1.2743	10.10526
	CO_3	1 3636	10.13467
	Cs_2CO_3	7 4035	10.86944
	$CsHCO_3$	4 4065	10.64409
	$FeCO_3$	2 6324	10.42034
	$Fe(HCO_3)_2$	2 0209	10.30554
	K_2CO_3..	3 1402	10 49696
	$KHCO_3$	2 2748	10 35694
	K_2O	2 1402	10.33046
	Li_2CO_3	1 6789	10 22503
	$LiHCO_3$.	1 5442	10 18869
	Li_2O	0 67894	9.83183
	$MgCO_3$	1 9162	10 28243
	$Mg(HCO_3)_2$	1 6628	10.22083
	MgO	0 91616	9 96197
	$MnCO_3$	2 6117	10 41692
	$Mn(HCO_3)_2$.	2 0105	10 30331
	MnO	1 6117	10 20728
	Na_2CO_3	2 4086	10 38177
	$NaHCO_3$	1 9090	10 28081
	Na_2O .	1 4086	10 14880
	$(NH_4)_2CO_3$	2 1834	10 33913
	NH_4HCO_3	1 7964	10 25440
	$PbCO_3$	6 0718	10 78332
	Rb_2CO_3	5 2481	10 72000
	$RbHCO_3$	3 3287	10.52228
	Rb_2O	4 2481	10 62820
	$SrCO_3$	3.3547	10 52565
	$Sr(HCO_3)_2$	2 3820	10 37695
	SrO	2 3547	10 37193
CO_3.	$BaCO_3$	3 2890	10 51706
	CO_2 .	0 73338	9 86533
Cs_2CO_3	CO_2 .	0 13507	9 13056
$CsHCO_3$	CO_2	0 22694	9 35591
CuCNS	CNS	0 47743	9 67891
$FeCO_3$	CO_2 .	0 37989	9 57966
Fe $(HCO_3)_2$	CO_2.	0.49484	9 69446
HCN..	Ag	3 9917	10 60116
	AgCN	4 9544	10 69499
KCN	Ag .	1 6568	10 21927
	AgCN	2 0564	10 31310
K_2CO_3	CO_2. ..	0 31845	9.50304
$KHCO_3$	CO_2. . . .	0.43960	9 64306
K_2O	CO_2.	0.46724	9 66954
Li_2CO_3.	CO_2 ...	0 59562	9 77497
$LiHCO_3$.	CO_2 .	0 64760	9 81131
Li_2O	CO_2 ...	1 4729	10 16817
$MgCO_3$..	CO_2..... .	0.52188	9 71757
Mg $(HCO_3)_2$	CO_2	0.60141	9 77917
MgO.	CO_2....	1.0915	10 03803
$MnCO_3$	CO_2..... ..	0.88290	9 58308

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm	Weighed	Sought	Factor	Logarithm
Carbon:			−10	Cesium:			−10
Mn				Cs=			
$(HCO_3)_2$	CO_2	0.49738	9.69669	132.91			
MnO	CO_2	0 62047	9 79272	AgCl	CsCl	1 1746	10 06990
Na_2CO_3	CO_2	0.41517	9 61823	Cl	Cs	3.7485	10 57386
$NaHCO_3$	CO_2	0 52383	9 71919		CsCl	4.7485	10 67655
Na_2O	CO_2	0.70991	9 85120	Cs	Cl	0.26677	9 42614
$(NH_4)_2$.					CsCl	1 2668	10 10270
CO_3	CO_2	0 45800	9 66087		Cs_2CO_3	1 2258	10 08840
NH_4					Cs_2O	1 0602	10 02538
HCO_3	CO_2	0 55668	9 74560		Cs_2PtCl_6	2 5348	10 40394
$PbCO_3$	CO_2	0 16470	9 21668		Cs_2SO_4	1.3614	10 13398
Rb_2CO_3	CO_2	0 19054	9 28000	CsCl	AgCl	0 85134	9 93010
$RbHCO_3$	CO_2	0 30041	9 47772		Cl	0 21059	9 32345
Rb_2O	CO_2	0.23540	9 37180		Cs	0 78941	9 89730
$SrCO_3$	CO_2	0 29809	9.47435		Cs_2O	0.83692	9 92268
Sr					Cs_2PtCl_6	2 0010	10 30124
$(HCO_3)_2$	CO_2	0.41981	9.62305		Cs_2SO_4	1 0747	10 03128
SrO	CO_2	0.42468	9.62807	Cs_2CO_3	Cs	0 81582	9 91160
Cerium:					Cs_2PtCl_6	2 0679	10 31553
Ce=					Cs_2SO_4	1 1106	10 04557
140.13				Cs_2O	Cs	0.94323	9 97462
Ce	$Ce_2(C_2O_4)_3$.				CsCl	1.1949	10 07732
	$3H_2O$	2.1350	10 32941		Cs_2PtCl_6	2 3909	10 37855
	$Ce(NO_3)_4$	2.7700	10 44248		Cs_2SO_4	1.2841	10.10859
	$Ce(NO_3)_4$.				SO_3	0 28408	9 45344
	$(NH_4NO_3)_2$.			Cs_2PtCl_6	Cs	0 39451	9 59606
	H_2O	4 0411	10 60650		CsCl	0 49976	9 69876
	CeO_2	1 2284	10 08933		Cs_2CO_3	0 48358	9 68447
	Ce_2O_3.	1 1713	10 06866		Cs_2O	0 41826	9.62145
	$Ce_2(SO_4)_3$	2 0283	10.30712	Cs_2SO_4	Cs	0 73455	9 86602
Ce_2.					CsCl	0 93051	9 96872
$(C_2O_4)_3$.					Cs_2CO_3	0 90038	9 95443
$3H_2O$	Ce	0 46837	9 67059		Cs_2O	0 77877	9 89141
	$Ce_2(SO_4)_3$	0.94908	9 97772	SO_3	Cs_2O	3.5201	10 54656
$Ce(NO_3)_4$	Ce	0 36101	9 55752	Chlorine:			
	CeO_2	0 44345	9 64684	Cl=			
	Ce_2O_3	0 42284	9 62617	35.457			
$Ce(NO_3)_4$				Ag	Cl	0.32867	9 51676
$(NH_4$					HCl	0 33802	9 52894
$NO_3)_2$.				AgCl	Cl	0.24737	9.39334
H_2O	Ce	0 24746	9 39350		ClO_3	0 58224	9 76510
	CeO_2	0 30397	9 48283		ClO_4	0 69387	9 84128
	Ce_2O_3.	0 28984	9 46216		HCl	0 25440	9 40552
CeO_2	Ce	0 81409	9 91067	$BaCrO_4$	Cl	0.27988	9 44698
	$Ce(NO_3)_4$	2 2551	10 35316	Ca	Cl	1 7693	10 24780
	$Ce(NO_3)_4$.			Cl	Ag	3 0426	10 48324
	$(NH_4NO_3)_2$				AgCl	4 0426	10 60666
	H_2O	3 2898	10 51717		$BaCrO_4$	3 5729	10 55302
	Ce_2O_3	0 95352	9 97933		Ca	0 56519	9 75220
Ce_2O_3	Ce	0 85377	9 93134		HCl	1 0284	10 01218
	$Ce(NO_3)_4$	2 3650	10 37383		K	1 1026	10 04243
	$Ce(NO_3)_4$				KCl	2 1026	10 32276
	$(NH_4NO_3)_2$				Li	0 19573	9 29166
	H_2O	3 4502	10 53784		Mg	0 34295	9 53523
	CeO_2.	1 0487	10 02067		$MgCl_2$	1 3430	10.12806
	$Ce_2(SO_4)_3$	1 7317	10 23847		MnO_2	1 2259	10 08844
$Ce_2(SO_4)_3$	Ce	0 49303	9 69288		Na	0.64859	9 81197
	$Ce_2(C_2O_4)_3$.				NaCl	1 6486	10 21711
	$3H_2O$	1 0527	10 02228		NH_4	0 50880	9 70654
	Ce_2O_3	0 57748	9 76153		$PbCrO_4$	4 5579	10 65877
				ClO_3	AgCl	1 7175	10 23490

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Chlorine:			−10
ClO_3	KCl	0.89331	9.95100
	NaCl	0.70041	9 84535
ClO_4	AgCl	1.4412	10 15872
	KCl	0 74960	9 87483
	NaCl	0.58773	9 76918
HCl	Ag	2.9584	10 47106
	AgCl	3.9308	10 59448
	NH_4Cl	1 4671	10 16646
	$(NH_4)_2SO_4$	1.8119	10.25813
K	Cl	0 90692	9.95757
KCl	Cl	0 47559	9.67724
	ClO_3	1 1194	10.04900
	ClO_4	1 3340	10 12517
Li	Cl	5 1091	10 70834
Mg	Cl	2.9159	10.46477
$MgCl_2$	Cl	0.74463	9 87194
MnO_2	Cl	0.81576	9.91156
Na	Cl	1 5418	10 18803
NaCl	Cl	0 60658	9 78289
	ClO_3	1 4277	10 15465
	ClO_4	1 7015	10 23082
NH_4	Cl	1 9654	10 29346
NH_4Cl	HCl	0.68162	9 83354
$(NH_4)_2SO_4$	HCl	0 55191	9 74187
$PbCrO_4$	Cl	0 21940	9 34123
Chromium: Cr= 52.01			
$BaCrO_4$	Cr	0.20527	9 31233
	CrO_3	0.39472	9 59629
	CrO_4	0 45787	9.66074
	Cr_2O_3	0 30000	9 47712
	$Cr_2(SO_4)_3.18H_2O$	1 4139	10 15043
Cr	$BaCrO_4$	4 8716	10 68767
	Cr_2O_3	1 4614	10.16478
	$PbCrO_4$	6.2146	10 79341
CrO_3	$BaCrO_4$	2 5334	10 40371
	Cr_2O_3	0.76002	9 88083
	K_2CrO_4	1.9418	10 28821
	$K_2Cr_2O_7$	1 4709	10 16759
	$PbCrO_4$	3 2319	10 50945
CrO_4	$BaCrO_4$	2 1840	10 33926
	$PbCrO_4$	2 7861	10 44500
Cr_2O_3	$BaCrO_4$	3 3334	10.52288
	Cr	0 68425	9 83522
	CrO_3	1.3157	10.11917
	CrO_4	1 5262	10 18362
	$PbCrO_4$	4 2523	10.62863
$Cr_2(SO_4)_3$ $18H_2O$	$BaCrO_4$	0.70725	9 84957
	$PbCrO_4$	0 90223	9.95532
K_2CrO_4	CrO_3	0 51498	9 71179
	$PbCrO_4$	1 6643	10 22124
$K_2Cr_2O_7$	CrO_3	0.67985	9.83241
	$PbCrO_4$	2 1972	10.34187
$PbCrO_4$	Cr	0.16091	9 20659
	CrO_3	0.30942	9.49055
	CrO_4	0 35892	9 55500
	Cr_2O_3	0 23516	9.37137

Weighed	Sought	Factor	Logarithm
Chromium:			−10
$PbCrO_4$	$Cr_2(SO_4)_3.18H_2O$	1 1084	10 04468
	K_2CrO_4	0.60084	9 77876
	$K_2Cr_2O_7$	0.45513	9 65813
Cobalt: Co= 58.94			
Co	$Co(NO_3)_2.6H_2O$	4.9381	10.69356
	$Co(NO_2)_3.(KNO_2)_3$	7.6735	10.88499
	CoO	1 2715	10 10430
	Co_3O_4	1.3620	10 13416
	$CoSO_4$	2 6298	10 41992
	$CoSO_4.7H_2O$	4 7695	10.67847
	$(CoSO_4)_2(K_2SO_4)_3$	7 0644	10 84908
$Co(NO_3)_2$ $6H_2O$	Co	0.20251	9 30644
$Co(NO_2)_3$ $(KNO_2)_3$	Co	0 13032	9 11501
	CoO	0 16570	9 21931
CoO	Co	0 78650	9 89570
	$Co(NO_2)_3$ $(KNO_2)_3$	6 0352	10 78069
	Co_3O_4	1 0712	10 02986
	$CoSO_4$	2 0683	10.31562
	$(CoSO_4)_2.(K_2SO_4)_3$	5 5562	10 74477
Co_3O_4	Co	0 73424	9 86584
	CoO	0 93356	9 97014
$CoSO_4$	Co	0 38026	9 58008
	CoO	0.48348	9 68438
$CoSO_4$. $7H_2O$	Co	0 20967	9 32153
	CoO	0.26658	9 42583
$(CoSO_4)_2$. $(K_2SO_4)_3$	Co	0 14155	9 15092
	CoO	0.17998	9 25523
Columbium (niobium) Cb= 92 91			
Cb	Cb_2O_5	1 4305	10 15550
Cb_2O_5	Cb	0 69904	9 84450
Copper: Cu=63 57			
Cu	$Cu_2C_2H_3O_2.(AsO_2)_3$	3 9871	10 60065
	CuCNS	1.9136	10 28185
	CuO	1 2517	10 09750
	Cu_2O	1 1258	10 05148
	Cu_2S	1.2522	10 09766
	$CuSO_4.5H_2O$	3.9281	10 59419
$Cu_2C_2H_3O_2$. $(AsO_2)_3$	Cu	0.25081	9 39935
	$Mg_2As_2O_7$	0.91868	9.96316
CuCNS	Cu	0.52257	9 71815

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm	Weighed	Sought	Factor	Logarithm
Copper:			−10	Fluorine:			−10
CuCNS	CuO	0.65410	9.81564	K_2SiF_6	H_2SiF_6	0.65414	9.81567
CuO	Cu	0.79892	9.90250		KF	0.52754	9.72226
	CuCNS	1.5288	10.18436		SiF_6	0.64499	9.80955
	Cu_2S	1.0004	10.00016	SiF_4	$BaSiF_6$	2.6852	10.42897
	$CuSO_4\cdot$				H_2SiF_6	1.3845	10.14131
	$5H_2O$	3.1383	10.49669	SiF_6	$BaSiF_6$	1.9669	10.29379
Cu_2O	Cu	0.88822	9.94852		CaF_2	1.6489	10.21719
	Cu_2S	1.1122	10.04618		H_2SiF_6	1.0142	10.00612
Cu_2S	Cu	0.79862	9.90234		K_2SiF_6	1.5504	10.19045
	CuO	0.99962	9.99984	Gallium:			
	Cu_2O	0.89912	9.95382	Ga=			
	$CuSO_4\cdot$			69.72			
	$5H_2O$	3.1371	10.49652	Ga	Ga_2O_3	1.3442	10.12847
$CuSO_4\cdot$					Ga_2S_3	1.6898	10.22782
$5H_2O$	Cu	0.25457	9.40581	Ga_2O_3	Ga	0.74392	9.87153
	CuO	0.31865	9.50331	Ga_2S_3	Ga	0.59180	9.77218
	Cu_2S	0.31877	9.50348	Germanium:			
$Mg_2As_2O_7$	$Cu_2C_2H_3O_2\cdot$			Ge=			
	$(AsO_2)_3$	1.0885	10.03684	72.60			
Erbium:				Ge	GeO_2	1.4408	10.15860
Er=					K_2GeF_6	3.6473	10.56197
167.2				GeO_2	Ge	0.69407	9.84140
Er	Er_2O_3	1.1435	10.05825	K_2GeF_6	Ge	0.27418	9.43803
Er_2O_3	Er	0.87448	9.94175	Gold:			
Fluorine:				Au=			
F=19.000				197.2			
BaF_2	$BaSiF_6$	1.5934	10.20233	Au	$AuCl_3$	1.5394	10.18735
$BaSiF_6$	BaF_2	0.62759	9.79767		$HAuCl_4\cdot$		
	F	0.40799	9.61065		$4H_2O$	2.0898	10.32010
	HF	0.42963	9.63310		$KAu(CN)_4\cdot$		
	H_2SiF_6	0.51563	9.71233		H_2O	1.8174	10.25944
	SiF_4	0.37241	9.57103	$AuCl_3$	Au	0.64960	9.81265
	SiF_6	0.50841	9.70621	$HAuCl_4\cdot$			
CaF_2	F	0.48668	9.68724	$4H_2O$	Au	0.47852	9.67990
	HF	0.51250	9.70970	$KAu(CN)_4\cdot$			
	H_2SiF_6	0.61508	9.78893	H_2O	Au	0.55025	9.74056
	SiF_6	0.60647	9.78281	Hydrogen:			
$CaSO_4$	F	0.27912	9.44580	H=			
	HF	0.29393	9.46825	1.0081			
F	$BaSiF_6$	2.4511	10.38935	AgCNS	HCNS	0.35603	9.55149
	CaF_2	2.0547	10.31276	$BaSO_4$	HCNS	0.25313	9.40335
	$CaSO_4$	3.5826	10.55420	CuCNS	HCNS	0.48571	9.68638
	H_2SiF_6	1.2638	10.10169	H	H_2O	8.9357	10.95113
	K_2SiF_6	1.9320	10.28602		O	7.9357	10.89959
HF	$BaSiF_6$	2.3276	10.36690	HCNS	AgCNS	2.8087	10.44851
	CaF_2	1.9512	10.29030		$BaSO_4$	3.9505	10.59665
	$CaSO_4$	3.4021	10.53175		CuCNS	2.0588	10.31362
	K_2SiF_6	1.8347	10.26356	H_2O	H	0.11191	9.04887
2HF	H_2SiF_6	3.6004	10.55636	O	H	0.12601	9.10041
6HF	H_2SiF_6	1.2001	10.07924	Indium:			
H_2SiF_6	$BaSiF_6$	1.9394	10.28767	In=			
	CaF_2	1.6258	10.21107	114.76			
	F	0.79125	9.89831	In	In_2O_3	1.2091	10.08247
	2HF	0.27774	9.44364		In_2S_3	1.4190	10.15200
	6HF	0.83323	9.92076	In_2O_3	In	0.82704	9.91753
	K_2SiF_6	1.5287	10.18433	In_2S_3	In	0.70470	9.84800
	SiF_4	0.72226	9.85869	Iodine:			
	SiF_6	0.98601	9.99388	I=126.92			
KF	K_2SiF_6	1.8956	10.27774	Ag	HI	1.1858	10.07402
K_2SiF_6	F	0.51759	9.71398		I	1.1765	10.07059
	HF	0.54505	9.73644	AgCl	I	0.88547	9.94717

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Iodine:			−10
AgI...	HI	0.54484	9.73627
	I	0.54055	9.73283
	IO_3	0.74497	9.87214
	IO_4	0.81312	9.91015
	I_2O_5	0.71090	9.85181
	I_2O_7	0.77905	9.89156
HI..	Ag	0.84329	9.92598
	AgI	1.8354	10.26373
	Pd	0.41703	9.62017
	PdI_2	1.4092	10.14896
	TlI	2.5898	10.41327
I	Ag	0.84998	9.92941
	AgCl	1.1293	10.05283
	AgI	1.8500	10.26717
	Pd	0.42034	9.62360
	PdI_2	1.4203	10.15239
	TlI	2.6104	10.41670
IO_3	AgI	1.3423	10.12786
	PdI_2	1.0306	10.01308
	TlI	1.8941	10.27740
IO_4	AgI	1.2298	10.08985
	PdI_2	0.94422	9.97507
	TlI	1.7353	10.23938
I_2O_5	AgI	1.4067	10.14819
	PdI_2	1.0800	10.03342
	TlI	1.9848	10.29773
I_2O_7	AgI	1.2836	10.10844
	PdI_2	0.98551	9.99366
	TlI	1.8112	10.25797
Pd..	HI	2.3979	10.37983
	I	2.3790	10.37640
PdI_2	HI	0.70965	9.85104
	I	0.70406	9.84761
	IO_3	0.97032	9.98692
	IO_4	1.0591	10.02493
	I_2O_5	0.92594	9.96658
	I_2O_7	1.0147	10.00634
TlI	HI	0.38613	9.58673
	I	0.38309	9.58330
	IO_3	0.52796	9.72260
	IO_4	0.57626	9.76062
	I_2O_5	0.50382	9.70227
	I_2O_7	0.55211	9.74203
Iron: Fe = 55.84			
Ag	$Fe_7(CN)_{18}$, prussian blue	0.44247	9.64588
CN	$Fe_7(CN)_{18}$	1.8346	10.26355
CO_2	$FeCO_3$	2.6324	10.42034
	$Fe(HCO_3)_2$	2.0209	10.30554
	FeO	1.6324	10.21281
Fe	$Fe(HCO_3)_2$	3.1855	10.50317
	FeO	1.2865	10.10942
	Fe_2O_3	1.4298	10.15528
	$FePO_4$	2.7009	10.43151
	FeS	1.5741	10.19704
	$FeSO_4$	2.7203	10.43461
	$FeSO_4.7H_2O$	4.9788	10.69712
	$FeSO_4(NH_4)_2SO_4.6H_2O$	7.0225	10.84649
$FeAsO_4$	$Mg_2As_2O_7$	0.79707	9.90150

Weighed	Sought	Factor	Logarithm
Iron:			−10
$FeCl_3$	Fe_2O_3	0.49220	9.69214
$Fe_7(CN)_{18}$, prussian blue	Ag	2.2600	10.35412
	CN	0.54507	9.73645
$FeCO_3$	CO_2	0.37989	9.57966
	FeO	0.62011	9.79247
	Fe_2O_3	0.68917	9.83832
$Fe(HCO_3)_2$	CO_2	0.49484	9.69446
	Fe	0.31393	9.49683
	FeO	0.40388	9.60625
	Fe_2O_3	0.44885	9.65210
FeO	CO_2	0.61261	9.78719
	Fe	0.77728	9.89058
	$FeCO_3$	1.6126	10.20753
	$Fe(HCO_3)_2$	2.4760	10.39375
	Fe_2O_3	1.1114	10.04585
	$FePO_4$	2.0994	10.32209
	FeS	1.2236	10.08762
	SO_3	1.1144	10.04705
Fe_2O_3	Fe	0.69940	9.84472
	$FeCl_3$	2.0317	10.30786
	$FeCO_3$	1.4510	10.16168
	$Fe(HCO_3)_2$	2.2279	10.34790
	$Fe(HCO_3)_3$	2.9922	10.47599
	FeO	0.89980	9.95415
	Fe_3O_4	0.96660	9.98525
	$FePO_4$	1.8890	10.27624
	FeS	1.1010	10.04177
	$FeSO_4$	1.9026	10.27934
	$FeSO_4.7H_2O$	3.4821	10.54185
	$FeSO_4.(NH_4)_2SO_4$ $6H_2O$	4.9115	10.69122
	$Fe_2(SO_4)_3$	2.5041	10.39866
Fe_3O_4	Fe_2O_3	1.0346	10.01475
$FePO_4$	Fe	0.37024	9.56849
	FeO	0.47633	9.67791
	Fe_2O_3	0.52805	9.72267
FeS..	Fe	0.63527	9.80296
	FeO	0.81729	9.91238
	Fe_2O_3	0.90830	9.95823
$FeSO_4$	Fe	0.36761	9.56539
	Fe_2O_3	0.52561	9.72066
	SO_3	0.52706	9.72186
$FeSO_4$ $7H_2O$	Fe	0.20085	9.30288
	Fe_2O_3	0.28718	9.45815
$FeSO_4$ $(NH_4)_2$ $SO_4.$ $6H_2O$	Fe	0.14240	9.15351
	Fe_2O_3	0.20360	9.30878
$Fe_2(SO_4)_3$	Fe_2O_3	0.39934	9.60134
$Mg_2As_2O_7$	$FeAsO_4$	1.2546	10.09850
SO_3	FeO	0.89733	9.95295
	$FeSO_4$	1.8973	10.27814
Lanthanum: La = 138.92			
La	La_2O_3	1.1728	10.06921

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Lanthanum:			−10
La_2O_3	La	0.85269	9.93079
Lead: Pb= 207.21			
$BaSO_4$	$PbSO_4$	1 2992	10 11369
Pb	$PbCl_2$	1 3422	10 12783
	$PbCO_3$.	1 2896	10 11046
	$(PbCO_3)_2.Pb(OH)_2$.	1 2478	10 09614
	$PbCrO_4$	1 5599	10 19309
	PbO	1 0772	10 03230
	PbO_2	1 1544	10 06237
	$Pb(OH)_2$	1 1642	10 06601
	PbS	1 1547	10 06248
	$PbSO_4$ . .	1 4636	10 16542
$Pb(C_2H_3O_2)_2.3H_2O$	$PbCrO_4$	0 85204	9 93046
	$PbSO_4$	0 79945	9 90279
$PbCl_2$	Pb	0 74503	9 87217
	PbO	0 80256	9 90448
$PbCO_3$	Pb .	0 77543	9 88954
	PbO . . .	0 83530	9 92184
	$PbSO_4$	1 1349	10 05496
$(PbCO_3)_2.Pb(OH)_2$	Pb . . .	0 80141	9 90386
	$PbCrO_4$	1 2501	10 09694
	$PbSO_4$	1 1729	10 06928
$PbCrO_4$	Pb	0 64108	9 80691
	$Pb(C_2H_3O_2)_2.3H_2O$	1 1737	10 06954
	$(PbCO_3)_2.Pb(OH)_2$	0 79994	9 90306
	PbO	0 69058	9 83922
	Pb_3O_4 .	0 70708	9 84947
	$PbSO_4$.	0 93828	9 97233
$Pb(NO_3)_2$	PbO	0 67389	9 82859
	PbO_2	0 72220	9 85865
	$PbSO_4$	0 91560	9 96171
PbO	Pb	0 92832	9 96770
	$PbCl_2$	1.2460	10 09552
	$PbCO_3$	1.1972	10 07816
	$PbCrO_4$	1 4481	10 16078
	$Pb(NO_3)_2$ . .	1 4839	10 17141
	PbO_2 . .	1 0717	10.03007
	PbS .	1.0720	10 03017
	$PbSO_4$	1 3587	10.13312
PbO_2	Pb	0 86623	9 93763
	$Pb(NO_3)_2$	1 3847	10.14135
	PbO . .	0 93311	9 96993
	$PbSO_4$ . .	1 2678	10 10305
Pb_3O_4	$PbCrO_4$.	1 4143	10 15053
	$PbSO_4$.	1 3270	10.12286
$Pb(OH)_2$	Pb	0.85899	9 93399
PbS . .	Pb	0 86601	9 93752
	PbO . . .	0.93288	9 96983
	$PbSO_4$	1 2675	10.10294
$PbSO_4$.	$BaSO_4$ . .	0 76968	9 88631
	Pb . .	0.68325	9 83458
	$Pb(C_2H_3O_2)_2.3H_2O$ . . .	1.2509	10 09721
	$PbCO_3$.	0.88113	9 94504
Lead:			−10
$PbSO_4$.	$(PbCO_3)_2.Pb(OH)_2$.	0 85256	9 93072
	$PbCrO_4$.	1 0658	10 02767
	$Pb(NO_3)_2$ . .	1 0922	10 03829
	PbO . .	0 73601	9 86688
	PbO_2.	0.78877	9 89696
	Pb_3O_4	0 75360	9 87714
	PbS . .	0 78897	9 89706
Lithium: Li=6 940			
CO_2	Li_2CO_3 .	1 6789	10 22503
	$LiHCO_3$	1 5442	10 18869
	Li_2O	0 67894	9 83183
Li . .	LiCl	6 1091	10 78598
	Li_2CO_3	5 3235	10 72620
	Li_2O	2 1527	10 33290
	Li_3PO_4	5 5620	10 74523
	Li_2SO_4	7 9207	10 89877
LiCl . . .	Li	0 16369	9 21402
	Li_2CO_3	0 87141	9 94022
	Li_2O	0 35238	9 54702
	Li_3PO_4	0 91044	9 95925
	Li_2SO_4	1.2966	10 11279
Li_2CO_3.	CO_2 . .	0 59562	9 77497
	Li .	0 18785	9 27380
	LiCl . .	1 1476	10 05978
	$LiHCO_3$	1 8394	10 26469
	Li_2O	0 40438	9 60679
	Li_3PO_4	1 0448	10 01903
$LiHCO_3$.	CO_2 . .	0 64760	9 81131
	Li_2CO_3	0 54364	9 73531
	Li_2O	0 21984	9 34211
	Li_3PO_4	0 56800	9 75435
Li_2O .	CO_2 . .	1 4729	10 16817
	Li	0 46452	9 66701
	LiCl	2 8378	10 45298
	Li_2CO_3	2 4729	10 39321
	$LiHCO_3$	4 5487	10 65789
	Li_3PO_4	2 5837	10 41224
	Li_2SO_4.	3 6794	10 56578
	SO_3	2 6794	10 42803
Li_3PO_4.	Li	0 17979	9 25477
	LiCl	1 0984	10 04075
	Li_2CO_3	0 95712	9 98097
	$LiHCO_3$	1 7606	10 24565
	Li_2O	0 38705	9 58776
	Li_2SO_4	1 4241	10 15354
	$Li_2SO_4.H_2O$	1 6575	10 21944
Li_2SO_4	Li	0 12625	9 10123
	LiCl .	0 77128	9 88721
	Li_2O	0 27178	9 43422
	Li_3PO_4	0 70220	9 84646
	SO_3 .	0 72822	9 86226
$Li_2SO_4.H_2O$	Li_3PO_4	0 60333	9 78056
SO_3 . . .	Li_2O	0 37322	9 57197
	Li_2SO_4	1.3732	10 13774
Magnesium: Mg= 24.32			
$BaSO_4$. .	$MgSO_4$	0 51572	9 71242
	$MgSO_4.7H_2O$.	1 0560	10.02367

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Magnesium:			−10
Br	Mg	0 15216	9 18230
	$MgBr_2$	1 1522	10 06151
	$MgBr_2.6H_2O$	1 8285	10 26209
Cl	Mg	0.34295	9 53523
	$MgCl_2$	1 3430	10 12806
	$MgCl_2.6H_2O$	2 8673	10.45747
CO_2	$MgCO_3$	1 9162	10 28243
	MgO	0 91616	9 96197
I	Mg	0 095808	8 98140
	MgI_2	1 0958	10 03973
Mg	Br	6 5720	10 81770
	Cl	2 9159	10 46477
	I	10 438	11 01860
	$MgCO_3$	3 4675	10 54002
	MgO	1 6579	10 21956
	$Mg_2P_2O_7$	4 5765	10 66053
	$MgSO_4$	4 9498	10 69459
$MgBr_2$	Br	0 86794	9 93849
$MgBr_2.6H_2O$	Br	0 54690	9 73791
$MgCl_2$	Cl	0 74463	9 87194
	$Mg_2P_2O_7$	1.1687	10.06770
$MgCl_2.6H_2O$	Cl	0 34876	9 54253
	$Mg_2P_2O_7$	0 54738	9 73829
$MgCl_2.KCl.6H_2O$	$Mg_2P_2O_7$	0 40053	9 60263
$MgCO_3$	CO_2	0 52188	9 71757
	Mg	0 28839	9.45998
	$Mg(HCO_3)_2$	1 7355	10 23943
	MgO	0 47812	9 67954
	$Mg_2P_2O_7$	1 3198	10 12051
$Mg(HCO_3)_2$	$MgCO_3$	0 57620	9 76057
	MgO	0 27549	9.44011
	$Mg_2P_2O_7$	0 76047	9 88108
MgI_2	I	0 91257	9 96027
MgO	CO_2	1 0915	10 03803
	Mg	0.60317	9.78044
	$MgCO_3$	2 0915	10 32046
	$Mg(HCO_3)_2$	3 6299	10 55989
	$Mg_2P_2O_7$	2.7604	10 44097
	$MgSO_4$	2.9856	10.47503
	SO_3	1.9856	10.29790
$Mg_2P_2O_7$	Mg	0.21851	9 33947
	$MgCl_2$	0 85565	9 93230
	$MgCl_2.6H_2O$	1.8269	10.26171
	$MgCl_2.KCl.6H_2O$	2 4967	10 39737
	$MgCO_3$	0.75768	9 87949
	$Mg(HCO_3)_2$	1 3150	10.11892
	MgO	0.36226	9.55903
	$MgSO_4$	1 0816	10 03406
	$MgSO_4.7H_2O$	2.2147	10 34531
$MgSO_4$	$BaSO_4$	1 9390	10 28758
	Mg	0 20203	9.30541
	MgO	0.33494	9 52497
	$Mg_2P_2O_7$	0 92457	9.96594
	SO_3	0 66506	9 82286
$MgSO_4.7H_2O$	$BaSO_4$	0 94696	9 97633

Weighed	Sought	Factor	Logarithm
Magnesium:			−10
$MgSO_4.7H_2O$	$Mg_2P_2O_7$	0.45153	9 65469
	SO_3	0 32480	9.51161
SO_3	MgO	0.50362	9.70210
	$MgSO_4$	1.5036	10.17714
	$MgSO_4.7H_2O$	3.0789	10.48839
Manganese: Mn = 54.93			
$BaSO_4$	$MnSO_4$	0.64686	9.81081
CO_2	$MnCO_3$	2.6117	10 41692
	MnO	1 6117	10 20728
Mn	$MnCO_3$	2.0925	10.32066
	MnO	1.2913	10.11102
	Mn_2O_3	1 4369	10 15743
	Mn_3O_4	1.3884	10 14251
	$Mn_2P_2O_7$	2.5835	10.41220
$MnCO_3$	CO_2	0.38290	9 58308
	Mn	0.47790	9 67934
	$Mn(HCO_3)_2$	1.5396	10 18742
	MnO	0 61710	9.79036
	Mn_3O_4	0.66351	9.82184
	$Mn_2P_2O_7$	1 2346	10 09154
	MnS	0 75683	9 87900
	$MnSO_4$	1.3136	10.11845
$Mn(HCO_3)_2$	$MnCO_3$	0.64950	9.81258
	MnO	0 40081	9.60294
	Mn_3O_4	0 43095	9.63443
MnO	CO_2	0 62047	9.79272
	Mn	0.77443	9.88898
	$MnCO_3$	1.6205	10 20964
	$Mn(HCO_3)_2$	2 4949	10 39706
	Mn_2O_3	1.1128	10 04641
	Mn_3O_4	1.0752	10.03149
	$Mn_2P_2O_7$	2.0007	10 30118
	MnS	1 2264	10 08864
	$MnSO_4$	2.1287	10 32812
	SO_3	1.1287	10.05259
MnO_2	Mn_3O_4	0.87730	9 94315
	$Mn_2P_2O_7$	1 6325	10 21284
Mn_2O_3	Mn	0 69593	9 84257
	MnO	0.89864	9.95359
	Mn_3O_4	0.96621	9 98507
Mn_3O_4	Mn	0.72027	9 85749
	$MnCO_3$	1 5071	10.17816
	$Mn(HCO_3)_2$	2 3205	10.36557
	MnO	0.93007	9 96851
	MnO_2	1 1399	10 05685
	Mn_2O_3	1 0350	10.01493
	$MnSO_4$	1 9799	10 29663
$Mn_2P_2O_7$	Mn	0 38708	9 58780
	$MnCO_3$	0.80995	9.90846
	MnO	0.49982	9.69882
	MnO_2	0 61257	9.78716
	$MnSO_4$	1.0640	10 02694
MnS	Mn	0.63145	9 80034
	$MnCO_3$	1.3213	10.12100
	MnO	0.81538	9.91136
	$MnSO_4$	1 7357	10 23948
$MnSO_4$	$BaSO_4$	1.5459	10.18919
	Mn	0.36380	9 56086

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Manganese:			−10
$MnSO_4$	MnO	0.46977	9.67188
	Mn_3O_4	0.50509	9.70337
	$Mn_2P_2O_7$	0.93986	9.97306
	MnS	0.57613	9.76052
	SO_3	0.53023	9.72447
SO_3	MnO	0.88596	9.94741
	$MnSO_4$	1.8860	10.27553
Mercury: Hg= 200.61			
Hg	$HgCl$	1.1767	10.07068
	$HgCl_2$	1.3535	10.13146
	HgO	1.0798	10.03333
	HgS	1.1598	10.06439
$HgCl$	Hg	0.84980	9.92932
	$HgCl_2$	1.1502	10.06077
	$HgNO_3$	1.1125	10.04629
	HgO	0.91758	9.96264
	Hg_2O	0.88369	9.94630
	HgS	0.98561	9.99371
$HgCl_2$	Hg	0.73883	9.86854
	$HgCl$	0.86941	9.93923
	HgS	0.85690	9.93293
$Hg(CN)_2$	HgS	0.92093	9.96423
$HgNO_3$	$HgCl$	0.89890	9.95371
	HgS	0.88596	9.94742
$Hg(NO_3)_2$	HgS	0.71673	9.85536
$Hg(NO_3)_2.H_2O$	HgS	0.67905	9.83190
HgO	Hg	0.92613	9.96667
	$HgCl$	1.0898	10.03736
	HgS	1.0741	10.03106
Hg_2O	$HgCl$	1.1316	10.05370
	HgS	1.1153	10.04741
HgS	Hg	0.86221	9.93561
	$HgCl$	1.0146	10.00629
	$HgCl_2$	1.1670	10.06707
	$Hg(CN)_2$	1.0859	10.03577
	$HgNO_3$	1.1287	10.05258
	$Hg(NO_3)_2$	1.3952	10.14464
	$Hg(NO_3)_2.H_2O$	1.4727	10.16810
	HgO	0.93098	9.96894
	Hg_2O	0.89659	9.95259
	$HgSO_4$	1.2751	10.10553
$HgSO_4$	HgS	0.78427	9.89447
Molybdenum. Mo= 95.95			
Mo	MoO_3	1.5003	10.17617
	MoS_3	2.0024	10.30155
	$PbMoO_4$	3.8266	10.58281
MoO_3	Mo	0.66655	9.82383
	MoS_3	1.3347	10.12538
	$(NH_4)_2MoO_4$	1.3618	10.13411
	$(NH_4)_3PO_4.12MoO_3$	1.0863	10.03596
	$PbMoO_4$	2.5506	10.40664
MoS_3	Mo	0.49940	9.69845
	MoO_3	0.74923	9.87462
	$(NH_4)_2MoO_4$	1.0203	10.00873
Molybdenum:			−10
$(NH_4)_2.MoO_4$	MoO_3	0.73432	9.86589
	MoS_3	0.98010	9.99127
	$(NH_4)_3PO_4.12MoO_3$	0.79771	9.90184
	$PbMoO_4$	1.8730	10.27253
$(NH_4)_3.PO_4\,12MoO_3$	MoO_3	0.92054	9.96404
	$(NH_4)_2MoO_4$	1.2536	10.09816
$PbMoO_4$	Mo	0.26133	9.41719
	MoO_3	0.39206	9.59336
	$(NH_4)_2MoO_4$	0.53391	9.72747
Neodymium: Nd= 144.27			
Nd	Nd_2O_3	1.1664	10.06683
Nd_2O_3	Nd	0.85737	9.93317
Nickel: Ni= 58.69			
Ni	$Ni(C_4H_7N_2O_2)_2$, Ni-glyoxime	4.9227	10.69221
	$Ni(NO_3)_2\,6H_2O$	4.9549	10.69504
	NiO	1.2726	10.10470
	$NiSO_4$	2.6367	10.42107
	$NiSO_4.7H_2O$	4.7855	10.67993
$Ni(C_4H_7N_2O_2)_2$, Ni-glyoxime	Ni	0.20314	9.30779
	NiO	0.25852	9.41249
$Ni(NO_3)_2.6H_2O$	Ni	0.20182	9.30496
	NiO	0.25684	9.40966
	$NiSO_4$	0.53215	9.72603
NiO	Ni	0.78578	9.89530
	$Ni(C_4H_7N_2O_2)_2$, Ni-glyoxime	3.8682	10.58751
	$Ni(NO_3)_2\,6H_2O$	3.8935	10.59034
	$NiSO_4$	2.0719	10.31637
	$NiSO_4.7H_2O$	3.7604	10.57523
$NiSO_4$	Ni	0.37926	9.57893
	$Ni(NO_3)_2.6H_2O$	1.8792	10.27397
	NiO	0.48265	9.68363
	$NiSO_4.7H_2O$	1.8149	10.25886
$NiSO_4.7H_2O$	Ni	0.20896	9.32007
	NiO	0.26593	9.42477
	$NiSO_4$	0.55098	9.74114
Nitrogen: N= 14.008			
$AgNO_2$	HNO_2	0.30552	9.48504
	N_2O_3	0.24698	9.39267
HNO_2	$AgNO_2$	3.2731	10.51496
HNO_3	N	0.22229	9.34692
	NH_3	0.27028	9.43182
	NH_4Cl	0.84895	9.92888
	$(NH_4)_2PtCl_6$	3.5233	10.54695

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Nitrogen:			−10
HNO_3	NO	0 47620	9.67779
	Pt	1 5490	10.19007
	SO_3	0.63523	9.80293
KNO_3	N_2O_5	0.53418	9.72769
N	HNO_3	4.4986	10.65308
	$NaNO_3$	6.0683	10.78307
	NH_3	1.2159	10.08490
	NH_4Cl	3.8191	10.58196
	$(NH_4)_2PtCl_6$	15.850	11.20003
	$(NH_4)_2SO_4$	4 7166	10.67363
	NO_2	3.2844	10.51646
	NO_3	4.4266	10.64607
	N_2O_3	2 7133	10.43350
	N_2O_5	3 8555	10.58608
	Pt	6 9685	10.84314
	SO_3	2.8577	10.45601
$NaNO_3$	N	0 16479	9 21693
	N_2O_5	0 63535	9 80301
NH_3	HNO_3	3 6998	10.56818
	N	0 82244	9.91510
	NO_3	3 6406	10.56117
	N_2O_5	3.1709	10 50118
NH_4Cl	HNO_3	1 1779	10 07112
	N	0 26184	9.41804
	NO_3	1 1591	10 06412
	N_2O_5	1.0095	10.00413
$(NH_4)_2PtCl_6$	HNO_3	0.28382	9 45305
	N	0 063092	8 79997
	NO_3	0 27928	9 44604
	N_2O_5	0.24325	9.38605
$(NH_4)_2SO_4$	N	0.21202	9 32637
	N_2O_5	0 81743	9 91245
NO	HNO_3	2 1000	10 32221
	NO_2	1 5332	10 18560
	NO_3	2 0664	10 31521
	N_2O_3	1 2666	10 10264
	N_2O_5	1 7998	10.25522
NO_2	N	0 30447	9 48354
	NO	0 65223	9 81440
NO_3	N	0 22591	9.35393
	NH_3	0 27468	9 43883
	NH_4Cl	0 86275	9 93588
	NO	0 48394	9 68479
	Pt	1 5742	10 19707
N_2O_3	$AgNO_2$	4 0488	10 60733
	N	0 36855	9 56650
	NO	0.78952	9 89736
N_2O_5	KNO_3	1 8720	10 27231
	N	0 25937	9 41392
	$NaNO_3$	1 5739	10 19699
	NH_3	0 31537	9 49882
	NH_4Cl	0 99055	9 99587
	$(NH_4)_2PtCl_6$	4 1110	10 61395
	$(NH_4)_2SO_4$	1 2233	10 08755
	NO	0 55562	9 74478
	Pt	1 8074	10 25706
	SO_3	0 74119	9 86993
Pt	HNO_3	0 64556	9.80993
	N	0 14350	9 15686

Weighed	Sought	Factor	Logarithm
Nitrogen:			−10
Pt	NO_2	0.63523	9 80293
	N_2O_5	0.55328	9.74294
SO_3	HNO_3	1.5742	10.19707
	N	0.34994	9.54399
	N_2O_5	1.3492	10 13007
Osmium: Os= 190.2			
Os	OsO_4	1.3365	10.12597
OsO_4	Os	0.74823	9.87403
Palladium: Pd= 106 7			
K_2PdCl_6	Pd	0.26834	9 42868
	$PdCl_2.2H_2O$	0.53729	9 73021
Pd	K_2PdCl_6	3 7267	10 57132
	$PdCl_2.2H_2O$	2 0023	10 30153
	PdI_2	3.3790	10 52879
	$Pd(NO_3)_2$	2.1623	10.33491
$PdCl_2.2H_2O$	K_2PdCl_6	1.8612	10.26979
	Pd	0.49942	9 69847
PdI_2	Pd	0.29594	9 47121
$Pd(NO_3)_2$	Pd	0.46247	9 66509
Phosphorus P=30 98			
Ag_3PO_4	P	0.074005	8 86926
	PO_4	0.22689	9 35581
	P_2O_5	0 16956	9 22932
$Ag_4P_2O_7$	P	0 10233	9 01001
	PO_4	0 31373	9 49656
	P_2O_5	0.23446	9 37007
Al_2O_3	P_2O_5	1 3926	10 14382
$AlPO_4$	PO_4	0 77884	9 89145
	P_2O_5	0 58204	9.76495
$Ca_3(PO_4)_2$	P_2O_5	0 45764	9 66052
$FePO_4$	PO_4	0 62976	9 79917
	P_2O_5	0 47063	9 67268
$Mg_2P_2O_7$	Na_2HPO_4	1 2757	10.10574
	$Na_2HPO_4.12H_2O$	3 2181	10.50760
	$NaNH_4HPO_4.4H_2O$	1 8786	10 27384
	P	0 27835	9.44459
	PO_4	0 85337	9 93114
	P_2O_5	0 63774	9 80464
Na_2HPO_4	$Mg_2P_2O_7$	0.78390	9.89426
	P_2O_5	0.49992	9.69890
$Na_2HPO_4.12H_2O$	$Mg_2P_2O_7$	0.31074	9 49240
	P_2O_5	0 19817	9.29704
$NaNH_4HPO_4.4H_2O$	$Mg_2P_2O_7$	0 53231	9 72616
	P_2O_5	0.33947	9.53080
$(NH_4)_3PO_4.12MoO_3$	P	0 016509	8.21773
	PO_4	0 050615	8.70428
	P_2O_5	0.037826	8 57779
P	Ag_3PO_4	13 513	11.13074

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Phosphorus:			−10
P	$Ag_4P_2O_7$	9 7721	10 98999
	$Mg_2P_2O_7$	3.5926	10.55541
	$(NH_4)_3PO_4.12MoO_3$	60 571	11 78227
	P_2O_5	2 2912	10 36005
	$P_2O_5\ 24MoO_3$	58 050	11.76380
	$U_2P_2O_{11}$	11 525	11 06165
PO_4	Ag_3PO_4	4 4075	10 64419
	$Ag_4P_2O_7$	3 1874	10 50344
	$AlPO_4$	1.2840	10 10855
	$FePO_4$	1 5879	10 20083
	$Mg_2P_2O_7$	1 1718	10.06886
	$(NH_4)_3PO_4.12MoO_3$	19.757	11.29572
	$P_2O_5.24MoO_3$	18 934	11 27725
	$U_2P_2O_{11}$	3 7592	10 57510
P_2O_5	Ag_3PO_4	5 8977	10 77068
	$Ag_4P_2O_7$	4 2651	10 62993
	Al_2O_3	0 71809	9 85618
	$AlPO_4$	1 7181	10 23505
	$Ca_3(PO_4)_2$	2 1851	10 33948
	$FePO_4$	2 1248	10 32732
	$Mg_2P_2O_7$	1 5680	10 19536
	Na_2HPO_4	2 0003	10.30110
	$Na_2HPO_4\ 12H_2O$	5.0462	10 70296
	$NaNH_4HPO_4.4H_2O$	2 9458	10.46920
	$(NH_4)_3PO_4.12MoO_3$	26 437	11 42221
	P	0 43646	9 63995
	$P_2O_5.24MoO_3$	25 336	11 40375
	$U_2P_2O_{11}$	5 0303	10 70159
$P_2O_5.24MoO_3$	P	0 017227	8 23620
	PO_4	0 052814	8 72275
	P_2O_5	0 039469	8 59625
$U_2P_2O_{11}$	P	0 086767	8 93835
	PO_4	0.26601	9 42490
	P_2O_5	0.19880	9.29841
Platinum: Pt= 195.23			
$H_2PtCl_6.6H_2O$	K_2PtCl_6	0 93839	9.97238
	Pt	0 37683	9 57615
K_2PtCl_6	$H_2PtCl_6.6H_2O$	1 0657	10 02762
	Pt	0 40157	9 60376
	$PtCl_4$	0 69330	9.84092
	$PtCl_4.5H_2O$	0 87859	9.94379
$(NH_4)_2PtCl_6$	Pt	0 43965	9 64311
	$PtCl_4$	0 75905	9 88027
	$PtCl_6$	0 91875	9 96320
Pt	$H_2PtCl_6.6H_2O$	2 6537	10 42385
	K_2O	0 48247	9 68347
	K_2PtCl_6	2 4902	10 39624
	$(NH_4)_2PtCl_6$	2 2745	10 35689
	$PtCl_4$	1 7265	10 23716
	$PtCl_4.5H_2O$	2 1879	10 34002
$PtCl_4$	K_2PtCl_6	1 4424	10 15908
	$(NH_4)_2PtCl_6$	1 3174	10 11973

Weighed	Sought	Factor	Logarithm
Platinum:			−10
$PtCl_4$	Pt	0.57922	9 76284
$PtCl_4.5H_2O$	K_2PtCl_6	1 1382	10 05621
	Pt	0.45706	9 65998
$PtCl_6$	$(NH_4)_2PtCl_6$	1.0884	10 03680
Potassium: K= 39.096			
Ag	KBr	1.1032	10 04265
	KCl	0.69107	9 83952
	$KClO_3$	1.1360	10 05538
	$KClO_4$	1.2843	10 10867
	KCN	0.60358	9.78073
	KI	1 5389	10 18721
AgBr	KBr	0 63373	9 80190
	$KBrO_3$	0.88933	9.94906
AgCl	KCl	0.52012	9 71611
	$KClO_3$	0.85500	9 93197
	$KClO_4$	0.96662	9 98526
AgCN	KCN	0.48630	9 68690
AgI	KI	0.70705	9 84945
	KIO_3	0.91148	9 95975
$BaCrO_4$	K_2CrO_4	0.76648	9 88450
	$K_2Cr_2O_7$	0 58060	9 76388
$BaSO_4$	$KHSO_4$	0 58334	9 76592
	K_2S	0 47233	9 67425
	K_2SO_4	0 74652	9 87304
Br	K	0.48921	9.68950
	KBr	1 4892	10 17296
CaF_2	$KF.2H_2O$	2 4111	10.38221
$CaSO_4$	$KF\ 2H_2O$	1 3828	10 14076
Cl	K	1 1026	10 04243
	KCl	2 1026	10 32276
	$KClO_3$	3.4564	10 53862
	$KClO_4$	3 9076	10 59191
	K_2O	1.3283	10 12328
CO_2	K_2CO_3	3.1402	10 49696
	K_2O	2 1402	10 33046
I	KI	1 3080	10 11662
	KIO_3	1 6862	10 22692
K	Br	2 0441	10 31050
	Cl	0.90692	9 95757
	KBr	3 0441	10 48346
	KCl	1.9069	10 28033
	$KClO_3$	3 1347	10 49619
	$KClO_4$	3 5439	10 54948
	KI	4 2464	10 62802
	KNO_3	2 5860	10 41264
	K_2O	1 2046	10 08085
	K_2PtCl_6	6.2176	10.79362
	K_2SO_4	2 2285	10 34802
	Pt	2.4968	10 39738
K_3AsO_4	$Mg_2As_2O_7$	0 60590	9 78240
KBr	Ag	0 90646	9 95735
	AgBr	1.5780	10 19810
	Br	0 67150	9 82704
	K	0 32850	9 51654
	K_2O	0 39572	9 59739
$KBrO_3$	AgBr	1 1244	10 05094
KCl	Ag	1 4470	10 16048
	AgCl	1 9226	10 28389

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Potassium.			−10
KCl	Cl	0 47559	9 67724
	K	0 52441	9 71967
	$KClO_3$	1 6438	10 21586
	$KClO_4$	1 8584	10 26915
	K_2CO_3	0 92687	9 96702
	$K_2Cr_2O_7$	1.9732	10 29517
	$KHCO_3$	1.3429	10 12803
	KNO_3	1 3561	10 13230
	K_2O	0 63171	9 80052
	K_2PtCl_6	3 2605	10 51329
	K_2SO_4	1 1686	10 06768
	Pt	1 3093	10 11705
$KClO_3$	Ag	0 88027	9 94462
	AgCl	1 1696	10 06803
	Cl	0 28932	9 46138
	KCl	0 60833	9 78414
$KClO_4$	Ag	0 77862	9 89132
	AgCl	1 0345	10 01474
	Cl	0 25591	9 40809
	K	0 28217	9 45052
	KCl	0 53808	9 73085
	K_2O	0 33991	9 53137
KCN	Ag	1 6568	10 21927
	AgCN	2 0564	10 31310
K_2CO_3	CO_2	0 31845	9 50304
	KCl	1 0789	10 03298
	K_2O	0 68155	9 83350
	KOH	0 81191	9 90951
	K_2PtCl_6	3 5178	10 54627
	K_2SO_4	1 2609	10 10066
K_2CrO_4	$BaCrO_4$	1 3047	10 11550
$K_2Cr_2O_7$	$BaCrO_4$	1 7224	10 23612
	KCl	0 50680	9 70483
	K_2O	0 32015	9 50535
$KF.2H_2O$	CaF_2	0 41475	9 61779
	$CaSO_4$	0 72316	9 85924
K_2HAsO_4	$Mg_2As_2O_7$	0 71170	9 85230
$KHCO_3$	KCl	0 74468	9 87197
	K_2O	0 47042	9 67249
	K_2PtCl_6	2 4280	10 38526
	K_2SO_4	0 87027	9 93965
$KHSO_4$	$BaSO_4$	1.7143	10 23408
	K_2SO_4	0 63986	9 80609
KI	Ag	0 64982	9 81279
	AgI	1 4143	10 15055
	I	0.76450	9.88338
	K	0 23550	9 37198
	K_2O	0 28368	9 45283
KIO_3	AgI	1 0971	10 04025
	I	0 59304	9 77308
$KMnO_4$	Mn_2O_3	0 49947	9 69851
	MnS	0 55048	9 74074
K_2MnO_4	Mn_2O_3	0 40041	9 60251
	MnS	0 44130	9 64473
KNO_2	K_2SO_4	1 0238	10 01020
	N_2O_3	0 44661	9.64993
KNO_3	K	0 38669	9 58736
	KCl	0 73739	9 86770
	K_2O	0 46582	9 66822
	K_2PtCl_6	2 4043	10 38098
	K_2SO_4	0 86175	9 93538

Weighed	Sought	Factor	Logarithm
Potassium:			−10
KNO_3	N	0.13855	9.14161
	NH_3	0.16846	9.22650
	NO	0.29680	9.47247
	N_2O_5	0 53418	9.72769
K_2O	Cl	0.75287	9.87672
	CO_2	0.46724	9.66954
	K	0.83013	9.91915
	KBr	2.5270	10 40261
	KCl	1 5830	10 19948
	$KClO_3$	2.6022	10 41534
	$KClO_4$	2 9419	10 46863
	K_2CO_3	1 4672	10.16650
	$K_2Cr_2O_7$	3.1235	10.49465
	$KHCO_3$	2.1257	10.32751
	KI	3.5251	10 54717
	KNO_3	2.1468	10 33178
	KOH	1.1913	10.07601
	K_2PtCl_6	5.1614	10.71277
	K_2SO_4	1.8500	10.26716
	N_2O_5	1.1468	10 05947
KOH	K_2CO_3	1.2317	10 09049
	K_2O	0.83944	9.92399
K_2PtCl_6	K	0.16083	9 20638
	KCl	0.30670	9.48671
	K_2CO_3	0.28427	9 45373
	$KHCO_3$	0 41185	9 61474
	KNO_3	0.41593	9.61902
	K_2O	0 19375	9.28723
	K_2SO_4	0 35842	9.55439
	$K_2SO_4.Al_2(SO_4)_3.24H_2O$	1 9515	10.29037
	$K_2SO_4.Cr_2(SO_4)_3.24H_2O$	2.0545	10.31271
K_2S	$BaSO_4$	2.1171	10.32575
	K_2SO_4	1.5805	10.19879
K_2SiO_3	SiO_2	0.38936	9.59035
K_2SO_4	$BaSO_4$	1.3396	10 12696
	K	0.44873	9.65198
	KCl	0.85569	9.93232
	K_2CO_3	0.79312	9 89934
	$KHCO_3$	1.1491	10 06035
	$KHSO_4$	1.5628	10.19391
	KNO_2	0.97679	9.98980
	KNO_3	1.1604	10 06462
	K_2O	0.54055	9 73284
	K_2PtCl_6	2.7900	10.44561
	K_2S	0.63272	9 80121
	SO_3	0.45945	9.66224
$K_2SO_4.Al_2(SO_4)_3.24H_2O$	K_2PtCl_6	0.51242	9.70963
$K_2SO_4.Cr_2(SO_4)_3.24H_2O$	K_2PtCl_6	0.48673	9.68729
$Mg_2As_2O_7$	K_3AsO_4	1.6504	10 21760
	K_2HAsO_4	1.4051	10.14770
Mn_2O_3	$KMnO_4$	2 0021	10.30149
	K_2MnO_4	2.4974	10 39749

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm	Weighed	Sought	Factor	Logarithm
Potassium:			−10	Rubidium:			−10
MnS	$KMnO_4$	1.8166	10.25926	Rb_2PtCl_6	$RbHCO_3$	0.50610	9.70423
	K_2MnO_4	2.2660	10.35527		Rb_2O	0.32294	9.50912
N	KNO_3	7.2176	10.85839	Rb_2SO_4	Rb	0.64025	9.80635
NH_3	KNO_3	5.9360	10.77350		RbCl	0.90583	9.95705
NO	KNO_3	3.3692	10.52753		Rb_2CO_3	0.86499	9.93701
N_2O_3	KNO_2	2.2391	10.35007		$RbHCO_3$	1.0973	10.04032
N_2O_5	KNO_3	1.8720	10.27231		Rb_2O	0.70017	9.84520
	K_2O	0.87202	9.94053	Selenium:			
Pt	K	0.40051	9.60262	Se=			
	KCl	0.76375	9.88295	78.96			
SiO_2	K_2SiO_3	2.5683	10.40965	H_2SeO_3	Se	0.61221	9.78690
SO_3	K_2SO_4	2.1765	10.33776	H_2SeO_4	Se	0.54464	9.73611
Praseodym-				Se	H_2SeO_3	1.6334	10.21310
ium:					H_2SeO_4	1.8361	10.26389
Pr=					SeO_2	1.4053	10.14776
140.92					SeO_3	1.6079	10.20626
Pr	Pr_2O_3	1.1703	10.06830	SeO_2	Se	0.71161	9.85224
Pr_2O_3	Pr	0.85447	9.93170	SeO_3	Se	0.62193	9.79374
Rhodium.				Silicon:			
Rh=				Si=28.06			
102.91				$BaSiF_6$	SiF_4	0.37241	9.57103
Na_3RhCl_6	Rh	0.26755	9.42740		SiO_2	0.21495	9.33233
Rh	Na_3RhCl_6	3.7377	10.57260	H_2SiO_3	SiO_2	0.76925	9.88607
	$RhCl_3$	2.0336	10.30827	K_2SiF_6	SiF_4	0.47246	9.67436
$RhCl_3$	Rh	0.49173	9.69173		SiO_2	0.27269	9.43567
Rubidium:				Si	SiO_2	2.1404	10.33050
Rb=				SiF_4	$BaSiF_6$	2.6852	10.42897
85.48					K_2SiF_6	2.1166	10.32564
AgCl	Rb	0.59636	9.77551		SiO_2	0.57717	9.76130
	RbCl	0.84372	9.92620	SiO_2	$BaSiF_6$	4.6523	10.66767
Cl	Rb	2.4108	10.38216		H_2SiO_3	1.3000	10.11393
	RbCl	3.4108	10.53286		K_2SiF_6	3.6672	10.56433
Rb	AgCl	1.6768	10.22449		Si	0.46720	9.66950
	Cl	0.41480	9.61784		SiF_4	1.7326	10.23870
	RbCl	1.4148	10.15069		SiO_3	1.2664	10.10257
	Rb_2CO_3	1.3510	10.13066		SiO_4	1.5328	10.18549
	Rb_2O	1.0936	10.03885		Si_2O	0.60040	9.77844
	Rb_2PtCl_6	3.3864	10.52973		$Si(OH)_4$	1.5999	10.20410
	Rb_2SO_4	1.5619	10.19365	SiO_3	SiO_2	0.78964	9.89743
RbCl	AgCl	1.1852	10.07380	SiO_4	SiO_2	0.65240	9.81451
	Cl	0.29319	9.46714	Si_2O	SiO_2	1.6656	10.22156
	Rb	0.70681	9.84931	$Si(OH)_4$	SiO_2	0.62502	9.79590
	Rb_2CO_3	0.95492	9.97997	Silver:			
	Rb_2O	0.77296	9.88816	Ag=			
	Rb_2PtCl_6	2.3935	10.37904	107.880			
	Rb_2SO_4	1.1040	10.04295	Ag	AgBr	1.7408	10.24075
Rb_2CO_3	Rb	0.74018	9.86934		AgCl	1.3287	10.12342
	RbCl	1.0472	10.02003		AgCN	1.2412	10.09383
	$RbHCO_3$	1.2685	10.10331		AgI	2.1765	10.33776
	Rb_2PtCl_6	2.5065	10.39907		$AgNO_3$	1.5748	10.19722
	Rb_2SO_4	1.1561	10.06299		Ag_2O	1.0742	10.03107
$RbHCO_3$	Rb_2CO_3	0.78830	9.89669		Ag_3PO_4	1.2935	10.11176
	Rb_2PtCl_6	1.9759	10.29577		$Ag_4P_2O_7$	1.4031	10.14710
	Rb_2SO_4	0.91134	9.95968		Br	0.74079	9.86969
Rb_2O	Rb	0.91442	9.96115		Cl	0.32867	9.51676
	RbCl	1.2937	10.11184		I	1.1765	10.07059
	Rb_2PtCl_6	3.0966	10.49088	AgBr	Ag	0.57445	9.75925
	Rb_2SO_4	1.4282	10.15480		Br	0.42555	9.62895
Rb_2PtCl_6	Rb	0.29530	9.47027	AgCl	Ag	0.75263	9.87658
	RbCl	0.41779	9.62096		$AgNO_3$	1.1852	10.07380
	Rb_2CO_3	0.39896	9.60093		Ag_2O	0.80844	9.90765

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Silver:			−10
AgCl	Br	0.55754	9.74628
	Cl	0 24737	9 39334
AgCN	Ag	0 80569	9.90617
AgI	Ag	0 45945	9 66224
	I	0 54055	9 73283
$AgNO_3$	Ag	0 63501	9.80278
	AgCl	0 84371	9.92620
Ag_2O	Ag	0 93096	9 96893
	AgCl	1 2369	10 09235
Ag_3PO_4	Ag	0 77311	9 88824
$Ag_4P_2O_7$	Ag	0 71269	9 85290
Br	Ag	1 3499	10 13031
	AgBr	2.3499	10 37105
	AgCl	1 7936	10 25372
Cl	Ag	3 0426	10 48324
	AgCl	4 0426	10.60666
I	Ag	0 84998	9 92941
	AgI	1.8500	10 26717
Sodium: Na= 22.997			
Ag	NaBr	0.95396	9 97953
	NaCl	0 54184	9 73387
	NaI	1 3897	10 14291
AgBr	NaBr	0 54800	9 73878
AgCl	NaCl	0 40781	9 61046
	$NaClO_3$	0 74268	9 87080
	$NaClO_4$	0 85431	9 93161
AgI	NaI	0 63849	9 80515
$BaSO_4$	$NaHSO_4$	0.51437	9 71128
	$NaHSO_4.H_2O$	0 59156	9 77200
	Na_2S	0 33439	9 52426
	Na_2SO_3	0 54003	9.73242
	$Na_2SO_3.7H_2O$	1 0803	10 03355
	Na_2SO_4	0 60858	9 78432
	$Na_2SO_4\ 10H_2O$	1 3804	10 14001
B_2O_3	$Na_2B_4O_7$	1 4451	10 15990
	$Na_2B_4O_7$ $10H_2O$	2 7386	10 43753
Br	Na	0 28776	9 45904
	NaBr	1.2878	10 10984
	Na_2O	0 38787	9 58869
$CaCl_2$	NaCl	1 0533	10 02254
$CaCO_3$	Na_2CO_3	1 0591	10 02493
CaF_2	NaF	1 0757	10 03171
CaO	Na_2CO_3	1 8902	10 27651
$CaSO_4$	Na_2CO_3	0 77864	9 89134
Cl	Na	0 64859	9 81197
	NaCl	1 6486	10 21711
	Na_2O	0 87421	9 94162
CO_2	Na_2CO_3	2 4086	10 38177
	Na_2O	1 4086	10 14880
H_3BO_3	$Na_2B_4O_7$	0 81363	9 91043
	$Na_2B_4O_7$ $10H_2O$	1 5419	10 18806
I	Na	0 18119	9 25814
	NaI	1 1812	10 07232
	Na_2O	0 24422	9 38779
KBF_4	$Na_2B_4O_7$	0 39962	9 60165
	$Na_2B_4O_7.$ $10H_2O$	0 75732	9 87928

Weighed	Sought	Factor	Logarithm
Sodium:			−10
$Mg_2As_2O_7$	Na_2HAsO_3	1 0946	10 03925
	Na_2HAsO_4	1 1977	10 07833
$MgCl_2$	NaCl	1 2276	10 08905
$Mg_2P_2O_7$	Na_2HPO_4	1.2757	10.10574
	$Na_2HPO_4.$ $12H_2O$	3.2181	10.50760
	$NaNH_4HPO_4.$ $4H_2O$	1.8786	10.27384
	$Na_4P_2O_7.$ $10H_2O$	2 0041	10.30192
N	$NaNO_3$	6 0683	10.78307
Na	Br	3 4751	10 54096
	Cl	1.5418	10 18803
	I	5.5190	10 74186
	NaBr	4 4751	10 65080
	NaCl	2 5418	10 40514
	Na_2CO_3	2 3047	10 36262
	$NaHCO_3$	3.6533	10 56269
	NaI	6 5190	10.81418
	Na_2O	1 3479	10.12965
	Na_2SO_4	3 0885	10 48975
	$(UO_2)_3ZnNa$ $(C_2H_3O_2)_9.$ $6H_2O$	66 882	11 82531
$Na_2B_4O_7$	B_2O_3	0 69199	9 84010
	H_3BO_3	1.2291	10.08957
	KBF_4	2 5024	10.39835
$Na_2B_4O_7.$ $10H_2O$	B_2O_3	0 36515	9 56247
	H_3BO_3	0 64854	9 81194
	KBF_4	1 3204	10 12072
NaBr	Ag	1 0483	10 02047
	AgBr	1 8248	10 26122
	Br	0 77654	9 89016
	Na	0 22346	9 34920
	Na_2O	0 30120	9 47885
	$(UO_2)_3ZnNa$ $(C_2H_3O_2)_9.$ $6H_2O$	14 945	11 17451
NaCl	Ag	1 8456	10 26613
	AgCl	2 4521	10 38954
	Cl	0 60658	9 78289
	Na	0 39342	9 59486
	$NaClO_3$	1 8212	10 26035
	$NaClO_4$	2 0949	10 32116
	Na_2CO_3	0 90673	9 95748
	$NaHCO_3$	1 4373	10 15754
	Na_2HPO_4	1 2145	10 08439
	Na_2O	0 53028	9.72451
	Na_2SO_4	1 2151	10.08461
	$(UO_2)_3ZnNa$ $(C_2H_3O_2)_9$ $6H_2O$	26 313	11 42017
$NaClO_3$	AgCl	1 3465	10 12920
	NaCl	0.54910	9 73965
$NaClO_4$	AgCl	1 1705	10 06839
	NaCl	0 47735	9 67884
Na_2CO_3	$CaCO_3$	0 94421	9 97507
	CaO	0 52904	9 72349
	$CaSO_4$	1 2843	10 10866
	CO_2	0.41517	9 61823

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Sodium:			−10
Na_2CO_3	Na	0.43389	9.63738
	NaCl	1.1029	10 04252
	$NaHCO_3$	1.5851	10 20007
	Na_2O	0 58483	9.76703
	NaOH	0.75478	9 87782
	Na_2SO_4	1 3401	10.12713
	$(UO_2)_3ZnNa(C_2H_3O_2)_9 \cdot 6H_2O$	29.019	11 46269
$Na_2CO_3 \cdot 10H_2O$	Na_2SO_4	0 49640	9 69584
NaF	CaF_2	0.92959	9.96829
	$(UO_2)_3ZnNa(C_2H_3O_2)_9 \cdot 6H_2O$	36.624	11.56376
Na_2HAsO_3	$Mg_2As_2O_7$	0.91359	9 96075
Na_2HAsO_4	$Mg_2As_2O_7$	0 83496	9 92167
$NaHCO_3$	Na	0 27372	9.43731
	NaCl	0 69576	9 84246
	Na_2CO_3	0 63086	9.79993
	Na_2O	0 36895	9.56696
	$(UO_2)_3ZnNa(C_2H_3O_2)_9 \cdot 6H_2O$	18 307	11.26262
Na_2HPO_4	$Mg_2P_2O_7$	0 78390	9.89426
	NaCl	0 82340	9 91561
	Na_2O	0 43663	9 64012
	$Na_4P_2O_7$	0 93655	9 97153
	P_2O_5	0 49992	9 69890
$Na_2HPO_4 \cdot 12H_2O$	$Mg_2P_2O_7$	0 31074	9.49240
	$Na_4P_2O_7$	0 37125	9.56967
	P_2O_5	0 19817	9 29704
$NaHSO_3$	SO_2	0 61558	9 78928
$NaHSO_4$	$BaSO_4$	1 9441	10 28872
$NaHSO_4 \cdot H_2O$	$BaSO_4$	1.6905	10 22800
NaI	Ag	0 71960	9 85709
	AgI	1 5662	10 19485
	I	0 84660	9 92768
	Na	0 15340	9 18582
	Na_2O	0.20676	9 31547
	$(UO_2)_3ZnNa(C_2H_3O_2)_9 \cdot 6H_2O$	10 260	11 01113
$NaNH_4HPO_4 \cdot 4H_2O$	$Mg_2P_2O_7$	0 53231	9 72616
	NH_3	0 08146	8 91094
	P_2O_5	0 33947	9 53080
$NaNO_3$	N	0 16479	9 21693
	Na_2O	0 36465	9 56188
	NH_3	0 20037	9 30183
	NO	0 35301	9 54779
	N_2O_5	0.63535	9 80301
	$(UO_2)_3ZnNa(C_2H_8O_2)_9 \cdot 6H_2O$	18 094	11 25754
Na_2O	Br	2 5782	10 41131

Weighed	Sought	Factor	Logarithm
Sodium:			−10
Na_2O	Cl	1 1439	10.05838
	CO_2	0.70991	9 85120
	I	4.0946	10 61221
	Na	0 74191	9 87035
	NaBr	3 3201	10.52115
	NaCl	1 8858	10 27549
	Na_2CO_3	1 7099	10 23297
	$NaHCO_3$	2 7104	10 43304
	Na_2HPO_4	2 2903	10 35988
	NaI	4 8365	10 68453
	$NaNO_3$	2 7424	10 43812
	NaOH	1 2906	10 11080
	Na_2SO_4	2 2914	10 36010
	N_2O_5	1 7424	10 24114
	SO_3	1 2914	10 11107
	$(UO_2)_3ZnNa(C_2H_3O_2)_9 \cdot 6H_2O$	49 620	11 69566
NaOH	Na_2CO_3	1 3249	10 12218
	Na_2O	0 77483	9 88920
	$(UO_2)_3ZnNa(C_2H_3O_2)_9 \cdot 6H_2O$	38 447	11 58486
$Na_4P_2O_7$	Na_2HPO_4	1 0677	10 02847
	$Na_2HPO_4 \cdot 12H_2O$	2 6936	10 43033
$Na_4P_2O_7 \cdot 10H_2O$	$Mg_2P_2O_7$	0 49898	9 69808
Na_2S	$BaSO_4$	2 9905	10 47574
Na_2SO_3	$BaSO_4$	1 8517	10 26758
	SO_2	0 50819	9 70603
$Na_2SO_3 \cdot 7H_2O$	$BaSO_4$	0 92565	9 96645
	SO_2	0 25404	9 40490
Na_2SO_4	$BaSO_4$	1 6432	10 21568
	Na	0 32378	9 51025
	NaCl	0 82298	9.91539
	Na_2CO_3	0.74622	9 87287
	$Na_2CO_3 \cdot 10H_2O$	2 0145	10 30416
	Na_2O	0 43641	9 63990
	SO_3	0 56359	9 75096
	$(UO_2)_3ZnNa(C_2H_3O_2)_9 \cdot 6H_2O$	21 655	11 33556
$Na_2SO_4 \cdot 10H_2O$	$BaSO_4$	0 72442	9 85999
NH_3	$NaNH_4HPO_4 \cdot 4H_2O$	12 276	11 08906
	$NaNO_3$	4 9908	10 69817
NO	$NaNO_3$	2 8327	10 45221
N_2O_5	$NaNO_3$	1 5739	10 19699
	Na_2O	0 57393	9 75886
P_2O_5	Na_2HPO_4	2.0003	10 30110
	$Na_2HPO_4 \cdot 12H_2O$	5 0462	10 70296
	$NaNH_4HPO_4 \cdot 4H_2O$	2 9458	10 46920
SO_2	$NaHSO_3$	1 6245	10.21072
	Na_2SO_3	1.9677	10 29397
	$Na_2SO_3 \cdot 7H_2O$	3 9364	10 59510

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm
Sodium:			−10
SO_3	Na_2O	0 77434	9 88893
	Na_2SO_4	1.7743	10 24904
$(UO_2)_3ZnNa(C_2H_3O_2)_9.6H_2O$	Na	0.014952	8 17469
	$NaBr$	0.066910	8 82549
	$NaCl$	0 038004	8 57983
	Na_2CO_3	0 034460	8 53731
	NaF	0 027305	8 43624
	$NaHCO_3$	0 054623	8 73738
	NaI	0 097470	8 98887
	$NaNO_3$	0 055267	8 74246
	Na_2O	0 020153	8 30434
	$NaOH$	0 026010	8 41514
	Na_2SO_4	0 046179	8 66444
Strontium: $Sr=87.63$			
CO_2	$SrCO_3$	3 3547	10 52565
SO_3	SrO	1 2944	10 11207
	$SrSO_4$	2 2944	10 36067
Sr	$SrCO_3$	1 6848	10 22655
	$Sr(NO_3)_2$	2 4152	10 38296
	SrO	1 1826	10 07283
	$SrSO_4$	2 0962	10 32143
$SrCl_2$	$SrCO_3$	0 93122	9 96905
	SrO	0 65364	9 81534
	$SrSO_4$	1 1586	10 06394
$SrCO_3$	CO_2	0 29809	9 47435
	Sr	0 59354	9 77345
	$SrCl_2$	1 0739	10 03095
	$Sr(HCO_3)_2$	1 4201	10 15232
	$Sr(NO_3)_2$	1 4335	10 15641
	SrO	0 70191	9 84628
	$SrSO_4$	1 2442	10 09488
$Sr(HCO_3)_2$	$SrCO_3$	0 70417	9 84768
	SrO	0 49426	9 69396
$Sr(NO_3)_2$	Sr	0 41404	9 61704
	$SrCO_3$	0 69758	9 84359
	SrO	0 48964	9 68988
	$SrSO_4$	0 86791	9 93848
SrO	SO_3	0 77256	9 88793
	Sr	0 84560	9 92717
	$SrCl_2$	1 5299	10 18466
	$SrCO_3$	1 4247	10 15372
	$Sr(HCO_3)_2$	2 0232	10 30604
	$Sr(NO_3)_2$	2 0423	10 31012
	$SrSO_4$	1 7726	10 24860
$SrSO_4$	SO_3	0 43584	9 63933
	Sr	0 47705	9 67857
	$SrCl_2$	0 86311	9 93606
	$SrCO_3$	0 80375	9 90512
	$Sr(NO_3)_2$	1 1522	10 06152
	SrO	0 56416	9 75140
Sulfur: $S=32.06$			
As_2S_3	H_2S	0 41556	9 61864
	S	0 39098	9 59215

Weighed	Sought	Factor	Logarithm
Sulfur:			−10
$BaSO_4$	FeS_2	0 25696	9 40987
	H_2S	0.14599	9 16431
	H_2SO_3	0.35162	9 54608
	H_2SO_4	0.42017	9 62343
	S	0 13735	9 13783
	SO_2	0.27444	9.43845
	SO_3	0.34299	9.53528
	SO_4	0 41153	9.61440
CdS	H_2S	0.23587	9 37267
	S	0 22191	9 34619
FeS_2	$BaSO_4$	3.8916	10 59013
H_2S	As_2S_3	2.4064	10 38136
	$BaSO_4$	6 8499	10 83569
	CdS	4.2396	10 62733
	SO_3	2.3494	10 37096
H_2SO_3	$BaSO_4$	2 8439	10 45392
H_2SO_4	$BaSO_4$	2 3800	10 37657
	$(NH_4)_2SO_4$	1 3473	10 12947
	SO_3	0.81630	9 91185
$(NH_4)_2SO_4$	H_2SO_4	0.74221	9 87053
	SO_3	0.60587	9 78238
S	As_2S_3	2 5577	10 40785
	$BaSO_4$	7 2807	10 86217
	CdS	4.5062	10 65381
SO_2	$BaSO_4$	3 6438	10 56155
SO_3	$BaSO_4$	2 9156	10 46472
	H_2S	0 42563	9 62904
	$(NH_4)_2SO_4$	1 6505	10 21762
SO_4	$BaSO_4$	2 4299	10 38560
Tantalum: $Ta=180.88$			
Ta	$TaCl_5$	1 9801	10 29669
	Ta_2O_5	1 2211	10 08677
$TaCl_5$	Ta	0 50502	9 70331
	Ta_2O_5	0 61670	9 79007
Ta_2O_4	Ta_2O_5	1 0376	10 01602
Ta_2O_5	Ta	0 81891	9 91323
	$TaCl_5$	1 6215	10 20993
	Ta_2O_4	0.96378	9 98398
Tellurium: $Te=127.61$			
H_2TeO_4	Te	0 65905	9 81892
$H_2TeO_4.2H_2O$	Te	0 55565	9 74480
Te	H_2TeO_4	1.5173	10 18108
	$H_2TeO_4.2H_2O$	1.7997	10 25520
	TeO_2	1 2508	10.09718
	TeO_3	1 3761	10 13866
	$(TeO_2)_2SO_3$	1 5645	10 19436
TeO_2	Te	0 79951	9 90282
TeO_3	Te	0.72667	9.86134
$(TeO_2)_2SO_3$	Te	0.63920	9.80564
Thallium: $Tl=204\ 39$			
Tl	$TlCl$	1 1735	10 06947
	Tl_2CO_3	1 1468	10.05949

Weighed	Sought	Factor	Logarithm
Thallium:			−10
Tl	Tl_2CrO_4	1.2838	10.10850
	$TlHSO_4$	1.4749	10.16877
	TlI	1.6210	10.20977
	$TlNO_3$	1.3034	10.11507
	Tl_2O	1.0391	10.01667
	Tl_2PtCl_6	1.9980	10 30060
	Tl_2SO_4	1.2350	10 09166
TlCl	Tl	0.85217	9 93053
	Tl_2PtCl_6	1.7027	10.23113
Tl_2CO_3	Tl	0.87199	9.94051
	Tl_2PtCl_6	1.7423	10.24111
Tl_2CrO_4	Tl	0.77894	9.89150
$TlHSO_4$	Tl	0.67800	9 83123
TlI	Tl	0.61691	9.79023
	Tl_2PtCl_6	1.2326	10.09083
$TlNO_3$	Tl	0.76724	9.88493
	Tl_2PtCl_6	1.5330	10.18553
Tl_2O	Tl	0.96233	9 98333
	Tl_2PtCl_6	1.9228	10 28393
Tl_2PtCl_6	Tl	0.50049	9.69940
	TlCl	0.58732	9.76887
	Tl_2CO_3	0.57397	9 75889
	TlI	0 81129	9.90917
	$TlNO_3$	0.65234	9 81447
	Tl_2O	0.52008	9 71607
	Tl_2SO_4	0 61811	9.79106
Tl_2SO_4	Tl	0.80972	9.90834
	Tl_2PtCl_6	1.6178	10.20894
Thorium: Th= 232.12			
Th	ThO_2	1 1379	10 05609
$ThCl_4$	ThO_2	0.70630	9.84899
$Th(NO_3)_4.6H_2O$	ThO_2	0.44899	9 65224
ThO_2	Th	0.87884	9 94391
	$ThCl_4$	1 4158	10 15101
	$Th(NO_3)_4.6H_2O$	2 2272	10.34776
Tin: Sn= 118.70			
Sn	$SnCl_2$	1.5974	10 20342
	$SnCl_2.2H_2O$	1.9010	10.27898
	$SnCl_4$	2.1948	10.34140
	$SnCl_4.(NH_4Cl)_2$	3 0962	10.49083
	SnO	1.1348	10 05492
	SnO_2	1.2696	10 10366
$SnCl_2$	Sn	0 62601	9.79658
	SnO_2	0.79477	9.90024
$SnCl_2.2H_2O$	Sn	0 52604	9.72102
	SnO_2	0 66786	9 82468
$SnCl_4$	Sn	0 45561	9.65860
	SnO_2	0.57844	9.76226
$SnCl_4.(NH_4Cl)_2$	Sn	0.32297	9.50917
	SnO_2	0.41004	9.61283
SnO	Sn	0.88122	9.94508

Weighed	Sought	Factor	Logarithm
Tin:			−10
SnO	SnO_2	1 1188	10.04875
SnO_2	Sn	0 78766	9 89634
	$SnCl_2$	1.2582	10.09976
	$SnCl_2.2H_2O$	1 4973	10.17532
	$SnCl_4$	1 7288	10 23774
	$SnCl_4.(NH_4Cl)_2$	2 4388	10 38717
	SnO	0.89383	9.95125
Titanium: Ti= 47.90			
Ti	TiO_2	1 6681	10 22221
TiO_2	Ti	0 59950	9 77779
Tungsten: W= 183.92			
W	WO_2	1.1740	10 06966
	WO_3	1 2610	10 10071
WO_2	W	0 85180	9 93034
WO_3	W	0.79303	9.89929
Uranium: U=238.07			
U	UO_2	1.1344	10 05477
	U_3O_8	1 1792	10 07159
	$(UO_2)_2P_2O_7$	1 4998	10 17602
	$U_2P_2O_{11}$	1 4998	10 17602
UO_2	U	0.88151	9 94523
	U_3O_8	1 0395	10 01682
	$U_2P_2O_{11}$	1 3221	10 12125
U_3O_8	U	0.84802	9 92841
	UO_2	0.96200	9 98318
	$UO_2(NO_3)_2.6H_2O$	1.7888	10 25256
$UO_2(NO_3)_2.6H_2O$	U_3O_8	0.55903	9 74744
$(UO_2)_2P_2O_7$	U	0.66677	9 82398
$U_2P_2O_{11}$	U	0.66677	9 82398
	UO_2	0.75639	9.87875
Vanadium: V=50.95			
V	V_2O_5	1.7851	10 25166
VO_4	V_2O_5	0 79121	9 89829
V_2O_5	V	0.56020	9.74834
	VO_4	1.2639	10 10171
Ytterbium: Yb= 173.04			
Yb	Yb_2O_3	1.1387	10 05641
Yb_2O_3	Yb	0.87820	9 94359
Yttrium: Y=88.92			
Y	Y_2O_3	1 2699	10 10377
Y_2O_3	Y	0.78746	9 89623
Zinc: Zn= 65.38			
$BaSO_4$	ZnS	0 41744	9 62060
	$ZnSO_4.7H_2O$	1.2319	10 09058
Zn	$ZnNH_4PO_4$	2 7287	10 43595

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS—(Continued)

Weighed	Sought	Factor	Logarithm	Weighed	Sought	Factor	Logarithm
Zinc:			−10	Zinc:			−10
Zn	ZnO	1 2447	10 09507	$Zn_2P_2O_7$	Zn	0.42912	9 63257
	$Zn_2P_2O_7$	2.3304	10.36743		ZnO	0.53413	9.72765
	ZnS	1 4904	10 17329	ZnS	$BaSO_4$	2 3955	10 37940
$ZnCl_2$	ZnO	0.59709	9 77604		Zn	0 67098	9.82671
$ZnCO_3$	ZnO	0.64902	9.81225		ZnO	0.83518	9 92178
$ZnNH_4$.					$ZnSO_4.7H_2O$	2.9511	10.46998
PO_4	Zn	0.36648	9 56405	$ZnSO_4$.			
	ZnO	0.45616	9 65912	$7H_2O$	$BaSO_4$	0.81174	9.90942
ZnO	Zn	0.80339	9 90493		ZnO	0 28301	9 45180
	$ZnCl_2$	1.6748	10 22396		ZnS	0.33886	9.53002
	$ZnCO_3$	1.5408	10 18775	Zirconium:			
	$ZnNH_4PO_4$	2 1922	10 34088	Zr=			
	$Zn_2P_2O_7$	1 8722	10.27235	91.22			
	ZnS	1 1973	10 07822	Zr	ZrO_2	1 3508	10 13059
	$ZnSO_4.7H_2O$	3 5335	10 54820	ZrO_2	Zr	0 74030	9.86941

HEAT OF FORMATION AND SOLUTION

The following table gives the heat of formation of compounds from the elements in their standard states (18° C, 1 atm.) and the heat of solution in water in kilogram calories (mean) per gram-formula weight. To convert to B.T.U. multiply by 3.9685. To convert to kilojoules multiply by 4.186.

Values given are for 18° C and 1 atm. unless otherwise indicated. The heat of solution is given in most cases for a definite number of water molecules to one of the substance. Where this is not stated the dilution is understood to be such that additional dilution produces a negligible thermal effect.

The symbol ∞ indicates that the substance is formed in an "infinite" amount of water.

Name	Formula	Physical state	Heat of formation. Kilo-cal	Water mols	Heat of solution. Kilo-cal.
Acetic acid	$HC_2H_3O_2$	solid$^{7^\circ}$	120 2	150	−2 15$^{7^\circ}$
		liquid	117 71		
		200	118 07		
Acetylene	C_2H_2	gas	− 54 337		
Aluminum					
bromide	$AlBr_3$	solid	+126 6	3000	+85 3$^{9^\circ}$
		dil. sol	211 9		
carbide	Al_4C_3	solid	81.48		
chloride	$AlCl_3$	solid	166 8		+77 90
		600	244 68		
	$AlCl_3.6H_2O$	solid	641 82	450	+13 1$^{16^\circ}$
fluoride	AlF_3	solid	329 03		
	$AlF_3.5H_2O$	solid	375 39		
hydroxide	$Al(OH)_3$	ppt	304 66		
iodide	AlI_3	solid	71 21	2200	+88 89$^{9^\circ}$
		dil. sol.	160 3		
nitride	AlN	solid	131 4		
oxide (corundum)	Al_2O_3	solid	399 05		
oxide (powder)	Al_2O_3	amorph.	389 49		
silicate	$Al_2Si_2O_7$	solid	767 5		
sulfate	$Al_2(SO_4)_3$	solid	714 46		
		dil. sol.	883 88		
	$Al_2(SO_4)_3.18H_2O$	solid	2106 6		+8 1
sulfide	Al_2S_3	solid	126.4		+75 03
Alum, see under appropriate metal					
Ammonia	NH_3	liquid	15 84		
		gas	10 94		
		200	19 43	200	+8 459$^{18^\circ}$
Ammonium					
acetate	$NH_4C_2H_3O_2$	solid	150 25	200	+0 250$^{24^\circ}$
bromide	NH_4Br	solid	64 708	200	−4 444$^{18^\circ}$
	$NH_3 + HBr$	solid	45 5		
carbonate	$(NH_4)_2CO_3$	dil sol.	223 4		
carbonate, acid	NH_4HCO_3	solid	203 1	1200	−6 69$^{15^\circ}$
chloride	NH_4Cl	solid	75 080	200	−3 395$^{18^\circ}$
		∞	71 279		
chloroplatinite	$(NH_4)_2PtCl_4$	solid	194 0		−8 411
chromate	$(NH_4)_2CrO_4$	solid	274 31	700	−5 73$^{18^\circ}$
		dil. sol.	267 62		
cyanate	NH_4CNO	dil sol.	68 9		
cyanide	NH_4CN	solid	0 956	400	−4 349
dichromate	$(NH_4)_2Cr_2O_7$	solid	420 07	550	−12 9$^{16^\circ}$
		600	407 41		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Ammonium					
ferrocyanide	$(NH_4)_4Fe(CN)_6.3H_2O$	solid	216.0		$-6.69^{14°}$
fluoride	NH_4F	solid	111.71		-1.51
		dil. sol.	110.20		
fluosilicate	$(NH_4)_2SiF_6$	solid	619.36	1200	$-8.36^{7°}$
hydroxide	NH_4OH	200	87.814		
iodide	NH_4I	solid	48.555	200	$-3.560^{18°}$
		200	44.994		
nitrate	NH_4NO_3	solid	87.93	200	$-6.332^{18°}$
nitrite	NH_4NO_2	solid	62.15	400	$-4.755^{12°}$
		400	57.491		
oxalate	$(NH_4)_2C_2O_4$	solid	267.15		-7.89
	$(NH_4)_2C_2O_4.H_2O$	solid	339.07		-11.5
oxalate, acid	$NH_4HC_2O_4$	400	226.69		
perchlorate	NH_4ClO_4	solid	78.304	220	$-6.356^{20°}$
persulfate	$(NH_4)_2S_2O_8$	solid	382.80	1000	$-9.08^{18°}$
phosphate, mono-	$NH_4H_2PO_4$	dil. sol.	339.07		
phosphate, ortho-	$(NH_4)_3PO_4$	dil. sol.	397.61		
selenide	$(NH_4)_2Se$	dil. sol.	38.95		
sulfate	$(NH_4)_2SO_4$	solid	277.66	400	$-2.39^{18°}$
		400	275.29		
sulfate, acid	NH_4HSO_4	solid	240.43	200	$-0.024^{18°}$
		800	240.98		
sulfhydrate	NH_4HS	solid	38.95		-3.3
		dil. sol.	35.675		
sulfide	$(NH_4)_2S$	200	55.245		
sulfide, penta-	$(NH_4)_2S_5$	solid	64.76		
		dil. sol.	56.15	1000	$-8.6^{18°}$
sulfite	$(NH_4)_2SO_3$	solid	210.20	440	$-1.53^{18°}$
		dil. sol.	208.70		
sulfite, acid	NH_4HSO_3	dil. sol.	179.2		
sulfocyanate	NH_4CNS	solid	19.4		$-5.663^{12°}$
Antimonic acid, ortho-	H_3SbO_4	dil. sol.	216.56		
Antimonous acid	H_3SbO_3	dil. sol.	166.8		
Antimony					
bromide	$SbBr_3$	solid	61.41		
		liquid	58.28		
chloride, tri-	$SbCl_3$	solid	91.398		
		liquid	88.292		
chloride, penta-	$SbCl_5$	solid	107.31		
		liquid	104.88		
		gas	93.812		
fluoride	SbF_3	solid	216.5	200	-1.67
		dil. sol.	214.8		
hydride (stibine)	SbH_3	gas	-34.815		
iodide	SbI_3	solid	$+44.21$		
oxide, tri-	Sb_2O_3	solid	165.4		
oxide, tetra	Sb_2O_4	solid	211.2		
oxide, penta-	Sb_2O_5	solid	230.8		
		dil. sol.	227.96		
oxychloride (ous)	$SbOCl$	solid	89.200		
sulfide (black)	Sb_2S_3	solid	35.84		
Arsenic					
acid, ortho-	H_3AsO_4	solid	214.98	300	$-0.406^{18°}$
		dil. sol.	214.6		
bromide (ous)	$AsBr_3$	solid	46.36		
		liquid	43.49		
chloride (ous)	$AsCl_3$	solid	72.40		
		liquid	71.390		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Arsenic					
hydride (arsine)	AsH_3	gas	− 43 49		
	$AsH_3.6H_2O$	solid$^{-10°}$	+366.79		
iodide (ous)	AsI_3	solid	14 3		
oxide, tri-	As_2O_3	solid	147 9		
		dil. sol.	148 6		
oxide, penta-	As_2O_5	solid	217 90		+5 998
		dil. sol.	223 9		
oxide	As_4O_6	gas	267 86		
sulfide, di-	As_2S_2	solid	19 1		
Arsenious acid, ortho-	H_3AsO_3	dil. sol.	176.8		
Auric, see *gold*					
Barium					
acetate	$Ba(C_2H_3O_2)_2$	solid	358 4	600	+5 26$^{11°}$
arsenate	$Ba_3(AsO_4)_2$	ppt.	817.69		
bromide	$BaBr_2$	solid	180 4	400	+4 97$^{18°}$
		400	185 4		
	$BaBr_2.2H_2O$	solid	326.4	400	−4 182$^{18°}$
carbonate	$BaCO_3$	ppt.	290 85		
chlorate	$Ba(ClO_3)_2$	solid	174 0	600	−6 69$^{10°}$
	$Ba(ClO_3)_2.H_2O$	solid	246 8	600	−11 23$^{18°}$
chloride	$BaCl_2$	solid	205 33	400	+2 08$^{18°}$
		2000	207 55		
	$BaCl_2.2H_2O$	solid	349 08	400	−4 922$^{18°}$
chromate	$BaCrO_4$	ppt.	334 05		
cyanide	$Ba(CN)_2$	solid	57 11		+1 768$^{9°}$
		dil. sol.	59 02		
ferrocyanide	$Ba_2Fe(CN)_6$	dil. sol.	135 0		
	$Ba_2Fe(CN)_6\ 6H_2O$	solid	556 51		−11 5$^{14°}$
fluoride	BaF_2	ppt.	287 70		
fluosilicate	$BaSiF_6$	solid	677 42		
hydride	BaH_2	solid	40 86		
hydroxide	$Ba(OH)_2$	solid	225 86	660	+11 40$^{15°}$
		400	237 49		
	$Ba(OH)_2.8H_2O$	solid	799 05	660	−14 5$^{15°}$
hypobromite	$Ba(BrO)_2$	dil. sol.	174 4		
hypochlorite	$Ba(ClO)_2$	dil. sol.	180 9		
hypophosphite	$Ba(H_2PO_2)_2$	dil. sol.	414 10		
	$Ba(H_2PO_2)_2\ H_2O$	solid	482 20	400	+0 287$^{18°}$
iodate	$Ba(IO_3)_2$	solid	245 16		
		dil. sol.	236 6		
	$Ba(IO_3)_2.H_2O$	solid	316 37		
iodide	BaI_2	solid	144 8		+10 30$^{16°}$
		dil sol.	155 08		
nitrate	$Ba(NO_3)_2$	solid	238 28	400	−9 462$^{18°}$
		1600	228 44		
nitride	Ba_3N_2	solid	90 80		
nitrite	$Ba(NO_2)_2$	solid	185.7	800	−5 687$^{12°}$
	$Ba(NO_2)_2.H_2O$	solid	256 87	800	−8 60$^{12°}$
oxalate	$BaC_2O_4.H_2O$	ppt.	397 37		
oxide	BaO	solid	133 1	600	+35 84$^{18°}$
oxide, di-	BaO_2	solid	151 7		
perchlorate	$Ba(ClO_4)_2$	solid	210 3	800	−1 67$^{10°}$
phosphate, mono-	$BaH_4(PO_4)_2$	solid	735 9		
phosphate, di-	$BaHPO_4$	solid	424 6		
phosphate, tri-	$Ba_3(PO_4)_2$	solid	991 64		
platinochloride	$BaPtCl_6$	solid	284 83	5000	+9 08$^{18°}$
selenide	$BaSe$	solid	88 17		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Barium					
silicate	$BaSiO_3$	fused	356 04		
sulfate	$BaSO_4$	ppt.	345 28		
		dil. sol.	339 31		
sulfhydrate	$Ba(SH)_2$	dil. sol.	136 2		
sulfide	BaS.	solid	111 1		
		dil. sol.	118 5		
sulfite	$BaSO_3$	ppt.	279 57		
Beryllium					
chloride	$BeCl_2$	solid	112 5		
	$BeCl_2.4H_2O$	solid	188 1		
fluoride	BeF_2	dil sol.	240 84		
hydroxide	$Be(OH)_2$	ppt.	206 7		
iodide	BeI_2	sol	67 38		
nitrate	$Be(NO_3)_2$	dil. sol.	184 7		
sulfate	$BeSO_4$	solid	276 47		
	$BeSO_4\ 4H_2O$	solid	567 51		+1 10
Bismuth					
chloride	$BiCl_3$	solid	90 61		
hydroxide	$Bi(OH)_3$	dil. sol.	171 1		
oxide	Bi_2O_3	solid	135 5		
oxychloride	BiOCl	solid	87 69		
Boric acid	H_3BO_3	solid	251 61	400	−5 401$^{18°}$
		dil. sol.	246 12		
Boron					
bromide	BBr_3	liquid	42 77	400	+83 63
chloride	BCl_3	liquid	93 67		
		gas	89 13		
fluoride	BF_3.	gas	256 87		+24 37
oxide	B_2O_3	solid	279 81		
Bromic acid	$HBrO_3$	200	12 7		
Bromine (atomic)	Br	gas	− 26 691		
Bromine	Br_2	solid	+ 2 581		
		gas	− 7 646		
chloride	BrCl	liquid	0 700		
Bromous acid	HBrO	dil. sol.	25 57		
Cadmium					
bromide	$CdBr_2$	solid	75 79	400	+0 43$^{18°}$
		400	76 23		
carbonate	$CdCO_3$	ppt.	178 7		
chloride	$CdCl_2$	solid	92 999	400	+3 106$^{18°}$
		400	96 08		
	$CdCl_2.2\frac{1}{2}H_2O$	solid	269 99	400	−2 939$^{18°}$
cyanide	$Cd(CN)_2$	solid	− 36 80		
fluoride	CdF_2	1200	172 50		
hydroxide (ord ppt.)	$Cd(OH)_2$	ppt.	133 57		
iodide	CdI_2	solid	48 387		
		400	47 431	400	−0 956$^{19°}$
nitrate	$Cd(NO_3)_2$	400	117 06		
	$Cd(NO_3)_2.4H_2O$	solid	395 63	400	−5 042$^{19°}$
oxide	CdO	solid	65 23		
selenide	CdSe	solid	16 7		
		ppt.	22		
sulfate	$CdSO_4$	solid	217 92	400	+10 68$^{18°}$
		400	228 61		
sulfide	CdS.	solid	33 93		
telluride	CdTe	solid	15.8		
Caesium					
bromide	CsBr	solid	97 468	110	−6.738$^{25°}$
		dil. sol.	90.80		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution Kilo-cal
Caesium					
carbonate...	Cs_2CO_3	solid	273 14	220	+11 83$^{15\circ}$
		dil. sol.	285 21		
carbonate, acid	$CsHCO_3$	solid	231 3	220	−4 30$^{15\circ}$
		dil. sol	227 0		
chloride....	$CsCl$	solid	106 48	220	−4 588$^{19\circ}$
		400	101 77		
fluoride....	CsF	solid	131 97	110	+8.363$^{15\circ}$
		400	140 38		
hydroxide..	$CsOH$	solid	100 26	110	+16 4$^{15\circ}$
		400	116 82		
iodide	CsI	solid	83 752	110	−8 24$^{15\circ}$
		dil sol.	75 75		
nitrate	$CsNO_3$	solid	121 79	400	−9 606$^{20\circ}$
		400	112 19		
oxide, mono-	Cs_2O	solid	82 20	600	+83 15$^{18\circ}$
oxide, tetra-..	Cs_2O_4	solid	137 64		
sulfate..	Cs_2SO_4	solid	340 98	220	−4 97$^{15\circ}$
		440	335 96		
sulfate, acid	$CsHSO_4$	solid	275 27	220	−3 728$^{15\circ}$
		220	271 69		
sulfide..	Cs_2S	solid	87 46		+27 24
		dil. sol.	114 70		
Calcium					
acetate	$Ca(C_2H_3O_2)_2$	solid	357 95	440	+6 93$^{16\circ}$
		dil. sol.	364 88		
	$Ca(C_2H_3O_2)_2.H_2O$	solid	427 48	600	+5 85$^{17\circ}$
aluminate, mono-	$CaO.Al_2O_3$	fused	549 59		
aluminate, di-	$2CaO.Al_2O_3$	fused	692 96		
aluminate, tri-	$3CaO.Al_2O_3$	fused	836 33		
aluminum silicate	$3CaO.Al_2O_3.2SiO_2$	solid	1486 3		
arsenate	$Ca_3(AsO_4)_2$	ppt	793 31		
bromide	$CaBr_2$	solid	162 2		+24 37
		dil sol.	186 9		
	$CaBr_2.6H_2O$	solid	598 09	400	−1 10$^{20\circ}$
carbide	CaC_2	solid	14 6		
carbonate	$CaCO_3$	colloid	287 93		
chloride .	$CaCl_2$	solid	190 7	400	+17 99$^{18\circ}$
	$CaCl_2.H_2O$	solid	265 23	300	+11 71$^{18\circ}$
	$CaCl_2.6H_2O$	solid	623 44	400	−4 564$^{18\circ}$
cyanamide	$CaCN_2$	solid	85 07		
cyanide..	$Ca(CN)_2$	dil. sol.	60 45		
ferrocyanide	$Ca_2Fe(CN)_6.12H_2O$	solid	963 21		−4 54$^{10\circ}$
fluoride. .	CaF_2	ppt	286 26		
formate.	$Ca(CHO_2)_2$	solid	326 88	360	+0 669$^{18\circ}$
hydride..	CaH_2	solid	45 88		
hydroxide.	$Ca(OH)_2$	solid	236 1		
		dil sol	238 76		
hypochlorite	$Ca(ClO)_2$	dil. sol.	181 60		
iodide	CaI_2	solid	128 6	400	+27 69$^{18\circ}$
		dil. sol.	156 3		
	$CaI_2.8H_2O$	solid	701 56		+1 74$^{20\circ}$
nitrate	$Ca(NO_3)_2$	solid	225 3	400	+3 943$^{19\circ}$
		400	229 15		
	$Ca(NO_3)_2.4H_2O$	solid	509 92	400	−7 24$^{19\circ}$
nitride...	Ca_3N_2	solid	109.0		
nitrite	$Ca(NO_2)_2.4H_2O$	solid	405 50		
oxalate	CaC_2O_4	ppt.	333 3		
oxide...	CaO	solid	151 71		
peroxide .	CaO_2	solid	155 8		
	$CaO_2.8H_2O$	solid	718 52		

HEAT OF FORMATION AND SOLUTION (Cont.)

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Calcium					
phosphate, mono-	$CaH_4(PO_4)_2$	ppt.	743 13		
phosphate, tri-	$Ca_3(PO_4)_2$	solid	982 1		
phosphate, acid.	$CaHPO_4$	ppt.	432 50		
selenide	CaSe	solid	88 41		
silicate	$CaSiO_3$	fused	375 15		
silicide	$CaSi_2$	solid	224 6		
sulfate (anhydrite)	$CaSO_4$	solid	335 72		+5 26
	$CaSO_4\,2H_2O$	solid	477 80		−0 24
sulfhydrate	$Ca(SH)_2$	dil. sol.	137 4		
sulfide	CaS	solid	113 50		
		dil. sol.	119 71		
thiosulfate	CaS_2O_3	∞	270 49		
Carbon					
dichloride	C_2Cl_4	liquid	6 0		
		gas	− 1 150		
dioxide	CO_2	gas	+ 94 385		
		sat.	99 140		+4 755
disulfide	CS_2	liquid	− 22 0		
		gas	− 28 67		
monoxide	CO	gas	+ 26 428		
oxybromide	$COBr_2$	gas	22 0		
oxychloride	$COCl_2$	gas	52 09		
		liquid	57 993		
tetrachloride	CCl_4	gas	25 400		
		liquid	33 190		
Carbonic acid	H_2CO_3	dil sol.	167 53		
Cerium	Ce	dil sol	164 9		
chloride (ous)	$CeCl_3$	600	283 39		
oxide (ic)	CeO_2	solid	234 9		
sulfate (ous)	$Ce_2(SO_4)_3$	dil sol.	792 84		
Chloric acid	$HClO_3$	400	19 1		
Chlorine (atomic)	Cl	gas	− 28 746		
oxide, mono-	Cl_2O	gas	− 18 26	800	+9 439[18°]
oxide, di-	ClO_2.	liquid	− 30 11		
		gas	− 23 49		
Chlorous acid, hypo-	HClO	200	+ 29 773		
Chromic acid	H_2CrO_4	dil. sol.	206 69		
Chromium					
bromide (ic) (blue)	$CrBr_3$	dil sol.	146 5		
bromide (ic) (green)	$[CrBr_2]Br$	dil. sol.	135 0		
	$(Cr.4H_2O\,Br_2)Br.2H_2O$	solid	544 57	250	+0 669
bromide (ic)	$(Cr.6H_2O)Br_3$	solid	542 42		−14 34
chloride (ic) (rose) (forms green solution)	$CrCl_3$	solid	139 55		+30.59
chloride (ic) (green)	$(CrCl_2.4H_2O)Cl\,2H_2O$	solid	580 41	150	−0 048
chloride (ic) (gray)	$(Cr.6H_2O)Cl_3$	solid	577 30		+12 02
chloride (ic)	$(Cr.4H_2O.Cl)Cl_2.6H_2O$.	solid	854 01		0
chloride (ic)	$(Cr.4H_2O.Cl)Cl_2$	solid	435 37		+8 36
chloride (ous)	$CrCl_2$	solid	99 64		+18.6
		dil. sol.	118 3		
	$CrCl_2.4H_2O$	solid	389 73		+1 9
hydroxide (ic)	$Cr(OH)_3$	ppt.	245.88		
oxide (ic)	Cr_2O_3	solid	267 39		
		amorph.	266.19		
oxide, tri-	CrO_3	solid	136 0	80	+2 461[18°]

Name	Formula	Physical state	Heat of formation. Kilo-cal	Water mols	Heat of solution. Kilo-cal
Chromium					
sulfate (ic) (violet)	$Cr_2(SO_4)_3$	dil. sol.	753 89	...	...
sulfate (ic) (green)	$Cr_2(SO_4)_3$	dil. sol.	730 95		
sulfate (ic) (violet)	$(Cr\ 6H_2O)_2(SO_4)_3.2H_2O$	solid	1701 1		+10 11
sulfate (ic)	$(Cr.6H_2O)_2(SO_4)_3\ 3H_2O$	solid	1771 1		+8 29
sulfate (ic) (green)	$Cr_2(SO_4)_3\ 6H_2O$	solid	1127 4		+13 4
Cobalt					
bromide (ous)	$CoBr_2$	solid	54 96		+18 4
		dil sol.	73 36		
	$CoBr_2\ 6H_2O$	solid	485 07		−1 29
chloride (ous)	$CoCl_2$	solid	76 942	400	+18 45$^{17°}$
fluoride (ous)	CoF_2	dil. sol.	172 81		
hydroxide (ic)	$Co(OH)_3$	ppt.	219 36		
hydroxide (ous)	$Co(OH)_2$	ppt.	128 32		
iodide (ous)	CoI_2.	dil sol.	42 77		
nitrate	$Co(NO_3)_2$	solid	104 2	300	+11 95$^{18°}$
	$Co(NO_3)_2\ 6H_2O$	solid	531 19	400	−4 97$^{18°}$
oxide (ous)	CoO	solid	57 49		
		amorph.	50 18		
oxide (ous) (ic)	Co_3O_4	solid	192 6		
selenide	$CoSe$	solid	13 4		
		ppt.	11 5		
sulfate	$CoSO_4$	800	225 09		
	$CoSO_4\ 7H_2O$	solid	707 29	800	−3 560$^{19°}$
sulfide	CoS	ppt	19 8		
telluride	$CoTe$	solid	11 5		
Copper					
acetate (ic)	$Cu(C_2H_3O_2)_2$	solid	214 6	320	+2 39$^{16°}$
		dil sol	217 0		
	$Cu(C_2H_3O_2)_2\ H_2O$	solid	285 07	400	+0 167$^{18°}$
am chloride (ic)	$CuCl_2\ 2NH_4Cl$	solid	197 6	550	+4 78$^{15°}$
	$CuCl_2.2NH_4Cl\ 2H_2O$	solid	332 86		−6 21
am. sulfate (ic)	$CuSO_4\ 4NH_3$	solid	295 10		
bromide (ic)	$CuBr_2$	solid	32 02	400	+8 244$^{20°}$
		400	40 14		
	$CuBr_2\ 4H_2O$	solid	315 18		−1 43
bromide (ous)	$CuBr$	solid	24 61		
carbonate	$CuCO_3$	ppt.	141 5		
chlorate (ic)	$Cu(ClO_3)_2$	400	22 2		
chloride (ic)	$CuCl_2$	solid	51 422	600	+11 11$^{18°}$
		800	62 605		
	$CuCl_2\ 2H_2O$	solid	195 03	200	+3 704$^{18°}$
chloride (ous)	$CuCl$	solid	32 50		
cyanide (ous)	$CuCN$	solid	− 27 96		
fluoride (ic)	CuF_2	400	+139 8		
formate (ic)	$Cu(CHO_2)_2$	solid	179 5	600	+0 526$^{15°}$
		dil sol	179 9		
	$Cu(CHO_2)_2\ 4H_2O$	solid	461 17	500	−7 89$^{10°}$
hydroxide (ic) (green)	$Cu(OH)_2$	ppt.	104 97		
iodide (ic)	CuI_2	solid	3 10		
		dil sol.	9 08		
iodide (ous)	CuI	solid	15 8		
nitrate	$Cu(NO_3)_2$	solid	72 40	280	+10 47$^{8°}$
		200	82 796		
	$Cu(NO_3)_2\ 3H_2O$	solid	290 56		−2 39
	$Cu(NO_3)_2\ 6H_2O$	solid	503 80	400	−10 70$^{18°}$
oxide (ic)	CuO	solid	34 89		
oxide (ous)	Cu_2O	solid	39 90		
oxychloride	$CuCl_2\ 3CuO$	solid	160 57		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Copper					
selenate	$CuSeO_4$	400	128 6		
	$CuSeO_4\ 5H_2O$	solid	473 1		−2 652
selenide (ic)	$CuSe$	ppt.	4 78		
selenide (ous)	Cu_2Se	solid	7 41		
sulfate (ic)	$CuSO_4$	solid	178.7	800	+15 89$^{18°}$
		800	194.65		
	$CuSO_4\ 5H_2O$	solid	539.33	800	−2 796$^{18°}$
sulfate (ous)	Cu_2SO_4	solid	173.5		
sulfide (ic)	CuS	solid	11.61		
sulfide (ous)	Cu_2S	solid	18 97		
telluride	Cu_2Te	solid	4.06		
Cyanic acid	$HCNO$	dil sol	36 56		
Cyanogen	C_2N_2	liquid	− 65 47		
		gas	− 70 73		
chloride	$CNCl$	liquid	− 28.20		
		gas	− 36 56		
iodide	CNI	solid	− 42 29		
		dil. sol	− 44 92	100	−2 77$^{20°}$
Dysprosium					
sulfate	$Dy_2(SO_4)_3 + 8H_2O$			1200	+6 3
Erbium acetate	$Er(C_2H_3O_2)_3 + 4H_2O$			1500	+0 7
Ethane	C_2H_6	gas	23 4		
Ethyl alcohol	C_2H_5OH	liquid	65 902		
		gas	55 795		
Ethylene	C_2H_4	gas	− 9 56		
Ferric and **Ferrous** salts, see under *Iron*					
Fluosilicic acid	H_2SiF_6	200	545 04		
	$H_2SiF_6.4H_2O$	liquid	789 25		+7 9
Gold					
bromide (ic)	$AuBr_3$	solid	13 38	2000	−3 752$^{18°}$
bromide (ous)	$AuBr$	solid	4 54		
chloride (ic)	$AuCl_3$	solid	27.00	900	+4.444$^{18°}$
chloride (ous)	$AuCl$	solid	10 27		
iodide (ous)	AuI	solid	0 96		
Hydrazine	N_2H_4	dil sol.	− 3 250		
sulfate	$N_2H_4\ H_2SO_4$	solid	+224 37		
		dil sol.	215 77	1200	−8 531$^{19°}$
Hydrazoic acid	HN_3	dil. sol.	− 54 48		
Hydrobromic acid	HBr	gas	+ 8 650	200	+19 88$^{18°}$
		∞	28 602		
	$HBr\ 2H_2O$	solid$^{-15°}$	164 40		
Hydrochloric acid	HCl	gas	22 03		
		∞	39 558	200	+17 44$^{18°}$
Hydrocyanic acid	HCN	gas	− 30 108		
		dil. sol	− 23 90		+5 97
Hydroferricyanide acid	$H_3Fe(CN)_6$.	dil. sol.	−148 1		
Hydroferrocyanic acid	$H_4Fe(CN)_6$	solid	−122 8	200	+0 406$^{10°}$
		dil sol.	−122 3		
Hydrofluoric acid	HF	liquid	+ 94 86		+4 54
		600	75.699		
		gas	63 991		
Hydriiodic acid.	HI	gas	− 5 926	200	+19 24$^{18°}$
		∞	+ 13 333		
Hydrogen (atomic)	H	gas	− 50 42		
oxide (water)	H_2O	liquid	+68 387		
		gas	57 826		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Hydrogen					
peroxide	H_2O_2	liquid	44.516	200	+0 454$^{15°}$
		gas	32.903		
		200	44 970		
selenide	H_2Se	dil. sol.	− 13 4		+2 39$^{18°}$
		gas	− 15 8		
sulfide	H_2S	liquid	+ 9 56		
		gas	5 26		
		dil sol.	9 869		+4 564
telluride	H_2Te	gas	− 33 93		
Hydrosulfurous acid	$H_2S_2O_4$	dil. sol.	+166 1		
Hydroxylamine	NH_2OH	solid	27 60		
Indium					
bromide	$InBr_3$	solid	97 25		
		dil sol	112.8		
chloride, mono-	$InCl$	solid	44 68		
chloride, di-	$InCl_2$	solid	86 74		
chloride, tri-	$InCl_3$	solid	128 6		
		dil sol.	145 28		
iodide	InI_3	solid	32 50		
		dil sol.	66 91		
oxide, sesqui-	In_2O_3	solid	23 90		
Iodic acid	HIO_3	solid	56 392		−2 15
Iodine (atomic)	I	gas	− 25 470		
Iodine	I_2	gas	− 15 1		
bromide, mono-	IBr	liquid	+ 2 63		
chloride, mono-	ICl	solid	6 69		
		liquid	4 54		
chloride, tri-	ICl_3	solid	16 7		
oxide, penta-	I_2O_5	solid	42 055	1500	−1 79$^{18°}$
Iridium					
chloride, di-	$IrCl_2$	solid	20 5		
chloride, tri-	$IrCl_3$	solid	60 45		
oxide, di-	IrO_2	solid	5 02		
Iron					
acetate	$Fe(C_2H_3O_2)_3$	1800	357 23		
ammonium sulfate	$Fe_2(SO_4)_3\ (NH_4)_2SO_4$	1000	458 55		
ammonium sulfate (ic)	$FeNH_4(SO_4)_2\ 12H_2O$	solid	1295 8		
ammonium sulfate (ous)	$FeSO_4\ (NH_4)_2SO_4\ 6H_2O$	solid	927 36		
bromide (ic)	$FeBr_3$	1000	95 10		
bromide (ous)	$FeBr_2$	dil sol.	77 90		
carbonate (ous)	$FeCO_3$	solid	185 2		
		ppt.	179 2		
chlorate (ic)	$Fe(ClO_3)_3$	600	67 38		
chloride (ic)	$FeCl_3$	solid	96 30		+31 78
	$FeCl_3\ 2\tfrac{1}{2}H_2O$	solid	277 90	1200	+21 0$^{18°}$
	$FeCl_3\ 6H_2O$	solid	532 62	1200	+5 73$^{21°}$
chloride (ous)	$FeCl_2$	solid	81 864	400	+17.90$^{18°}$
	$FeCl_2\ 2H_2O$	solid	227 7	300	+8 6$^{20°}$
	$FeCl_2.4H_2O$	solid	370 37	400	+2.748$^{18°}$
ferrocyanide (ic)	$Fe_4[Fe(CN_6]_3$	ppt.	−319 00		
fluoride (ic)	FeF_3	150	+242 53		
fluoride (ous)	FeF_2	1200	177 1		
hydroxide (ic)	$Fe(OH)_3$	ppt	197 37		
hydroxide (ous)	$Fe(OH)_2$	ppt.	135 87		
iodide (ic)	FeI_3	1000	49 46		
iodide (ous)	FeI_2	dil sol.	47 55		
nitrate (ic)	$Fe(NO_3)_2$	800	158 4		
	$Fe(NO_3)_3\ 9H_2O$	solid	782 80	150	−9 08

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Iron					
nitrate (ous)	$Fe(NO_3)_2$	dil. sol.	120.2		
oxide (ic) (ordinary)	Fe_2O_3	solid	190.7		
oxide (ous)	FeO	solid	64.04		
oxide (ous) (ic) (fused)	Fe_3O_4	solid	265.95		
oxide (ous) (ic) (magnetite)	Fe_3O_4	solid	266.91		
selenide (ous)	$FeSe$	solid	19.1		
		ppt	14.3		
silicate	$FeSiO_3$	solid	264.52		
sulfate (ic)	$Fe_2(SO_4)_3$	1200	641.77		
sulfate (ous)	$FeSO_4$	solid	217.23	110	+14.901$^{14°}$
		400	231.95		
	$FeSO_4.7H_2O$	solid	715.11	400	−4.32$^{14°}$
sulfide (ous)	FeS	solid	23.06		
sulfide, di- (pyrite)	FeS_2	solid	35.60		
telluride (ous)	$FeTe$	solid	7.65		
Lanthanum					
chloride	$LaCl_3$	solid	266.67	1200	+31.30$^{16°}$
oxide	La_2O_3	solid	456.87		
sulfate	$La_2(SO_4)_3$	dil. sol	987.10		
	$La_2(SO_4)_3.8H_2O$	solid	1530.0	2400	+4.06$^{8°}$
sulfide, di-	LaS_2	solid	162.0		
sulfide	La_2S_3	solid	317.33		
Lead					
acetate	$Pb(C_2H_3O_2)_2$	solid	234.00	220	+1.41$^{11°}$
	$Pb(C_2H_3O_2)_2.3H_2O$	solid	446.12	100	−5.50$^{11°}$
bromide	$PbBr_2$	solid	66.261		
		dil. sol.	56.225	2500	−10.04$^{18°}$
carbonate	$PbCO_3$	solid	168.9		
chloride	$PbCl_2$	solid	85.664		
		dil. sol.	79.116		−6.55
chromate	$PbCrO_4$	solid	218.2		
fluoride	PbF_2	solid	159.10		
hydroxide	$Pb(OH)_2$	ppt	137.6		
iodide	PbI_2	solid	41.840		
nitrate	$Pb(NO_3)_2$	solid	108.292	400	−7.599$^{18°}$
		400	100.67		
nitride	PbN_6	solid	−100.60		
oxalate	PbC_2O_4	solid	+206.2		
oxide, mono-	PbO	solid	52.473		
oxide, di-	PbO_2	solid	62.60		
oxide, sub-	Pb_2O	solid	51.255		
oxide, (red)	Pb_3O_4	solid	174.19		
oxybromide	$PbBr_2.PbO$	solid	119.7		
	$PbBr_2.2PbO$	solid	171.3		
oxychloride	$PbCl_2.PbO$	solid	142.65		
	$PbCl_2.2PbO$	solid	195.9		
	$PbCl_2.3PbO$	solid	247.79		
oxyiodide	$PbI_2 + PbO$	solid	3.6		
phosphite	$PbHPO_3$	solid	231.8		
selenide	$PbSe$	solid	12.4		
		ppt.	23.7		
sulfate	$PbSO_4$	solid	214.6		
sulfide	PbS	ppt.	22.2		
sulfocyanate	$Pb(CNS)_2$	solid	− 28.67		
telluride	$PbTe$	solid	+ 5.5		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Lead					
thiosulfate	PbS_2O_3	solid	147 2		
Lithium					
bromide	$LiBr$	solid	83 728	850	$+11\ 25^{14°}$
		200	95 064		
carbide	Li_2C_2	solid	13 6		$+37\ 04^{17°}$
carbonate	Li_2CO_3	solid	290 8	220	$+3\ 06^{15°}$
	Li_2CO_3	dil. sol.	293 91		
carbonate, acid	$LiHCO_3$	500	232 3		
chloride	$LiCl$	solid	97 420	200	$+8\ 507^{18°}$
		∞	106 04		
cyanide	$LiCN$	200	31 30		
fluoride	LiF	solid	145 54	110	$-1.03^{15°}$
		dil. sol.	144 49		
fluosilicate	Li_2SiF_6	solid	677 49	800	$+1\ 816$
		dil. sol.	679 31		
hydride	LiH	solid	21 5	2000	$+31\ 30^{18°}$
hydroxide	$LiOH$	solid	116 4	110	$+4\ 468^{24°}$
		∞	121 00		
iodide	LiI	solid	64 994	200	$+14.77^{18°}$
		200	79 759		
nitrate	$LiNO_3$	solid	115 82	400	$+0\ 430^{21°}$
		∞	116 27		
	$LiNO_3.3H_2O$	solid	328 32		
nitride	Li_3N	solid	45 88		$+131\ 2$
oxide	Li_2O.	solid	141 7	220	$+31\ 30^{15°}$
selenide	Li_2Se	solid	95 34		$+10\ 66^{20°}$
		dil. sol.	106 1		
silicate	Li_2SiO_3	fused	372 76		
		solid	434 89		
sulfate	Li_2SO_4	solid	337 9		$+6\ 380$
	$Li_2SO_4.H_2O$	solid	409 08	400	$+3\ 417^{18°}$
sulfhydrate	$LiSH$	dil. sol.	64 11		
sulfide	Li_2S	dil. sol.	115 4		
Magnesium					
ammonium arsenate	$MgNH_4AsO_4\ 6H_2O$	solid	763 92		
ammonium phosphate	$MgNH_4PO_4.6H_2O$	solid	901 56		
ammonium sulfate	$MgSO_4.(NH_4)_2SO_4.6H_2O$	solid	1016 5		$-9\ 80$
ammonium sulfite	$3MgSO_3.(NH_4)_2SO_3.6H_2O$	solid	1375 6		
arsenate	$Mg_3(AsO_4)_2$	solid	731 43		
arsenate, acid	$MgHAsO_4$	dil. sol.	322 8		
bromide	$MgBr_2$	solid	124 0		$+43.25^{15°}$
		400	167 3		
carbonate	$MgCO_3$	solid	267 39		
chloride	$MgCl_2$	solid	153 2	800	$+35\ 986^{16°}$
	$MgCl_2.6H_2O$	solid	596 37	200	$+2.939^{18°}$
cyanamide	$MgCN_2$.	solid	59 26		
cyanide	$Mg(CN)_2$	dil. sol.	40 38		
dithionate	$MgS_2O_6.6H_2O$	solid	797 38	400	$-2\ 963^{19°}$
fluoride	MgF_2	ppt.	263 80		
hydroxide (brucite)	$Mg(OH)_2$	solid	223 4		
hydroxide	$Mg(OH)_2$	ppt	218 6		
iodide	MgI_2	solid	86 74		$+49\ 70$
		dil sol.	136 7		
nitrate	$Mg(NO_3)_2$	400	209 51		
	$Mg(NO_3)_2.6H_2O$	solid	623 90	400	$-4\ 229^{18°}$
nitride	Mg_3N_2	solid	118 3		
oxide (bomb)	MgO		145 76		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Magnesium					
phosphate	$Mg_3(PO_4)_2$	colloid	915.18		
silicate	$MgSiO_3$	solid	346.48		
sulfate	$MgSO_4$	solid	301.08	400	+20.3$^{18°}$
		400	321.33		
	$MgSO_4.7H_2O$	solid	803.85	400	−3.871$^{18°}$
sulfide	MgS	solid	82.20		
sulfite	$MgSO_3$	solid	238.5		
	$MgSO_3.6H_2O$	solid	671.21		
sulfhydrate	$Mg(SH)_2$	dil. sol.	117.3		
Manganese					
acetate	$Mn(C_2H_3O_2)_2$	solid	272.88	500	+12.2$^{17°}$
		dil. sol.	285.31		
	$Mn(C_2H_3O_2)_2.4H_2O$	solid	556.99	600	+1.67$^{16°}$
bromide	$MnBr_2$	solid	90.80		
		dil. sol.	106.8		
carbide	Mn_3C	solid	12.4		
carbonate	$MnCO_3$	solid	212.9		
chloride	$MnCl_2$	solid	112.69	350	+16.01$^{18°}$
		400	128.79		
	$MnCl_2.4H_2O$	solid	400.72	400	+1.53$^{18°}$
dithionate	$MnS_2O_6.6H_2O$	solid	736.20	400	−1.9$^{18°}$
fluoride, di-	MnF_2	dil. sol.	206.0		
fluoride, sesqui-	MnF_3	dil. sol.	260.46		
formate	$Mn(CHO_2)_2$	solid	242.3	500	+4.30$^{24°}$
	$Mn(CHO_2)_2.2H_2O$	solid	386.38	300	−2.87$^{24°}$
hydroxide	$Mn(OH)_3$	ppt.	219.8		
hydroxide (ous)	$Mn(OH)_2$	ppt.	163.4		
iodide	MnI_2	dil. sol.	76.46		
nitrate	$Mn(NO_3)_2$	solid	136.2	300	+12.69$^{14°}$
		400	149.1		
	$Mn(NO_3)_2.6H_2O$	solid	565.59	400	−6.141$^{18°}$
oxalate	MnC_2O_4	ppt.	259.50		
oxide (ic)	Mn_2O_3	solid	227.0		
oxide (ous)	MnO	solid	90.8		
oxide, di-	MnO_2	solid	125.4		
oxide, di- (hydrated ppt.)	MnO_2	amorph.	115.89		
oxide (ous) (ic)	Mn_3O_4	solid	327.84		
phosphate	$Mn_3(PO_4)_2$	solid	733.10		
selenide	$MnSe$	ppt.	27		
		solid	23.9		
silicate	$MnSiO_3$	solid	299.40		
sulfate (ous)	$MnSO_4$	solid	247.07	400	+13.79$^{18°}$
		400	261.01		
	$MnSO_4.H_2O$	solid	321.39	400	+7.790$^{18°}$
	$MnSO_4.5H_2O$	solid	602.87	400	+0.0478$^{18°}$
	$MnSO_4.7H_2O$	solid	744.81		
sulfide (ous)	MnS	ppt	47.31		
		solid	60		
Manganic acid	$HMnO_4$	dil. sol.	123.3		
Methane	CH_4	gas	19.1		
Methyl alcohol	CH_3OH	liquid	60.001		
		gas	50.896		
		dil. sol.	61.89		+2.01
Mercury					
acetate (ic)	$Hg(C_2H_3O_2)_2$	solid	198.1		
acetate (ous)	$Hg_2(C_2H_3O_2)_2$	solid	203.35		
bromide (ic)	$HgBr_2$	solid	41.58		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Mercury					
bromide (ous)	Hg_2Br_2	ppt.	49 22		
chloride (ic)	$HgCl_2$	solid	53 429	300	$-3\ 321^{18°}$
chloride (ous)	Hg_2Cl_2	ppt.	63 01		
cyanide (ic)	$Hg(CN)_2$	solid	− 62 13		−3 11
dimercuri-diammonium chloride	$NHg_2Cl.NH_4Cl$	solid	141 5		
dimercuri-tetra ammonium chloride	$NHg_2Cl.3NH_4Cl$	solid	289 6		
fulminate (ic)	$HgC_2N_2O_2$	solid	− 64 52		
iodide (ic) (red)	HgI_2	solid	25 33		
iodide (ic) (yellow)	HgI_2	solid	22 2		
iodide (ous) (yellow)	Hg_2I_2	solid	28 865		
nitrate (ic)	$Hg(NO_3)_2$	dil sol	58 1		
nitrate (ous)	$Hg_2(NO_3)_2$	dil. sol.	59 499		
	$Hg_2(NO_3)_2\ 2H_2O$	solid	207 9		
nitride (ous)	Hg_2N_6	solid	− 97 49		
oxalate (ic)	HgC_2O_4	solid	160 10		
oxide (ic) (red)	HgO	solid	21 7		
oxide (ous)	Hg_2O	solid	21 5		
oxybromide (ic)	$HgBr_2\ HgO$	solid	64 52		
	$HgBr_2.3HgO$	solid	108 2		
oxychloride (ic)	$HgCl_2\ HgO$	solid	75 75		
	$HgCl_2.2HgO$	solid	97 73		
	$HgCl_2.3HgO$	solid	118 5		
	$HgCl_2\ 4HgO$	solid	139 3		
selenide (ic)	$HgSe$	ppt.	5 26		
sulfate (ic)	$HgSO_4$	solid	162 5		
sulfate (ous)	Hg_2SO_4	solid	171 59		
sulfide (red)	HgS	solid	10 90		
sulfide (black)	HgS	amorph	10 5		
sulfocyanate	$Hg(CNS)_2$	solid	− 50 42		
Molybdenum					
oxide, di-	MoO_2	solid	131 4		
oxide, tri-	MoO_3	solid	174 0		
Molybdic acid	H_2MoO_4	solid	+247 07		
		dil. sol.	246 60		
Neodymium					
chloride	$NdCl_3$	solid	246 60	2000	+35 60
		dil sol	282 20		
iodide	NdI_3	solid	155 3	2000	$+48\ 98^{19°}$
		dil sol.	204 3		
oxide	Nd_2O_3	solid	434 89		
sulfate	$Nd_2(SO_4)_3$	solid	919 48	500	+36 56
		dil. sol.	956 04		
sulfide	Nd_2S_3	solid	262 61		
Nickel					
bromide	$NiBr_2$	solid	53 29		+18 9
		dil sol	72 40		
bromide ammonia	$NiBr_2.6NH_3$	solid	221 7		
chloride	$NiCl_2$	solid	74 983	400	$+19\ 16^{18°}$
		800	94 266		
	$NiCl_2.6H_2O$	solid	505 55	400	$-1\ 15^{19°}$
chloride ammonia	$NiCl_2.6NH_3$	solid	248 75		
cyanide	$Ni(CN)_2$	solid	− 23 25		
dithionate	NiS_2O_6	dil. sol.	+290 09		
	$NiS_2O_6.6H_2O$	solid	702 75	400	$-2\ 413^{19°}$

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Nickel					
fluoride ..	NiF_2	dil. sol.	171 4		
hydroxide (ic)	$Ni(OH)_3$	ppt.	196 66		
hydroxide (ous)	$Ni(OH)_2$	ppt.	129 80		
iodide	NiI_2..	dil sol.	41 82		
nitrate	$Ni(NO_3)_2$	solid	102 7	280	+11 7$^{18°}$
	$Ni(NO_3)_2.6H_2O$	solid	532 26	400	−7 479$^{18°}$
oxide	NiO	solid	57 83		
selenide. . .	$NiSe$	solid	13 4		. ...
		ppt.	14 8		....
sulfate. . .	$NiSO_4$	400	227 05		
	$NiSO_4.7H_2O$	solid	710 11	800	−4 253$^{19°}$
sulfide .	NiS	ppt.	20 8		
telluride	$NiTe$	solid	10 8		
Nitric acid.	HNO_3	liquid	42 366		+7 169$^{10°}$
		gas	35 341		
		∞	49 797		
Nitrogen (atomic).	N. . .	gas	−129 0		
oxide (ic)	NO	gas	− 21 5		
oxide (ous). .	N_2O. .	gas	− 17 0		
		liquid	− 18 73		
oxide, tetra-. .	NO_2. .	gas (ideal)	− 7 431		
	N_2O_4	gas (ideal)	− 1 86		
oxide, penta-	N_2O_5	solid	+ 14 6	400	+16 68$^{10°}$
		gas	− 1 2		+29 797$^{10°}$
oxybromide	$NOBr$	gas	− 17 54		
oxychloride	$NOCl$	gas	− 12 66		
selenide. .	NSe. .	solid	− 42 29		
sulfide. . .	NS.	solid	− 31 78		
Nitrous acid	HNO_2	200	+ 28 91		
Osmium					
oxide, tetra-.	OsO_4	solid	93 43		
		liquid$^{40°}$	90 036		
Oxalic acid ..	$H_2C_2O_4$	solid	197 04		
		dil sol.	194 5	300	−2 27$^{18°}$
	$H_2C_2O_4\ 2H_2O$	solid	339 79	300	−8 578$^{20°}$
Oxygen (atomic)	O	gas	− 81 48		
(ozone)	O_3.	gas	− 34 41		
		dil sol	− 32 50		+1 9
Palladium					
am. chloride.	$PdCl_2\ 2NH_3$	solid	105 4		
	$PdCl_2\ 4NH_3$	solid	158 2		
am. iodide	$PdI_2\ 2NH_3$	solid	73 84		
	$PdI_2.4NH_3$	solid	121 6		
bromide .	$PdBr_2$	solid	27 96		
chloride.. .	$PdCl_2$	solid	43 49		
cyanide..	$Pd(CN)_2$	solid	− 49 0		
hydride..	Pd_2H..	solid	+ 17 7		
hydroxide (ic)	$Pd(OH)_4$..	ppt	168 0		
hydroxide (ous).	$Pd(OH)_2$..	ppt.	91 76		
iodide	PdI_2	solid	17 92		
oxide, mono-	PdO.	solid	21 5		
Perchloric acid	$HClO_4$..	liquid	19 4	500	+20 3$^{19°}$
		200	39 67		
	$HClO_4.2H_2O$	solid	100 4		+7 65
Periodic acid	HIO_4. . .	dil. sol.	45 40		
Phosphonium					
bromide	$PH_3\ HBr$	solid	25 57		−3 03
chloride .	PH_3HCl	solid	31 06		
iodide	$PH_3.HI$.	solid	12 07		−4 78

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal
Phosphoric acid					
meta-	HPO_3	solid	224 90		+9 749
ortho-	H_3PO_4	solid	303 13	150	+2 700$^{19°}$
		liquid	300 74	200	+5 352$^{20°}$
		400	306 17		
pyro	$H_4P_2O_7$	solid	531 64		+8 005
		liquid	529 37		+10 23
Phosphorous acid					
hypo-	H_3PO_2	solid	141 36	150	−0 167$^{12°}$
		liquid	139 02	150	+2 17$^{19°}$
ortho-	H_3PO_3	solid	228 94	150	+0 119$^{19°}$
		liquid	225 86	150	+2 939$^{19°}$
pyro-	$H_4P_2O_5$	dil. sol.	384 23		
Phosphorus					
bromide, tri-	PBr_3	liquid	45 40		
bromide, penta-	PBr_5	solid	60 69		
chloride, tri-	PCl_3	liquid	76 94	1000	+65 138$^{19°}$
		gas	70 01		
chloride, penta-	PCl_5	solid	106 6	1000	+123 44$^{22°}$
hydride (phosphine)	PH_3	gas	− 5 97		
hydride (solid)	P_2H	solid	+ 11 9		
iodide, tri-	PI_3	solid	11 0		
iodide, tetra-	P_2I_4	solid	19 8		
nitride	P_3N_5	solid	75 03		
oxide, penta-	P_2O_5	solid	365 83		
oxybromide	$POBr_3$	solid	106 8		
oxychloride	$POCl_3$	liquid	147 15	1000	+72 187$^{20°}$
Platinic acid					
bromo-	H_2PtBr_6	dil. sol.	115 4		
	$H_2PtBr_6.9H_2O$	solid	733 8		−2 87
chloro-	H_2PtCl_6	dil. sol.	165 6		
	$H_2PtCl_6\ 6H_2O$	solid	571 57	500	+4 349
Platinum					
bromide	$PtBr_4$	solid	40 14	1000	+9 80
chloride, di-	$PtCl_2$	solid	35 84		
chloride, tetra-	$PtCl_4$	solid	62 60		
		dil. sol.	81 96		
	$PtCl_4.5H_2O$	solid	425 81	100	−1 84
hydroxide	$Pt(OH)_2$	ppt.	87 69		
iodide	PtI_4	solid	16 7		
oxide, mono-	PtO	solid	17 0		
Potassium					
acetate	$KC_2H_3O_2$	solid	174 48	200	+3 35$^{20°}$
aluminum sulfate	$KAl(SO_4)_2\ 12H_2O$	solid	1439 9	1200	−10 11$^{18°}$
arsenate (tribasic)	K_3AsO_4	400	389 73		
arsenate (dibasic)	K_2HAsO_4	400	335 01		
arsenate (monobasic)	KH_2AsO_4	dil. sol.	280 77		−4 78
		400	275 99		
arsenite, ortho-	KH_2AsO_3	800	230 1		
bromate	$KBrO_3$	solid	83 107	400	−10 0$^{18°}$
bromide	KBr	solid	94 027	200	−5 066$^{18°}$
		∞	88 889		
bromopalladite	K_2PdBr_4	dil. sol.	208 4		
bromoplatinate	K_2PtBr_6	solid	248 51		−12 26
		dil. sol.	236 1		
bromoplatinite	K_2PtBr_4	solid	221 0		−10 56
		dil. sol.	210 5		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Potassium					
carbonate...	K_2CO_3.	solid	274 96	400	$+6.499^{16^\circ}$
		400	281 46	....	
carbonate, acid	$KHCO_3$.	solid	231 3	220	$-5\ 329^{15^\circ}$
		200	225.8	....	
chlorate.. ..	$KClO_3$.. . ..	solid	89.869	400	-10.27^{18°
		∞	79.379	....	
chloride....	KCl....	solid	104 30	200	-4.444^{18°
		∞	99 879	....	
chloriridate...	K_2IrCl_6 .	solid	279 57	..	
		dil. sol.	266 91	.. ..	-3 11
	K_3IrCl_6	solid	365 59	..	
chloropalladate . .	K_2PdCl_6	solid	290 09		-15 1
		dil. sol.	275 03		
chloropalladite	K_2PdCl_4. .	solid	261 41	300	$-13\ 62^{19^\circ}$
		dil. sol.	247 79	....	
chloroplatinate	K_2PtCl_6 .	solid	299 64	...	
		dil. sol.	286 26	...	-13 76
chloroplatinite..	K_2PtCl_4 .	solid	254 72	..	-12 11
		dil. sol.	242.53	..	
chromate....	K_2CrO_4.	solid	329 51	540	-5 26
		800	324.30	..	
cyanate ..	KCNO	solid	100 12	400	$-5\ 161^{20^\circ}$
		dil. sol.	94.86	..	
cyanide .	KCN. .	solid	28 20	200	-2.87^{18°
		200	25 09		
dichromate	$K_2Cr_2O_7$	solid	481 72	1000	$-17\ 44^{18^\circ}$
		∞	463 35	.	
dithionate, see under *thionate, di-*					
ferric sulfate	$KFe(SO_4)_2.12H_2O$	solid	1323 5	.	-16 0
ferricyanide	$K_3Fe(CN)_6$.	solid	48 98	400	-14.3^{13°
		dil. sol.	34 41	.	
ferrocyanide	$K_4Fe(CN)_6$ ..	solid	131 7	1000	$-12\ 4^{17^\circ}$
		dil. sol.	119 24		
	$K_4Fe(CN)_6.3H_2O$	solid	340 98	1000	$-16\ 5^{17^\circ}$
ferrous sulfate	$K_2Fe(SO_4)_2.6H_2O$	solid	985 19	..	-11 0
fluoride	KF..	solid	134 10	110	$+4.110^{15^\circ}$
		400	138.21	.	
	$KF.2H_2O$.	solid	277.11	110	-2.2^{15°
fluoride, acid	KHF_2	solid	219.36	400	$-5\ 97^{15^\circ}$
fluosilicate	K_2SiF_6....	solid	681.96	.	
		dil. sol.	667 63	.	
hydride	KH	solid	14 1	..	
hydroxide	KOH	solid	102 01	175	$+12\ 95^{21^\circ}$
		∞	114 85	....	
hypochlorite	KClO .	400	86.141	....	
hypophosphite	KH_2PO_2	dil. sol.	202 9		
iodate	KIO_3 ..	solid	121 48	400	$-6\ 762^{18^\circ}$
iodide	KI . ..	solid	78.758	400	$-5\ 114^{18^\circ}$
		∞	73.62	...	
iodide, tri-	KI_3	dil. sol.	71.92	...	
magnesium chloride (melt)	$KCl.MgCl_2$	solid	260 69	....	$+28\ 20^{18^\circ}$
	$KCl.MgCl_2.6H_2O$	solid	702 27	...	$-3\ 08^{15^\circ}$
magnesium sulfate	$K_2Mg(SO_4)_2$	solid	642 78	600	$+10.5^{19^\circ}$
	$K_2Mg(SO_4)_2.6H_2O$	solid	1073 6	600	-10.01^{18°
mercuric bromide..	$KBr.HgBr_2$	solid	137.9	..	
	$2KBr.HgBr_2$	solid	229 9	660	$-9\ 749^{18^\circ}$
mercuric chloride .	$KCl.HgCl_2$	solid	159.9	700	-9.56^{14°
	$2KCl.HgCl_2$	solid	266 67	1000	$-15\ 03^{14^\circ}$
	$2KCl.HgCl_2.H_2O$.	solid	336 44	600	$-16\ 39^{18^\circ}$

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Potassium					
nitrate	KNO_3	solid	118 78	200	−8 459$^{18°}$
		∞	110 11		
nitrite	KNO_2	dil. sol.	85.78		
oxalate	$K_2C_2O_4$	solid	320 43		−4 78
oxalate, acid	KHC_2O_4	solid	264 52		−9 56
oxalate, tetra-	$KHC_2O_4.H_2C_2O_4$	solid	465 00		−15 8
oxide	K_2O	solid	86 26	300	+75 03$^{17°}$
perchlorate	$KClO_4$	dil. sol.	112 07		
		∞	99 236		
periodate	KIO_4	dil. sol.	97 73		
permanganate	$KMnO_4$	solid	194 3		
persulfate	$K_2S_2O_8$	solid	444 69	3300	−11 6$^{9°}$
		dil. sol.	430 11		
phos. ortho-	K_3PO_4	dil. sol.	479 33		
phos. hydrogen	K_2HPO_4	dil. sol.	426 05		
phos. dihydrogen	KH_2PO_4	solid	372 05		−4 78
		dil. sol.	367 27		
phosphite	K_2HPO_3	dil. sol.	350 06		
selenide	K_2Se	solid	85 3	1800	+8 60$^{13°}$
	$K_2Se.9H_2O$	solid	728 32	4000	−19 1$^{14°}$
	$K_2Se.14H_2O$	solid	1071 5	4000	−20 3$^{13°}$
	$K_2Se.19H_2O$	solid	1422 2		−29 39$^{14°}$
silver bromide	$AgBr + KBr$	solid	−0 4		
silver cyanide	$KAg(CN)_2$	solid	+6 69	400	−8 554$^{11°}$
silver iodide	$KI.AgI$	solid	97 49		
silver iodide	$3KI.AgI$	solid	255 92		
sulfate	K_2SO_4	solid	338 62	400	−6 547$^{18°}$
		∞	331 93		
sulfate, acid	$KHSO_4$	solid	272 88	200	−3 799$^{17°}$
		800	269 75		
sulfate, pyro-	$K_2S_2O_7$	solid	466 91		−3 82
		dil. sol.	463 09		
sulfhydrate	KHS	400	63 967		
	$KHS.\frac{1}{4}H_2O$	solid	80 29	1000	+0 765$^{17°}$
sulfide, mono-	K_2S	solid	88 17		+22 5
		400	110 59		
	$K_2S.2H_2O$	solid	243 49	1200	+3 82$^{18°}$
	$K_2S.5H_2O$	solid	457 59	1000	−5 26$^{16°}$
sulfide, tetra-	K_2S_4	solid	113 7	100	+1 2$^{10°}$
	$K_2S_4.\frac{1}{2}H_2O$	solid	151 3		−2 20$^{12°}$
sulfite	K_2SO_3	solid	265 95	300	+1 4$^{12°}$
		600	267 39		
	$K_2SO_3\ H_2O$	solid	334 53		
sulfite, acid	$KHSO_3$	400	207 74		
sulfocyanate	$KCNS$	solid	54 24	100	−12.2
		dil. sol.	42 06		
tartrate	$K_2C_4H_4O_6$	solid	419 36	400	−2 844$^{18°}$
		dil. sol.	416 49		
	$K_2C_4H_4O_6.\frac{1}{2}H_2O$	solid	456 87	400	−6 141$^{18°}$
tartrate, acid	$KHC_4H_4O_6$	solid	369 18		
		dil. sol.	357 71		
thionate, di-	$K_2S_2O_6$	solid	407 91		
thionate, tri-	$K_2S_3O_6$	solid	394 27	500	−12 45$^{18°}$
thionate, tetra-	$K_2S_4O_6$	solid	395.46	500	−13 14$^{17°}$
thionate, penta-	$K_2S_5O_6$	solid	398.09		−10 0
		dil. sol.	388 05		
	$K_2S_5O_6\ \frac{1}{2}H_2O$	solid	503 7	2000	−13 14$^{10°}$
thiosulfate	$K_2S_2O_3$	solid	266 67	800	−5 02$^{10°}$
		dil. sol.	261 65		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Potassium					
thiosulfate	$K_2S_2O_3.H_2O$	solid	336.20	.	$-6.21^{14°}$
zinc sulfate	$K_2Zn(SO_4)_2$	solid	572.05	600	$+7.909^{18°}$
	$K_2Zn(SO_4)_2.6H_2O$	solid	1002.2	600	$-11.80^{18°}$
Praseodymium					
chloride	$PrCl_3$	solid	240.38	2500	$+33.45^{18°}$
		dil. sol.	273.84		...
	$PrCl_3.7H_2O$	solid	747.20	2000	$+5.26^{17°}$
nitrate	$Pr(NO_3)_2$	dil. sol.	315.41		......
oxide	PrO_2	solid	215.1	.	....
oxide, tri-	Pr_2O_3	solid	416.97	.	......
Rubidium					
bromide	RbBr	solid	96.06	110	$-5.95^{15°}$
		400	89.61	.	.
carbonate	Rb_2CO_3	solid	273.84		+8.746
		dil. sol.	282.68	.	...
carbonate, acid	$RbHCO_3$	solid	230.6	110	$-4.731^{15°}$
		dil. sol.	225.8		.
chloride	RbCl	solid	104.97	400	$-4.23^{21°}$
		400	100.53	.	
fluoride	RbF	solid	133.31	110	$+5.806^{16°}$
		400	139.12		..
hydroxide	RbOH	solid	101.20	110	$+14.27^{15°}$
iodide	RbI	solid	80.77	110	$-6.499^{15°}$
		dil. sol.	74.31		.
nitrate	$RbNO_3$	solid	119.62	400	$-8.769^{21°}$
		200	110.99	...	
oxide, mono-	Rb_2O	solid	82.92	..	$+80.05^{19°}$
oxide, di-	Rb_2O_2	solid	107.05		
oxide, tetra-	Rb_2O_4	solid	135.0		.
sulfate	Rb_2SO_4	solid	339.98	220	$-6.667^{18°}$
		440	333.45		....
sulfate, acid	$RbHSO_4$	solid	274.10	220	$-3.728^{15°}$
		330	270.32	..	....
sulfide	Rb_2S	solid	87.69	.	+24.61
		dil. sol.	112.31	...	......
sulfocyanate	RbCNS	solid	56.87	.	−14.3
		dil. sol.	42.77		...
Ruthenium					
chloride	$RuCl_3$	solid	62.84		....
oxide, di-	RuO_2	solid	52.57		..
Selenic acid	H_2SeO_4	solid	130.23	400	+13.36
		liquid	126.64	400	+16.7
Selenious acid	H_2SeO_3	solid	128.03		−4.110
		dil. sol	123.92		...
Selenium	Se_2	gas	34.89	..	......
chloride, mono-	Se_2Cl_2	liquid	22.15	.	....
chloride, tetra-	$SeCl_4$	solid	46.165	.	....
hydride, see *hydrogen selenide*					
nitride, see *nitrogen selenide*					
oxide, di-	SeO_2	solid	56.416		−0.908
Silicic acid, ortho-	H_4SiO_4	colloid	333.81		
Silicon					
bromide, tetra	$SiBr_4$	liquid	91.52	2000	$+19.8^{9°}$
carbide	SiC	solid	1.43	...	.
chloride, tetra	$SiCl_4$	liquid	149.1	..	
		gas	142.7	.	....

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Silicon					
fluoride, tetra	SiF_4	gas	361.29		
hydride	SiH_4	gas	11.9		
iodide, tetra-	SiI_4	solid	27.72	12,000	+20.5$^{9°}$
oxide, di-	SiO_2	fused	198.3		
oxide, di- (α quartz)	SiO_2	solid	201.34		
sulfide (white)	SiS_2	solid	32.02		+9.32$^{10°}$
sulfide (yellow)	SiS_2	solid	28.91		+10.8$^{10°}$
Silver					
acetate	$AgC_2H_3O_2$	solid	97.01		−4.397
bromide	$AgBr$	solid	23.85		
carbide	Ag_2C_2	solid	−83.87		
carbonate	Ag_2CO_3	solid	+120.9		
chlorate	$AgClO_3$	solid	1.67		−7.53
		dil. sol.	−5.73		
chloride	$AgCl$	solid	+30.59		
cyanate	$AgCNO$	solid	23.7		
cyanide	$AgCN$	solid	−33.45		
fluoride	AgF	solid	+48.698		+4.301$^{10°}$
	$AgF.2H_2O$	solid	191.26		−1.4$^{10°}$
iodide	AgI	ppt.	14.93		
nitrate	$AgNO_3$	solid	30.11	400	−5.472$^{18°}$
		400	24.66		
nitride	AgN_3	solid	−66.19		
nitrite	$AgNO_2$	solid	+12.7		−8.84
oxalate	$Ag_2C_2O_4$	solid	159.6		
oxide	Ag_2O	solid	6.953		
oxide, per	Ag_2O_2	solid	5.400		
perchlorate	$AgClO_4$	solid	12.23		+2.17
		dil. sol.	14.41		
selenide	$AgSe$	ppt.	−0.956		
sulfate	Ag_2SO_4	solid	+166.1		
		dil. sol.	161.5		
sulfide	Ag_2S	solid	5.02		
sulfocyanate	$AgCNS$	solid	−21.03		
Sodium					
acetate	$NaC_2H_3O_2$	solid	+171.16	200	+3.943$^{18°}$
		400	175.10		
	$NaC_2H_3O_2.3H_2O$	solid	384.71	400	−4.588
aluminate	$NaAlO_2$	solid	271.69		
amide	$NaNH_2$	solid	32.26		+31.06$^{21°}$
arsenate	Na_3AsO_4	solid	358.		
		500	381.60		
	$Na_3AsO_4.12H_2O$	solid	1214.8	600	−12.7$^{18°}$
arsenate (disodium)	Na_2HAsO_4	400	329.03		
arsenate, acid	NaH_2AsO_4	300	273.12		
arsenite	Na_2HAsO_3	400	271.69		
borate	$NaBO_2$	300	231.5		
borate, tetra-	$Na_2B_4O_7$	solid	742.18		+10.27
		dil. sol.	752.45		
	$Na_2B_4O_7.10H_2O$	solid	1462.14	1600	−25.854$^{18°}$
bromide	$NaBr$	solid	86.333	200	−0.191$^{18°}$
		200	86.15		
	$NaBr.2H_2O$	solid	227.72	300	−4.71$^{18°}$
bromoplatinate	Na_2PtBr_6	solid	220.8	800	+9.940$^{18°}$
		dil. sol.	230.8		
	$Na_2PtBr_6.6H_2O$	solid	649.71	800	−8.60$^{18°}$
carbide	Na_2C_2	solid	−4.78		
carbonate	Na_2CO_3	solid	+270.56	400	+5.639$^{18°}$
		400	276.18		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Sodium					
carbonate.	$Na_2CO_3.H_2O$	solid	342 32	400	+2 25$^{18°}$
	$Na_2CO_3.10H_2O$	solid	976 16	400	−16 15$^{18°}$
carbonate, acid	$NaHCO_3$.	solid	227 5		−4.30$^{15°}$
		200	223 35		
chlorate ..	$NaClO_3$. .	solid	82.34		.
		dil. sol.	77 06		
chloride	NaCl	solid	98 36	200	−1 281$^{18°}$
		∞	97 08		. .
chloroplatinate	Na_2PtCl_6	solid	271 93	800	+8 507$^{18°}$
		dil. sol.	280 29		
	$Na_2PtCl_6.6H_2O$	solid	701 32	900	−10 61$^{18°}$
chloroplatinite. .	Na_2PtCl_4	solid	227 0	.	+10 04
		dil sol.	237 0		
chromate. . . .	Na_2CrO_4	solid	316 61	600	+2 39$^{11°}$
		800	319 00		
	$NaCrO_4.10H_2O$	solid	1018 4	1200	−15 79$^{11°}$
cyanate	NaCNO	solid	97 01	2000	−4 803$^{13°}$
		dil. sol.	92 23		
cyanide ..	NaCN	solid	22 9	100	−0 502$^{9°}$
		200	22 5		
	$NaCN.\frac{1}{2}H_2O$	solid	57 59	110	−1 0$^{6°}$
	$NaCN.2H_2O$	solid	163 7	100	−4 421$^{4°}$
dichromate	$Na_2Cr_2O_7$	dil. sol.	458 86		
dithionate, see under *thionate, di-*					
fluoride	NaF	solid	136 30	400	−0 478$^{12°}$
		dil. sol.	135 70		
formate	$NaCHO_2$	solid	157 01	150	−0 526$^{12°}$
		400	156 49		
fluosilicate	Na_2SiF_6	solid	660 94		
		dil sol.	658 31		
hydride .	NaH	solid	13 14	200	+26 05$^{18°}$
hydroxide .	NaOH	solid	101 91	160	+10 30$^{22°}$
		∞	112 04		
	$NaOH.H_2O$	solid	173 24	180	+7 192$^{22°}$
hypochlorite	NaOCl	dil. sol.	83 39		
iodide	NaI	solid	69 46	200	+1 410$^{18°}$
		200	70 870	.	
	$NaI.2H_2O$	solid	211 64	200	−4 014$^{18°}$
iodoplatinate	Na_2PtI_6	dil. sol.	167 0		
manganate	Na_2MnO_4	solid	267 62		
manganese sulfate	$Na_2SO_4.MnSO_4$	solid	574 91		+12 9
molybdate	Na_2MoO_4	solid	361 77		
nitrate .	$NaNO_3$	solid	112 45	200	−5 018$^{17°}$
		∞	107 33		. .
nitrite	$NaNO_2$	solid	86 50	250	−3 513
		dil. sol.	83 15	.	. . .
oxalate	$Na_2C_2O_4$	solid	316 01	1500	−5 50
		450	310 44		. . .
oxalate, acid	$NaHC_2O_4$	solid	257 83	300	−5 50
		400	252 33	.	. .
	$NaHC_2O_4.H_2O$	solid	330 23	300	−9 56
oxide .	Na_2O.	solid	99 16		+56 39
perchlorate.	$NaClO_4$	solid	100 60	400	−3 58$^{10°}$
		dil. sol.	97 25		. . . .
peroxide	Na_2O_2	solid	118 42		.
phos. (trisod.)	Na_3PO_4	solid	447 08		. . .
		900	471 30	. . .	.
	$Na_3PO_4.12H_2O$	solid	1306 3	600	−14 6$^{18°}$

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Sodium					
phos. (disod.)	Na_2HPO_4	solid	414 98	400	+5 639$^{18°}$
		600	420 62		
	$Na_2HPO_4.2H_2O$	solid	557 78	400	−0 382$^{18°}$
	$Na_2HPO_4.7H_2O$	solid	910 88	400	−11 5$^{18°}$
phos., pyro-	$Na_4P_2O_7$	solid	755 08	800	+11.85$^{18°}$
		1600	767 03		
	$Na_4P_2O_7.10H_2O$	solid	1462 4	800	−11 66$^{18°}$
phos , pyro- (disod.)	$Na_2H_2P_2O_7$	solid	657 83		−2 27
		1200	655 68		
	$Na_2H_2P_2O_7$ $6H_2O$	solid	1079 8		−13 91
phosphite	Na_2HPO_3	solid	335 44	500	+9 152$^{14°}$
		dil. sol.	344 57		
	$Na_2HPO_3.5H_2O$	solid	344 57	500	−4 588$^{15°}$
phosphite, acid	NaH_2PO_3	solid	286 50	500	+0 741$^{15°}$
		600	287 22		
	$NaH_2PO_3.2\frac{1}{2}H_2O$	solid	463 56	500	−5 26$^{15°}$
		300	364 61		
selenate	Na_2SeO_4	solid	261 41		
selenate, acid	$NaHSeO_4$	dil. sol.	201 84		
selenide	Na_2Se	solid	69 53	200	+ 18 59$^{14°}$
	$Na_2Se.4\frac{1}{2}H_2O$	solid	403 83		−7 89
	$Na_2Se.9H_2O$	solid	714 22		−10 5
	$Na_2Se.16H_2O$	solid	1190 0	3000	−22 0$^{14°}$
selenide, acid	NaHSe	dil. sol	44 68		
silicate	Na_2SiO_3	solid	368 94		
sulfate	Na_2SO_4	solid	326 31	400	+0 55$^{18.5}$
		∞	326 67		
	$Na_2SO_4.10H_2O$	solid	1029 6	400	−18 90$^{18°}$
sulfate, acid	$NaHSO_4$	solid	265 19	200	+1 2$^{17°}$
		800	266 86		
sulfhydrate	$NaHS_2$	solid	57 11	600	+4 30$^{16°}$
		400	61 458		
sulfhydrate	$NaHS.2H_2O$	solid	199 8	400	−1 53$^{18°}$
sulfide, mono-	Na_2S	solid	89 85		+15 5
		400	105 21		
	$Na_2S.4\frac{1}{2}H_2O$	solid	417 92	1000	−5 02$^{17°}$
	$Na_2S.5H_2O$	solid	453 766	1000	−6 69$^{13°}$
	$Na_2S.9H_2O$	solid	737 40	1000	−16 7$^{13°}$
sulfide, di-	Na_2S_2	dil sol.	105 62		
sulfide, tri-	Na_2S_3	dil sol.	107 3		
sulfide, tetra-	Na_2S_4	solid	98 93	1200	+9 80$^{17°}$
sulfite	Na_2SO_3	solid	259 26		+2 39$^{10°}$
		800	261 89		
	$Na_2SO_3.7H_2O$	solid	751 50	500	−10 99$^{10°}$
sulfite, acid	$NaHSO_3$	600	205 0		
sulfocyanate	NaCNS.	solid	42 77	100	−3 321$^{18°}$
tartrate	$Na_2C_4H_4O_6$	solid	412 19		−1 12
		dil. sol.	411 23		
	$Na_2C_4H_4O_6.2H_2O$	solid	553 89		−5 878
tartrate, acid	$NaHC_4H_4O_6$	solid	360 58		−5 663
		dil sol.	355 08		
	$NaHC_4H_4O_6.H_2O$	solid	431 78		−8 531
thionate, di-.	$Na_2S_2O_6$	solid	394 98	400	−5 687$^{19°}$
	$Na_2S_2O_6.2H_2O$	solid	537 64		−11 66
thionate, tri-	$Na_2S_3O_6$	dil. sol.	376 35		
	$Na_2S_3O_6.3H_2O$	solid	591 40	1000	−10 0$^{11°}$
thionate, tetra-	$Na_2S_4O_6$	dil sol.	377 06		
	$Na_2S_4O_6.2H_2O$	solid	523 54	600	−9 80$^{10°}$

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal
Sodium					
thiosulfate	$Na_2S_2O_3$	solid	254 24	440	$+1.7^{15°}$
		dil. sol.	255 92		
	$Na_2S_2O_3 \cdot 5H_2O$	solid	609 32	400	$-11\ 37^{18°}$
tungstate	Na_2WO_4	solid	388 05		
		dil. sol.	383 99		+4 06
uranate	Na_2UO_4	solid	420 31		
vanadate	Na_3VO_4	solid	449 23		
Stannic acid	SnO_2+H_2O	solid	133 5		
Stannic and **Stannous** salts, see under *Tin*					
Strontium					
acetate	$Sr(C_2H_3O_2)_2$	solid	359 62	200	$+5\ 568^{12°}$
		dil. sol.	365 35		
	$Sr(C_2H_3O_2)_2 \cdot \frac{1}{2}H_2O$	solid	394 27	220	$+52\ 57^{12°}$
arsenate	$Sr_3(AsO_4)_2$	ppt	795 70		
bromide	$SrBr_2$	solid	171 09	400	$+16.0^{18°}$
		dil sol.	187 34		
	$SrBr_2.6H_2O$	solid	604 07	400	$-6\ 452^{18°}$
carbonate	$SrCO_3$	ppt.	291 28		
chloride	$SrCl_2$	solid	197 85	400	$+11\ 16^{18°}$
		2000	209 14		
	$SrCl_2 \cdot 6H_2O$	solid	626 81	400	$-7\ 503^{18°}$
cyanide	$Sr(CN)_2$	dil. sol.	60 69		
	$Sr(CN)_2 \cdot 4H_2O$	solid	338 35	200	$-4\ 158^{8°}$
dithionate	SrS_2O_6	dil. sol.	404 54		
	$SrS_2O_6 \cdot 4H_2O$	solid	687 22	400	$-9\ 247^{18°}$
fluoride	SrF_2	ppt.	288 89		
hydride	SrH_2	solid	42 06		
hydroxide	$Sr(OH)_2$	solid	228 7	1100	$+10\ 32^{15°}$
	$Sr(OH)_2 \cdot 8H_2O$	solid	800 48	1100	$-14\ 27^{15°}$
iodide	SrI_2	solid	136 2		$+20\ 45^{12°}$
		dil. sol.	156 8		
	$SrI_2 \cdot 7H_2O$	solid	639 91		$-4\ 468^{15°}$
nitrate	$Sr(NO_3)_2$	solid	234 4	400	$-4\ 660^{18°}$
		1000	229 82		
	$Sr(NO_3)_2.4H_2O$	solid	515 65	400	$-12\ 31^{18°}$
oxide	SrO	solid	140 7	1100	$+29\ 99^{15°}$
peroxide	SrO_2	solid	153 2		
phosphate	$Sr_3(PO_4)_2$	ppt.	979 7		
selenide	$SrSe$	solid	90 08		
silicate	$SrSiO_3$	fused	363 20		
sulfate	$SrSO_4$	solid	341 22		
sulfhydrate	$Sr(SH)_2$	dil. sol.	137 9		
sulfide, mono-	SrS	solid	113 02		
Sulfocyanic acid	$HCNS$	dil. sol.	− 18 4		
Sulfur					
bromide, mono-	S_2Br_2	liquid	+ 2 01		
chloride, mono-	S_2Cl_2	liquid	14 34		
		gas	5 64		
chloride, di-	S_2Cl_4	liquid	14		
iodide, mono-	S_2I_2	solid	0 0		
oxide, di-	SO_2	liquid	75 269		
		gas	69 3		
		2000	77 850		+ 8 554
oxide, tri-	SO_3	solid	103 2		+37 28
		liquid	101 1	1600	$+39\ 164^{20°}$
		gas	91 52		+49 22
		200	139 1		
oxychloride (ic)	SO_2Cl_2	liquid	87 69	800	+62 84
		gas	80 76		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution Kilo-cal
Sulfur					
oxychloride (ous)	$SOCl_2$	liquid	48 03		
		gas	41 58		
pentoxydichloride	$S_2O_5Cl_2$	liquid	161 8		
		gas	148 9		
Sulfuric acid	H_2SO_4	solid	192 24		
		liquid	189 75	200	+17 75$^{18°}$
		∞	210 28		
	$H_2SO_4.H_2O$	liquid	264 83		
per-	$H_2S_2O_8$	dil. sol.	309 92		
pyro-	$H_2SO_4.SO_3$	liquid	293 91		
thio-	$H_2S_2O_3$	1500	138 6		
Sulfurous acid	H_2SO_3	200	145 09		
(See also *thionic acids*)					
Tantalum					
oxide	Ta_2O_5	solid	300 12		
Telluric acid	H_2TeO_4	dil. sol.	169 2		
Tellurium					
chloride	$TeCl_4$	solid	77 42		
oxide, di-	TeO_2	solid	78 304		
	$TeO_2.H_2O$	solid	144 8		
oxide, tri-	TeO_3	solid	83 15		
Tellurous acid	H_2TeO_3	solid	145 6		
Thallium					
bromide, mono-	$TlBr$	solid	41 052		
bromide, tri-	$TlBr_3$	dil sol.	56 416		
chloride, mono-	$TlCl$	solid	48 698		
		dil sol.	38 47	4500	−10 04$^{18°}$
chloride, tri-	$TlCl_3$	solid	80 74	300	+ 8 435
		dil. sol.	89 176		
	$TlCl_3.4H_2O$	solid	364 90	300	− 2 13
fluoride	TlF	dil. sol.	77 300		
hydroxide (ic)	$Tl(OH)_3$	solid	145 07		
hydroxide (ous)	$TlOH$	solid	56 87	235	− 3 154$^{18°}$
iodide	TlI	solid	30 11		
nitrate (ous)	$TlNO_3$	solid	58 806	300	− 9 964$^{18°}$
		dil. sol.	48 841		
nitride	TlN_3	solid	− 54 72		
oxide (ous)	Tl_2O	solid	+ 42 151	570	− 3 082$^{18°}$
selenide	Tl_2Se	solid	11 9		
sulfate (ous)	Tl_2SO_4	solid	217 78	1600	− 8 268$^{18°}$
		800	209 51		
sulfide	Tl_2S	solid	22 0		
telluride	Tl_2Te	solid	7 17		
Thionic acid					
thionic, di-	$H_2S_2O_6$	400	274 31		
thionic, tri-	$H_2S_3O_6$	dil sol	261 89		
thionic, tetra-	$H_2S_4O_6$	dil. sol.	262 37		
thionic, penta-	$H_2S_5O_6$	dil. sol	267 62		
(See also *sulfuric acids*)					
Thorium					
bromide	$ThBr_4$	solid	281 01		+70 180
		dil. sol.	351 26		
carbonate	$Th(CO_3)_2$		855 20		
chloride	$ThCl_4$	solid	335 01		+56 63$^{15°}$
		dil. sol.	392 12		
	$ThCl_4 2H_2O$	solid	487 70		+41 076
hydroxide (dried ppt.)	$Th(OH)_4$	ppt.	336 20		

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Thorium					
iodide	ThI_4	dil sol.	291 76		...
oxide...	ThO_2	solid	330 95	.	. .
sulfate....	$Th(SO_4)_2$	dil. sol.	661 89		. .
	$Th(SO_4)_2.4H_2O$	solid	930.23	..	+ 5.02
Tin					
bromide (ic).	$SnBr_4$	solid	95 10		+16 5
		liquid	92 23		...
bromide (ous)	$SnBr_2$	solid	61 41		− 1 67
chloride (ic).	$SnCl_4$	liquid	127 4	250	+29.917$^{20°}$
chloride (ous)	$SnCl_2$	solid	81 147	300	+ 0.358$^{15°}$
	$SnCl_2.2H_2O$	solid	223 7	200	− 5 28$^{18°}$
hydroxide (ous)	$Sn(OH)_2$	colloid	136.37	.	.....
iodide (ous)	SnI_2	solid	35 84	.	. .
oxide (ic) (fused)	SnO_2	solid	138 1	.	.....
oxide (ous)..	SnO	solid	69 77		
pot. chloride	K_2SnCl_6	solid	360 17	800	− 3 369$^{12°}$
		600	356 80		.
Titanium					
chloride, tetra-	$TiCl_4$	liquid	183 5	2000	+57 83$^{18°}$
oxide, di-....	TiO_2	solid	217.4	..	.....
		amorph.	214.1	.	.....
Tungsten					
oxide, di-	WO_2	solid	126 2		
oxide, tri-...	WO_3	solid	191 4	.	.
oxide, penta-	W_2O_5	solid	311 11		.
Tungstic acid....	H_2WO_4	solid	280 05		.
		dil. sol.	280 05		.
Uranium					
oxide, di-.	UO_2	solid	256 63		
oxide, tri-..	UO_3	solid	290 09		
oxide (ous) (ic)	U_3O_8	solid	845 17	.	
oxide, per.	$UO_4.2H_2O$	solid	439 91		
Uranyl					
acetate...	$UO_2(C_2H_3O_2)_2$	dil. sol.	476 47		
	$UO_2(C_2H_3O_2)_2.2H_2O$	solid	617 69	1000	− 4 30$^{18°}$
nitrate..	$UO_2(NO_3)_2$	solid	322 10	220	+18 9$^{12°}$
	$UO_2(NO_3)_2.6H_2O$	solid	756 75	220	− 5.448$^{12°}$
sulfate....	UO_2SO_4	dil. sol.	449 46		...
	$UO_2SO_4.3H_2O$	solid	649 94	1000	+ 5 02$^{18°}$
Vanadium					
chloride, di-.	VCl_2	solid	147 2	.	....
chloride, tri-	VCl_3	liquid	187 1		....
chloride, tetra-	VCl_4	liquid	162 01		....
oxide, di-	V_2O_2	solid	209 08		.....
oxide, tri-	V_2O_3	solid	349 58		.....
oxide, tetra-	V_2O_4	solid	409 08		.....
oxide, penta-	V_2O_5	solid	437 28		.....
oxytrichloride	$VOCl_3$	liquid	201 2		.....
Water, see *hydrogen oxide*					
Zinc					
acetate....	$Zn(C_2H_3O_2)_2$	solid	261 17	720	+ 9 80$^{22°}$
	$Zn(C_2H_3O_2)_2.H_2O$	solid	332 62	800	+ 6 93$^{23°}$
	$Zn(C_2H_3O_2)_2.2H_2O$	solid	403 59	500	+ 4 30$^{10°}$
bromide........	$ZnBr_2$	solid	77 90	.	+15 03
		400	92 95		.....
carbonate....	$ZnCO_3$	ppt.	193 3		...
chloride. ..	$ZnCl_2$	solid	99 547	600	+15 72$^{18°}$
		400	115 27	.	.....

Name	Formula	Physical state	Heat of formation. Kilo-cal.	Water mols	Heat of solution. Kilo-cal.
Zinc					
cyanide	$Zn(CN)_2$	solid	−16.2		
ethyl	ZnC_4H_{10}	liquid	+7.41		
fluoride	ZnF_2	dil. sol.	192.31		
dithionate	ZnS_2O_6	400	310.87		
	$ZnS_2O_6.6H_2O$	solid	723.54		−2.25
hydroxide	$Zn(OH)_2$	solid	158.4		
	$Zn(OH)_2.H_2O$	amorph	221.87		
	$ZnO_2.2H_2O$	solid	252.33		
iodide	ZnI_2	solid	49.70		+11.7
nitrate	$Zn(NO_3)_2$	400	136.11		
	$Zn(NO_3)_2.6H_2O$	solid	552.24	400	$-5.854^{18°}$
oxide (fused)	ZnO	solid	84.35		
selenide	$ZnSe$	solid	33.45		
		ppt.	31.30		
silicate	$ZnSiO_3$	solid	286.50		
sulfate	$ZnSO_4$	solid	229.51	400	$+18.54^{17°}$
		400	248.05		
	$ZnSO_4.6H_2O$	solid	659.26	400	$-0.836^{18°}$
	$ZnSO_4.7H_2O$	solid	731.00	400	$-4.277^{18°}$
sulfide	ZnS	solid	45.88		
telluride	$ZnTe$	solid	33.21		
Zirconium					
oxide	ZrO_2	fused	178.7		

HEAT OF COMBUSTION

For Organic Compounds

The heat of combustion is given in kilogram calories per gram molecular weight of the substance when combustion takes place at atmospheric pressure and 20° C. The final products of combustion are gaseous carbon dioxide, liquid water and nitrogen gas for C, H, N compounds. For method of computing heats of formation see statement following this table.

Selections from a compilation by Kharasch, Bureau of Standards Journal of Research **2**, 359 (1929).

Name	Formula	Physical state	Heat of combustion, kg. calories
Acetaldehyde	CH_3CHO	liquid	279.0
Acetamide	CH_3CONH_2	solid	282.6
Acetanilide	$CH_3CONHC_6H_5$	solid	1,010.4
Acetic acid	CH_3CO_2H	liquid	209.4
Acetic anhydride	$(CH_3CO)_2O$	liquid	431.9
Acetone	$(CH_3)_2CO$	liquid	426.8
Acetonitrile	CH_3CN	liquid	302.4
Acetophenone	$C_6H_5COCH_3$	solid	988.9
Acetylacetone	$CH_3COCH_2COCH_3$	liquid	615.9
Acetylene	$(CH)_2$	gas	312.0
Acrolein	$CH_2:CHCHO$	liquid	389.6
Acrylic acid	$CH_2:CHCO_2H$	liquid	327.5
Adipic acid	$(CH_2)_4(CO_2H)_2$	solid	669.0
Alanine	$CH_3CH(NH_2)CO_2H$	solid	387.7
Aldol, *see β-hydroxybutyr-aldehyde*			
Alizarin, *see Dihydroxyanthraquinone*			
Allyl alcohol	$CH_2:CHCH_2OH$	liquid	442.4
Allylene	$CH_3C:CH$	gas	465.1
p-Aminoazobenzene	$H_2NC_6H_4N_2C_6H_5$	solid	1,574.0
p-Aminophenol	$HOC_6H_4NH_2$	solid	760.0
Amygdalin	$C_{20}H_{27}O_{11}N$	solid	2,348.4
Amyl acetate	$C_4H_9CO_2C_2H_5$	liquid	1,042.5
Amyl alcohol (ferm.)	$(CH_3)_2CH_2CH_2CH_2OH$	liquid	793.7
Amylene	C_5H_{10}	liquid	803.4
Anethole	$C_{10}H_{12}O$	solid	1,324.4
Aniline	$C_6H_5NH_2$	liquid	811.7
p-Anisidine	$CH_3OC_6H_4NH_2$	solid	924.0
Anisole	$C_6H_5OCH_3$	liquid	905.1
Anthracene	$C_6H_4:(CH)_2:C_6H_4$	solid	1,700.4
Anthraquinone	$C_{14}H_8O_2$	solid	1,544.5
Arabinose	$C_5H_{10}O_5$	solid	559.9
Arabitol	$C_5H_{12}O_5$	solid	661.2
Arachidic acid	$C_{20}H_{40}O_2$	solid	3,025.9
Azelaic acid	$(CH_2)_7(CO_2H)_2$	solid	1,141.7
Azobenzene	$(C_6H_5N)_2$	solid	1,545.9
Azoxybenzene	$(C_6H_5N)_2O$	solid	1,534.5
Behenic acid	$C_{22}H_{44}O_2$	solid	3,338.4
Benzalacetone	$C_6H_5CH:CHCOCH_3$	solid	1,257.4
Benzaldehyde	C_6H_5CHO	liquid	841.3
Benzamide	$C_6H_5CONH_2$	solid	847.6
Benzanilide	$C_6H_5CONHC_6H_5$	solid	1,575.5
Benzene	C_6H_6	liquid	782.3
Benzenediazonium nitrate	$C_6H_5N_2NO_3$	solid	782.6
Benzidine	$(C_6H_4NH_2)_2$	solid	1,560.9
Benzil	$(C_6H_5CO)_2$	solid	1,624.6
* Benzoic acid	$C_6H_5CO_2H$	solid	771.2
Benzoic anhydride	$(C_6H_5CO)_2O$	solid	1,555.1
Benzoin	$C_6H_5.CHOH.COC_6H_5$	solid	1,671.4
Benzonitrile	C_6H_5CN	liquid	865.5
Benzophenone	$(C_6H_5)_2CO$	solid	1,556.5

* Accepted value by Int. Union of Pure and Appld. Chem., Lyons, 1923.

HEAT OF COMBUSTION (Continued)

For Organic Compounds

Name	Formula	Physical state	Heat of combustion, kg. calories
Benzoyl chloride	C_6H_5COCl	liquid	782.8
Benzoyl peroxide	$(C_6H_5CO)_2O_2$	solid	1,551.7
Benzyl alcohol	$C_6H_5CH_2OH$	liquid	894.3
Benzylamine	$C_6H_5CH_2NH_2$	liquid	969.4
Benzyl carbylamine	$C_6H_5CH_2NC$	liquid	1,046.5
Benzyl chloride	$C_6H_5CH_2Cl$	liquid	886.4
Benzyl cyanide	$C_6H_5CH_2CN$	liquid	1,023.5
Borneol	$C_{10}H_{18}O$	liquid	1,469.6
Brucine	$C_{23}H_{26}O_4N_2$	solid	2,933.0
n-Butyl alcohol	C_4H_9OH	liquid	638.6
tert.-Butyl alcohol, *see Trimethyl carbinol*			
n-Butylamine	$C_4H_9NH_2$	liquid	710.6
sec.-Butylamine	$(CH_3)(C_2H_5){:}CHNH_2$	liquid	713.0
tert.-Butylamine	$(CH_3)_3CNH_2$	liquid	716.0
tert.-Butylbenzene	$C_6H_5C(CH_3)_3$	liquid	1,400.4
n-Butyramide	$C_3H_7CONH_2$	solid	596.0
n-Butyric acid	$C_3H_7CO_2H$	liquid	524.3
n-Butyronitrile	C_3H_7CN	liquid	613.3
Caffeine	$C_8H_{10}O_2N_4$	solid	1,014.2
Camphene	$C_{10}H_{16}$	solid	1,468.8
Camphor	$C_{10}H_{16}O$	solid	1,411.0
Cane sugar, *see Sucrose*			
Capric acid	$C_9H_{18}O_2$	solid	1,458.1
Caproic acid	$C_5H_{11}CO_2H$	liquid	831.0
Carbon disulfide	CS_2	liquid	246.6
Carbon subnitride	$(C.CN)_2$	solid	514.8
Carbon tetrachloride	CCl_4	liquid	37.3
Carbonyl sulfide	COS	gas	130.5
Carvacrol	$C_{10}H_{14}O$	liquid	1,354.5
Cetyl alcohol	$C_{16}H_{34}O$	solid	2,504.5
Cetyl palmitate	$C_{32}H_{64}O$	solid	4,872.8
Chloracetic acid	$ClCH_2CO_2H$	solid	171.0
o-Chlorobenzoic acid	$ClC_6H_4CO_2H$	solid	734.5
Chloroform	$CHCl_3$	liquid	89.2
Chrysene	$C_{14}H_{10}$	solid	2,139.1
Cinnamic acid (*trans*)	$C_6H_5CH{:}CHCO_2H$	solid	1,040.2
Cinnamic aldehyde	$C_6H_5CH{:}CHCHO$	liquid	1,112.3
Cinnamic anhydride	$C_{18}H_{14}O_3$	solid	2,091.3
d-Citrene	$C_{10}H_{16}$	liquid	1,473.0
Citric acid (anhydr.)	$C_6H_8O_7$	solid	474.5
Codeine	$C_{18}H_{21}O_3N.H_2O$	solid	2,327.6
Coniine	$C_8H_{17}N$	liquid	1,275.5
Creatine (anhydr.)	$C_4H_9O_2N_3$	solid	559.8
Creatinine	$C_4H_7ON_3$	solid	563.4
o-Cresol	$CH_3C_6H_4OH$	liquid	882.6
o-Cresol	$CH_3C_6H_4OH$	solid	879.5
m-Cresol	$CH_3C_6H_4OH$	liquid	880.5
p-Cresol	$CH_3C_6H_4OH$	liquid	882.5
p-Cresol	$CH_3C_6H_4OH$	solid	880.0
m-Cresolmethyl ether	$CH_3C_6H_4OCH_3$	liquid	1,057.0
Crotonaldehyde	C_3H_5CHO	liquid	542.1
Cyanoacetic acid	$NC\,CH_2CO_2H$	solid	298.8
Cyanogen	$(CN)_2$	gas	258.3
Cycloheptanol	$CH_2(CH_2)_5CHOH$	liquid	1,050.2
Cyclohexanol	$CH_2(CH_2)_4CHOH$	liquid	890.7
Cycloheptene	C_7H_{12}	liquid	1,049.9
Cycloheptane	$(CH_2)_7$	liquid	1,087.3

For Organic Compounds

Name	Formula	Physical state	Heat of combustion, kg. calories
Cyclohexane	$(CH_2)_6$	liquid	937.8
Cyclohexene, *see Tetrahydrobenzene*			
Cyclopentane	$(CH_2)_5$	liquid	783.6
Cyclopropane, *see Trimethylene*			
Cymene	$C_6H_4(CH_3)(CH_3CHCH_3)$—(1, 4)	liquid	1,402.8
Decahydronaphthalene (*cis*)	$C_{10}H_{18}$	liquid	1,502.5
Decahydronaphthalene (*trans*)	$C_{10}H_{18}$	liquid	1,499.5
Decane	$C_{10}H_{22}$	liquid	1,610.2
Dextrose, *see Glucose*			
Diallyl	$(CH_2CH{:}CH_2)_2$	vapor	903 4
Diamyl ether	$(C_5H_{11})_2O$	liquid	1,609.3
Diamylene	$C_{10}H_{20}$	liquid	1,582.2
Dibenzyl	$(C_6H_5CH_2)_2$	solid	1,810 6
Dibenzyl amine	$(C_6H_5CH_2)_2NH$	solid	1,853.0
o-Dichlorobenzene	$C_6H_4Cl_2$	liquid	671.8
Diethylacetic acid	$(C_2H_5)_2CHCO_2H$	liquid	830.8
Diethyl amine	$(C_2H_5)_2NH$	liquid	716.9
Diethylaniline	$C_6H_5N(C_2H_5)_2$	liquid	1,451.6
Diethyl carbonate	$CO(OC_2H_5)_2$	liquid	647.9
Diethyl ether	$(C_2H_5)_2O$	liquid	651.7
Diethyl ketone	$(C_2H_5)_2CO$	liquid	735.6
Diethyl malonate	$CH_2(CO_2C_2H_5)_2$	liquid	860.4
Diethyl oxalate	$(CO_2C_2H_5)_2$	liquid	716.0
Diethyl succinate	$(CH_2CO_2C_2H_5)_2$	liquid	1,007.3
Dihydrobenzene	C_6H_8	liquid	847.8
Δ_1-Dihydronaphthalene	$C_{10}H_{10}$	liquid	1,296.3
Δ_1-Dihydronaphthalene	$C_{10}H_{10}$	solid	1,298.3
Dihydroxyanthraquinone	$C_{14}H_6O_2(OH)_2$—(1, 2)	solid	1,448.9
Diisoamyl	$[(CH_3)_2CHCH_2CH_2]_2$	liquid	1,615.8
Diisobutylene	$[(CH_3)_2CHCH_2]_2$	liquid	1,252.4
Diisopropyl	$[(CH_3)_2CH]_2$	vapor	993.9
Diisopropyl ketone	$[(CH_3)_2CH]_2CO$	liquid	1,045.5
Dimethyl amine	$(CH_3)_2NH$	liquid	416.7
Dimethylaniline	$C_6H_5N(CH_3)_2$	liquid	1,142.7
Dimethyl carbonate	$CO(OCH_3)_2$	liquid	340.8
Dimethyl ether	$(CH_3)_2O$	gas	347.6
Dimethylethyl carbinol	$C_2H_5(CH_3)_2CHOH$	liquid	784.6
Dimethyl fumarate	$(CHCO_2CH_3)_2$	solid	664.3
2, 5-Dimethylhexane	$(CH_3)_2CH.C_2H_4.CH(CH_3)_2$	liquid	1,303.3
3, 4-Dimethylhexane	$[(C_2H_5)(CH_3)CH]_2$	liquid	1,303.7
Dimethyl maleate	$(CHCO_2CH_3)_2$	solid	669.2
Dimethyl oxalate	$(CO_2CH_3)_2$	solid	401.9
2, 2-Dimethylpentane	$(CH_3)_3C\ C_3H_7$	liquid	1,148.9
2, 3-Dimethylpentane	$(CH_3)_2CHCH(CH_3)C_2H_5$	liquid	1,148.9
2, 4-Dimethylpentane	$(CH_3)_2CHCH_2CH(CH_3)_2$	liquid	1,148.9
3, 3-Dimethylpentane	$(CH_3)_2C(C_2H_5)_2$	liquid	1,147.9
Dimethyl phthalate	$C_6H_4(CO_2CH_3)_2$	liquid	1,119.7
Dimethyl succinate	$(CH_2CO_2CH_3)_2$	solid	703.3
m-Dinitrobenzene	$C_6H_4(NO_2)_2$	solid	696.8
Dinitrophenol	$C_6H_3(OH)(NO_2)_2$—(1, 2, 4)	solid	648.0
Dinitrotoluene	$C_6H_3(CH_3)(NO_2)_2$—(1, 2, 4)	solid	852.8
Diphenyl	$(C_6H_5)_2$	solid	1,493.6
Diphenyl amine	$(C_6H_5)_2NH$	solid	1,536.2
Diphenyl carbinol	$(C_6H_5)_2CHOH$	solid	1,615.4
Diphenylmethane	$(C_6H_5)_2CH_2$	solid	1,655.0
Diphenylnitrosamine	$(C_6H_5)_2N.NO$	solid	1,532.6

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion, kg. calories
Dipropargyl	$(CH\vdots C\,CH_2)_2$	vapor	882.9
Dipropyl ketone	$(C_3H_7)_2CO$	liquid	1,050.5
Dulcitol	$C_6H_{14}O_6$	solid	729.1
Durene	$C_6H_2(CH_3)_4$—(1, 2, 4, 5)	solid	1,393.6
Eicosane	$C_{20}H_{42}$	solid	3,183.1
Erythritol	$C_4H_{10}O_4$	solid	504.1
Ethane	C_2H_6	gas	368.4
Ethine, *see Acetylene*			
Ethyl acetate	$CH_3CO_2C_2H_5$	liquid	536.9
Ethyl acetoacetate	$CH_3COCH_2CO_2C_2H_5$	liquid	690.8
Ethyl alcohol	C_2H_5OH	liquid	327.6
Ethyl amine	$C_2H_5NH_2$	liquid	408.5
Ethylaniline	$C_6H_5NHC_2H_5$	liquid	1,121.5
Ethylbenzene	$C_2H_5C_6H_5$	liquid	1,091.2
Ethyl benzoate	$C_6H_5CO_2C_2H_5$	liquid	1,098.7
Ethyl bromide	C_2H_5Br	vapor	340.5
Ethyl *n*-butyrate	$C_3H_7CO_2C_2H_5$	liquid	851.2
Ethyl carbylamine	C_2H_5NC	liquid	477.1
Ethyl chloride	C_2H_5Cl	vapor	316.7
Ethylcycloheptane	$C_2H_5C_7H_{13}$	liquid	1,406.8
Ethyl formate	$HCO_2C_2H_5$	liquid	391.7
3-Ethylhexane	$(C_2H_5)_2CH.C_3H_7$	liquid	1,302.3
Ethyl iodide	C_2H_5I	liquid	356.0
Ethyl isobutyrate	$(CH_3)_2CHCH_2CO_2C_2H_5$	liquid	845.7
Ethyl isocyanate	C_2H_5NCO	liquid	424.5
Ethyl nitrate	$C_2H_5ONO_2$	vapor	322.4
Ethyl nitrite	C_2H_5ONO	vapor	332.6
3-Ethylpentane	$(C_2H_5)_3CH$	liquid	1,149.9
Ethyl propionate	$C_2H_5CO_2C_2H_5$	liquid	690.8
Ethyl salicylate	$HOC_6H_4CO_2C_2H_5$	liquid	1,051.2
Ethyl valerate	$C_4H_9CO_2C_2H_5$	liquid	1,017.5
Ethylene	$CH_2{:}CH_2$	gas	331.6
Ethylene chloride	$(CH_2Cl)_2$	vapor	271.0
Ethylene diamine	$(CH_2NH_2)_2$	liquid	452.6
Ethylene glycol	$(CH_2OH)_2$	liquid	281.9
Ethylene iodide	$(CH_2I)_2$	solid	324.8
Ethylene oxide	CH_2CH_2O	liquid	302.1
Ethylidene chloride	CH_3CHCl_2	liquid	267.1
Eugenol	$C_{10}H_{12}O_2$	liquid	1,286.6
Fenchane	$C_{10}H_{18}$	liquid	1,502.6
Fluorene	$(C_6H_4)_2{:}CH_2$	solid	1,584.9
Fluorobenzene	C_6H_5F	liquid	747.2
Formaldehyde	CH_2O	gas	134.1
Formamide	$HCONH_2$	solid	134.9
Formic acid	HCO_2H	liquid	62.8
l-Fructose	$C_6H_{12}O_6$	solid	675.6
Fumaric acid (*trans*)	$(CHCO_2H)_2$	solid	320.0
Furfural	C_4H_3OCHO	liquid	559.5
Galactose	$C_6H_{12}O_6$	solid	670.7
Gallic acid	$C_6H_2(OH)_3CO_2H$—(1, 3, 5, 6)	solid	633.7
d-Glucose	$C_6H_{12}O_6$	solid	673.0
Glutaric acid	$(CH_2)_3(CO_2H)_2$	solid	514.9
Glycerol	$(CH_2OH)_2CHOH$	liquid	397.0
Glyceryl tributyrate	$C_{15}H_{26}O_6$	liquid	1,941.1
Glycine	$H_2NCH_2CO_2H$	solid	234.5
Glycogen	$(C_6H_{10}O_5)x$ per kg	solid	4,186.8
Glycollic acid	CH_2OHCO_2H	solid	166.6
Glycylglycine	$C_4H_8O_3N_2$	solid	470.7

For Organic Compounds

Name	Formula	Physical state	Heat of combustion, kg. calories
n-Heptaldehyde	$CH_3(CH_2)_5CHO$	liquid	1,062.4
n-Heptane	C_7H_{16}	liquid	1,149.9
Heptine-1	$CH{:}C(CH_2)_4CH_3$	liquid	1,091.2
n-Heptyl alcohol	$CH_3(CH_2)_5CH_2OH$	liquid	1,104.9
Heptyl amine	$C_7H_{15}NH_2$	liquid	1,178.9
Heptylic acid	$C_7H_{14}O_2$	liquid	986.1
n-Hexane	C_6H_{14}	liquid	989.8
Hexachlorbenzene	C_6Cl_6	solid	509.0
Hexachlorethane	C_2Cl_6	solid	110.0
Hexadecane	$C_{16}H_{34}$	solid	2,559.1
Hexahydronaphthalene	$C_{10}H_{14}$	liquid	1,419.3
Hexamethylbenzene	$C_6(CH_3)_6$	solid	1,711.9
Hexamethylenetetramine	$(CH_2)_6N_4$	solid	1,006.7
Hexamethylethane	$[(CH_3)_3C]_2$	solid	1,301.8
Hexyl amine	$C_6H_{13}NH_2$	liquid	1,022.2
Hexylene	C_6H_{12}	liquid	952.6
Hippuric acid	$C_6H_5CONHCH_2CO_2H$	solid	1,012.4
Hydantoic acid	$C_3H_6O_3N_2$	solid	308.6
Hydrazobenzene	$(C_6H_5NH)_2$	solid	1,597.3
Hydroquinol	$C_6H_4(OH)_2$	solid	683.7
Hydroquinoldimethyl ether	$(CH_3O)_2C_6H_4$	solid	1,014.7
p-Hydroxyazobenzene	$HOC_6H_4N_2C_6H_5$	solid	1,502.0
o-Hydroxybenzaldehyde	$C_6H_4(OH)CHO$	liquid	796.0
m-Hydroxybenzaldehyde	$C_6H_4(OH)CHO$	solid	788.7
p-Hydroxybenzaldehyde	$C_6H_4(OH)CHO$	solid	792 7
m-Hydroxybenzoic acid	$HOC_6H_4CO_2H$	solid	726.1
p-Hydroxybenzoic acid	$HOC_6H_4CO_2H$	solid	725 4
β-Hydroxybutyraldehyde	$CH_3CHOHCH_2CHO$	liquid	546.6
Indigo	$C_{16}H_{10}O_2N_2$	solid	1,815.0
Indole	C_8H_7N	solid	1,022.2
Inositol	$C_6H_{12}O_6$	solid	662.1
Iodoform	CHI_3	solid	161.9
Isoamyl amine	$(CH_3)_2CHC_2H_4NH_2$	liquid	866.8
Isobutane	$(CH_3)_3CH$	gas	683.4
Isobutyl alcohol	$(CH_3)_2CH_2CH_2OH$	liquid	638 2
Isobutyl amine	$C_4H_9NH_2$	liquid	713.6
Isobutylene	$(CH_3)_2C{:}CH_2$	gas	647.2
Isobutyraldehyde	$(CH_3)_2CHCHO$	vapor	596.8
Isobutyramide	$(CH_3)_2CHCONH_2$	solid	595.9
Isobutyric acid	$(CH_3)_2CHCO_2H$	liquid	517.4
Isoeugenol	$C_{10}H_{12}O_2$	liquid	1,277.6
Isopentane	C_5H_{12}	gas	843.5(?)
Isopentane	C_5H_{12}	liquid	838.3(?)
Isophthalic acid	$C_6H_4(CO_2H)_2$	solid	768.3
Isopropyl alcohol	$(CH_3)_2CHOH$	liquid	474.8
Isopropylbenzene	$(CH_3)_2CHC_6H_5$	liquid	1,247.3
Isopropyltoluene	$C_6H_4(CH_3)(CH_3CHCH_3)$—(1, 3)	liquid	1,409.5
Isopropyltoluene, *see Cymene*			
Isosafrole	$C_{10}H_{10}O_2$	liquid	1,233.9
Lactic acid	$CH_3CHOHCO_2H$	liquid	326.0
Lactose (anhydr.)	$C_{12}H_{22}O_{11}$	solid	1,350.8
Lauric acid	$C_{12}H_{24}O_2$	solid	1,771.7
Leucine	$C_6H_{13}O_2N$	solid	855.6
d-Limonene	$C_{10}H_{16}$	liquid	1,471.2
Maleic acid (*cis*)	$(CHCO_2H)_2$	solid	326.1
Maleic anhydride	$(CHCO)_2O$	solid	333.9
l-Malic acid	$(CHOHCH_2){:}(CO_2H)_2$	solid	320.1

HEAT OF COMBUSTION (Continued)

For Organic Compounds

Name	Formula	Physical state	Heat of combustion kg. calories
Malonic acid	$CH_2(CO_2H)_2$	solid	207.2
Maltose	$C_{12}H_{22}O_{11}$	solid	1,350.2
Mandelic acid	$C_6H_5CHOHCO_2H$	solid	890.3
d-Mannitol	$C_6H_{14}O_6$	solid	727.6
Menthene	$C_{10}H_{18}$	liquid	1,523.2
Menthol	$C_{10}H_{20}O$	solid	1,508.8
Mesitylene	$(CH_3)_3C_6H_3$—(1, 3, 5)	liquid	1,243.6
Mesityl oxide	$(CH_3)_2C{:}CHCOCH_3$	liquid	846.7
Mesotartaric acid	$(CHOH)_2(CO_2H)_2$	solid	276.0
Methane	CH_4	gas	210.8
Methyl acetate	$CH_3CO_2CH_3$	liquid	381.2
Methyl alcohol	CH_3OH	liquid	170.9
Methyl amine	CH_3NH_2	liquid	256.1
Methylaniline	$C_6H_5NHCH_3$	liquid	973.5
Methyl benzoate	$C_6H_5CO_2CH_3$	liquid	943.5
Methyl bromide	CH_3Br	vapor	184.0
Methyl butyl ketone	$CH_3COC_4H_9$	liquid	895.2
Methyl *tert*-butyl ketone, *see Pinacoline*			
Methyl butyrate	$C_3H_7COC_2H_3$	liquid	692.8
Methyl carbylamine	CH_3NC	liquid	320.1
Methyl chloride	CH_3Cl	gas	164.2
Methyl cinnamate	$C_{10}H_{10}O_2$	solid	1,213.0
Methylcyclobutane	$CH_3CHCH_2CH_2CH_2$	liquid	784.2
Methylcycloheptane	$CH_3C_7H_{13}$	liquid	1,244.5
Methylcyclohexane	$CH_3C_6H_{11}$	liquid	1,091.8
Methylcyclopentane	$CH_3CH.C_3H_6.CH_2$	liquid	937.9
Methyldiethyl carbinol	$CH_3(C_2H_5)_2CHOH$	liquid	927.0
Methylene chloride	CH_2Cl_2	vapor	106.8
Methylene iodide	CH_2I_2	liquid	178.4
Methylethyl ether	$CH_3OC_2H_5$	vapor	503.4
Methylethyl ketone	$CH_3COC_2H_5$	liquid	582.3
Methyl formate	HCO_2CH_3	liquid	233.1
2-Methylheptane	$(CH_3)_2CH\ C_5H_{11}$	liquid	1,306.1
2-Methylhexane	$(CH_3)_2CHC_4H_9$	liquid	1,148.9
3-Methylhexane	$(C_2H_5)(CH_3)CHC_3H_7$	liquid	1,148.9
Methylhexyl ketone	$CH_3COC_6H_{13}$	liquid	1,205.1
Methyl iodide	CH_3I	liquid	194.7
Methyl isobutyrate	$(CH_3)_2CHCO_2CH_3$	liquid	694.2
Methyl isocyanate	CH_3NCO	liquid	269.4
Methylisopropyl ketone	$CH_3COCH(CH_3)_2$	liquid	733.9
Methyl lactate	$CH_3CHOHCO_2CH_3$	liquid	497.2
Methyl propionate	$C_2H_5CO_2CH_3$	vapor	552.3
Methylpropyl ketone	$CH_3COC_3H_7$	liquid	735.6
Methyl salicylate	$HOC_6H_4CO_2CH_3$	liquid	898.3
Milk sugar, *see Lactose*			
Morphine	$C_{17}H_{19}O_3N.H_2O$	solid	2,146.3
Mucic acid	$C_6H_{10}O_8$	solid	483.6
Myristic acid	$C_{14}H_{28}O_2$	solid	2,085.8
Naphthalene	$C_{10}H_8$	solid	1,232.5
α-Naphthoic acid	$C_{10}H_7CO_2H$	solid	1,231.8
β-Naphthoic acid	$C_{10}H_7CO_2H$	solid	1,227.6
α-Naphthol	$C_{10}H_7OH$	solid	1,185.4
β-Naphthol	$C_{10}H_7OH$	solid	1,187.2
α-Naphthonitrile	$C_{10}H_7CN$	solid	1,326.2
β-Naphthonitrile	$C_{10}H_7CN$	solid	1,321.0
α-Naphthoquinone	$C_{10}H_6O_2$	solid	1,100.8
β-Naphthoquinone	$C_{10}H_6O_2$	solid	1,106.4
α-Naphthyl amine	$C_{10}H_7NH_2$	solid	1,263.5

HEAT OF COMBUSTION (Continued)

For Organic Compounds

Name	Formula	Physical state	Heat of combustion, kg. calories
β-Naphthyl amine	$C_{10}H_7NH_2$	solid	1,261.0
Narceine	$C_{23}H_{27}O_8N.2H_2O$	solid	2,802.9
Narcotine	$C_{22}H_{23}O_7N$	solid	2,644.5
Nicotine	$C_{10}H_{14}N_2$	liquid	1,427.7
o-Nitraniline	$C_6H_4(NH_2)(NO_2)$	solid	765.8
m-Nitraniline	$C_6H_4(NH_2)(NO_2)$	solid	765.2
p-Nitraniline	$C_6H_4(NH_2)(NO_2)$	solid	761.0
m-Nitrobenzaldehyde	$O_2NC_6H_4CHO$	solid	800.4
Nitrobenzene	$C_6H_5NO_2$	liquid	739.2
m-Nitrobenzoic acid	$O_2NC_6H_4CO_2H$	solid	729.1
Nitroethane	$C_2H_5NO_2$	liquid	322.2
Nitroglycerine, *see Trinitroglycerol*			
Nitromethane	CH_3NO_2	liquid	169.4
o-Nitrophenol	$HOC_6H_4NO_2$	solid	689.1
m-Nitrophenol	$HOC_6H_4NO_2$	solid	684.4
p-Nitrophenol	$HOC_6H_4NO_2$	solid	688.8
Nitropropane	$C_3H_7NO_2$	liquid	477.9
o-Nitrotoluene	$CH_3C_6H_4NO_2$	liquid	897.0
p-Nitrotoluene	$CH_3C_6H_4NO_2$	solid	888.6
Octahydronaphthalene	$C_{10}H_{16}$	liquid	1,461.7
n-Octane	C_8H_{18}	liquid	1,302.7
Octyl alcohol	$C_8H_{18}O$	liquid	1,262.0
Oleic acid	$C_{18}H_{34}O_2$	liquid	2,657.0
Oxalic acid	$(CO_2H)_2$	solid	60.2
Oxamide	$(CONH_2)_2$	solid	203.2
Palmitic acid	$C_{16}H_{32}O_2$	solid	2,398.4
Papaverine	$C_{20}H_{21}O_4N$	solid	2,478.1
Pentamethylbenzene	$C_6H(CH_3)_5$	solid	1,554.0
n-Pentane	C_5H_{12}	gas	838.3
n-Pentane	C_5H_{12}	liquid	833.4
Phenacetin	$C_{10}H_{13}O_2N$	solid	1,285.2
Phenanthraquinone	$C_{14}H_8O_2$	solid	1,544.0
Phenanthrene	$C_{14}H_{10}$	solid	1,692.5
Phenetole	$C_6H_5OC_2H_5$	liquid	1,060.3
Phenol	C_6H_5OH	solid	732.2
Phenylacetic acid	$C_6H_5CH_2CO_2H$	solid	930.2
Phenylacetylene	$C_6H_5C:CH$	liquid	1,024.2
Phenylalanine	$C_9H_{11}O_2N$	solid	1,111.3
p-Phenylenediamine	$C_6H_4(NH_2)_2$	solid	843.4
Phenylethylene, *see Styrene*			
Phenylglycine	$C_2H_5NHCH_2CO_2H$	solid	955.1
Phenylhydrazine	$C_6H_5N_2H_3$	solid	875.4
Phenylhydroxylamine	C_6H_5NHOH	liquid	803.7
Phenyl iodide	C_6H_5I	liquid	770.7
Phloroglucinol	$C_6H_3(OH)_3$	solid	635.7
Phthalic acid	$C_6H_4(CO_2H)_2$	solid	771.0
Phthalic anhydride	$C_6H_4(CO)_2O$	solid	783.4
Phthalimide	$C_8H_5O_2N$	solid	849.5
Picric acid	$C_6H_2(OH)(NO_2)_3$—(1, 2, 4, 6)	solid	611.8
Pinacoline	$CH_3COC(CH_3)_3$	solid	891.8
Piperidine	$C_5H_{11}N$	liquid	826.6
Piperonal	$C_8H_6O_3$	solid	870.7
Propane	C_3H_8	gas	526.3
Propine, *see Allylene*			
Propionaldehyde	C_2H_5CHO	liquid	434.2
Propionamide	$C_2H_5CONH_2$	solid	439.9
Propionic acid	$C_2H_5CO_2H$	liquid	367.2
Propionic anhydride	$(C_2H_5CO)_2O$	liquid	746.6

HEAT OF COMBUSTION (Continued)

For Organic Compounds

Name	Formula	Physical state	Heat of combustion, kg. calories
Propionitrile	C_2H_5CN	liquid	456.4
n-Propyl alcohol	C_3H_7OH	liquid	480.5
Propyl amine	$C_3H_7NH_2$	liquid	558.3
n-Propylbenzene	$C_3H_7C_6H_5$	liquid	1,246.4
Propyl bromide	C_3H_7Br	vapor	497.3
Propyl carbylamine	C_3H_7NC	liquid	639.6
Propyl chloride	C_3H_7Cl	vapor	478.3
Propylene	$CH_3CH{:}CH_2$	gas	490.2
Propylene glycol	$CH_3CHOHCH_2OH$	liquid	431.0
n-Propyl iodide	C_3H_7I	liquid	514.3
n-Propyltoluene	$C_6H_4(CH_3)(C_3H_7)$—(1, 3)	liquid	1,405.4
Pseudocumene	$C_6H_3(CH_3)_3$—(1, 2, 4)	liquid	1,241.7
Pyridine	C_5H_5N	liquid	658.5
Pyrocatechol	$C_6H_4(OH)_2$	solid	684.8
Pyrogallol	$C_6H_3(OH)_3$	solid	638.7
Pyrrole	C_4H_5N	liquid	567.7
Quercitol	$C_6H_{12}O_5$	solid	704.2
Quinoline	C_9H_7N	liquid	1,123.5
Quinone	$O{:}C_6H_4{:}O$	solid	656.6
Raffinose	$C_{18}H_{32}O_{16}$	solid	2,025.5
Retene	$C_{18}H_{18}$	solid	2,306.8
Resorcinol	$C_6H_4(OH)_2$	solid	683.0
Resorcinoldimethyl ether	$(CH_3O)_2C_6H_4$	liquid	1,022.6
Rhamnose	$C_6H_{12}O_6$	solid	718.2
Safrole	$C_{10}H_{10}O_2$	liquid	1,244.1
Salicylaldehyde, *see o-Hydroxybenzaldehyde*			
* Salicylic acid	$HOC_6H_4CO_2H$—(1, 2)	solid	723.1
Sarcosine	$CH_3NHCH_2CO_2H$	solid	401.1
Sebacic acid	$(CH_2)_8(CO_2H)_2$	solid	1,297.3
Skatole	C_9H_9N	liquid	1,170.5
d-Sorbose	$C_6H_{12}O_6$	solid	668.3
Starch	$(C_6H_{10}O_5)x$ per kg.	solid	4,178.8
Stearic acid	$C_{18}H_{36}O_2$	solid	2,711.8
Strychnine	$C_{21}H_{22}O_2N_2$	solid	2,685.7
Styrene	$C_6H_5CH{:}CH_2$	liquid	1,047.1
Suberic acid	$(CH_2)_6(CO_2H)_2$	solid	985.2
Succinic acid	$(CH_2CO_2H)_2$	solid	357.1
Succinic acid nitrile	$(CH_2CN)_2$	liquid	545.7
Succinic anhydride	$(CH_2CO)_2O$	solid	369.6
Succinimide	$C_4H_5O_2N$	solid	437.9
Sucrose	$C_{12}H_{22}O_{11}$	solid	1,349.6
Sylvestrene	$C_{10}H_{16}$	liquid	1,464.7
d-Tartaric acid	$(CHOH)_2(CO_2H)_2$	solid	275.1
d, l-Tartaric acid (anhydr.)	$(CHOH)_2(CO_2H)_2$	solid	278.4
Terephthalic acid	$C_6H_4(CO_2H)_2$	solid	770.4
Terpin hydrate	$C_{10}H_{22}O_3$	solid	1,451.0
Terpineol	$C_{10}H_{18}O$	solid	1,469.5
Tetrahydrobenzene	C_6H_{10}	liquid	891.9
Tetrahydronaphthalene	$C_{10}H_{12}$	liquid	1,352.4
Tetramethylmethane	$(CH_3)_4C$	gas	842.6
Tetraphenylmethane	$(C_6H_5)_4C$	solid	3,102.4
Tetryl	$C_7H_5N_5O_8$	solid	842.3
Thebaine	$C_{19}H_{21}O_3N$	solid	2,441.3
Thiophene	C_4H_4S	liquid	670.5
Thujane	$C_{10}H_{18}$	liquid	1,506.4
Thymol	$C_{10}H_{14}O$	liquid	1,353.4
Thymol	$C_{10}H_{14}O$	solid	1,349.7
Thymoquinone	$C_{10}H_{12}O_2$	solid	1,271.3

* Recommended as a secondary thermochemical standard.

HEAT OF COMBUSTION (Continued)

For Organic Compounds

Name	Formula	Physical state	Heat of combustion, kg. calories
Toluene	$CH_3C_6H_5$	liquid	934.2
o-Toluic acid	$CH_3C_6H_4CO_2H$	solid	928.9
m-Toluic acid	$CH_3C_6H_4CO_2H$	solid	928.6
p-Toluic acid	$CH_3C_6H_4CO_2H$	solid	926.9
o-Toluidine	$CH_3C_6H_4NH_2$	liquid	964.3
m-Toluidine	$CH_3C_6H_4NH_2$	liquid	965.3
p-Toluidine	$CH_3C_6H_4NH_2$	solid	958.4
o-Tolunitrile	$CH_3C_6H_4CN$	liquid	1,030.3
Toluquinone	$C_7H_6O_2$	solid	803.2
Triaminotriphenyl carbinol	$(C_6H_4NH_2)_3COH$	solid	2,483.5
Tribenzyl amine	$(C_6H_5CH_2)_3N$	solid	2,762.1
Trichloracetic acid	$Cl_3C.CO_2H$	solid	92.8
Triethyl amine	$(C_2H_5)_3N$	liquid	1,036.8
Triethyl carbinol	$(C_2H_5)_3CHOH$	liquid	1,080.0
Triisoamyl amine	$[(CH_3)_2CHCH_2CH_2]_3N$	liquid	2,459.3
Triisobutyl amine	$[(CH_3)_2CHCH_2]_3N$	liquid	1,973.6
Trimethyl amine	$(CH_3)_3N$	liquid	578.6
2, 2, 3-Trimethylbutane	$(CH_3)_3C.CH(CH_3)_2$	liquid	1,147.9
Trimethyl carbinol	$(CH_3)_3COH$	liquid	629.3
Trimethylene	$CH_2CH_2CH_2$	gas	496.8
Trimethylethylene	$(CH_3)_2C:CHCH_3$	liquid	796.0
Trimethylethylene	$(CH_3)_2C:CHCH_3$	vapor	803.6
2, 2, 4-Trimethylpentane	$(CH_3)_3C.CH_2CH(CH_3)_2$	liquid	1,303.9
Trinitrobenzene	$C_6H_3(NO_2)_3$—(1, 3, 5)	solid	663.7
Trinitroglycerol	$C_3H_5(NO_3)_3$	liquid	332.4
Trinitrotoluene	$C_6H_2(CH_3)(NO_2)_3$—(1, 2, 4, 6)	solid	820.7
Triphenyl amine	$(C_6H_5)_3N$	solid	2,267.8
Triphenylbenzene	$C_6H_3(C_6H_5)_3$—(1, 3, 5)	solid	2,936.7
Triphenyl carbinol	$(C_6H_5)_3CHOH$	solid	2,340.8
Triphenylmethane	$(C_6H_5)_3CH$	solid	2,388.7
Triphenyl methyl	$(C_6H_5)_3C$	solid	2,378.5
Tyrosine	$C_9H_{11}O_3N$	solid	1,070.2
Undecylic acid	$C_{11}H_{22}O_2$	solid	1,615.9
Urea	$(NH_2)_2CO$	solid	151.6
Urethane	$NH_2CO_2C_2H_5$	solid	397.2
Uric acid	$C_5H_4O_3N_4$	solid	460.2
n-Valeric acid	$C_4H_9CO_2H$	liquid	681.6
Vanillin	$C_6H_3(OH)(OCH_3)CHO$—(1, 2, 4)	solid	914.1
o-Xylene	$(CH_3)_2C_6H_4$	liquid	1,091.7
m-Xylene	$(CH_3)_2C_6H_4$	liquid	1,088.4
p-Xylene	$(CH_3)_2C_6H_4$	liquid	1,089.1
Xylose	$C_5H_{10}O_5$	solid	561.5

HEAT OF FORMATION

FOR ORGANIC COMPOUNDS

The heat of formation of a compound "A" is equal to the sum of the heats of formation of the products of combustion minus the heat of combustion (see preceding table) of the compound "A." The heat of formation of:

Free elements..................	0	kg-cal
CO_2 (gas)......................	94.38	"
$\frac{1}{2}H_2O$ (liquid from 1 H).........	34.19	"
HF (dilute aqueous solution).....	75.6	"
SO_2 (gas)......................	69.3	"
HBr (aqueous solution)..........	28.54	"
HCl (aqueous solution)..........	39.46	"
HNO_3 (aqueous solution)........	49.80	"
H_2SO_4 (aqueous solution)........	207.5	"

Example I

To calculate the heat of formation of methane (CH_4) where

Heat of combustion of methane = 210.8
Heat of formation of CO_2 = 94.38
Heat of formation of $\frac{1}{2}H_2O$ = 34.19

and where the combustion occurs according to the equation:

$$CH_4 + 2O_2 = CO_2 \text{ (gas)} + 2H_2O \text{ (liquid)}$$

Then the heat of formation of $CH_4 = 94.38 + 4(34.19) - 210.8 = +20.34$ kg-cal. per gram molecular weight.

Example II

To calculate the heat of formation of ethylene (C_2H_4) where

Heat of combustion of ethylene = 331.6

and the combustion occurs according to the equation:

$$C_2H_4 + 3O_2 = 2CO_2 + 2H_2O$$

The heat of formation of $C_2H_4 = 2(94.38) + 4(34.19) - 331.6 = -6.08$ kg-cal. per gram molecular weight.

Example III

To calculate the heat of formation of ethylamine ($C_2H_5NH_2$) where

Heat of combustion of ethylamine = 408.5

and the combustion occurs according to the equation:

$$C_2H_5NH_2 + 3.75O_2 = 2CO_2 + 3.5(H_2O) + N_2$$

The heat of formation of $C_2H_5NH_2 = 2(94.38) + 7(34.19) + O(N_2) - 408.5 = +19.59$ kg-cal. per gram molecular weight.

COMBUSTION CONSTANTS OF GASES

The flue products are based upon air with 21% oxygen and 79% nitrogen; flame temperatures are not corrected for dissociation; the high or gross heat value is one which would be obtained by burning in a Junker's calorimeter; it includes the heat of condensation of the water formed by combustion and assumes that all products of combustion are cooled to the initial temperature; the low or net heat value assumes that all of the products of combustion except water have been cooled to the initial temperature; the difference between the gross and the net is equal to the heat of vaporization of water at the initial temperature.

	Formula	Mol. wt.	Sp. gr. air 1	Wt. per cu. ft. dry	B.t.u. per mol. high (gross)	B.t.u. per mol. low (net)	B.t.u. per cu. ft. high (gross) 60° F. 30 in. satd. H_2O
Acetylene	C_2H_2	26.02	0.8981	0.06858	562,000	543,000	1456
Ammonia	NH_3	17.03	0.5878	0 04489	...	...	...
Benzene	C_6H_6	78.05	2.6940	0.2057	1,413,000	1,356,000	3658
Butane	C_4H_{10}	58.08	2 0047	0.15309	1,237,000	1,142,000	3204
Butylene	C_4H_8	56.06	1.9352	0.14778	1,171,000	1,095,000	3033
Carbon dioxide	CO_2	44.00	1 5288	0.11598	...	...	...
Carbon monoxide	CO	28.00	0.9665	0.07381	122,400	122,400	317.1
Ethane	C_2H_6	30.05	1.0371	0.07920	668,300	611,300	1731
Ethylene	C_2H_4	28.03	0.9676	0.07389	622,400	584,400	1613
Hydrogen	H_2	2.02	0.0695	0.00531	123,100	104,100	318.8
Hydrogen sulfide	H_2S	34.08	1.1767	0.08986	...	...	...
Methane	CH_4	16.03	0.5534	0.04226	384,000	346,000	995
Naphthalene	$C_{10}H_8$	128.06	...	...	2,219,000	2,143,000	...
Nitrogen	N_2	28.02	0.9671	0.07385	...	...	...
Oxygen	O_2	32 00	1.1046	0.08435	...	...	...
Propane	C_3H_8	44.06	1 5210	0 11615	952,000	876,000	2465
Propylene	C_3H_6	42.05	1 4513	0.11083	893,000	836,000	2313
Toluene	C_7H_8	92.06	3 1778	0.2427	1,685,000	1,609,000	4364
Xylene	C_8H_{10}	106 08	3 6616	0 27962	1,955,000	1,860,000	5064
Water	H_2O	18.02	0 6219	0 04749	.	...	...

HEAT OF COMBUSTION OF LIQUID FUELS

Fuel	B.t.u. per lb	Gram-calories per gram	Ultimate analysis					Lbs. per gallon	Specific gravity at 60° F
			C	H	S	N	O		
Alcohol, fuel or denatured	11,620	6,456	.	.	.		.	6 836	0.820
Crude oil, California	18,910	10,506	84 00	12 70	0 75	1 70	1 20	7.636	0 917
Kansas	19,130	10,628	84 15	13 00	1 90	0 45	....	7 670	0.921
Mexico	18,755	10,419	83 70	10 20	4 15		..	8 120	0.975
Oklahoma	19,502	10,834	85 70	13 11	0 40	0 30	...	7 236	0 869
Pennsylvania	19,505	10,836	86 06	13 88	0 06	0 00	0.00	6 769	0 813
Texas	19,460	10,811	85 05	12 30	1 75	0 70	0 00	7 286	0 875
Wyoming	19,510	10 839	..	. .	.	.....	....	7 228	0 868
Gas oil	19,200	10,667		.	.		.	7 184	0 863
Gasoline	20,750	11 528	84 90	14 76	0 08	.	..	6 152	0 739
Fuel oil, California	18,835	10,464	84 67	12 36	1 16		...	7 956	0 9554
Mexico	18,510	10,283	84.02	10 06	4 93			8 223	0 987
Mid-continent	19,376	10,764	85 62	11 98	0 35	0 50	0 60	7.428	0 892
Furnace oil	19,025	10,569	....	..		.		7 462	0 896
Kerosene	19,810	11 006	....	.			..	6 822	0 819

COMBUSTION CONSTANTS OF GASES (Continued)

	B.t.u. per cu. ft. low (net) 60° F. 30 in. satd. H_2O	B.t.u. per cu. ft. high (gross) 60° F. 30 in. dry	B.t.u. per cu. ft. low (net) 60° F. 30 in. dry	B.t.u. per cu. ft. high (gross) 32° F. 30 in.	B.t.u. per cu. ft. low (net) 32° F. 30 in.	Theoretical flame temp. deg. F.	Cu. ft. per cu. ft. fuel gas or mol. per mol. — Required for combustion — Oxygen	Air
Acetylene	1396	1483	1433	1567	1514	4770	2.5	11.90
Ammonia	....	....	....	....	....	....	....	....
Benzene	3509	3722	3577	3933	3774	4110	7.5	35.70
Butane	2955	3261	3010	3445	3180	3870	6.5	30.95
Butylene	2834	3087	2887	3262	3050	4030	6.0	28.58
Carbon dioxide	....	....	....	....	....	....	....	....
Carbon monoxide	317.1	322.6	322.6	341.0	341 0	4475	0.5	2.38
Ethane	1582	1762	1612	1862	1703	3820	3.5	16 67
Ethylene	1514	1641	1541	1734	1631	4250	3.0	14.29
Hydrogen	269.1	324 5	274.5	343.0	290.0	4010	0.5	2.38
Hydrogen sulfide	....	....	....	....	....	.	1.5	7.14
Methane	896	1012	912	1069	963	3750	2.0	9.52
Naphthalene	....	....	....	....	....	4100	12.0	57.10
Nitrogen	....	....	....	....	....	..	....	....
Oxygen	.		....	....	....	..	....	....
Propane	2266	2509	2309	2652	2440	3840	5.0	23.80
Propylene	2164	2354	2204	2487	2328	4090	4.5	21.43
Toluene	4165	4441	4241	4693	4481	4050	9.0	42.87
Xylene	4815	5153	4902	5446	5181	4010	10.5	50 00
Water	....	....	....	....	....	....	....	....

COMBUSTION CONSTANTS OF GASES (Continued)

	Cu. ft. per cu. ft. fuel gas or mol. per mol.			Ignition temp. at atmospheric pressure				Inflammability in air at atmospheric pressure and ordinary temp	
	Flue products			In air		In oxygen			
	CO_2	H_2O	N_2	Deg. F.	Deg. C.	Deg. F.	Deg. C.	% lower limit mixture	% upper limit mixture
Acetylene	2 0	1.0	9.40	763–824	406–440	781–824	416–440		...
Ammonia	...		...	...	...	.			...
Benzene	6 0	3 0	28 20	1364	740	1224	662	1 4	5 5
Butane	4 0	5 0	24 45	...	...	...	...	...	...
Butylene	4.0	4 0	22 58	...	...	...	...	.	...
Carbon dioxide	...	...	...	...	...	...		...	.
Carbon monoxide	1.0	...	1 88	1191–1216	644–658	1179–1216	637–658	16 3	71.2
Ethane	2.0	3 0	13.17	968–1166	520–630	968–1166	520–630	3 3	10.6
Ethylene	2 0	2.0	11.29	1008–1018	542–547	932–966	500–519	3 4	14 1
Hydrogen	...	1.0	1.88	1076–1094	580–590	1076–1094	580–590	6 2	71.4
Hydrogen sulfide	1 0 SO_2	1 0	5 64	...	...	...	...	...	...
Methane	1.0	2 0	7.52	1202–1382	650–750	1033–1292	556–700	5 8	13.3
Naphthalene	10.0	4.0	45.00	...	...	...	.	...	...
Nitrogen	...	...	...	...	...	.	.	...	...
Oxygen	...	...	...	...	...	...	.	...	...
Propane	3.0	4 0	18 80	...	...	914–1058	490–576		...
Propylene	3.0	3.0	16.93	...	...	...		.	...
Toluene	7.0	4 0	33 87	1490	810	1026	552		...
Xylene	8.0	5.0	39 50	...	...	...			...
Water	...	...	...	.	...	.	.		...

HEATS OF COMBUSTION AND COMPOSITION OF MANUFACTURED AND NATURAL GASES

Products of combustion, theoretical flame temperatures, air required and B.T.U. of gas-air mixture are based upon air with 21 % oxygen and 79 % nitrogen; heat values are calculated from the table as given under "Combustion Constants of Gases;" flame temperatures are not corrected for dissociation; carburetted water gas, coal gas, coke-oven gases and oil gas contain a small amount of benzene and oxygen.

	Combustion Values								Composition								
	Theoretical flame temp. ° F.	B.T.U per cu. ft., high (gross) 60° F., 30 in. Hg, satd H_2O	B.T.U. per cu. ft., low (net) 60° F., 30 in. Hg, satd. H_2O	Cu. ft. air required per cu. ft. gas	Cu. ft. CO_2 per cu. ft. of gas burned	Cu. ft. H_2O per cu. ft of gas burned	Cu. ft. of N_2 per cu. ft. of gas burned	High (gross) B.T.U. per cu. ft. gas-air mixture	% CO_2	% CO	% C_2H_6 (ethane)	% C_2H_4 (ethylene)	% H_2	% CH_4 (methane)	% N_2	% O_2	% C_3H_8 (propane)
Blast-furnace gas	2660	93	91.6	0.70	0.392	0.032	0.55	54.7	13.0	26.2	....	....	3.2	...	57.6	...	....
Blue water gas	4167	310	285	2.28	0.469	0.518	1.81	94.5	3.5	43.4	....	.	51.8	....	1.3	...	....
Carburetted water gas	4090	578	529	4.85	0.758	0.904	3.85	98.8	1.5	33.9	....	12.8	35 2	14.8	1.8	...	....
Coal gas	3910	634	560	5.50	0.573	1.282	4.36	97.5	1.1	9 0	....	6.6	47.0	34.0	2.3	..	...
Coke-oven gas	3430	536	476	4.65	0.420	1 205	4.71	95.0	1 4	5.1	...	2.9	57.4	28.5	4.2	0.5	....
Coke-oven gas	3860	600	538	5.28	0.529	1 206	4 21	95 6	2.6	6.1	. .	5 2	47.9	33.9	3.7	0.6	....
Natural gas at Follansbee, W. Va.	3835	2221	1970	21.55	2.667	3 662	17 00	98.6	....	....	31.8	....	....	....	0.5	..	67 7
Natural gas, Follansbee residual	3830	1868	1711	17.97	2.188	3 182	14.21	98.5	..	....	79.4	. .	.	. .	0.6	...	20.0
Natural gas at McKean County, Pa.	3770	1482	1350	14.25	1.663	2 756	11 29	97.3	..	....	67 0	...	. .	32.3	0.7	..	....
Natural gas at Sandusky, Ohio	3740	1047	946	10.04	1.087	2 045	7.98	94.7	0.2	....	12.5	...	....	83.5	3.8	...	....
Oil gas	3970	516	461	4 25	0 458	1.129	3.39	98 3	2.8	10 6	...	2.7	53.5	27.0	3.4	...	....
Producer gas	3050	136	128	1.08	0.311	0.165	1.44	65 3	5.7	22 0	....	0.4	10 5	2.6	58.8	...	....

HEATS OF COMBUSTION AND COMPOSITION OF REPRESENTATIVE COALS

Analysis on coal "as received." First name is that of the county, second name that of the mine.

	Type	B.t.u. per pound	Ultimate analysis					Proximate analysis			
			% C	% H	% N	% O	% S	% Moisture	% Volatile matter	% Fixed carbon	% Ash
Alabama:											
Bibb, Belle Ellen	Bituminous	14,140	78.3	5.3	1.4	7.6	1.2	3.2	31 0	59.6	6.2
Jefferson, Bessemer	"	14,620	81.7	4.7	1.5	6.5	0 7	2.4	24.4	68.4	4.8
Shelby, Aldrich	"	13,650	75.0	5.2	1.0	10.0	0 8	2.3	38.6	51.9	7.2
Alaska:											
Moose Creek	"	12,150	67.6	5 3	1.9	15.9	0.3	4.7	35.5	50.9	8.9
Arkansas:											
Hartford, Central No. 10	"	13,270	77.4	4.1	1.6	5.3	1.1	2.9	19.3	67.3	10 5
Huntington, No. 6 Central	Semi-bituminous	13,700	78.7	4.4	1.6	4.4	1.9	3.2	18.1	69.7	9.0
Colorado:											
Gunnison, Somerset	Bituminous	12,630	70.6	5.5	1.5	12.7	0.4	4.3	39.7	46 7	9.3
Weld, Erie	Sub-bituminous	9,520	54.8	6.3	1.2	33.8	0.3	24.6	29.8	42.0	3.6
Illinois:											
Christian, Pana	Bituminous	10,860	59.8	5.6	1.1	19.1	3 7	13.0	37 0	39.3	10.7
Franklin, Orient	"	12,160	69.0	5.4	1.6	15.0	1.0	7.3	36.7	47.9	8.1
Williamson, Herrin	"	11,860	67.1	5.2	1.5	16.7	0.9	9.4	33.0	49.0	8.6
Indiana:											
Green, Jasonville	"	11,540	64.5	5.8	1.5	19.8	1.1	13.5	36.3	42.9	7.3
Knox, South Bruceville	"	11,540	62.3	5.5	1.0	17.1	3.2	9.5	38.3	41.4	10 9
Sullivan, Vandalia	"	11,420	63.8	5.9	1.4	20.9	1.3	14.9	34.3	44.1	6.7
Iowa:											
Lucas, Chariton	"	10,240	55 8	5.7	1.1	21.5	3 2	15 4	30.5	41 5	12 6
Polk, Altoona	"	10,240	54.7	5.5	0.8	18.8	6.2	13 9	37.0	35.2	14.0
Kansas:											
Cherokee, Stone City	"	13,080	71.8	5 2	1.2	10.2	3.3	5.1	34 5	52.2	8.3
Crawford, Edison	"	12,500	68.8	4.9	1.2	8.7	4.6	3.9	34 2	50.1	11.8
Kentucky:											
Christian, Mannington	"	11,680	.	.	..	.	3 1	9 2	33 7	46.4	10.7
Webster	"	12,500	70.4	5 1	1.6	12.6	1.1	5.4	34.9	50.4	9.3
Maryland:											
Allegany, Frostburg	Semi-bituminous	13,430	76.9	4.3	1.9	4.9	1.1	2.2	17.2	69.1	10.9
Allegany, Ocean	Semi-bituminous	14,190	81.0	4 5	1.9	4.0	1.0	1.2	17.9	73.2	7.7
Montana:											
Carbon, Washoe	Sub-bituminous	10,550	59.8	5.6	1.3	21.0	1 1	10 5	34 7	43 7	11.2
Musselshell, Roundup	"	10,690	62.0	5.6	1.0	22.7	0.7	13.6	32.9	45.5	8.1
New Mexico:											
San Juan, Farmington	Bituminous	11,630	..	...	...	...	1.3	6.9	38.1	43.0	11.9
North Dakota:											
Ward, Burlington	Lignite	6,010	37 4	6.4	0.6	45.0	0.2	36.9	24.9	27 7	10.4
Williams, Wheelock	"	5,990	35 2	7.1	0.5	47.5	1.3	42.1	25.0	24.4	8.5
Ohio:											
Columbian, New Salisbury	Bituminous	12,730	69 9	5 2	1 4	8.3	4.3	3.5	36.7	48.9	10 9
Jefferson, Yellow Creek	"	12,720	69.7	5.2	1.4	8.0	5.1	3.4	36.3	49 6	10.7
Oklahoma:											
Coal, Lehigh	"	11,260	62.8	5 0	1.5	14.5	4.3	6.6	38.6	42.9	11.9
Latimer, Degnan	"	13 630		.	.		0.9	3.7	36.8	53.8	5.6
Pittsburg, Ridgway	"	13,280	73.8	5.4	1 8	9 6	1.7	3.8	38 0	50.6	7.6

HEATS OF COMBUSTION AND COMPOSITION OF REPRESENTATIVE COALS (Continued)

	Type	B.t.u. per pound	Ultimate analysis % C	% H	% N	% O	% S	Proximate analysis % Moisture	% Volatile matter	% Fixed carbon	% Ash
Oregon:											
Coos, Beaverhill	Sub-bituminous	9,030	51 1	5.5	1.2	28 2	0.8	16.1	31.1	39 6	13.2
Pennsylvania:											
Armstrong, Montgomeryville	Cannel	10,460	56 9	4 5	1 1	5 6	3.7	1.8	32.8	37.3	28.2
Armstrong, W. Kittanning......	Bituminous	13,040	71 4	5.3	1 3	9 1	3 1	3.4	35 5	51.3	9.7
Bedford, Hopewell......	"	13,810	77 4	4 1	1.4	3.4	1 0	1 6	16 3	70.0	12.1
Cambria, Bakerton	Semi-bituminous	14,460	..	...	...	...	1.1	2 2	22.2	70.3	5.3
Cambria, Nanty Glo....	"	14,380	....		...	....	1 9	2 5	20 0	71.5	6.1
Cambria, Windber......	"	14,620	83.9	4.3	1.3	2 4	1 2	2 6	17.0	73 7	6 9
Jefferson, Punxsutawney	Bituminous	13,860	76 6	5.1	1.2	7 2	2 0	2 6	30 4	59.1	7 9
Somerset, Seanor.......	Semi-bituminous	13,740	78.5	4.3	1.2	4.5	2.5	2.4	17.3	71.4	9.0
Rhode Island:											
Providence, Cranston...	Anthracite	11,620	82.4	0.5	0.1	1.8	0 9	4.5	3 0	78.7	13.8
Texas:											
Webb, Dolores.........	Cannel	11,070	59.3	5 8	1.2	12.7	2.1	4.4	46 0	30.5	19.0
Virginia:											
Montgomery, Blacksburg...........	Semi-bituminous	12,740	75.3	3.6	0.9	4.8	0.5	1.9	14.0	68.9	15.2
Pulaski, Guntan Park..	Semi-anthracite	10,960	....	...	...	....	0.8	3.8	9.4	62.2	24.0
Tazewell, Pocahontas...	Semi-bituminous	14,610	84 0	4 7	1.2	5.2	0 5	3.0	20.3	72.2	4.5
Wise, Josephine	Bituminous	13,270	73 7	5.1	1.6	8.8	0.9	2.6	33 8	53.6	10.0
Washington:											
Kittitas, Ellensburg.....	"	11,010	61 3	5 5	1 5	14 4	1 4	10.3	30.4	43.4	15 9
Thurston, Tono	Sub-bituminous	8,700	49 9	6 3	0 9	32.4	1.2	21.7	34.8	33.3	10.3
West Virginia:											
Brook, Collier	Bituminous	12,940	72 1	5 3	1 4	10.5	2.6	4.4	37 4	50.1	8.1
Grant, Bismarck........	Semi-bituminous	13,590	.	...	...	....	2.7	3.0	16.7	71.0	9.3
Mineral, Emoryville....	"	12,600	..	..	..	...	2.5	2.4	16 1	65.9	15 6
Ohio, Elm Grove..... .	Bituminous	13,200	72 8	5.3	1.4	8.8	3.6	3.0	41 4	45.6	8.1
Wyoming:											
Lincoln, Elkol..........	Sub-bituminous	10,080	57 8	6 3	0.9	31.1	0 7	20.8	35.4	40.6	3.2
Lincoln, Green River...	Bituminous	13,310	74.5	5 3	1.3	12.5	1.0	3.6	38.4	52.5	5.5

HEAT OF COMBUSTION, VARIOUS SUBSTANCES

Approximate values of heat of combustion in kilogram calories per gram of substance. Products of combustion are gaseous unless otherwise stated.

Substance	Kg-cal. per gram of substance	Observer
Asphalt	9.530	Slossen, Colburn
Bagasse (refuse from sugar cane), 12% H_2O	4.045	Aufhäuser—1931, 1935
Bamboo, 10.5% H_2O	4.110	
Buckwheat hulls, 10% H_2O	4.219	Aufhäuser—1931, 1935
Butter	9.200	
Carbon:		
amorphous	8.080	Mean
charcoal	8.100	Mean
diamond	7.860	Berthelot
graphite	7.900	Berthelot
Casein	5.860	
Charcoal, 4% H_2O	7.260	
Coconut shells, 13% H_2O	4.200	Freise—1932
Copper (to CuO)	.590	Thomsen
Dynamite, 75%	1.290	Roux, Sarran
Egg white	5.700	
Egg yolk	8.100	
Fats, animal, mean	9.500	
Gunpowder	0.720–0.750	
Hemoglobin	5.900	
Hydrogen, to liquid	33.900	Mean
Hydrogen, to gas	29.150	Berthelot
Iron (to Fe_2O_3)	1.582	
Leather, cuttings 13.7% H_2O	4.729	Aufhäuser
Magnesium (to MgO)	6.080	
Nitrocellulose, 11.29% N.	2.576	Ball—1931
Oak bark, 7% H_2O	4.522	Fieldner
Oil:		
cotton seed	9.500	
lard	9.300	Mean
linseed	9.434	Caldwell, Mattiello—1932
olive	9.400	Mean
paraffin	9.800	Mohler
petroleum:		
crude	11.500	Mean
heavy	10.200	Mean
light	10.000	Mean
rape	9.500	Stohmann
sperm	10.000	Gibson
Paraffin (to CO_2, H_2O l)	11.140	Stohmann
Paraffin (to CO_2, H_2O g)	10.340	Stohmann
Pitch	8.400	
Rubber	3.349	Aufhäuser
Sulfur:		
monoclinic	2.240	Thomsen
rhombic	2.200	Mean
Tallow	9.500	Stohmann
Woods:		
beech, 13% H_2O	4.170	Gottlieb
birch, 12% H_2O	4.210	Gottlieb
oak, 13% H_2O	3.990	Gottlieb
pine, 12% H_2O	4.420	Gottlieb

FREE ENERGY

The free energy change of a chemical reaction is the sum of the free energies of formation from their elements of the products of the reaction less the free energy of formation of the reacting substances.

The free energy values $\Delta F°$ given in the following table refer to the energy of formation from the elements in their standard states at 25° C. The free energy of all elements in their standard states and of H^+ is taken as zero.

Values are in kilogram calories per mole at 25 °C.

Substance	$\Delta F°$ kg cal.	Substance	$\Delta F°$ kg cal.
Ag^+	18 448	Cd (g)	18 616
AgBr (s)	−22.910	(l)	.563
AgCN (s)	38 499	Cd^{++}	−18 348
$Ag(CN)_2^-$	72.047	$CdBr_2.4H_2O$ (s)	−72.070
AgCl (s)	−26.220	$CdCl_2$ (s)	−82.260
AgI (s)	−15.820	CdI_2 (s)	−48.169
$AgNO_2$ (s)	4.900	Cl_2 (l)	1.146
$Ag(SO_3)_2^{---}$	−226.545	(aq)	1.650
Ag_2O (s)	−2.395	Cl^-	−31.345
Au_2O_3 (s)	19.100	ClO^-	−6.500
Br (g)	18.250	ClO_3^-	−.250
Br_2 (g)	.755	ClO_4^-	−9.000
(s)	.314	Cu (g)	63.210
(aq)	.977	(l)	4.300
Br^-	−24.595	Cu^{++}	15.912
Br_3^-	−25.230	CuCl (s)	−28.440
BrO_3^-	2.300	CuO (s)	−30.300
C (diamond)	.390	$Cu(OH)_2$ (s)	−85.090
CCl_4 (l)	−15.600	CuS	−11.620
$CH_3CO_2^-$, acetate ion	−89.720	$CuSO_4$ (s)	−155.850
CH_4 (g)	−11.617	$CuSO_4.H_2O$ (s)	−216.610
CH_4O, methyl alcohol (g)	−38.890	$CuSO_4.3H_2O$ (s)	−331.530
(l)	−39.960	$CuSO_4.5H_2O$ (s)	−445 960
CN^-	39.370	Cu_2O (s)	−35.000
$(CN)_2$ (g)	92.000	Cu_2S (α)	−19.110
CNI (s)	42 790	(β)	−18.970
CNO^-	−23 750	Fe^{++}	−20 240
CO (g)	−32.510	Fe^{+++}	−3.120
$COCl_2$ (g)	−48.770	H_2 (aq)	4.182
$CO(NH_2)_2$, urea (s)	−47.280	H^+	0
(aq)	−48 840	HBr (g)	−12.540
COS (g)	−39 600	(aq)	−24 574
CO_2 (g)	−94.260	HBrO (aq)	−19.680
(aq)	−92.250	$HBrO_3$ (aq)	2 300
CO_3^{--}	−125 760	HCN (g)	28.910
CS_2 (g)	17.600	(l)	28 870
(l)	17 150	(aq)	27.510
C_2H_2, acetylene (g)	50 840	HCNO (aq)	−29 100
C_2H_4, ethylene (g)	12 300	HCOOH, formic acid (l)	−84.040
$C_2H_4O_2$, acetic acid (g)	−91.230	(aq)	−87.920
(l)	−94 500	HCO_3^-	−140.000
(aq)	−96 210	HCl (g)	−22.741
$(C_2H_5)_2O$, ether (g)	−28 090	(aq)	−31.345
(l)	−28 300	HClO (aq)	−19.018
C_2H_5OH, ethyl alcohol (g)	−38.690	$HClO_3$ (aq)	−.250
(l)	−45 100	HF (g)	−64.91
C_2H_6, ethane (g)	−10 700	(aq)	1.000
C_6H_6, benzene (g)	30.640	$(HF)_6$ (g)	−210.000
(l)	27.100	HI (g)	315
$C_{12}H_{22}O_{11}$, sucrose (s)	−371.600	(aq)	−12 361
Ca (β)	.078	HIO (aq)	−23 170

FREE ENERGY (Continued)

Substance	Δ F° kg cal.	Substance	Δ F° kg cal.
HIO_3 (aq)	−31.580	NO_2^-	−8.500
HNO_2 (aq)	−13.070	NO_3^-	−26.500
HNO_3 (g)	−18.210	N_2O_4 (g)	22.640
(aq)	−26.500	Na^+	−62.588
HO_2^-	−15.610	NaCl (s)	−91.792
$HPbCl_5$ (aq)	−104.700	O_2 (aq)	3.904
$HPbO_2^-$	−80.602	O_3 (g)	32.400
HS^-	2.980	OH^-	−37.455
HSO_3^-	−123.920	Pb (g)	41.764
H_2CO_3 (aq)	−148.810	(l)	.533
$H_2C_2O_4$, oxalic acid (s)	−165.900	Pb^{++}	−5.551
H_2O (g)	−54.507	$PbBr_2$ (s)	−62.063
(l)	−56.560	$PbCO_3$ (s)	−149.000
(s)	−56.418	$PbCl_2$ (s)	−75.056
H_2O_2 (g)	−24.730	$PbCl_5^-$	−104.700
(l)	−28.230	PbI_2 (s)	−41.510
(aq)	−31.470	PbO (red)	−45.050
H_2S (g)	−7.840	(yellow)	−44.896
(aq)	−6.490	$PbOH^+$	−53.440
H_2SO_3 (aq)	−126.330	$Pb(OH)_2$ (aq)	−96.888
H_2SO_4 (aq)	−176.500	PbO_2 (s)	−52.070
Hg (g)	7.632	PbS (s)	18.000
(s)	.1493	$PbSO_4$ (s)	−176.500
Hg_2^{++}	36.854	$Pb_3(CO_3)_2(OH)_2$ (s)	−407.700
HgBr (s)	−21.351	Pb_3O_4 (s)	−147.342
HgCl (s)	−25.163	S (g)	30.240
$HgCl_2$ (g)	−34.569	(λ) (l)	.094
(l)	−41.932	(monocl)	.0183
(s)	−43.550	S^{--}	23.450
HgI (s)	−13.290	S_2 (g)	18.280
HgO (red)	−13.808	S_6 (g)	11.900
Hg_2Cl_2 (s)	−50.274	S_8 (g)	10.000
Hg_2SO_4 (s)	−162.100	SO_2 (g)	−69.660
I (g)	15.470	(aq)	−69.770
I_2 (l)	.920	SO_2Cl_2 (g)	−71.560
(aq)	3.926	SO_3 (g)	−85.890
I^-	−12.361	SO_3^{--}	−116.680
I_3^-	−12.315	SO_4^{--}	−176.500
IO_3^-	−31.580	$S_2O_3^{--}$	−125.110
K^+	−67.431	$SiCl_4$ (l)	−113.710
$KClO_3$ (s)	−69.250	Sn (gray)	.0095
N_2 (aq)	4.358	Sn^{++}	−3.138
NH_3 (g)	−3.910	$SnCl_4$ (l)	−113.210
(l)	−2.620	Tl (α)	−.004
(s)	−1.585	(β)	.035
(aq)	−6.300	(l)	.468
NH_4^+	−18.930	TlBr (s)	−39.770
NH_4Cl (s)	−47.810	TlCl (s)	−44.195
NH_4OH (aq)	−62.860	TlI (s)	−30.020
NO (g)	20.869	TlOH (s)	−45.400
(l)	24.594	Tl_2O (s)	−32.410
(s)	26.398	Zn (g)	22.885
NOCl (g)	16.010	Zn^{++}	−17.492
NO_2 (g)	11.920	ZnO (s)	−75.720

CHARACTERISTICS AND FUNCTIONS OF THE VITAMINS

Compiled by H. J. Prebluda

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Vitamin A............ (animal sources) **Carotenes** (plant sources) (provitamin A) Fat soluble A Anti-Xerophthalmic vitamin	*Vitamin A_1* ($C_{20}H_{29}OH$) *Vitamin A_2* ($C_{22}H_{31}OH$) Pale, viscous, fat-soluble, heat and oxygen labile liquids found in fish liver oils. *Carotenes*—orange red pigments—Kryptoxanthin, alpha and beta carotene—found in plants and are precursors of vitamin A being changed to this vitamin in the human body. Have same fat soluble and labile properties of vitamin A especially to oxidation. One molecule of beta carotene has physiological potency of two molecules of vitamin A. Alpha carotene has 50% activity of beta carotene.	Vitamin A is essential for growth, normal vision and for maintenance of normal condition of epithelial tissue. Prevention of nyctalopia (night blindness) and regeneration of retinal visual purple bleached by light. Dried out epithelial tissue deficient in vitamin A seems to have less resistance to invasion by bacteria. Requirements are greatest during periods of rapid growth, pregnancy, lactation or illness.	Dryness and keratinization of the eye conjuctiva (xerophthalmia) hyperkeratosis of mucous membrane and dermal structures. Dryness of skin. Retardation of growth.	Leafy portions of green plants Salt water fish liver oils—A_1 Fresh water fish liver oils—A_2 Eggs Butter Cream Provitamin A found in pigmented plants such as carrots, sweet potatoes, yellow corn, etc. Apricots
Vitamin B_1.......... Thiamin chloride Thiamin hydrochloride Aneurin Anti-beri-beri vitamin Anti-neuritic vitamin	A white crystalline powder having the formula $C_{12}H_{17}ON_4SCl.HCl$, soluble in alcohol and water. Heat and alkali labile stable to aeration.	Necessary in formation of enzymes participating in carbohydrate metabolism. Essential for maintenance of good appetite, normal	Retarded growth, loss of appetite, leg weakness, convulsive seizures associated with spastic paralysis and focal accumulation	Liver Yeast Milk Eggs Fruits Legumes

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
	Molecular structure includes a pyridine and thiazole group which is broken down by sulfite treatment.	digestion and gastric tonicity. Necessary for lactation and reproduction. Lack of vitamin B_1 has been responsible for various forms of nerve disturbances and suboptimal growth of infants and children.	of pyruvic acid in central nervous systems with accompanying polyneuritis. Emotional instability and enlargement of heart.	Leafy vegetables Lean meat Embryos of cereal grains
Vitamin B_2.. (Member of the vitamin B Complex) Riboflavin Vitamin G Lactoflavin (from milk) Ovoflavin (from eggs) Hepatoflavin (from liver)	An orange yellow pigment ($C_{17}H_{20}N_4O_6$) containing an iso-alloxazine nucleus combined with *d*-ribose. Solutions of riboflavin exhibit a strong greenish-yellow fluorescence in ultra violet which is the basis for fluorometric assay of this vitamin. Riboflavin is water soluble, heat stable in acid or neutral solutions and readily destroyed in an alkaline medium. Visible light (blue and violet regions) destroys this vitamin.	Necessary for growth and respiration of all tissues and cells. Has been demonstrated to increase vitality and postpone senility in succeeding generations of experimental animals. Necessary for growth of domestic animals. Necessary for egg hatchability.	A reddening and slimy denuded appearance of the lips, waxy accumulations at the nasolabial folds of the skin, ocular lesions accompanied by burning sensation and light sensitivity, roughening of skin around the mouth and across tip of nose. Curled toe paralysis in chicks.	Milk Liver Eggs Wheat germ Fermentation by-products Meat Leafy vegetables
Niacin....... Nicotinic acid Pellagra preventive P-P factor	3-pyridine carboxylic acid which is somewhat soluble in hot water. The amide derivative is	A component of co-enzymes important in glycolysis and cellular respiration.	Pellagra with burning soreness of mouth, loss of appetite, loss of weight, and diges-	Liver Kidney Lean meat Peanuts

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Anti-black tongue factor (Member of vitamin B complex)	more soluble and called niacinamide. Relatively stable to heat.	Essential for health and growth. Necessary for maintaining normal function of skin and gastro-intestinal tract.	tive nervous disturbances.	Yeast Eggs Fish Bran Green leafy vegetables
Vitamin B_6............ (Member of vitamin B complex) Pyridoxin Adermin Rat acrodynia factor	Derivative of pyridine. Commercially available as hydrochloride—white powder ($C_8H_{11}NO_3.HCl$) which is stable in solution in absence of strong light. Acid solutions stable to autoclaving below pH5.	Significance in human nutrition not fully established. Has been found useful in alleviating certain nervous and muscular disorders. Probably plays role in unsaturated fatty acid utilization and liver metabolism. Important in chick, hog, and dog nutrition.	Microcytic hypochromic anemia in dogs, lack of coordination of gait of pigs. One of the vitamins lacking in individuals having multiple deficiencies in pellagra.	Liver Yeast Crude cane molasses Cereals Legumes Milk
Pantothenic Acid...... Pantothen Filtrate factor Chick anti-dermatitis factor Factor II (Member of vitamin B complex)	Beta-alanine derivative of a substituted butyryl lactone. A white solid not readily soluble in water. Commercially available as calcium salt $Ca(C_9H_{16}O_5N)_2$ which is water soluble. Stable to autoclaving, light oxidizing and reducing agents. Unstable to alkali.	Significance in human nutrition not established. Essential for certain bacteria, rats, chickens, and dogs, as well as humans Necessary for maintaining normal adrenal activity. Thought to be one of several substances playing a role in preventing grey hair. Essential for growth and reproduction of chicks.	Dermatitis in chicks. Retarded growth and greying of hair in rats. Deficiency usually occurs along with pellagra	Yeast Liver Kidney Eggs Cane Molasses Milk Wheat germ

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Choline (Member of vitamin B complex)	Hydroxyethyl trimethyl ammonium hydroxide—a colorless viscous liquid which has strong basic properties. Basic constituent of lecithin and the chloride is available commercially. The latter is a colorless crystalline hygroscopic solid—very soluble in water. Salty, bitter taste.	Essential in fat metabolism to mobilize fatty acids, supplies "labile" methyl groups.	Impairment of liver and renal functions. "Slipped tendon" of fowl.	Liver Egg yolk Brain Kidney Heart Sweet breads Yeast Cereal germs Legumes Green leafy vegetables Potatoes Milk
Vitamin C Ascorbic acid Anti-scorbutic vitamins Cevitamic acid	A hexuronic acid. A white crystalline solid soluble in water with sour acid taste. Insoluble in oils. Destroyed by exposure to air, light, and alkali. Deterioration accelerated by metals such as iron and copper. Strong reducing agent. Cannot be stored in the body.	Prevents and cures scurvy. Necessary for formation and maintenance of intercellular tooth and bone structure. Prevents capillary fragility. Increases resistance to bacterial toxins and infections. Infection increases vitamin C requirement of body.	Scurvy. Dental caries. Gum infections. Slow healing of wounds. Defective formation of bones and teeth.	Citrus fruits Alfalfa Cabbage Green and red peppers Raw turnip Tomato Pineapple
Vitamin D Anti-rachitic vitamin	At least ten active vitamin D sterols are known. The two important sterols are vitamin D_2 (activated ergosterol, calciferol) derived mainly from vegetable sources and vitamin	Regulation of calcification of bone structure Regulates absorption and utilization of calcium and phosphorous.	Rickets. Poor bone development. Tooth decay. Osteomalacia.	Fish liver oils Mackerel Herring Sardines Egg yolk Tuna Liver

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
	D_3 (activated 7-dihydrocholesterol) derived mainly from animal sources. Vitamin D is fat soluble, heat stable and not readily destroyed by oxidation. Can be produced in many foodstuffs by irradiation or exposure to sunlight. Light energy activates sterils present to active vitamin D. In similar fashion sterols beneath skin are activated to form vitamin D upon exposure to ultra violet or sunlight. Activated ergosterol dissolved in vegetable oils = viosterol.			
Vitamin E . . . . . Alpha tocopherol Anti-sterility vitamin	Has chromane structure ($C_{20}H_{50}O_2$). Thick viscous oil-soluble in fat solvents. Heat stable and resistant to mild oxidation. Ferric salts and rancid fats destroy physiological activity. Obtained from natural sources in unsaponifiable fraction.	Has anti-oxidant properties. Has not been demonstrated to be effective in humans but has been shown to prevent sterility in male and female rats. Important in muscular and nervous systems.	No definite deficiency symptoms in humans. Has been used with success in habitual and threatened abortion as well as certain neuromuscular disorders.	Wheat germ oil Corn oil Lettuce Spinach Egg yolk Meat Legume Seeds

*

Characteristics and Functions of the Vitamins (Continued)

Factor and synonyms	Description and properties	Importance	Deficiency symptoms	Chief natural sources
Vitamin K............ Anti-hemorrhagic factor Coagulation vitamin	Natural product is naphthoquinone compound—oily liquid and insoluble in H_2O. Fat-soluble, stable to heat and reducing agents. Labile to alcoholic alkali, oxidizing agents, strong acids, and $AlCl_3$. Occurs in nature as a phytyl derivative (vitamin K_1) in green leaves. The difarnesyl derivative (vitamin K_2) is formed by putrefaction. A commercial synthetic 2, methyl 1,4 naphthoquinone has vitamin K activity and is called Menadione.	Aids in prevention of hemorrhage in newborn. Essential in promoting normal prothrombin content and clotting of blood.	Obstructive jaundice. Hemorrhagic tendency. Poor healing of wounds after post-operative conditions.	Alfalfa concentrate Spinach Cabbage Cauliflower Kale Carrot greens Tomatoes

Vitamin Unit Table

Vitamin A	1 International Unit = 1 USP Unit Activity of 0.6 micrograms* of beta-carotene
Vitamin B_1	1 International Unit = 1 USP Unit Activity of 3 0 micrograms of crystalline thiamin chloride
Riboflavin	Quantities expressed in micrograms or milligrams
Niacin Niacin amide	Quantities expressed in micrograms or milligrams
Pantothenic acid	Quantities expressed in micrograms or milligrams
Choline	Quantities expressed in milligrams
Pyridoxine	Quantities expressed in micrograms or milligrams
Vitamin C	Expressed in milligrams 1 International Unit = 1 USP Unit and is equal to activity of 0.05 milligrams of synthetic ascorbic acid.
Vitamin D (For humans and four-footed animals)	1 International Unit = 1 USP Unit Potency of 0 025 micrograms of pure Vitamin D_2 (calciferol) made by irradiation of ergosterol.
Vitamin E	Measured in micrograms or milligrams One I.U is the alpha tocopherol activity of 0.1 gm of the International standard solution containing 1 mg. of pure synthetic alpha tocopherol acetate.

* Note.—One microgram = 0.000001 grams.

Abbreviations

A = Vitamin A
B = Vitamin B_1
C = Vitamin C
D = Vitamin D
E = Vitamin E
K = Vitamin K
N = Nicotinic Acid or Niacin
R = Riboflavin

Reaction indicates the type and degree of reaction of the food in the body. The relative acidity or basicity is indicated by the designation h, high, m, medium; and l, low

Recommended Dietary Allowances[1]

	Calories	Protein grams	Calcium grams	Iron mg	Vitamin A I.U.[2]	Thiamin mg.[3]	Riboflavin mg[3]	Niacin (nicotinic acid) mg.[3]	Ascorbic acid mg.	Vitamin D I.U.
Man (154 lb., 70 kg.)										
Sedentary	2500	70	0.8	12[4]	5000	1.2	1.6	12	75	[5]
Moderately active	3000	70	0.8	12[4]	5000	1.5	2.0	15	75	[5]
Very active	4500	70	0.8	12[4]	5000	2.0	2.6	20	75	[5]
Woman (123 lb., 56 kg.)										
Sedentary	2100	60	0.8	12	5000	1.1	1.5	11	70	[5]
Moderately active	2500	60	0.8	12	5000	1.2	1.6	12	70	[5]
Very active	3000	60	0.8	12	5000	1.5	2.0	15	70	[5]
Pregnancy (latter half)	2500[6]	85	1.5	15	6000	1.8	2.5	18	100	400 to 800
Lactation	3000	100	2.0	15	8000	2.0	3.0	20	150	400 to 800
Children up to 12 yrs.[7]										
Under 1 yr.[8]	100/2.2 lb. (1 kg.)	3.5/2.2 lb. (1 kg.)	1.0	6	1500	0.4	0.6	4	30	400 to 800
1–3 yrs. (29 lb., 13 kg.)	1200	40	1.0	7	2000	0.6	0.9	6	35	400
4–6 yrs. (42 lb., 19 kg.)	1600	50	1.0	8	2500	0.8	1.2	8	50	400
7–9 yrs. (55 lb., 25 kg.)	2000	60	1.0	10	3500	1.0	1.5	10	60	400
10–12 yrs. (75 lb., 34 kg.)	2500	70	1.2	12	4500	1.2	1.8	12	75	400
Children over 12 yrs.[7]										
Girls, 12–15 yrs. (108 lb., 49 kg.)	2600	80	1.3	15	5000	1.3	2.0	13	80	400
16–20 yrs. (119 lb., 54 kg.)	2400	75	1.0	15	5000	1.2	1.8	12	80	400
Boys, 13–15 yrs. (103 lb., 47 kg.)	3200	85	1.4	15	5000	1.5	2.0	15	90	400
16–20 yrs. (141 lb., 64 kg.)	3800	100	1.4	15	6000	1.8	2.5	18	100	400

Recommended Dietary Allowances[1] (Continued)

[1] Revised 1945 Food and Nutrition Board, National Research Council.

[2] The allowance depends on the relative amounts of vitamin A and carotene. The allowances of the table are based on the premise that approximately two-thirds of the vitamin A value of the average diet in this country is contributed by carotene and that carotene has half or less than half the value of vitamin A.

[3] For adults (except pregnant and lactating women) receiving diets supplying 2,000 calories or less, such as reducing diets, the allowances of thiamin, riboflavin, and niacin may be 1 mg., 1.5 mg., and 10 mg. respectively. The fact that figures are given for different calorie levels for thiamin, riboflavin, and niacin does not imply that we can estimate the requirement of these factors within 500 calories, but they are added merely for simplicity of calculation. Other members of the B complex also are required, though no values can be given. Foods supplying adequate thiamin, riboflavin, and niacin will tend to supply sufficient of the remaining B vitamins.

[4] There is evidence that the male adult needs little or no iron. The allowance will be provided if the diet is satisfactory in other respects.

[5] For persons who have no opportunity for exposure to clear sunshine and for elderly persons, the ingestion of small amounts of vitamin D may be desirable. Other adults probably have little need for vitamin D.

[6] During the latter part of pregnancy the allowance should increase approximately 20 percent over the preceding level. The value of 2500 calories represents the allowance for pregnant, sedentary women.

[7] Allowances for children are based on the needs for the middle year in each group (as 2, 5, 8, etc.) and are for moderate activity and for average weight at the middle year of the age group

[8] Needs of infants increase from month to month with size and activity The amounts given are for approximately 6 to 8 months. The allowance in calories and the protein in grams are indicated per kilogram weight. The values should be divided by 2.2 to obtain the figures per pound weight. The dietary requirements for some of the nutrients such as protein and calcium are less if derived largely from human milk.

COMPOSITION AND VALUE OF FOODS

Compiled mainly from the publications of the U. S. Department of Agriculture.

The proportions of **protein, fat, carbohydrate** and **mineral matter** are given as percent by weight of the food named. The fuel value is stated in kilogram calories per 100 grams.

The standard daily requirement for an average adult has been accepted as 3000 calories; 75 g of protein, 0.69 g of calcium, 1.32 g of phosphorus, 0.015 g of iron.

The relative value of the food as a source of **vitamins** is shown by letters indicating the vitamins present with subscripts showing the relative abundance. Symbol **N** is used to indicate nicotinic acid and **R**, riboflavin. The best sources are indicated as rich in the particular vitamin by the subscript r. Other classifications are shown by the subscripts e, g and f for excellent, good and fair respectively.

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins r = rich g = good e = excellent f = fair	Reaction h = high m = med. l = low
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Animal Foods									
Cheese:									
American, pale	28 8	35 9	3	453	93	68	0013	Ar, Rf	Acid l
Camembert	21	22		282	93	68	0013	Ar	
Cheddar	27 7	36 8	4 1	473	92	68	0013	Ar, Rg	Acid l
Cottage	20 9	1 0	4 3	112	11	37	..	Af, Bf, Rf	
Cream, full	25 9	33 7	2 4	430	92	68	0013	Ar, Rg	
Neufchatel	18 7	27 4	1 5	337	93	68	0013	Ar, Rf	
Roquefort	22 6	29 5	1 8	375	93	68	0013	Ae, Rf	
Swiss	27 6	34 9	1 3	443	1 1	81	0014	Ag	
Eggs:									
Plain	13 4	10 5		159	067	18	0030	Ar, Be, De, Eg, Rf	Acid m
Scrambled	12	18		210	087	24	0041	Ar, Bf, De, Eg, Rf	Acid m
Whites, boiled	12 3	2		55 1	015	014	00010	Rf	Acid l
Yolks, boiled	15 7	33 3		376	14	53	0086	Ar, Be, De, Eg, Rf	Acid h
Fish:									
Caviar	30	20	...	300	14	18	.	Ag, Bg, Dg, Eg	...
Clams	6 5	4	4 2	47 4	11	044	0044	Af, Bf, Cf, Df, Rf	Acid
Codfish, salt, cooked	21 5	3	....	90 4	030	32	0015	Af, Bf, Df	Acid m
Crab, canned	15 8	1 5	.7	81 6	018	19	.	Bf	Acid
Haddock, fresh, raw	16 8	3		73 9	019	19	00090	Af, Bg, Rf	Acid
Halibut, fresh	18 4	5 2		125	021	22	0010	Af, Bf	Acid m
smoked	20 6	15 0		225	023	24	0013	Af, Bf	Acid m
Herring, fresh	18 9	7 1		146	021	22	0011	Ag, Bf, Dg	Acid
smoked	36.4	15 8		299	039	34	0023	Ag, Bf, Dg	Acid

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Pro-tein	Fat	Carbo-hydrate		Cal-cium	Phos-phorus	Iron	r = rich g = good e = excellent f = fair	h = high m = med. l = low
Animal Foods (Cont.)									
Fish: (Cont.)									
Lobster, canned. .	18 1	1 1	5	86 0	018	18	00090	Bf	Acid
Mackerel, fresh	11 4	3 5		80 5	021	22	0010	Ag, Bf	Acid m
Oysters, raw. .	6 0	1 3	3 3	50 7	051	15	0045	Ag, Bg, Cf, Dg, Rg	Acid m
Salmon, canned .	21 8	12 1		202	024	25	0012	Ag, Bf, Dg, Nf	Acid m
fresh	13 5	8 1		132	024	25	0012	Ag, Bg, Dg, Nf	Acid m
Sardines, canned	22 4	19 7		278	025	28	0013	Ag, Bf, Dg	Acid m
Shrimp, canned .	25 4	1 0	2	115	094	29	0027	Af	Acid
Trout, fresh	17 7	10 3		169	019	20	0013	Af, Bf	Acid m
Tuna, canned, oil	23 8	20 0	6	287	028	29	0014	Af, Bf, Df	Acid
fresh	17	3		95	019	20	00090	Af, Bf, Df	Acid
Whitefish	22 1	6 5		154				Af, Bf	Acid
Gelatin	84 2	1		376					
Meats:									
Beef:									
Chipped, dried	29 7	6 5	4	185	015	32	0045	Af, Bf, Ef, Rg	Acid
Corned, cooked	15 3	26 2		308	020	36	0051	Af, Bf, Ef, Rg	Acid
Kidneys	16 9	4 8	4	115	0099	19	0024	Ag, Bf, Cf, Ef, Ng, Rg	Acid m
Liver .	21 0	4 5	1 7	133	017	21	0079	Ag, Bf, Cg, Ef, Ng, Re	Acid m
Miscellaneous cuts, fat free	22 1	2 9		119	015	24	0033	Bf, Ef, Re	Acid m
Roast, loin	18 6	19 1		255	0090	18	0025	Af, Bf, Ef, Rg	Acid m
Rump, lean	19 6	18 7		213	018	29	0031	Af, Bf, Ef, Rg	Acid m
Steak, round	20 5	16 6		184	013	20	0023	Af, Bf, Ef, Ng, Rg	Acid m
sirloin .	18 6	18 5		249	014	17	0036	Af, Bf, Ef, Ng, Rg	Acid m

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron	r = rich g = good e = excellent f = fair	h = high m = med. l = low
Animal Foods (Cont.)									
Meats: (Cont.)									
Lamb:									
Chops, broiled	21 2	29 9	6.7	367	016	22	0030	Af, Bg, Rf	Acid m
Leg, roast	19 4	12 7		198	0097	23	0033	Af, Bg, Rf	Acid m
Miscellaneous:									
Bologna	18 4	17 6	3	241				Af, Bf, Rf	Acid
Frankfurters	19 7	18 6	1 1	258	012	22	0031	Af, Bf, Rf	Acid m
Mutton:									
Chop	23 9	18 5		270	0097	16	0023	Af, Bg, Rg	Acid m
Leg, roast	25 3	22 6		313	0048	27	0023	Af, Bg, Rg	Acid m
Pork:									
Bacon, smoked	9 9	64 8		646	012	22	0030	Af, Bg, Rf	Acid
Chop, loin, lean	19 7	19 0		260	022	032	0005	Af, Bg, Rf	Acid m
Ham, smoked, lean	20 2	20 8		274	012	22	0030	Af, Be, Rf	Acid m
Liver	21 3	4 5	1 4	136				Ae, Be, Cf, Df, Ne, Re	Acid
Roast	19 5	17 5		235	0094	17	0025	Bg, Rg	Acid m
Veal:									
Chops	19.4	10 0		174	012	22	0030	Bf, Rg	Acid m
Liver	20 4	5 3		127				Ag, Bf, Cg, Ef, Ne, Re	Acid
Roast, leg	20.5	6 7		148	013	24	0033	Bf, Rf	Acid m
Milk:									
Buttermilk, plain	3 0	5	4 8	36.4	10	095	00030	Af, Bg, Rg	Basic l
Condensed, sweetened	8 8	8 3	54 1	335	.30	23	00060	Ae, Bf, Rg	Basic l
unsweetened	9 6	9 3	11 2	172	.32	24	00070	Ae, Bf, Rg	Basic l

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight: Protein	Fat	Carbohydrate	Fuel value, calories per 100 g	Mineral content, percent by weight: Calcium	Phosphorus	Iron	Vitamins (r = rich, e = excellent, g = good, f = fair)	Reaction (h = high, m = med, l = low)
Animal Foods (Cont.)									
Milk: (Cont.)									
Cream, 18 per cent. .	2 5	18 5	4 5	201	.085	069	00020	A_r, B_f, D_f, R_f	Neutral
40 per cent.	2 2	40	3	381	.085	069	00020	A_r, B_f, D_g, R_f	Neutral
Human	1 5	3 3	6 5	62	. .			A_r, B_f, D_f, R_f	Basic
Ice cream, plain. .	5	12	20	208	10	088	00020	A_g, B_f, D_f	Basic l
Skimmed . .	3 4	3	5 1	37 5	12	096	00030	B_f, R_g	Basic l
Whole	3 3	4 0	5 0	71 6	12	.093	00020	A_e, B_f, D_f, R_g	Basic l
Poultry:									
Chicken, broiled	21 6	2 5		111	012	23	0032	B_f, R_e	Acid m
liver . .	22 4	4 2	2 4	141				A_e, B_g, C_f, D_g, E_g, N_g, R_e	Acid
roast	25	11 1		200	011	20	0024	B_g, R_e	Acid m
Duck . .	18	19		243	0099	20	0028	B_f, R_g	Acid
Goose	16 3	36 2		403	0092	18	0025	B_f, R_f	Acid l
Quail . .	24	6 4		154	015	27	00077	B_f, R_f	Acid
Squab	19	22		274	012	22	0030	B_f, R_f	Acid
Turkey, liver	22 9	5 2	6	144				A_e, B_g, C_f, D_g, E_g, N_g, R_e	Acid
roast. . . .	28 4	18 4	.	285	023	43	0060	B_f, R_f	Acid
Vegetable Foods									
Bread:									
Biscuits.	9 3	13 7	52 6	381	072	14	0015	. . .	Acid l
Brown . .	5 4	1 8	47 1	231	11	16	0026	A_f, B_g	Basic
Corn	7 9	4 7	46 3	266	082	13	00086	B_g, E_g	Acid l
Gluten.	9 3	1 4	49 8	256	. .	.		. . .	Acid l

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins (r = rich, g = good, e = excellent, f = fair)	Reaction (h = high, m = med., l = low)
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Vegetable Foods (Cont.)									
Bread: (Cont.)									
Graham . .	8 9	1 8	51 0	267	050	22	0025	A_f, B_g, E_g	Acid l
Griddle cakes, plain	7	5	31 6	200	075	11	00088	. . . . .	Acid l
Muffins, corn meal	8 5	7	44	273	.11	20	0017	A_g, B_f, E_f	Acid l
graham	8	4	46	252	074	17	0016	A_g, B_g	Acid l
Rye	9 0	6	52 7	260	.024	14	0016	A_f, B_g, R_f	Acid l
Rye and wheat	11 9	.3	51 5	262	10	17	0015	A_f, B_g, R_f	Acid l
Toast, plain	11 5	1 6	61 2	313	077	21	0018	A_f, B_f	Acid l
Waffles, plain	13 2	15 5	48	385	077	11	0010	A_f, B_f	Acid l
Wheat, cracked	8 7	1 7	50	250	063	17	0015	A_g, B_g, R_f	Acid l
white	9 3	1 2	52 2	266	.027	092	00090	A_f, B_f	Acid l
whole	9 7	9	48 5	251	048	17	0016	A_e, B_g, E_e, R_f	Acid l
Zwieback	9.8	9 9	73.5	434	053	14	0016	B_f	Acid l
Cake:									
Angel food..	9	.3	66	300	.030	.078	00030	....	Acid l
Cream puffs	11	17	50	397	......	......	.....	A_e, B_f	Acid
Devil's food	11 6	17	42 9	371	.12	.20	.0059	A_e, B_f	Acid l
Doughnuts	7.9	23.9	65.5	523.8	.11	.38	.001	A_g, B_f, R_f	Acid l
Fruit	5.9	10.9	64.1	388	.11	.17	.0052	A_g, B_f	Basic m
Gingerbread....... ..	5.8	9.0	62.6	368	.11	.059	.0038	A_f, B_f	Basic m
Sponge	6.3	10.7	65.9	396	.073	.22	.0033	A_g, B_f, E_f, R_f	Acid m
Cereals:									
Barley, pearl . .	8 5	1 1	77 5	364	.039	.18	0020	A_f, B_e, E_g, R_g	Acid m
Bran, unwashed	16 3	8 5	54 4	359	12	1 2	0076	B_g, R_g	Acid
Corn flakes .	8 2	4	86 7	383	.0071	11	00075	.. ..	Acid l

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Pro-tein	Fat	Carbo-hydrate		Cal-cium	Phos-phorus	Iron	r = rich g = good e = excellent f = fair	h = high m = med. l = low
Vegetable Foods (Cont.)									
Cereals: (Cont)									
Corn meal	8 4	4 7	74 0	381	0048	039	00025	Af, Bf, Rf	Acid
Cream of wheat, raw	11	9	78 6	366	021	12	00055	Bg	Acid
Farina, light	11 0	1 4	76 4	371	0030	020	00010	Bf	Acid
Grapenuts	11 5	1	79	371				Bg	Acid
Macaroni	13 7	2 0	73 3	367	.040	184	0025		Acid
Noodles	11 7	1.0	75 2	367				Af, Ef	Acid
Oats, rolled	16 6	6 6	65 2	387	054	442	0041	Bg, Ef	Acid l
Pop corn	10 7	5 0	77 3	413					Acid l
Puffed rice	8 3	3	83 7	370	00092	0088	00010		Acid l
Puffed wheat	16 2	1 8	73 2	374	028	044	0045	Af, Rf	Acid l
Rice, cooked	2 8	1	24 4	112	0018	044	00025		Acid l
Spaghetti	12 1	4	75 9	366	0039	031	00022		Acid
Tapioca	4	1	87 9	364	023	088	0016		Neutral
Wheatena, raw	11 5	1 47	70 6	342	044	42	0050	Br, Eg	Acid
Wheat germ meal	25 -30	8 -10	47	374		130		Br, Ee, Rg	
Wheat, shredded	12 1	1 8	75.2	365	041	32	0045	Ag, Bg, Ee, Rf	Acid
Chocolate, sweet	10	32 5	42 5	505				Df	
unsweetened	12 9	48 7	30 3	631	092	.45	0032	Df	
Cocoa	21 6	28 9	37 7	511	092	45	0032	Df	
Cookies:									
Gingersnaps	6 5	8 6	75 3	418	030	031	0016		Basic m
Hermits	8	12	64 8	400	013	014	00020	Af, Bf	Acid l
Macaroons	6 5	15 2	64 1	435	016	065	00075	Af, Bf	Acid l
Molasses	7 2	8 7	75 7	421	099	020	0034	Af, Bf	Basic h

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron	r = rich g = good e = excellent f = fair	h = high m = med. l = low
Vegetable Foods (Cont.)									
Cookies (Cont.)									
Oatmeal	12	12	86	500	045	12	0010	Af, Bf	Acid l
Sugar	7 0	10 2	72 1	423	014	021	00032		Acid l
Vanilla wafers	6 6	14 0	71 3	451	0041	0097	00011		Acid l
Crackers:									
Boston	11 0	8 5	70 3	416					Acid
Butter	9 6	10 1	71 2	427					Acid
Educator	11 7	13 5	79	484					Acid
Graham	10 0	9 4	72 3	431	020	097	0010	Bf	Acid
Oatmeal	11 8	11 1	67 1	434				Bf	Acid
Oyster	11 3	10 5	70 3	433					Acid
Pretzels	9 7	3 9	72 3	375					Acid
Saltines	10 6	12 7	68 0	442	023	092	0013		Acid m
Soda	9 8	9 1	72 6	424	023	12	00025		Acid m
Flour:									
Arrowroot			97 5	400					Acid
Barley	10 5	2 2	66 3	362				Bf	Acid
Buckwheat	6 4	1 2	77 5	357	040	23	0012		Acid
Corn flour	7 1	1 3	77 5	363				Bf	Acid
starch			90 0	369					Acid
Gluten (high)	14 2	1 8	70 5	367					Acid
Graham	13 3	2 2	69 5	368	040	.37	0037	Bf	Acid m
Rice	8 6	6 1	51 9	370					Acid l
Rye	6 8	9	78 3	359	018	29	0013	Bf	Acid

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron	r = rich g = good e = excellent f = fair	h = high m = med. l = low
Vegetable Foods (Cont.)									
Flour: (Cont)									
Wheat, patent . .	10.8	1 1	74 6	362	020	088	0010	B_f	Acid m
whole .	13.8	1 9	71 0	369	.031	.24	0025	B_g, R_f	Acid m
Fruits:									
Apple, baked	.2	8	29 2	125	0074	.013	00030	A_f, R_f	Basic l
raw . .	.4	5	13 0	63 9	0074	013	00030	A_f, B_g, C_e, R_f	Basic l
sauce	2	8	37 2	161	0058	0097	00020	A_f, R_f	Basic l
Apricots, canned	9		17 3	75 0	014	025	00030	A_e, C_f	Basic
fresh	1 1		13 4	59 5	014	025	00030	A_e, C_e	Basic
Bananas	1 3	6	21 0	101	0062	027	00055	A_g, B_g, C_e, R_f	Basic l
Blackberries, canned	8	2 1	56 4	254	012	026	0005	A_g	Basic
Blueberries, canned	6	.6	12 8	60 6	020	0084	00090	A_f	Basic
Cantaloupe	6	..	9 3	40	018	015	0005	A_r, B_f, C_g	Basic m
Cherries, canned	1 1	1	21 1	91 5	020	030	00040	A_g, C_f	Basic
fresh .	1 0	8	16 5	80 5	020	030	00040	A_g, C_g	Basic
Cranberries, raw	4	6	8 4	47 4	020	013	00060	A_f, C_f	Acid
Cranberry sauce .	2	.2	62	250	018	012	00060	C_f	Acid
Currants, fresh	1 5		12 8	58 4	026	.038	0005	C_g	Basic
Dates .	2 1	2 8	78 4	356	065	.056	0030	A_g, B_f	Basic m
Figs, dried .	4 3	.3	74 2	325	16	.12	0030	A_f, B_f, R_f	Basic m
fresh .	1 5		18 8	83 8	.053	.037	.	A_f, B_f, R_f	Basic
Grapefruit	8	.2	10 4	47	.028	026	00045	B_f, C_g, R_f	Basic
Grape juice	. . .	.	25	100	.011	.011	00030	A_f, B_f, C_f	Basic
Grapes, Concord.	1 3	1 6	14 9	99 2	020	031	.00030	A_f, B_f, C_f	Basic
Malaga .	8	1 4	20	96	020	031	0023	A_f, B_f, C_f	Basic

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins r = rich g = good e = excellent f = fair	Reaction h = high m = med. l = low
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Vegetable Foods (Cont.)									
Fruits: (Cont)									
Lemon juice	....	....	9 8	39 7	0041	0026	000075	A_f, B_f, C_g	Basic l
Lemons ..	1 0	7	7 4	45 2	036	022	0005	A_g, B_f, C_r	Basic l
Loganberries	4 6	.6	7 2	53	..	....	. ..	B_f, C_g	Basic
Muskmelon	.6	....	7 2	40 8	.018	.015	00030	A_r, B_g, C_r	Basic l
Nectarines	.6	....	15 9	67 2		....		C_g	Basic
Orange juice	...	...	10 8	43	029	016	00020	A_g, B_f, C_r, R_f	Basic l
Oranges..	.8	.2	11 6	52 9	044	020	00020	A_g, B_f, C_r, R_f	Basic l
Peaches, canned	.7	.1	10 8	48 5	012	022	00030	A_f, B_f, C_e, R_f	Basic l
fresh	.7	.1	5 8	41 9	016	023	00036	A_g, B_g, C_e, R_f	Basic l
Pears, canned	.3	.3	18 0	78.3	018	031	00030	A_f, B_f, C_f, R_f	Basic l
fresh	.6	.5	11 4	65 0	.018	031	00031	A_f, B_g, C_g, R_f	Basic l
Pineapple, canned	.4	.7	36 4	158	018	.034	0005	A_g, B_f, C_g, R_f	Basic
fresh	4	3	9 3	44 1	032	062	0011	A_g, B_g, C_r, R_f	Basic l
Plums, fresh..	1 0	....	20.1	87 1	020	032	0005	C_f	Acid
Prunes, stewed	5	1	22 3	94 8	.025	053	0015	A_e, C_f, R_g	Acid
Raisins	2 6	3 3	76 1	354	.066	13	.0021	A_f	Basic h
Raspberries, fresh	1 7	1 0	12 6	68 3	049	048	00060	C_g	Basic l
Rhubarb....	.6	7	2 5	23.1	047	011	0011	C_g	Basic m
cooked (with sugar)	5	4	66	272	..	.	.....	C_f	Basic
Strawberries, cooked	7	.	24 0	101	041	028	.00080	A_g, B_f, C_f	Basic
raw	1 0	.6	6 0	39 7	041	028	00080	A_g, B_g, C_r	Basic
Tangerines	2	1	9	125		...	.00061	C_r	Basic
Watermelon....	.4	2	6 7	30 9	011	0026	00030	A_f, B_f, C_g, R_f	Basic

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins r = rich g = good e = excellent f = fair	Reaction h = high m = med. l = low
	Protein	Fat	Carbohydrate		Calcium	Phosphorus	Iron		
Vegetable Foods (Cont.)									
Nuts:									
Almonds	21.0	54 9	15 8	679	.24	46	0039	Af, Bg	Basic m
Brazil . .	17 0	66 8	7 0	720	. .	. .	0039	Af, Bg	. . . . . .
Butternuts . .	27 9	61 2	3 5	698	. . .	.	0068	Af, Bg	. .
Chestnuts, dried	10 7	7 0	71 5	413	034	.092	00070	Bg	Basic l
Cocoanut, prepared	6 3	57 4	31 5	689	.059	.14	0027	Af, Bf, Dg	Basic m
Filberts . .	15 6	65 3	13 0	725	29	.35	0041	Bf	.
Hickory . . .	15 4	67 4	11 4	737	.	.	0029	Bf	
Peanuts, shelled	25 8	38 6	21 9	564	069	.40	0023	Bg, Ng	Acid l
Pecans . . .	9 6	70 5	15 3	757	.089	35	0026	Ag, Bf	
Pine	33 9	49 4	6 9	627	. .	.		. . . . . .	
Pistachios	22 3	54 0	16 3	660	. .	. . .	0079	. . . .	.
Walnuts, black .	27 6	56 3	10 0	685	. .		0060	Af, Bg	. .
English	18 4	64 4	11 6	728	.089	36	0021	Af, Bg	Acid l
Pie:									
Apple .	3 1	9 8	42 8	280	.011	.022	00030	Af, Bf, Rf	Basic
Custard .	4.2	6 3	26 1	183	.14	.16	0012	Ag, Bg	Acid
Lemon meringue	3.6	10 1	37 4	262	.014	.038	00058	Ag, Bf, Cf, Rg	Acid
Mince . .	5 8	12 3	38 1	308	.083	17	0025	Ag, Bg	Acid
Pumpkin	4	5 4	34	200	054	081	00079	Ae, Bg	Acid
Squash . .	4 4	8 4	21.7	185	.063	.073	00059	Af, Bg	Acid
Pudding:									
Apple tapioca	3	1	29 3	122	.0081	020	00041	Bf, Ef, Rf	Basic l
Bread . .	5 04	8 07	15 9	156	11	090	000010	Af, Bf, Ef	Acid l

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight: Protein	Percent by weight: Fat	Percent by weight: Carbohydrate	Fuel value, calories per 100 g	Mineral content, percent by weight: Calcium	Mineral content, percent by weight: Phosphorus	Mineral content, percent by weight: Iron	Vitamins (r = rich, e = excellent, g = good, f = fair)	Reaction (h = high, m = med., l = low)
Vegetable Foods (Cont.)									
Pudding. (Cont.)									
Cottage	6	9	56.1	329	16	23	0016	Af, Bf	Acid l
Rice	4.0	4.6	31.4	182	041	042	00023		Basic l
Tapioca, cream	3.3	3.2	28.2	159	052	053	00032	Ag, Bf	Basic l
Vegetables:									
Artichoke, French	2.9	.4	8.7	62.8	031	087	00095	Ae, Bg, Cg, Rg	Basic
Asparagus, canned	1.5	1	2.3	18.7	027	039	0010	Ag, Bg, Cg, Rg	Basic l
fresh	2.2	.2	3.2	26.2	.027	039	0010	Ag, Be, Cg, Rg	Basic l
Beans, kidney, canned	7.0	.2	17.3	106	039	14	0015	Af, Bg, Eg, Rf	Basic l
lima, dried	18.1	1.5	65.9	358	069	33	0075	Ag, Bg, Eg, Rf	Basic m
fresh	7.5	.8	22.0	131	.028	13	0020	Ag, Bg, Eg, Rf	Basic m
navy, dried	22.5	1.8	55.2	354	17	.44	0070	Ag, Bg, Cf, Eg, Rf	Basic l
string, fresh	2.3	.3	5.5	43.0	046	052	0011	Ae, Bf, Cg, Rf	Basic l
Beet greens, cooked	2.2	3.4	3.2	54.0	10	.	00313	Ag, Bf, Cf, Df, Ef, Rg	Basic
Beets, cooked	2.3	.1	7.4	40.8	029	038	00059	Af, Bf, Cf, Rf	Basic m
Brussel sprouts	4.4	.5	7.6	57.7	031	12	0010	Ag, Bg, Cf	Acid
Cabbage	1.6	.3	4.5	31.9	045	029	0013	Af, Bf, Ce, Rf, Kg	Basic l
Carrots	1.1	.4	8.2	46.3	055	044	00060	Ar, Bg, Cr, Rf	Basic m
Cauliflower	2.4	.2	4.0	31.0	12	057	00075	Af, Bg, Cf, Rf	Basic l
Celery	1.1	.1	3.3	18.7	078	037	0005	Ag, Bf, Cg, Eg, Rf	Basic l
Chard, Swiss	1.4	.2	3.5	25.0	15	040	0025	Ae, Bg, Cf, Df, Rg	Basic m
Corn, canned	2.8	1.2	18.2	100	0060	10	00080	Ag, Bf, Cf	Acid l
fresh on cob	3.1	1.1	19.2	104	0060	10	00080	Ag, Bf, Cf	Acid l
Cucumbers	.8	2	2.4	17.6	016	033	00020	Af, Bf, Cg	Basic l
Egg plant	1.2	.3	4.3	28.7	011	034	0005	Af, Bf, Cf	Basic

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight: Protein	Percent by weight: Fat	Percent by weight: Carbohydrate	Fuel value, calories per 100 g	Mineral content, percent by weight: Calcium	Mineral content, percent by weight: Phosphorus	Mineral content, percent by weight: Iron	Vitamins (r = rich, g = good, e = excellent, f = fair)	Reaction (h = high, m = med., l = low)
Vegetable Foods (Cont.)									
Vegetables: (Cont.)									
Lentils, dried	25 7	1 0	59 2	357	053	25	0043	A_g, B_e, E_g, R_g	Acid l
Lettuce, green leaf	1 2	3	2 2	19 8	043	043	0027	A_r, B_g, C_r, D_f, E_r, R_g	Basic l
Mushrooms	3 5	4	6 0	46 3	017	11	0031	B_g	Basic l
Okra	1 6	2	4 0	38 6	037	037	00063	A_g, B_f, C_g, R_f	Basic
Olives, green	1 1	27 6	11 6	309	.12	014	0029	A_g	Basic
ripe	1 7	25 9	4 3	266	.12	014	0029	A_g	Basic
Onions	1 6	3	9 1	49 6	035	046	.00060	B_f, C_g, R_f	Basic l
Parsnips	1 6	5	11 0	66 1	061	073	.00060	A_f, B_g	Basic m
Peas, canned	3 6	2	8 6	56 2	013	064	00083	A_e, B_g, C_f, E_g, R_g	Basic l
dried	24 6	1 0	57 5	365	085	40	0057	A_f, B_f, E_f, R_g	Basic l
green	7 0	5	15 2	103	026	13	0017	A_f, B_g, C_f, E_g, R_g	Basic l
Potatoes, boiled	2 5	1	20 3	97 0	013	057	0013	A_g, B_f, C_f	Basic l
sweet	1 8	.7	26 1	126	.020	045	0005	A_r, B_f, C_f, R_f	Basic l
Pumpkin	1 0	1	4 0	26 5	023	059	00080	A_g, B_f, C_g	Basic l
Radishes	1 3	1	5 1	29 8	.021	029	00060	B_g, C_g	Basic l
Rutabagas	1 3	2	7 3	41 9	.077	056	0005	A_f, B_g, C_e, R_f	Basic m
Sauerkraut	1 7	5	3 8	27 6	046	029	0011	A_f, B_f, C_f, R_f	Basic
Spinach, cooked	2 1	4 1	2 6	57 3	.067	066	0036	A_r, B_g, C_g, D_g, E_f, K_e, R_f	Basic h
Squash	1 4	5	8 2	47 4	020	.030	00060	A_g	Basic
Tomatoes, canned	1 2	2	3 5	23 1	011	026	00040	A_r, B_g, C_g, K_g, R_f	Basic l
fresh	9	4	3 3	23 1	.011	026	00040	A_r, B_e, C_r, K_g, R_f	Basic l
Turnips	1 3	2	6 8	40 8	064	.046	0005	A_f, B_f, C_g, R_f	Basic l
Watercress	1 7	3	2 8	22 7	17	.0044	0018	A_g, B_g, C_f, D_f, N_g, R_g	Basic
Yeast, compressed	11 7	4	21 0	138	.011	.445	.0003	B_r, N_g, R_g	..

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight: Protein	Percent by weight: Fat	Percent by weight: Carbohydrate	Fuel value, calories per 100 g	Mineral content, percent by weight: Calcium	Mineral content, percent by weight: Phosphorus	Mineral content, percent by weight: Iron	Vitamins (r = rich, e = excellent, g = good, f = fair)	Reaction (h = high, m = med., l = low)
Miscellaneous									
Candy:									
Butterscotch	1	45	95	789	031	0066	0014	A_f	Neutral
Chocolate creams	1 4	10 5	62 5	350	...			...	Neutral
fudge	2	9 6	76 2	400	032	039	00014	A_f	Neutral
sweet milk	10	31	45	500	21	062	0053	A_f, R_f	Neutral
Gum drops	10 5	...	77	350	..	.		...	Neutral
Marshmallows	6 66		80	346					....
Mints, after dinner			87 5	350				......	Neutral
Molasses candy	2 2	4 5	99.5	447	086	.18	0030	B_f	Basic
Nougat, chocolate		5	115	505				....	....
Nut bar	5 3	18 6	62	437	067	26	0015	B_g	....
Peanut brittle	12	21	75	537	12	.17	0039	B_g	Acid
Fats:									
Butter	1 0	85 0		795	.015	.017	00025	A_r, D_g, E_f	Neutral
Cod liver oil		100		900	.....			A_r, D_r	Neutral
Corn oil	.	100		900	.	..		A_f, E_g	Neutral
Crisco		100		900				E_f	Neutral
Lard		100		930	....			A_f, E_e	Neutral
Oleomargarine	1 2	83.0		777	...	.		A_g, E_g	Neutral
Olive oil		100		900	.....			A_f, E_f	Neutral
Peanut oil		100		900	....	....		A_f, E_f	Neutral
Jelly, cherry	1 1	...	77 2	321	.015	.010	0005	A_g, C_f	Neutral
Salad dressing:									
Cream	7	21 7	31 5	350	.081	.12	0010	A_g, B_f, D_f, R_f	Acid l
French		60	2	548	....			A_f, R_f	Neutral

COMPOSITION AND VALUE OF FOODS (Continued)

Food	Percent by weight			Fuel value, calories per 100 g	Mineral content, percent by weight			Vitamins	Reaction
	Pro-tein	Fat	Carbo-hydrate		Cal-cium	Phos-phorus	Iron	r = rich g = good e = excellent f = fair	h = high m = med. l = low
Miscellaneous (Cont.)									
Salad Dressing. (Cont)									
Mayonnaise	4	80	4	752	.0092	053	00080	Ae, Bf, Df, Rf	Acid l
Thousand Island	3.3	43	3.3	413	.043	.084	0014	Af, Bf, Df, Rf	Acid
Soup:									
Asparagus, cream of	2 5	3 2	5 5	62 8	13	10	.00048	Af, Bf, Df, Ef	Basic l
Bouillon	2 2	1	2	11 0					
Celery, cream of	2 1	2 8	5 0	55 1	11	.076	00030	Af, Bf, Df, Ef	Basic l
Chicken	10 5	8	2 4	60 6		.0088	00012		Acid
Chowder, clam	1 8	.8	6 7	43 0	.13	11	00051	Ag, Bf, Rf	Acid
corn	2 1	4 5	10 5	91	.11	11	00041		Acid
Consommé	2 5		4	12 1					Neutral
Oyster stew	4 8	6 3	7 2	105	.14	025	00078	Ag, Bg, Rf	Acid l
Potato	3 2	3 6	10	85	.12	.099	0005	Af, Bf	Basic l
Tomato	1 8	1 1	5 6	40 8	.076	.064	00015	Ag, Bg, Cf, Rg	Basic l
Vegetable	2 9		.5	14 3				Ag, Bg, Rg	Basic l
Sugar:									
Brown			95 0	389					Neutral
Granulated			100	410					Neutral
Maple			82 8	340	.11	0092	0030		Neutral
Syrup:									
Corn			85	340	.0060	.0092	000060		Neutral
Honey	4		81 2	335	.0041	.019	00070		
Maple			71 4	293	.11	.013	.0030		Neutral
Molasses	2 4		69 3	284	.22	045	.0077	Bf	Basic

DEHYDRATION OF METALLIC SULPHATES

Metallic sulphates.	Temp. of beginning of decomposition, °C.	Products formed.	Color of products.
$CaSO_4.2H_2O$	38	$CaSO_4.H_2O$	White
$CaSO_4.H_2O$	80	$2CaSO_4.H_2O$	White
$2CaSO_4.H_2O$	149	$CaSO_4$	White
$MgSO_4.7H_2O$	19	$MgSO_4.6H_2O$	White
$MgSO_4.6H_2O$	38	$MgSO_4.2H_2O$	White
$MgSO_4.2H_2O$	112	$MgSO_4.H_2O$	White
$MgSO_4.H_2O$	203	$MgSO_4$	White
$CdSO_4.\frac{8}{3}H_2O$	30	$CdSO_4.2H_2O$	White
$CdSO_4.2H_2O$	41	$CdSO_4.H_2O$	White
$CdSO_4.H_2O$	170	$CdSO_4$	White
$CoSO_4.7H_2O$	14	$CoSO_4.4H_2O$	Rose
$CoSO_4.4H_2O$	58	$CoSO_4.H_2O$	Lilac
$CoSO_4.H_2O$	276	$CoSO_4$	Lilac
$NiSO_4.7H_2O$	40	$NiSO_4.4H_2O$	Green
$NiSO_4.4H_2O$	106	$NiSO_4.H_2O$	Yellow
$NiSO_4.H_2O$	279	$NiSO_4$	Orange
$ZnSO_4.7H_2O$	25	$ZnSO_4.6H_2O$	White
$ZnSO_4.6H_2O$	28	$ZnSO_4.2H_2O$	White
$ZnSO_4.2H_2O$	115	$ZnSO_4.H_2O$	White
$ZnSO_4.H_2O$	225	$ZnSO_4$	White
$MnSO_4.5H_2O$	25	$MnSO_4.2H_2O$	Pale peach blossom
$MnSO_4.2H_2O$	60	$MnSO_4.H_2O$	Paler than above
$MnSO_4.H_2O$	152	$MnSO_4$	Paler than above
$CuSO_4.5H_2O$	27	$CuSO_4.3H_2O$	Blue
$CuSO_4.3H_2O$	93	$CuSO_4.H_2O$	Pale blue
$CuSO_4.H_2O$	155	$CuSO_4$	White
$Al_2(SO_4)_3.16H_2O$	51	$Al_2(SO_4)_3.13H_2O$	White
$Al_2(SO_4)_3.13H_2O$	82	$Al_2(SO_4)_3.10H_2O$	White
$Al_2(SO_4)_3.10H_2O$	97	$Al_2(SO_4)_3.7H_2O$	White
$Al_2(SO_4)_3.7H_2O$	109	$Al_2(SO_4)_3.4H_2O$	White
$Al_2(SO_4)_3.4H_2O$	180	$Al_2(SO_4)_3.H_2O$	White
$Al_2(SO_4)_3.H_2O$	316	$Al_2(SO_4)_3$	White
$FeSO_4.7H_2O$	21	$FeSO_4.4H_2O$	Light apple green
$FeSO_4.4H_2O$	80	$FeSO_4.H_2O$	White
$FeSO_4.H_2O$	406	Fe_2O_3, SO_3	Yellowish green

DECOMPOSITION OF ANHYDROUS METALLIC SULPHATES

Metallic sulphate.	Temp. at beginning of decomposition, °C.	Temp. of energetic decomposition, °C.	Products of decomposition.	Color of product.
$FeSO_4$	167	480	Fe_2O_3, $2SO_3$	Yellow brown
Fe_2O_3, $2SO_3$	492	560	Fe_2O_3	Red
$Bi_2(SO_4)_3$	570	639	$5Bi_2O_3$, $4(SO_3)_3$	White
$Al_2(SO_4)_3$	590	639	Al_2O_3	White
$PbSO_4$	637	705	$6PbO$, $5SO_3$	White
$CuSO_4$	653	670	$2CuO$, SO_3	Ornage
$MnSO_4$	699	790	Mn_3O_4	Dark red to black
$ZnSO_4$	702	720	$3ZnO$, $2SO_3$	White
$2CuO$, SO_3	702	736	CuO	Black
$NiSO_4$	703	764	NiO	Brownish green
$CoSO_4$	720	770	CoO	Brown to black
$3ZnO$, $2SO_3$	755	767	ZnO	White
$CdSO_4$	827	846	$5CdO$, SO_3	White
$5Bi_2O_3$, $4(SO_3)_3$	870	890	Bi_2O_3(?)	Yellow
$5CdO$, SO_3	878	890	CdO	Brown
$MgSO_4$	890	972	MgO	White
Ag_2SO_4	917	925	Ag	Silver white
$6PbO$, $5SO_3$	952	962	$2PbO$, SO_3(?)	White to yellow
$CaSO_4$	1200	...	CaO	White
$BaSO_4$	1510	...	BaO	White

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

The following collections of tables gives the specific gravity, grams per liter, pounds per cubic foot, and pounds per gallon for a large number of substances in aqueous solution. The three latter quantities have been computed from the per cent of the substance in solution and the specific gravity, assuming the density of water at 4° C. as unity. The U. S. gallon, cubic foot, and pound avoirdupois equivalents were used. The degree Baumé corresponding to the specific gravity is given according to the relation,

$$\text{Bé.} = 145 - \frac{145}{\text{Sp. Gr.}}.$$

The per cent by weight is indicated in every case.

The substances are arranged in alphabetical order. The specific gravity of alcohol solutions will be found in a separate group. Another table gives, with less detail, the specific gravity of solutions of many other substances.

Tables indicated by the symbol * have been computed on the basis of values for the specific gravity found in the International Critical Tables.

ACETIC ACID

Specific Gravity of Aqueous Acetic Acid Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $HC_2H_3O_2$	G. per liter	Lbs per cu ft	Lbs. per gal.
....	0.9982	0	..	.	.....
..	0.9996	1	9.996	0.6240	0.0834
0.2	1.0012	2	20.02	1.250	0.1671
0.4	1.0025	3	30.08	1.877	0.2510
0.6	1.0040	4	40.16	2.507	0.3351
0.8	1.0055	5	50.28	3.139	0.4196
1.0	1.0069	6	60.41	3.771	0.5042
1.2	1.0083	7	70.58	4.406	0.5890
1.4	1.0097	8	80.78	5.043	0.6741
1.6	1.0111	9	91.00	5.681	0.7594
1.8	1.0125	10	101.3	6.321	0.8450
2.0	1.0139	11	111.5	6.962	0.9307
2.2	1.0154	12	121.8	7.607	1.017
2.4	1.0168	13	132.2	8.252	1.103
2.6	1.0182	14	142.5	8.899	1.190
2.8	1.0195	15	152.9	9.547	1.276
3.0	1.0209	16	163.3	10.20	1.363
3.2	1.0223	17	173.8	10.85	1.450
3.3	1.0236	18	184.2	11.50	1.538
3.5	1.0250	19	194.8	12.16	1.625
3.7	1.0263	20	205.3	12.81	1.713
3.9	1.0276	21	215.8	13.47	1.801
4.1	1.0288	22	226.3	14.13	1.889
4.2	1.0301	23	236.9	14.79	1.977
4.4	1.0313	24	247.5	15.45	2.066
4.6	1.0326	25	258.2	16.12	2.154
4.7	1.0338	26	268.8	16.78	2.243
4.9	1.0349	27	279.4	17.44	2.332
5.1	1.0361	28	290.1	18.11	2.421
5.2	1.0372	29	300.8	18.78	2.510
5.4	1.0384	30	311.5	19.45	2.600
5.5	1.0395	31	322.2	20.12	2.689
5.7	1.0406	32	333.0	20.79	2.779
5.8	1.0417	33	343.8	21.46	2.869
6.0	1.0428	34	354.6	22.13	2.959
6.1	1.0438	35	365.3	22.81	3.049
6.2	1.0449	36	376.2	23.48	3.139
6.4	1.0459	37	387.0	24.16	3.229
6.5	1.0469	38	397.8	24.83	3.320
6.6	1.0479	39	408.7	25.51	3.411
6.8	1.0488	40	419.5	26.19	3.501

ACETIC ACID (Continued)

Specific Gravity of Aqueous Acetic Acid Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent $HC_2H_3O_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
6.9	1.0498	41	430.4	26.87	3.592
7.0	1.0507	42	441.3	27.55	3.683
7.1	1.0516	43	452.2	28.23	3.774
7.2	1.0525	44	463.1	28.91	3.865
7.4	1.0534	45	474.0	29.59	3.956
7.5	1.0542	46	484.9	30.27	4.047
7.6	1.0551	47	495.9	30.96	4.138
7.7	1.0559	48	506.8	31.64	4.230
7.8	1.0567	49	517.8	32.32	4.321
7.9	1.0575	50	528.8	33.01	4.413
8.0	1.0582	51	539.7	33.69	4.504
8.1	1.0590	52	550.7	34.38	4.596
8.2	1.0597	53	561.6	35.06	4.687
8.3	1.0604	54	572.6	35.75	4.779
8.4	1.0611	55	583.6	36.43	4.870
8.4	1.0618	56	594.6	37.12	4.962
8.5	1.0624	57	605.6	37.80	5.054
8.6	1.0631	58	616.6	38.49	5.146
8.7	1.0637	59	627.6	39.18	5.237
8.8	1.0642	60	638.5	39.86	5.329
8.8	1.0648	61	649.5	40.55	5.420
8.9	1.0653	62	660.5	41.23	5.512
9.0	1.0658	63	671.5	41.92	5.603
9.0	1.0662	64	682.4	42.60	5.695
9.1	1.0666	65	693.3	43.28	5.786
9.1	1.0671	66	704.3	43.97	5.877
9.2	1.0675	67	715.2	44.65	5.969
9.2	1.0678	68	726.1	45.33	6.059
9.3	1.0682	69	737.1	46.01	6.151
9.3	1.0685	70	748.0	46.69	6.242
9.3	1.0687	71	758.8	47.37	6.332
9.4	1.0690	72	769.7	48.05	6.423
9.4	1.0693	73	780.6	48.73	6.514
9.4	1.0694	74	791.4	49.40	6.604
9.4	1.0696	75	802.2	50.08	6.695
9.5	1.0698	76	813.0	50.76	6.785
9.5	1.0699	77	823.8	51.43	6.875
9.5	1.0700	78	834.6	52.10	6.965
9.5	1.0700	79	845.3	52.77	7.054
9.5	1.0700	80	856.0	53.44	7.143
9.5	1.0699	81	866.6	54.10	7.232
9.5	1.0698	82	877.2	54.76	7.321
9.4	1.0696	83	887.8	55.42	7.409
9.4	1.0693	84	898.2	56.07	7.496
9.4	1.0689	85	908.6	56.72	7.582
9.3	1.0685	86	918.9	57.36	7.668
9.2	1.0680	87	929.2	58.00	7.754
9.2	1.0675	88	939.4	58.64	7.839
9.1	1.0668	89	949.5	59.27	7.923
9.0	1.0661	90	959.5	59.90	8.007
8.9	1.0652	91	969.3	60.51	8.089
8.8	1.0643	92	979.2	61.13	8.171
8.6	1.0632	93	988.8	61.73	8.252
8.5	1.0619	94	998.2	62.31	8.330
8.3	1.0605	95	1007	62.89	8.408
8.1	1.0588	96	1016	63.45	8.482
7.8	1.0570	97	1025	64.01	8.556
7.6	1.0549	98	1034	64.54	8.627
7.2	1.0524	99	1042	65.04	8.695
6.9	1.0498	100	1050	65.54	8.761

ALBUMEN

Specific Gravity of Aqueous Albumen Solutions at 15.5° C.

Bé.	Sp. gr.	Per cent Albumen	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.37	1.0026	1	10 03	0.6259	0.0837
0.77	1.0054	2	20.11	1.255	0.1678
1.12	1.0078	3	30.23	1.887	0.2523
1.85	1.0130	5	50 65	3.162	0.4227
3.66	1.0261	10	102.6	6.406	0.8563
5.32	1.0384	15	155.8	9.724	1.300
7.06	1.0515	20	210.3	13.13	1.755
8.72	1.0644	25	266.1	16.61	2.221
10.42	1.0780	30	323.4	20.19	2.699
13.12	1.0919	35	382.2	23.86	3.189
13.78	1.1058	40	442.3	27.61	3.691
15.48	1.1204	45	504.2	31.47	4.207
17.16	1.1352	50	567 6	35.43	4.737
18.90	1.1511	55	633.1	39.52	5.283

ALUMINUM CHLORIDE

Specific Gravity of Aqueous Aluminum Chloride Solutions at $\frac{18°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $AlCl_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1 1	1 0075	1	10 08	0 6290	0.0841
2.3	1.0164	2	20 33	1 269	0.1696
4.8	1 0344	4	41 38	2 583	0.3453
7.3	1 0526	6	63 16	3 943	0 5271
9.6	1 0711	8	85 69	5.349	0.7151
12.0	1 0900	10	109 0	6.805	0.9096
14.3	1 1093	12	133 1	8.310	1.111
16.6	1 1290	14	158 1	9.867	1.319
18.3	1 1491	16	183 9	11.48	1.534

ALUMINUM CHLORIDE

Specific Gravity of Aluminum Chloride Solutions at 15° C. (Gerlach)

Bé.	Sp. gr.	Per cent Al_2Cl_6	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.0072	1	10.07	0.6288	0.0841
2.1	1 0144	2	20.29	1.267	0.1693
3.1	1.0216	3	30.65	1.913	0.2558
4.1	1.0289	4	41.16	2.570	0.3437
5.0	1.0360	5	51.80	3 234	0.4323
6.0	1.0435	6	62.61	3.909	0 5225
7.0	1 0510	7	73.57	4.593	0.6140
8.0	1.0585	8	84.68	5.286	0.7067
9.0	1.0659	9	95.93	5.989	0.8006
9.9	1.0734	10	107.3	6.701	0.8958
10.9	1.0812	11	118.9	7.425	0.9925
11.9	1.0890	12	130.7	8.158	1.091
12.8	1.0968	13	142.6	8.901	1.190
13.7	1.1047	14	154.7	9.655	1.291
14.7	1.1125	15	166.9	10.42	1.393
15.6	1.1207	16	179.3	11.19	1.496
16 6	1 1290	17	191.9	11.98	1.602
17.5	1.1372	18	204.7	12.78	1.708
18 4	1.1455	19	217.6	13.59	1.816
19.3	1.1537	20	230.7	14.40	1.926
20 2	1.1623	21	244.1	15.24	2 037
21.2	1 1709	22	257.6	16 08	2.150
22 1	1.1795	23	271.3	16.94	2 264
23 0	1.1882	24	285.2	17.80	2 380
23 8	1 1968	25	299.2	18 68	2 497
24 8	1.2058	26	313.5	19 57	2.616
25.7	1.2149	27	328.0	20.48	2 737
26.5	1.2241	28	342.7	21.40	2.860
27.4	1 2331	29	357.6	22.32	2.984
28.3	1.2422	30	372.7	23.26	3.110
29.2	1.2518	31	388.1	24.23	3.238
30.1	1.2615	32	403.7	25.20	3.369
30.9	1.2712	33	419.5	26.19	3.501
31.8	1.2808	34	435.5	27.19	3.634
32.6	1.2905	35	451.7	28.20	3.769
33 5	1.3007	36	468 3	29.23	3.908
34.4	1.3109	37	485.0	30.28	4.048
35.2	1.3211	38	502.0	31.34	4.189
36.1	1.3313	39	519.2	32.41	4.333
36.9	1.3415	40	536.6	33.50	4.478
37.8	1.3522	41	554.4	34.61	4.627

ALUMINUM SULFATE

Specific Gravity of Aqueous Aluminum Sulfate Solutions at $\frac{15°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $Al_2(SO_4)_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1 0093	1	10.09	0.6301	0.0842
2 8	1.0195	2	20.39	1 273	0.1702
5 6	1 0404	4	41 62	2 598	0.3473
8.4	1.0618	6	63.71	3.977	0.5317
11 2	1 0837	8	86.70	5.412	0.7235
13.9	1.1062	10	110 6	6.906	0.9232
16 6	1.1293	12	135.5	8.460	1.131
19.2	1.1529	14	161.4	10 08	1.347
21.8	1.1770	16	188.3	11.76	1.572
24.3	1.2017	18	216.3	13 50	1.805
26.8	1.2272	20	245.4	15 32	2.048
29.3	1.2534	22	275.7	17.21	2.301
31.7	1.2803	24	307.3	19.18	2.564
34.1	1.3079	26	340.1	21.23	2.838

Bé	Sp. gr	Per cent $Al_2(SO_4)_3 + 18H_2O$	G per liter	Lbs per cu ft.	Lbs. per gal.
1.3	1.0093	1.948	19.66	1 227	0.1641
2 8	1.0195	3.896	39.72	2.479	0.3314
5.6	1.0404	7 791	81.06	5 060	0.6765
8.4	1.0618	11.69	124 1	7.747	1.036
11 2	1.0837	15.58	168.9	10.54	1.409
13 9	1.1062	19 48	215 5	13 45	1.798
16.6	1.1293	23.37	264.0	16 48	2 203
19 2	1.1529	27.27	314.4	19 63	2.624
21.8	1.1770	31.16	366 8	22 90	3.061
24 3	1.2017	35 06	421 3	26 30	3.516
26 8	1 2272	38.96	478.1	29.84	3.990
29 3	1 2534	42 85	537.1	33.53	4 482
31.7	1.2803	46 75	598 5	37.36	4.995
34.1	1.3079	50 64	662.4	41 35	5.528

ALUMINUM SULFATE

Specific Gravity of Aluminum Sulfate Solutions at 15° C. (Larsson)

Alum-maker's Table

Bé.	Sp. gr.	100 kg. of solution contain				
		Kg. Al_2O_3	Kg. SO_3	Kg. sulfate with 13 per cent Al_2O_3	Kg. sulfate with 14 per cent Al_2O_3	Kg. sulfate with 15 per cent Al_2O_3
0.7	1.005	0.14	0.32	1.1	1.0	0.9
1.4	1.010	0.27	0.64	2.1	2.0	1.8
2.3	1.016	0.41	0.95	3.1	2.9	2.7
3.0	1.021	0.55	1.27	4.2	3.9	3.6
3.7	1.026	0.68	1.59	5.3	4.9	4.6
4.4	1.031	0.81	1.89	6.3	5.8	5.4
5.0	1.036	0.94	2.20	7.3	6.7	6.3
5.6	1.040	1.07	2.50	8.3	7.7	7.2
6.2	1.045	1.20	2.80	9.3	8.6	8.0
6.9	1.050	1.33	3.11	10.3	9.5	8.9
7.6	1.055	1.46	3.40	11.2	10.4	9.7
8.1	1.059	1.58	3.69	12.2	11.3	10.6
8.7	1.064	1.71	3.98	13.1	12.2	11.4
9.2	1.068	1.83	4.27	14.1	13.1	12.2
9.9	1.073	1.96	4.56	15.1	14.0	13.1
10.5	1.078	2.08	4.84	16.0	14.8	13.9
11.0	1.082	2.20	5.12	16.9	15.7	14.6
11.6	1.087	2.32	5.40	17.8	16.5	15.4
12.2	1.092	2.44	5.67	18.7	17.4	16.2
12.7	1.096	2.55	5.95	19.6	18.3	17.0
13.3	1.101	2.67	6.22	20.5	19.1	17.8
13.8	1.105	2.78	6.49	21.4	19.9	18.6
14.4	1.110	2.90	6.76	22.3	20.7	19.3
14.8	1.114	3.01	7.02	23.2	21.5	20.1
15.4	1.119	3.13	7.29	24.1	22.4	20.9
15.9	1.123	3.24	7.55	24.9	23.1	21.6
16.5	1.128	3.35	7.81	25.8	23.9	22.3
16.9	1.132	3.46	8.06	26.6	24.7	23.1
17.5	1.137	3.57	8.32	27.5	25.5	23.8
17.9	1.141	3.68	8.58	28.3	26.3	24.5
18.4	1.145	3.79	8.83	29.1	27.1	25.3
18.9	1.150	3.89	9.07	30.0	27.8	26.0
19.4	1.154	4.00	9.32	30.8	28.6	26.7
19.9	1.159	4.11	9.57	31.6	29.3	27.4
20.3	1.163	4.21	9.82	32.4	30.1	28.1
20.9	1.168	4.32	10.06	33.2	30.8	28.9
21.3	1.172	4.42	10.29	34.0	31.6	29.5
21.7	1.176	4.52	10.53	34.8	32.3	30.1

ALUMINUM SULFATE (Continued)

Specific Gravity of Aluminum Sulfate Solutions at 15° C. (Larsson)

Alum-maker's Table

Bé.	Sp gr	100 liters of solution contain				
		Kg Al_2O_3	Kg. SO_3	Kg. sulfate with 13 per cent Al_2O_3	Kg. sulfate with 14 per cent Al_2O_3	Kg sulfate with 15 per cent Al_2O_3
0.7	1 005	0 14	0 33	1 1	1	0 9
1.4	1 010	0 28	0.65	2 2	2	1 9
2 3	1 016	0 42	0.98	3.2	3	2.8
3 0	1 021	0 56	1 31	4 3	4	3 7
3.7	1 026	0 70	1 63	5 4	5	4 7
4.4	1 031	0 84	1.96	6 5	6	5 6
5.0	1 036	0 98	2 28	7 5	7	6 5
5 6	1 040	1 12	2 61	8 6	8	7 5
6 2	1 045	1 26	2 94	9 7	9	8 4
6 9	1 050	1 40	3 26	10 8	10	9 3
7 6	1.055	1 54	3 59	11.8	11	10.3
8 1	1 059	1 68	3 91	12 9	12	11.2
8 7	1 064	1 82	4 24	14.0	13	12.1
9 2	1.068	1.96	4.57	15 1	14	13.1
9 9	1.073	2 10	4 89	16 2	15	14.0
10 5	1 078	2.24	5.22	17.2	16	14.9
11.0	1 082	2 38	5 55	18 3	17	15.9
11.6	1 087	2 52	5 87	19 4	18	16.8
12.2	1.092	2 66	6 20	20 5	19	17.7
12.7	1 096	2 80	6 52	21.5	20	18 7
13 3	1 101	2 94	6 85	22 6	21	19 6
13.8	1 105	3 08	7 18	23 7	22	20 5
14 4	1 110	3 22	7 50	24 8	23	21 5
14.8	1 114	3 36	7 83	25 9	24	22 4
15 4	1 119	3 50	8.16	26 9	25	23 3
15 9	1.123	3 64	8 48	28.0	26	24 3
16 5	1.128	3 78	8 81	29 1	27	25 2
16 9	1.132	3 92	9 13	30 2	28	26 1
17 5	1.137	4 06	9 46	31 2	29	27.1
17.9	1.141	4 20	9 79	32 3	30	28 0
18 4	1 145	4 34	10 11	33 4	31	28 9
18 9	1.150	4 48	10 44	34 5	32	29 9
19 4	1 154	4 64	10 76	35 5	33	30.8
19 9	1 159	4 76	11 09	36 6	34	31.7
20 3	1.163	4 90	11.42	37 7	35	32.7
20 9	1.168	5 04	11 74	38 8	36	33 6
21.3	1 172	5.18	12 07	39 9	37	34.5
21 7	1 176	5 32	12 40	40 9	38	35.5

AMMONIA

Specific Gravity of Aqueous Ammonium Hydroxide Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent NH_3	G per liter	Lbs. per cu ft.	Lbs. per gal.
10.9	0.9939	1	9.939	0.6205	0.0829
11.5	0.9895	2	19.79	1.235	0.1652
11.7	0.9811	4	39 24	2.450	0.3275
13.9	0.9730	6	58.38	3.644	0.4872
15.1	0.9651	8	77.21	4.820	0 6443
16.2	0.9575	10	95.75	5.977	0.7991
17.3	0.9501	12	114 0	7.117	0.9515
18.5	0.9430	14	132.0	8.242	1.102
19.5	0.9362	16	149.8	9.351	1.250
20.6	0.9295	18	167.3	10.44	1 396
21.7	0.9229	20	184 6	11.52	1.540
22.8	0.9164	22	201.6	12 59	1.682
23.8	0 9101	24	218 4	13.64	1.823
24.9	0.9040	26	235.0	14.67	1.961
25.9	0.8980	28	251.4	15.70	2 098
27.0	0.8920	30	267.6	16.71	2.233

Values Determined in Sealed Tubes, at $\frac{15°}{4°}$ C.

Bé.	Sp. gr.	Per cent NH_3	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
34.9	0.849	45	382.1	23.85	3.188
38.3	0.832	50	416.0	25.97	3.472
41.8	0.815	55	448.3	27.98	3.741
45.9	0.796	60	477.6	29 82	3.985
50 4	0 776	65	504.4	31.49	4.209
55.4	0.755	70	528.5	32.99	4.410
61.0	0 733	75	549 8	34.32	4.588
66.9	0.711	80	568.8	35.51	4.747
73.5	0.688	85	584 8	36.51	4.880
80.5	0.665	90	598.5	37.36	4.995
88.1	0.642	95	609 9	38.07	5.090
96.5	0.618	100	618.0	38.58	5.157

AMMONIUM HYDROXIDE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Per cent NH_3	Total NH_3 g. per liter	Specific gravity	Per cent NH_3	Total NH_3 g. per liter
1.000	0.00	0.0	0.940	15.63	146.9
0.998	0.45	4.5	0.938	16.22	152.1
0.996	0.91	9.1	0.936	16.82	157.4
0.994	1.37	13.6	0.934	17.42	162.7
0.992	1.84	18.2	0.932	18.03	168.1
0.990	2.31	22.9	0.930	18.64	173.4
0.988	2.80	27.7	0.928	19.25	178.6
0.986	3.30	32.5	0.926	19.87	184.2
0.984	3.80	37.4	0.924	20.49	189.3
0.982	4.30	42.2	0.922	21.12	194.7
0.980	4.80	47.0	0.920	21.75	200.1
0.978	5.30	51.8	0.918	22.39	205.6
0.976	5.80	56.6	0.916	23.03	210.9
0.974	6.30	61.4	0.914	23.68	216.3
0.972	6.80	66.1	0.912	24.33	221.9
0.970	7.31	70.9	0.910	24.99	227.4
0.968	7.82	75.7	0.908	25.65	232.9
0.966	8.33	80.5	0.906	26.31	238.3
0.964	8.84	85.2	0.904	26.98	243.9
0.962	9.35	89.9	0.902	27.65	249.4
0.960	9.91	95.1	0.900	28.33	255.0
0.958	10.47	100.3	0.898	29.01	260.5
0.956	11.03	105.4	0.896	29.69	266.0
0.954	11.60	110.7	0.894	30.37	271.5
0.952	12.17	115.9	0.892	31.05	277.0
0.950	12.72	121.0	0.890	31.75	282.6
0.948	13.31	126.2	0.888	32.50	288.6
0.946	13.88	131.3	0.886	33.25	294.6
0.944	14.46	136.5	0.884	34.10	301.4
0.942	15.04	141.7	0.882	34.95	308.3

AQUA AMMONIA

Authority — W. C. Ferguson

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = \frac{140}{\text{Sp. Gr.}} - 130.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

The coefficient of expansion for Ammonia Solutions varying with the temperature, correction must be applied according to the following table:

Corrections to be added for each degree below 60° F.			Corrections to be subtracted for each degree above 60° F.			
Degrees Baumé	40° F.	50° F.	70° F.	80° F.	90° F.	100° F.
14	0.015 Bé.	0.017 Bé.	0 020 Bé.	0.022 Bé.	0.024 Bé.	0.026 Bé.
16	0.021 "	0.023 "	0.026 "	0.028 "	0.030 "	0.032 "
18	0.027 "	0.029 "	0.031 "	0.033 "	0 035 "	0.037 "
20	0.033 "	0.036 "	0 037 "	0.038 "	0.040 "	0.042 "
22	0.039 "	0.042 "	0.043 "	0.045 "	0.047 "	
26	0.053 "	0.057 "	0.057 "	0.059 "		

Bé.°	Sp. gr.	Per cent NH_3.	Bé.°	Sp. gr.	Per cent NH_3.
10.00	1.0000	0 00	12.25	0.9842	3.73
10.25	0.9982	0.40	12.50	0.9825	4.16
10.50	0.9964	0.80	12.75	0.9807	4.59
10.75	0.9947	1.21	13 00	0.9790	5.02
11.00	0.9929	1.62	13.25	0.9773	5.45
11.25	0.9912	2.04	13.50	0.9756	5.88
11.50	0.9894	2.46	13.75	0.9739	6.31
11.75	0.9876	2.88	14.00	0.9722	6.74
12.00	0.9859	3.30	14.25	0.9705	7.17

AQUA AMMONIA (Continued)

Be.°	Sp. Gr.	Per cent NH_3.	Be.°	Sp. gr.	Per cent NH_3.
14.50	0.9689	7.61	22.00	0.9211	21.60
14.75	0.9672	8.05	22.25	0.9195	22.08
15.00	0.9655	8.49	22.50	0.9180	22.56
15.25	0.9639	8.93	22.75	0.9165	23.04
15.50	0.9622	9.38	23.00	0.9150	23.52
15.75	0.9605	9.83	23.25	0.9135	24.01
16.00	0.9589	10.28	23.50	0.9121	24.50
16.25	0.9573	10.73	23.75	0.9106	24.99
16.50	0.9556	11.18	24.00	0.9091	25.48
16.75	0.9540	11.64	24.25	0.9076	25.97
17.00	0.9524	12.10	24.50	0.9061	26.46
17.25	0.9508	12.56	24.75	0.9047	26.95
17.50	0.9492	13.02	25.00	0.9032	27.44
17.75	0.9475	13.49	25.25	0.9018	27.93
18.00	0.9459	13.96	25.50	0.9003	28.42
18.25	0.9444	14.43	25.75	0.8989	28.91
18.50	0.9428	14.90	26.00	0.8974	29.40
18.75	0.9412	15.37	26.25	0.8960	29.89
19.00	0.9396	15.84	26.50	0.8946	30.38
19.25	0.9380	16.32	26.75	0.8931	30.87
19.50	0.9365	16.80	27.00	0.8917	31.36
19.75	0.9349	17.28	27.25	0.8903	31.85
20.00	0.9333	17.76	27.50	0.8889	32.34
20.25	0.9318	18.24	27.75	0.8875	32.83
20.50	0.9302	18.72	28.00	0.8861	33.32
20.75	0.9287	19.20	28.25	0.8847	33.81
21.00	0.9272	19.68	28.50	0.8833	34.30
21.25	0.9256	20.16	28.75	0.8819	34.79
21.50	0.9241	20.64	29.00	0.8805	35.28
21.75	0.9226	21.12			

AMMONIUM CHLORIDE

Specific Gravity of Aqueous Ammonium Chloride Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent NH_4Cl	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.2	1.0013	1	10.01	0 6251	0.0836
0.6	1.0045	2	20.09	1.254	0.1677
1.5	1.0107	4	40.43	2.524	0.3374
2.4	1 0168	6	61.01	3.809	0 5091
3.2	1.0227	8	81.82	5.108	0.6828
4.0	1.0286	10	102.9	6.421	0.8584
4.8	1 0344	12	124.1	7.749	1.036
5.6	1 0401	14	145.6	9.090	1.215
6.3	1.0457	16	167 3	10.44	1 396
7.1	1 0512	18	189.2	11.81	1 579
7.8	1.0567	20	211.3	13.19	1.764
8 5	1.0621	22	233.7	14.59	1.950
9.2	1.0674	24	256 2	15.99	2 138

AMMONIUM NITRATE

Specific Gravity of Aqueous Ammonium Nitrate Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent NH_4NO_3	G per liter	Lbs. per cu. ft.	Lbs. per gal.
0.3	1.0023	1	10 02	0.6257	0 0836
0 9	1.0064	2	20 13	1.257	0 1680
2.1	1 0147	4	40 59	2.534	0 3387
3 3	1 0230	6	61.38	3.832	0.5122
4 4	1 0313	8	82 50	5.150	0 6885
5 5	1.0397	10	104 0	6.491	0 8677
6 7	1 0482	12	125.8	7.852	1 050
7 8	1 0567	14	147 9	9 235	1 235
8 9	1.0653	16	170 4	10.64	1.422
10 0	1.0740	18	193 3	12 07	1 613
11 1	1.0828	20	216 6	13 52	1 807
12 2	1.0916	22	240 2	14 99	2 004
13 2	1.1005	24	264 1	16 49	2 204
14 3	1.1095	26	288 5	18.01	2 407
15 4	1.1186	28	313 2	19.55	2 614
16 4	1.1277	30	338 3	21.12	2 823
19 0	1.1512	35	402 9	25 15	3.362
21 6	1.1754	40	470.2	29 35	3.924
24 2	1.2003	45	540.1	33.72	4.508
26 7	1.2258	50	612.9	38.26	5.115

AMMONIUM NITRATE

SPECIFIC GRAVITY OF AQUEOUS AMMONIUM NITRATE SOLUTIONS AT 17.5° C. (GERLACH)

Bé.	Sp gr	Per cent NH_4NO_3	G per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1 0042	1	10 04	0.6269	0.0838
1 2	1.0085	2	20 17	1.259	0 1683
1 8	1 0127	3	30 38	1.897	0.2535
2.4	1 0170	4	40.68	2.540	0.3395
3.0	1 0212	5	51 06	3.188	0.4261
3.6	1.0255	6	61 53	3.841	0 5135
4 2	1.0297	7	72 08	4.500	0.6015
4.8	1 0340	8	82 72	5.164	0 6903
5.3	1 0382	9	93 44	5.833	0 7798
5.9	1 0425	10	104 3	6 508	0 8700
6.5	1 0468	11	115.1	7.188	0.9609
7.1	1 0512	12	126 1	7.875	1 053
7.6	1 0555	13	137.2	8.566	1 145
8.2	1 0599	14	148.4	9.263	1 238
8.8	1 0642	15	159.6	9.965	1 332
9 3	1 0686	16	171 0	10.67	1 427
9.9	1 0729	17	182 4	11 39	1 522
10.4	1 0773	18	193 9	12.11	1 618
10.9	1.0816	19	205.5	12.83	1 715
11.5	1 0860	20	217.2	13 56	1 813
12.0	1 0905	21	229.0	14.30	1 911
12.6	1 0950	22	240 9	15.04	2 010
13.1	1 0995	23	252 9	15 79	2 110
13.7	1 1040	24	265 0	16.54	2 211
14.2	1 1085	25	277 1	17.30	2 313
14 7	1 1130	26	289 4	18 07	2 415
15 2	1 1175	27	301 7	18 84	2 518
15 8	1 1220	28	314 2	19.61	2 622
16 3	1 1265	29	326 7	20.39	2 726
16 8	1 1310	30	339 3	21 18	2 832
17 3	1 1358	31	352 1	21 98	2 938
17 9	1 1406	32	365 0	22 79	3 046
18 4	1 1454	33	378 0	23 60	3 154
18.9	1 1502	34	391 1	24 41	3 264
19 5	1 1550	35	404 3	25 24	3 374
20 0	1 1598	36	417 5	26.07	3 484
20 5	1 1646	37	430 9	26.90	3 596
21.0	1 1694	38	444.4	27.74	3 708
21.5	1 1743	39	457.9	28.59	3 822
22.0	1 1790	40	471.6	29 44	3 936
22 5	1 1841	41	485.5	30.31	4.051
23 1	1 1892	42	499.5	31.18	4.168

AMMONIUM NITRATE (Continued)

Specific Gravity of Aqueous Ammonium Nitrate Solutions at 17.5° C. (Gerlach)

Bé.	Sp. gr	Per cent NH_4NO_3	G per liter	Lbs. per cu. ft.	Lbs per gal.
23 6	1.1942	43	513 5	32 06	4 285
24.1	1 1994	44	527 7	32 94	4 404
24 6	1.2045	45	542.0	33 84	4 523
25 1	1 2096	46	556.4	34.74	4 643
25 6	1 2147	47	570 9	35 64	4 764
26 1	1 2198	48	585.5	36 55	4 886
26 6	1 2249	49	600 2	37 47	5 009
27 1	1 2300	50	615.0	38.39	5 132
27.6	1 2353	51	630.0	39 33	5 258
28.1	1 2407	52	645 2	40 28	5 384
28 6	1 2460	53	660.4	41.23	5 511
29 1	1 2514	54	675 8	42 19	5 639
29 6	1 2567	55	691 2	43.15	5 768
30 1	1 2621	56	706 8	44 12	5 898
30 6	1 2674	57	722 4	45 10	6 029
31 1	1 2728	58	738.2	46 09	6 161
31 6	1 2781	59	754 1	47 07	6 293
32 0	1.2835	60	770 1	48 08	6 427
32 5	1 2888	61	786 2	49 08	6 561
33 0	1 2942	62	802 4	50 09	6 696
33 5	1 3005	63	819 3	51 15	6 837
34 0	1.3059	64	835 8	52.17	6 975

AMMONIUM SULFATE

SPECIFIC GRAVITY OF AQUEOUS AMMONIUM SULFATE SOLUTIONS AT $\frac{20°}{4°}$ C.*

Bé	Sp. gr.	Per cent $(NH_4)_2SO_4$	G per liter	Lbs per cu ft.	Lbs per gal
0.6	1.0041	1	10.04	0.6283	0.08379
1.5	1.0101	2	20.20	1.621	0.1686
3.1	1.0220	4	40.88	2.552	0.3412
4.7	1.0338	6	62.03	3.872	0.5176
6.3	1.0456	8	83.65	5.222	0.6981
7.9	1.0574	10	105.7	6.601	0.8824
9.4	1.0691	12	128.3	8.009	1.071
10.8	1.0808	14	151.3	9.446	1.263
12.3	1.0924	16	174.8	10.91	1.459
13.7	1.1039	18	198.7	12.40	1.658
15.0	1.1154	20	223.1	13.93	1.862
16.3	1.1269	22	247.9	15.48	2.069
17.6	1.1383	24	273.2	17.05	2.280
18.9	1.1496	26	298.9	18.66	2.494
20.1	1.1609	28	325.1	20.29	2.713
21.3	1.1721	30	351.6	21.95	2.934
24.2	1.2000	35	420.0	26.22	3.505
26.9	1.2277	40	491.1	30.66	4.098
29.5	1.2552	45	564.8	35.26	4.714
31.9	1.2825	50	641.3	40.03	5.351

AMMONIUM SULFATE

SPECIFIC GRAVITY OF AQUEOUS AMMONIUM SULFATE SOLUTIONS AT 19° C. (SCHIFF)

Bé.	Sp. gr.	Per cent $(NH_4)_2SO_4$	G. per liter	Lbs. per cu. ft.	Lbs per gal.
0.8	1.0057	1	10 06	0 6278	0.0839
1.6	1 0115	2	20 23	1.263	0.1688
2.5	1 0172	3	30 52	1.905	0.2547
3.3	1 0230	4	40.92	2.555	0.3415
4 0	1.0287	5	51 44	3.211	0 4292
4.8	1 0345	6	62.07	3.875	0.5180
5.6	1 0403	7	72.82	4 546	0 6077
6.4	1 0460	8	83.68	5.224	0.6983
7.1	1 0518	9	94 66	5.909	0.7900
7.9	1.0575	10	105 8	6.602	0.8825
8.6	1.0632	11	117 0	7.301	0 9760
9.4	1 0690	12	128 3	8.008	1.071
10 1	1 0747	13	139.7	8.722	1.166
10.8	1 0805	14	151.3	9.443	1.262
11.5	1 0862	15	162.9	10.17	1.360
12.2	1 0920	16	174.7	10 91	1.458
12.9	1 0977	17	186.6	11 65	1.557
13.6	1 1035	18	198 6	12.40	1 658
14.3	1.1092	19	210 7	13.16	1.759
14.9	1 1149	20	223 0	13.92	1.861
15.6	1 1207	21	235 3	14.69	1.964
16 3	1.1265	22	247 8	15.47	2.068
16.9	1.1323	23	260.4	16 26	2.173
17.6	1.1381	24	273.1	17 05	2.279
18.2	1.1439	25	286 0	17.85	2.387
18.9	1.1496	26	298 9	18 66	2 494
19 5	1 1554	27	312.0	19.47	2 603
20 1	1 1612	28	325.1	20.30	2.713
20 8	1.1670	29	338.4	21 13	2.824
21.3	1.1724	30	351.7	21 96	2.935
21.9	1.1780	31	365.2	22.80	3.048
22 5	1.1836	32	378.8	23 64	3.161
23.1	1.1892	33	392.4	24 50	3.275
23.6	1.1948	34	406 2	25 36	3.390
24.2	1.2004	35	420.1	26 23	3.506
24.8	1.2060	36	434.2	27 10	3.623
25.3	1.2116	37	448.3	27.99	3.741
25.9	1.2172	38	462 5	28 87	3 860
26.4	1 2228	39	476 9	29 77	3.980
27.0	1.2284	40	491 4	30.67	4.101
27 5	1 2343	41	506 1	31.59	4 223
28.1	1 2402	42	520.9	32.52	4.347
28.6	1.2462	43	535.9	33.45	4.472
29 2	1.2522	44	551.0	34.40	4.598
29 8	1 2583	45	566.2	35 35	4.725
30.3	1 2644	46	581.6	36 31	4 854
30.9	1 2705	47	597 1	37.28	4 983
31.4	1.2766	48	612 8	38 25	5.114
32.0	1 2828	49	628 6	39.24	5.246
32.5	1 2890	50	644 5	40.23	5.378

ARSENIC ACID

Specific Gravity of Aqueous Arsenic Acid Solutions at $\frac{15°}{4°}$ C.*

Bé.	Sp. gr.	Per cent H_3AsO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal
0.8	1.0057	1	10.06	0.6278	0.0839
1.8	1.0124	2	20 25	1.264	0.1690
3.7	1.0260	4	41 04	2.562	0.3425
5.6	1.0398	6	62 39	3.895	0.5206
7 4	1.0538	8	84 30	5 263	0.7035
9.3	1.0681	10	106.8	6.668	0.8914
11.1	1.0826	12	129.9	8.110	1.084
12.9	1.0975	14	153 7	9.592	1.282
14.7	1.1128	16	178 0	11.12	1.486
16.5	1.1285	18	203.1	12.68	1.695
18 3	1 1447	20	228.9	14.29	1.911
20.2	1 1614	22	255.5	15.95	2.132
22.0	1.1785	24	282.8	17.66	2.360
23 8	1.1961	26	311.0	19.41	2.595
25 6	1.2143	28	340.0	21 23	2.837
27 4	1 2331	30	369.9	23.09	3 087
32 0	1.2829	35	449.0	28.03	3.747
36.6	1.3370	40	534 8	33.39	4 463
41 1	1.3959	45	628 2	39.21	5.242
45 7	1.4602	50	730.1	45.58	6 093
50.3	1 5304	55	841.7	52.55	7.024
54.8	1 6070	60	964.2	60.19	8.046
59 2	1 6904	65	1099	68.59	9.169
63 6	1.7811	70	1247	77.83	10.40

Bé	Sp. gr	Per cent As_2O_5	G per liter	Lbs. per cu. ft	Lbs. per gal.
0 8	1 0057	0 810	8 143	0 5083	0 0680
1.8	1.0124	1.62	16 39	1.023	0.1368
3.7	1.0260	3.24	33.23	2 074	0.2773
5.6	1.0398	4.86	50 51	3.153	0.4216
7.4	1.0538	6.48	68.26	4.261	0.5696
9.3	1.0681	8.10	86 48	5.399	0.7217
11.1	1.0826	9.72	105.2	6.566	0.8778
12 9	1.0975	11.3	124.4	7.766	1.038
14 7	1.1128	13.0	144.2	8.999	1.203
16 5	1.1285	14.6	164.5	10.27	1.373
18 3	1 1447	16.2	185 4	11.57	1.547
20 2	1.1614	17.8	206 9	12.91	1.726
22 0	1.1785	19.4	229.0	14.30	1.911
23.8	1.1961	21.1	251.8	15.72	2.101
25.6	1.2143	22.7	275.3	17.19	2.297
27 4	1.2331	24.3	299.5	18.70	2.500
32.0	1.2829	28.3	363.6	22.70	3 034
36 6	1.3370	32.4	433.0	27.03	3.614
41.1	1.3959	36.4	508 6	31 75	4.244
45.7	1.4602	40.5	591.1	36.90	4.933
50.3	1.5304	44.5	681.5	42.54	5.687
54.8	1.6070	48.6	780.7	48.74	6.515
59 2	1.6904	52.6	889.6	55 54	7.424
63.6	1.7811	56.7	1009	63.02	8.424

BARIUM CHLORIDE

Specific Gravity of Aqueous Barium Chloride Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $BaCl_2$	G per liter	Lbs. per cu. ft.	Lbs. per gal.
2 3	1.0159	2	20.32	1.268	0.1696
4 8	1.0341	4	41.36	2.582	0.3452
7.3	1.0528	6	63.17	3.943	0.5272
9.8	1.0721	8	85.77	5.354	0.7158
12.2	1.0921	10	109.2	6.818	0 9114
14.7	1.1128	12	133.5	8.336	1.114
17.2	1.1342	14	158.8	9.913	1.325
19 6	1.1564	16	185.0	11.55	1.544
22.0	1.1793	18	212 3	13.25	1.771
24.5	1.2031	20	240.6	15.02	2.008
26.9	1.2277	22	270.1	16.86	2.254
29.3	1.2531	24	300.7	18.77	2.510
31.7	1.2793	26	332.6	20.76	2 776

Bé.	Sp gr.	Per cent $BaCl_2 + 2H_2O$	G per liter	Lbs per cu. ft.	Lbs. per gal.
2.3	1.0159	2.346	23 83	1.488	0.1989
4 8	1 0341	4.692	48.52	3.029	0.4049
7.3	1.0528	7 038	74.10	4.626	0.6184
9.8	1.0721	9.384	100 6	6.281	0.8396
12 2	1.0921	11 73	128 1	7.997	1.069
14 7	1.1128	14.08	156 6	9.778	1.307
17.2	1.1342	16.42	186 3	11.63	1.554
19 6	1.1564	18 77	217.0	13.55	1.811
22 0	1 1793	21 11	249 0	15.54	2.078
24 5	1.2031	23.46	282 2	17.62	2.355
26 9	1 2277	25.81	316.8	19.78	2 644
29 3	1.2531	28.15	352 8	22.02	2.944
31.7	1 2793	30.50	390.2	24.36	3.256

CADMIUM NITRATE

Specific Gravity of Aqueous Cadmium Nitrate Solutions at $\frac{18°}{4°}$ C.*

Bé.	Sp gr.	Per cent $Cd(NO_3)_2$	G per liter	Lbs per cu. ft.	Lbs per gal.
2 2	1.0154	2	20.31	1.268	0 1695
4 6	1.0326	4	41 30	2.578	0 3447
6 9	1 0502	6	63.01	3.934	0.5259
9 3	1 0683	8	85.46	5.335	0 7132
11 6	1.0869	10	108.7	6 785	0.9070
13 9	1 1061	12	132.7	8.286	1.108
16.2	1.1261	14	157 7	9.842	1.316
18.6	1.1468	16	183 5	11.45	1.531
20 9	1.1682	18	210 3	13.13	1.755
23 2	1 1904	20	238 1	14.86	1.987
28 9	1 2488	25	312.2	19.50	2.605
34.5	1 3124	30	393 7	24.58	3 286
40 1	1 3822	35	483.8	30.20	4 037
45.6	1 4590	40	583 6	36.43	4 870
51 1	1.5438	45	694 7	43.37	5.797
56 4	1 6356	50	817 8	51.05	6 825

CALCIUM CHLORIDE

Specific Gravity of Aqueous Calcium Chloride Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $CaCl_2$	G per liter	Lbs per cu ft	Lbs. per gal.
2.1	1.0148	2	20 30	1.267	0.1694
4.4	1.0316	4	41 26	2.576	0 3444
6.7	1 0486	6	62 92	3.928	0.5251
9.0	1.0659	8	85.27	5 323	0 7116
11.2	1.0835	10	108 4	6.764	0 9042
13.4	1.1015	12	132.2	8.252	1 103
15.5	1.1198	14	156 8	9 787	1 308
17.7	1.1386	16	182 2	11.37	1.520
19.8	1.1578	18	208.4	13 01	1.739
21.9	1.1775	20	235.5	14 70	1 965
27.0	1.2284	25	307 1	19 17	2 563
31.9	1 2816	30	384 5	24 00	3 209
36.6	1 3373	35	468 1	29 22	3 906
41.1	1 3957	40	558 3	34 85	4 659

Bé.	Sp gr	Per cent $CaCl_2 + 6H_2O$	G per liter	Lbs per cu ft	Lbs per gal.
2.1	1.0148	3 948	40 06	2 501	0 3343
4.4	1 0316	7 896	81 46	5 085	0 6800
6.7	1.0486	11 84	124 2	7.753	1 036
9.0	1.0659	15 79	168 3	10 51	1.405
11.2	1 0835	19 74	213 9	13 35	1.785
13.4	1.1015	23 69	260 9	16 29	2.177
15.5	1 1198	27 64	309.5	19.32	2 583
17.7	1.1386	31 58	359 6	22 45	3 001
19.8	1.1578	35 53	411 4	25 68	3.433
21.9	1.1775	39 48	465 9	29.02	3.879
27.0	1 2284	49 35	606 2	37 84	5 059
31.9	1.2816	59.22	759 0	47.38	6.334
36.6	1 3373	69 09	923 9	57.68	7 710
41.1	1 3957	78 96	1102 0	68 80	9.197

CHROMIC ACID

Specific Gravity of Aqueous Chromic Acid Solutions at $\frac{15°}{4°}$ C *

Bé.	Sp. gr.	Per cent CrO_3	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0 9	1 006	1	10 06	0.6280	0.0840
2.0	1 014	2	20.28	1.266	0.1692
4 2	1 030	4	41 20	2.572	0.3438
6.2	1 045	6	62.70	3.914	0.5232
8.2	1 060	8	84.80	5.294	0.7077
10.2	1.076	10	107.6	6.717	0.8979
12 3	1 093	12	131.2	8.188	1.095
14.4	1.110	14	155.4	9.701	1.297
16.3	1.127	16	180.3	11.26	1.505
18.4	1.145	18	206 1	12.87	1.720
20.3	1.163	20	232.6	14.52	1.941
22.2	1.181	22	259.8	16.22	2 168
24.2	1 200	24	288.0	17.98	2 403
26 2	1.220	26	317.2	19.80	2.647
28.1	1.240	28	347.2	21 67	2 897
29.9	1 260	30	378.0	23.60	3.154
34 6	1.313	35	459.6	28.69	3.835
39.2	1.371	40	548.4	34.24	4.577
44 0	1.435	45	645.8	40 31	5.389
48 7	1.505	50	752.5	46.98	6.280
53.3	1.581	55	869.6	54.28	7.257
57.8	1 663	60	997.8	62.29	8.327

CHROMIUM SULFATE

Specific Gravity of Aqueous Chromium Sulfate Solutions at $\frac{15°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $Cr_2(SO_4)_3$ (green)	G per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0081	1	10 08	0.6293	0.0841
2.5	1.0172	2	20.34	1.270	0.1698
5.0	1.0358	4	41.43	2.586	0.3458
7.6	1.0551	6	63.31	3.952	0.5283
10.1	1.0751	8	86.01	5 369	0.7178
12.7	1.0958	10	109.6	6.841	0.9145
15 2	1.1172	12	134.1	8.369	1.119
17.7	1.1392	14	159.5	9.956	1.331
20.2	1.1618	16	185.9	11.60	1.551
22.7	1.1851	18	213.3	13.32	1.780
25.1	1 2091	20	241 8	15.10	2.018
27.5	1.2339	22	271.5	16.95	2.265
29.9	1 2594	24	302 3	18.87	2.522
32.2	1.2856	26	334.3	20.87	2.789
34.5	1.3125	28	367 5	22.94	3 067
36.8	1.3401	30	402 0	25 10	3.355
42 3	1.4123	35	494.3	30.86	4 125
47.6	1.4893	40	595 7	37.19	4.971

Bé.	Sp. gr.	Per cent $Cr_2(SO_4)_3$ (violet)	G per liter	Lbs. per cu. ft.	Lbs per gal.
1.3	1.0091	1	10 09	0.6300	0.084
2.7	1.0191	2	20 38	1.272	0.1701
5.5	1.0395	4	41 58	2.596	0 3470
8.3	1.0604	6	63 62	3 972	0 5310
11.0	1.0817	8	86 54	5 402	0 7222
13 6	1.1034	10	110 3	6 888	0 9208
16.2	1.1257	12	135 1	8 433	1 127
18.8	1.1486	14	160 8	10.04	1.342
21.3	1.1722	16	187 6	11.71	1.565
23.8	1.1966	18	215 4	13 45	1 797
26.3	1.2218	20	244 4	15.25	2 039
28.8	1.2479	22	274 5	17.14	2 291
31.3	1.2750	24	306 0	19.10	2.554
33.7	1.3032	26	338 8	21 15	2.828
36.2	1 3325	28	373.1	23.29	3.114

CITRIC ACID

Specific Gravity of Citric Acid Solutions at 15° C.
(Gerlach)

Bé.	Sp. gr.	Per cent $C_6H_8O_7 + H_2O$	G per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0074	2	20.15	1.258	0.1681
2.1	1.0149	4	40.60	2.534	0.3388
3.2	1.0227	6	61.36	3.831	0.5121
4.3	1.0309	8	82.47	5.148	0.6883
5.5	1 0392	10	103.9	6.487	0.8672
6.5	1.0470	12	125.6	7.843	1.048
7.6	1.0549	14	147.7	9.220	1.232
8.6	1.0632	16	170.1	10.62	1.420
9.7	1.0718	18	192.9	12.04	1.610
10.8	1.0805	20	216.1	13.49	1.803
11.8	1 0889	22	239.6	14.95	1.999
12.8	1.0972	24	263.3	16.44	2.198
13 9	1 1060	26	287 6	17.95	2.400
15 0	1.1152	28	312 3	19.49	2.606
16 0	1.1244	30	337.3	21.06	2.815
17 1	1.1333	32	362.7	22.64	3.026
18 1	1.1422	34	388 3	24.24	3.241
19 1	1.1515	36	414.5	25.88	3.459
20.1	1.1612	38	441.3	27.55	3.682
21 2	1.1709	40	468.4	29.24	3.909
22 3	1.1814	42	496.2	30 98	4 141
23 1	1 1899	44	523 6	32.68	4.369
24 2	1.1998	46	551.9	34 45	4.606
25 2	1 2103	48	580 9	36.27	4.848
26 2	1 2204	50	610.2	38.09	5.092
27 2	1 2307	52	640 0	39 95	5.341
28 2	1.2410	54	670 1	41 83	5.592
29.1	1.2514	56	700 8	43 75	5.848
30 2	1 2627	58	732 4	45.72	6.112
31 2	1 2738	60	764 3	47.71	6.378
32 2	1.2849	62	796 6	49.73	6.648
33.1	1.2960	64	829 4	51.78	6.922
34.1	1 3071	66	862 7	53.85	7.199

COPPER NITRATE

Specific Gravity of Aqueous Cupric Nitrate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr	Per cent $Cu(NO_3)_2$	G. per liter	Lbs. per cu ft	Lbs per gal
1 0	1.007	1	10 07	0.6286	0 0840
2 1	1 015	2	20.30	1.267	0 1694
4 5	1 032	4	41 28	2 577	0 3445
6.9	1 050	6	63 00	3.933	0 5258
9 4	1.069	8	85 52	5.339	0 7137
11 7	1 088	10	108 8	6.792	0 9080
14 0	1.107	12	132 8	8 293	1 109
16 2	1 126	14	157 6	9 841	1 316
18 6	1.147	16	183 5	11 46	1 532
20 9	1 168	18	210 2	13 12	1 754
23 1	1 189	20	237 8	14 85	1 984
28 8	1 248	25	312 0	19 48	2 604

COPPER SULFATE

Specific Gravity of Aqueous Copper Sulfate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp gr.	Per cent $CuSO_4$	G per liter	Lbs. per cu ft.	Lbs per gal
1.3	1 009	1	10 09	0 6299	0 0842
2 7	1 019	2	20 38	1 272	0 1701
5 6	1 040	4	41 60	2 597	0 3472
8 5	1.062	6	63 72	3.978	0.5318
11 2	1 084	8	86 72	5 414	0 7237
14 0	1.107	10	110 7	6 911	0 9238
16 8	1.131	12	135 7	8 473	1 133
19 4	1.154	14	161 6	10 09	1 348
22.1	1 180	16	188.8	11.79	1.576
24 8	1 206	18	217 1	13 55	1 812

COPPER SULFATE (Continued)

Specific Gravity of Aqueous Copper Sulfate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $CuSO_4 + 5H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.009	1 564	15 78	0.9853	0.1317
2.7	1 019	3 129	31.88	1.990	0 2661
5.6	1.040	6 257	65 07	4.062	0.5431
8 5	1 062	9.386	99 68	6.223	0 8318
11.2	1 084	12 51	135 7	8 469	1.132
14 0	1.107	15.64	173 2	10.81	1 445
16 8	1.131	18 77	212 3	13 25	1 772
19 4	1 154	21.90	252 7	15.78	2 110
22 1	1 180	25 03	295.3	18.44	2.465
24 8	1 206	28 16	339 6	21 20	2 834

Specific Gravity of Aqueous Copper Sulfate Solutions at 18° C. (Schiff and Gerlach)

Bé	Sp. gr.	Per cent $CuSO_4$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1 0063	0.6393	6 433	0.4016	0 0537
1.8	1 0126	1.279	12.95	0.8082	0.1080
2.7	1 0190	1 918	19.54	1.220	0.1631
3 6	1.0254	2 557	26 22	1.637	0.2188
4 5	1 0319	3 196	32 98	2.059	0.2753
5 4	1 0384	3 836	39 83	2.486	0 3324
6 2	1 0450	4.475	46.76	2.919	0 3902
7.1	1 0516	5.114	53.78	3.357	0.4488
8 0	1 0582	5.753	60 88	3.801	0 5081
8.8	1 0649	6.393	68.08	4.250	0.5681
9.7	1 0716	7.032	75.35	4.704	0.6289
10.6	1.0785	7.671	82.73	5.165	0.6904
11.4	1 0854	8.311	90.20	5.631	0.7528
12 3	1.0923	8.950	97 76	6.103	0.8158
13 1	1.0993	9.589	105 4	6.581	0.8797
13.9	1.1063	10.23	113 2	7.064	0.9443
14.8	1.1135	10 87	121.0	7.554	1.010
15 6	1.1208	11 51	129 0	8.051	1.076
16 5	1.1281	12 15	137 0	8.554	1.143
17.3	1.1354	12.79	145.2	9.062	1.211
18.1	1.1427	13.42	153.4	9.577	1.280
18.9	1.1501	14.06	161.7	10.10	1.350
19.8	1.1585	14 70	170.3	10.63	1.421

COPPER SULFATE (Continued)

Specific Gravity of Aqueous Copper Sulfate Solutions at 19° C. (Schiff and Gerlach)

Bé.	Sp. gr.	Per cent $CuSO_4$	G per liter	Lbs per cu. ft	Lbs. per gal
20.6	1.1659	15.34	178.9	11.17	1.493
21.5	1.1738	15.98	187.6	11.71	1.566
22.3	1.1817	16.62	196.4	12.26	1.639
23.1	1.1898	17.26	205.4	12.82	1.714
24.0	1.1980	17.90	214.4	13.39	1.790
24.8	1.2063	18.54	223.6	13.96	1.866
25.6	1.2146	19.18	232.9	14.54	1.944

Specific Gravity of Aqueous Copper Sulfate Solutions at 18° C. (Schiff and Gerlach)

Bé	Sp. gr.	Per cent $CuSO_4 + 5H_2O$	G per liter	Lbs per cu. ft	Lbs. per gal
0.9	1.0063	1	10.06	0.6282	0.0840
1.8	1.0126	2	20.25	1.264	0.1690
2.7	1.0190	3	30.57	1.908	0.2551
3.6	1.0254	4	41.02	2.561	0.3423
4.5	1.0319	5	51.60	3.221	0.4306
5.4	1.0384	6	62.30	3.889	0.5199
6.2	1.0450	7	73.15	4.567	0.6105
7.1	1.0516	8	84.13	5.252	0.7021
8.0	1.0582	9	95.24	5.945	0.7948
8.8	1.0649	10	106.5	6.648	0.8887
9.7	1.0716	11	117.9	7.359	0.9837
10.6	1.0785	12	129.4	8.079	1.080
11.4	1.0854	13	141.1	8.809	1.178
12.3	1.0923	14	152.9	9.546	1.276
13.1	1.0993	15	164.9	10.29	1.376
13.9	1.1063	16	177.0	11.05	1.477
14.8	1.1135	17	189.3	11.82	1.580
15.6	1.1208	18	201.7	12.59	1.684
16.5	1.1281	19	214.3	13.38	1.789
17.3	1.1354	20	227.1	14.18	1.895
18.1	1.1427	21	240.0	14.98	2.003
18.9	1.1501	22	253.0	15.80	2.112
19.8	1.1585	23	266.5	16.63	2.224
20.6	1.1659	24	279.8	17.47	2.335
21.5	1.1738	25	293.5	18.32	2.449
22.3	1.1817	26	307.2	19.18	2.564
23.1	1.1898	27	321.2	20.05	2.681
24.0	1.1980	28	335.4	20.94	2.799
24.8	1.2063	29	349.8	21.84	2.919
25.6	1.2146	30	364.4	22.75	3.041

CUPRIC CHLORIDE

Specific Gravity of Aqueous Cupric Chloride Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr	Per cent $CuCl_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.4	1.017	2	20.34	1.270	0.1697
5.0	1.036	4	41.44	2.587	0.3458
7.7	1.056	6	63.36	3.955	0.5288
10.1	1.075	8	86.00	5.369	0.7177
12.7	1.096	10	109.6	6.842	0.9146
15.2	1.117	12	134.0	8.368	1.119
17.6	1.138	14	159.3	9.946	1.330
20.0	1.160	16	185.6	11.59	1.549
22.3	1.182	18	212.8	13.28	1.776
24.7	1.205	20	241.0	15.04	2.011

Specific Gravity of Aqueous Cupric Chloride Solutions at 17.5° C. (Franz)

Bé	Sp. gr	Per cent $CuCl_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.0091	1	10.09	0.6300	0.0842
2.6	1.0182	2	20.36	1.271	0.1699
3.9	1.0273	3	30.82	1.924	0.2572
5.1	1.0364	4	41.46	2.588	0.3460
6.3	1.0455	5	52.28	3.263	0.4363
7.5	1.0548	6	63.29	3.951	0.5282
8.7	1.0641	7	74.49	4.650	0.6216
9.9	1.0734	8	85.87	5.361	0.7166
11.1	1.0827	9	97.44	6.083	0.8132
12.2	1.0920	10	109.2	6.817	0.9113
13.8	1.1049	11	121.5	7.587	1.014
15.3	1.1178	12	134.1	8.374	1.119
16.8	1.1307	13	147.0	9.176	1.227
18.2	1.1436	14	160.1	9.995	1.336
19.6	1.1565	15	173.5	10.83	1.448
21.0	1.1696	16	187.1	11.68	1.562
22.4	1.1827	17	201.1	12.55	1.678
23.7	1.1958	18	215.2	13.44	1.796
25.1	1.2089	19	229.7	14.34	1.917
26.4	1.2223	20	244.5	15.26	2.040
27.7	1.2362	21	259.6	16.21	2.166
29.0	1.2501	22	275.0	17.17	2.295

CUPRIC CHLORIDE (Continued)

Specific Gravity of Aqueous Cupric Chloride Solutions at 17.5° C. (Franz)

Bé.	Sp gr	Per cent $CuCl_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
30.3	1.2640	23	290.7	18.15	2.426
31.5	1.2779	24	306.7	19.15	2.559
32.8	1.2918	25	323.0	20.16	2.695
34.0	1.3058	26	339.5	21.19	2.833
35.1	1.3198	27	356.3	22.25	2.974
36.3	1.3338	28	373.4	23.31	3.117
37.4	1.3478	29	390.9	24.40	3.262
38.5	1.3618	30	408.5	25.50	3.409
39.8	1.3784	31	427.3	26.68	3.566
41.1	1.3950	32	446.4	27.87	3.725
42.3	1.4116	33	465.8	29.08	3.887
43.5	1.4287	34	485.8	30.32	4.054
44.6	1.4447	35	505.6	31.57	4.220
45.8	1.4615	36	526.1	32.85	4.391
46.9	1.4782	37	546.9	34.14	4.564
48.0	1.4949	38	568.1	35.46	4.741
49.1	1.5116	39	589.5	36.80	4.920
50.1	1.5284	40	611.4	38.17	5.102

FERRIC CHLORIDE

Specific Gravity of Aqueous Ferric Chloride Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $FeCl_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.1	1.015	2	20.30	1.267	0.1694
4.5	1.032	4	41.28	2.577	0.3445
6.8	1.049	6	62.94	3.929	0.5253
9.1	1.067	8	85.36	5.329	0.7124
11.4	1.085	10	108.5	6.773	0.9055
13.7	1.104	12	132.5	8.270	1.106
15.9	1.123	14	157.2	9.815	1.312
18.0	1.142	16	182.7	11.41	1.525
20.2	1.162	18	209.2	13.06	1.745
22.3	1.182	20	236.4	14.76	1.973
27.5	1.234	25	308.5	19.26	2.574
32.7	1.291	30	387.3	24.18	3.232
37.8	1.353	35	473.6	29.56	3.952
42.7	1.418	40	567.2	35.41	4.733
47.4	1.485	45	668.3	41.72	5.577
51.5	1.551	50	775.5	48.41	6.472

FERRIC CHLORIDE

Specific Gravity of Aqueous Ferric Chloride Solutions at 17.5° C. (Franz)

Bé.	Sp. gr.	Per cent Fe_2Cl_6	G. per liter	Lbs. per cu. ft.	Lbs per gal.
1.1	1.0073	1	10 07	0.6288	0 0841
2.1	1 0146	2	20.29	1.267	0.1693
3.1	1.0219	3	30 66	1 914	0 2558
4.1	1 0292	4	41 17	2 570	0 3436
5.1	1 0365	5	51.83	3.235	0 4325
6.1	1 0439	6	62 63	3 910	0 5227
7.0	1 0513	7	73.59	4 594	0.6141
8.0	1 0587	8	84.70	5 287	0 7068
9.0	1 0661	9	95 95	5 990	0 8007
9.9	1 0734	10	107 3	6.701	0 8958
10.9	1.0814	11	119.0	7.426	0 9927
11 9	1 0894	12	130.7	8 161	1 091
12 9	1.0974	13	142 7	8 906	1 191
13 8	1 1054	14	154 8	9 661	1 291
14.8	1 1134	15	167 0	10 43	1 394
15 7	1.1215	16	179 4	11 20	1 497
16.6	1 1297	17	192 0	11 99	1 603
17 6	1.1378	18	204 8	12 79	1 709
18 4	1.1458	19	217.7	13 59	1.817
19 4	1.1542	20	230 8	14 41	1 926
20 5	1.1644	21	244.5	15 26	2 041
21 6	1 1746	22	258.4	16 13	2 157
22 6	1 1848	23	272.5	17 01	2 274
23 7	1 1950	24	286.8	17.90	2.393
24 7	1 2052	25	301.3	18.81	2 514
25 7	1 2155	26	316 0	19 73	2 637
26 7	1 2258	27	331 0	20 66	2 762
27 7	1 2365	28	346.2	21.61	2 889
28.7	1 2464	29	361.5	22 56	3 016
29.6	1 2568	30	377.0	23.54	3.146
30 6	1 2673	31	392 9	24.53	3 279
31 5	1 2778	32	408 9	25 53	3 412
32 5	1 2883	33	425.1	26.54	3 548
33 4	1 2988	34	441 6	27 57	3.685
34 3	1 3093	35	458 3	28.61	3 824
35 1	1.3199	36	475 2	29 66	3.965
36.0	1 3305	37	492 3	30.73	4.108
36.9	1.3411	38	509 6	31.81	4 253
37 7	1 3517	39	527 2	32.91	4.399
38.6	1.3622	40	544 9	34.02	4.547
39.5	1.3746	41	563.6	35.18	4.703
40 5	1.3870	42	582.5	36.37	4.861

FERRIC CHLORIDE (Continued)

Specific Gravity of Aqueous Ferric Chloride Solutions at 17.5° C. (Franz)

Bé	Sp. gr.	Per cent Fe_2Cl_6	G per liter	Lbs per cu ft	Lbs per gal
41 4	1.3994	43	601.7	37.56	5.022
42 3	1 4118	44	621 2	38 78	5 184
43 2	1.4242	45	640 9	40 01	5.348
44 1	1.4367	46	660 9	41 26	5.515
44.9	1 4492	47	681 1	42 52	5 684
45 8	1.4617	48	701 6	43 80	5.855
46.6	1.4742	49	722 4	45 09	6 028
47 5	1 4867	50	743 4	46 41	6 203
48 4	1.5010	51	765 5	47 79	6 388
49 3	1.5153	52	788 0	49 19	6 576
50 2	1.5296	53	810 7	50 61	6 765
51.1	1 5439	54	833 7	52 05	6 957
51 9	1 5582	55	857 0	53 50	7 152
52 8	1.5729	56	880 8	54 99	7 351
53 7	1 5876	57	904 9	56.49	7 552
54 5	1 6023	58	929 3	58 02	7 755
55 3	1 6170	59	954 0	59 56	7 962
56.1	1 6317	60	979 0	61 12	8 170

FERRIC NITRATE

Specific Gravity of Aqueous Ferric Nitrate Solutions at $\frac{18^\circ}{4^\circ}$ C *

Bé.	Sp. gr.	Per cent $Fe(NO_3)_3$	G per liter	Lbs per cu ft.	Lbs per gal.
0.9	1 0065	1	10 07	0 6283	0 0840
2.1	1 0144	2	20 29	1 267	0 1693
4.3	1 0304	4	41 22	2 573	0 3440
6.5	1 0468	6	62 81	3 921	0 5242
8.7	1 0636	8	85 09	5 312	0 7101
10.9	1 0810	10	108 1	6 748	0 9021
13.1	1 0989	12	131 9	8 232	1.101
15.2	1 1172	14	156 4	9 764	1 305
17.3	1 1359	16	181 7	11 35	1 517
19.5	1 1551	18	207 9	12 98	1 735
21.6	1 1748	20	235 0	14 67	1.961
26.9	1 2281	25	307 0	19 17	2 562

FERRIC NITRATE

Specific Gravity of Aqueous Ferric Nitrate Solutions at 17.5° C. (Franz)

Bé.	Sp. gr.	Per cent $Fe(NO_3)_3$	G. per liter	Lbs per cu. ft.	Lbs. per gal.
1.2	1 0080	1	10 08	0.6293	0.0841
2.3	1.0160	2	20.32	1 269	0.1696
3.4	1 0240	3	30.72	1.918	0 2564
4.5	1.0320	4	41 28	2.577	0.3445
5.6	1 0398	5	51 99	3.246	0.4339
6.5	1.0472	6	62.83	3.922	0 5244
7 5	1 0546	7	73.82	4.608	0 6161
8.5	1 0620	8	84 96	5.304	0.7090
9.4	1 0694	9	96 25	6.008	0.8032
10.4	1 0770	10	107.7	6.723	0 8988
11.4	1 0852	11	119.4	7.452	0 9962
12.4	1 0934	12	131.2	8.191	1.095
13.4	1.1016	13	143.2	8.940	1 195
14.3	1 1098	14	155.4	9.699	1.297
15.3	1.1182	15	167.7	10.47	1.400
16.3	1.1268	16	180.3	11 25	1 505
17.3	1 1354	17	193.0	12 05	1.611
18.3	1.1440	18	205.9	12 85	1.718
19.2	1.1526	19	219 0	13.67	1 828
20.1	1.1612	20	232 2	14 50	1 938
21 2	1.1712	21	246 0	15 35	2 053
22 2	1 1812	22	259 9	16.22	2.169
23 3	1.1912	23	274.0	17.10	2.286
24 3	1.2012	24	288.3	18.00	2 406
25 3	1 2110	25	302 8	18.90	2 527
26.3	1 2212	26	317.5	19 82	2 650
27.3	1 2314	27	332.5	20.76	2 775
28 2	1 2416	28	347 6	21.70	2 901
29 2	1 2518	29	363.0	22.66	3 029
30.1	1.2622	30	378 7	23 64	3.160
31.1	1.2730	31	394 6	24 64	3 293
32 1	1.2838	32	410 8	25.65	3 428
33 0	1.2946	33	427 2	26.67	3.565
33 9	1 3054	34	443 8	27.71	3.704
34.9	1 3164	35	460 7	28 76	3.845
35.8	1.3280	36	478 1	29 85	3.990
36.8	1.3396	37	495 7	30 94	4.136
37.7	1.3512	38	513 5	32 05	4.285
38 6	1.3628	39	531 5	33.18	4.435
39 5	1.3746	40	549 8	34 32	4.589
40.4	1.3864	41	568.4	35.49	4.744
41.3	1.3982	42	587.2	36.66	4.901

FERRIC NITRATE (Continued)

Specific Gravity of Aqueous Ferric Nitrate Solutions at 17.5° C. (Franz)

Bé.	Sp. gr.	Per cent $Fe(NO_3)_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
42.2	1.4100	43	606.3	37.85	5.060
43.0	1.4218	44	625.6	39.05	5.221
43.9	1.4338	45	645.2	40.28	5.384
44.8	1.4465	46	665.4	41.54	5.553
45.6	1 4592	47	685.8	42.81	5.723
46.5	1.4719	48	706.5	44.11	5.896
47.3	1 4846	49	727.5	45.41	6.071
48.2	1.4972	50	748.6	46.73	6.247
49.1	1 5122	51	771.2	48.15	6.436
50.1	1.5272	52	794.1	49.58	6.627
51.0	1.5422	53	817.4	51 03	6.821
51.9	1.5572	54	840.9	52.49	7.017
52.8	1.5722	55	864.7	53.98	7.216
53.8	1.5892	56	890.0	55.56	7.427
54.7	1.6062	57	915.5	57.15	7.640
55.7	1.6232	58	941.5	58.77	7.857
56.6	1.6402	59	967.7	60.41	8.076
57.5	1.6572	60	994.3	62.07	8.298
58.5	1.6764	61	1023	63.84	8.534
59.5	1 6956	62	1051	65.63	8 773
60.4	1.7148	63	1080	67.44	9 016
61.4	1.7340	64	1110	69.28	9.261
62.3	1.7532	65	1140	71.14	9.510

FERRIC SULFATE

Specific Gravity of Aqueous Ferric Sulfate Solutions at $\frac{17.5°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $Fe_2(SO_4)_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.3	1.016	2	20.32	1.269	0.1696
4.7	1.033	4	41.32	2.579	0.3448
6.9	1.050	6	63.00	3.933	0.5258
9.1	1.067	8	85.36	5.329	0.7124
11 2	1.084	10	108.4	6.767	0.9046
13.5	1.103	12	132.4	8.263	1.105
15.8	1.122	14	157.1	9.806	1.311
17.9	1.141	16	182.6	11.40	1.524
20.1	1.161	18	209.0	13.05	1 744
22.2	1.181	20	236.2	14.75	1.971
28.2	1.241	25	310.3	19.37	2.590
34.1	1.307	30	392.1	24.48	3.272
39.6	1.376	35	481.6	30.06	4.019
44.9	1.449	40	579.6	36.18	4 837
50.1	1.528	45	687.6	42.92	5 738
55.1	1.613	50	806.5	50.35	6.730
59.9	1 703	55	936.7	58.47	7.817
64.4	1.798	60	1079	67.35	9.003

FERROUS SULFATE

Specific Gravity of Aqueous Ferrous Sulfate Solutions at $\frac{18°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $FeSO_4$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.1	1.0007	0.2	2.001	0.1249	0.0167
0.4	1.0028	0.4	4.011	0.2504	0.0335
0.7	1.0046	0.6	6.028	0.3763	0.0503
0.9	1.0065	0.8	8.052	0.5027	0.0672
1.2	1.0085	1.0	10.09	0.6296	0.0842
2.6	1.0180	2	20.36	1.271	0.1699
5.2	1.0375	4	41.50	2.591	0.3463
7.9	1.0575	6	63.45	3.961	0.5295
10.6	1.0785	8	86.28	5.386	0.7200
13.2	1.1000	10	110.0	6.867	0.9180
15.8	1.1220	12	134.6	8.405	1.124
18.3	1.1445	14	160.2	10.00	1.337
20.8	1.1675	16	186.8	11.66	1.559
23.2	1.1905	18	214.3	13.38	1.788
25.5	1.2135	20	242.7	15.15	2.025

Bé.	Sp. gr.	Per cent $FeSO_4 + 7H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.1	1.0007	0.366	3.663	0.2287	0.0306
0.4	1.0028	0.732	7.341	0.4583	0.0613
0.7	1.0046	1.10	11.03	0.6887	0.0921
0.9	1.0065	1.46	14.74	0.9200	0.1230
1.2	1.0085	1.83	18.46	1.152	0.1540
2.6	1.0180	3.66	37.26	2.326	0.3110
5.2	1.0375	7.32	75.95	4.742	0.6339
7.9	1.0575	11.0	116.1	7.249	0.9691
10.6	1.0785	14.6	157.9	9.858	1.318
13.2	1.1000	18.3	201.3	12.57	1.680
15.8	1.1220	22.0	246.4	15.38	2.056
18.3	1.1445	25.6	293.3	18.31	2.447
20.8	1.1675	29.3	341.9	21.34	2.853
23.2	1.1905	32.9	392.2	24.48	3.273
25.5	1.2135	36.6	444.2	27.73	3.707

FORMIC ACID

Specific Gravity of Aqueous Formic Acid Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent HCO_2H	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
....	0.9982	0	....	......	......
0.3	1.0019	1	10.02	0.6255	0.0836
0.6	1.0044	2	20.09	1.254	0.1676
1.0	1.0070	3	30.21	1.886	0.2521
1.3	1.0093	4	40.37	2.520	0.3369
1.6	1.0115	5	50.58	3.157	0.4221
2.0	1.0141	6	60.85	3.798	0.5078
2.4	1.0170	7	71.19	4.444	0.5941
2.8	1.0196	8	81.57	5.092	0.6807
3.1	1.0221	9	91.99	5.743	0.7677
3.5	1.0246	10	102.5	6.396	0.8551
3.8	1.0271	11	113.0	7.053	0.9429
4.2	1.0296	12	123.6	7.713	1.031
4.5	1.0321	13	134.2	8.376	1.120
4.8	1.0345	14	144.8	9.041	1.209
5.2	1.0370	15	155.6	9.711	1.298
5.5	1.0393	16	166.3	10.38	1.388
5.8	1.0417	17	177.1	11.06	1.478
6.1	1.0441	18	187.9	11.73	1.568
6.4	1.0464	19	198.8	12.41	1.659
6.8	1.0488	20	209.8	13.09	1.750
7.1	1.0512	21	220.8	13.78	1.842
7.4	1.0537	22	231.8	14.47	1.935
7.7	1.0561	23	242.9	15.16	2.027
8.0	1.0585	24	254.0	15.86	2.120
8.3	1.0609	25	265.2	16.56	2.213
8.6	1.0633	26	276.5	17.26	2.307
8.9	1.0656	27	287.7	17.96	2.401
9.3	1.0681	28	299.1	18.67	2.496
9.6	1.0705	29	310.4	19.38	2.591
9.9	1.0729	30	321.9	20.09	2.686
10.2	1.0753	31	333.3	20.81	2.782
10.5	1.0777	32	344.9	21.53	2.878
10.7	1.0800	33	356.4	22.25	2.974
11.0	1.0823	34	368.0	22.97	3.071
11.3	1.0847	35	379.6	23.70	3.168
11.6	1.0871	36	391.4	24.43	3.266
11.9	1.0895	37	403.1	25.17	3.364
12.2	1.0919	38	414.9	25.90	3.463
12.5	1.0940	39	426.7	26.64	3.561
12.7	1.0963	40	438.5	27.38	3.660
13.1	1.0990	41	450.6	28.13	3.760
13.4	1.1015	42	462.6	28.88	3.861
13.6	1.1038	43	474.6	29.63	3.961
13.9	1.1062	44	486.7	30.38	4.062
14.2	1.1085	45	498.8	31.14	4.163
14.5	1.1108	46	511.0	31.90	4.264
14.7	1.1130	47	523.1	32.66	4.365
15.0	1.1157	48	535.5	33.43	4.469
15.4	1.1185	49	548.1	34.21	4.574
15.6	1.1207	50	560.4	34.98	4.676
15.8	1.1223	51	572.4	35.73	4.777
16.0	1.1244	52	584.7	36.50	4.879
16.3	1.1269	53	597.3	37.28	4.984
16.6	1.1295	54	609.9	38.08	5.090

FORMIC ACID (Continued)

Specific Gravity of Aqueous Formic Acid Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent HCO_2H	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
16.9	1.1320	55	622.6	38.87	5.196
17.2	1.1342	56	635.2	39.65	5.300
17.4	1.1361	57	647.6	40.43	5.404
17.6	1.1381	58	660.1	41.21	5 509
17.8	1.1401	59	672.7	41.99	5.613
18.1	1.1424	60	685.4	42.79	5.720
18.3	1.1448	61	698.3	43.59	5.828
18.6	1.1473	62	711.3	44.41	5.936
18.8	1.1493	63	724.1	45.20	6.042
19.1	1.1517	64	737.1	46.01	6.151
19.4	1.1543	65	750.3	46.84	6.261
19.6	1.1565	66	763.3	47.65	6.370
19.8	1.1584	67	776.1	48.45	6.477
20.0	1.1604	68	789.1	49 26	6.585
20.3	1.1628	69	802.3	50 09	6.696
20.6	1.1655	70	815.9	50.93	6.808
20 8	1.1677	71	829.1	51.76	6.919
21.1	1.1702	72	842.5	52.60	7.031
21.4	1.1728	73	856.1	53.45	7.145
21.6	1.1752	74	869.6	54.29	7.257
21.8	1.1769	75	882.7	55.10	7.366
22.0	1.1785	76	895.7	55 91	7.474
22.1	1.1801	77	908 7	56.73	7.583
22.3	1.1818	78	921.8	57.55	7.693
22.5	1.1837	79	935.1	58.38	7.804
22.7	1 1860	80	948.8	59.23	7 918
22.9	1.1876	81	962.0	60.05	8 028
23.1	1.1896	82	975.5	60.90	8.141
23.3	1.1914	83	988.9	61.73	8.252
23.5	1.1929	84	1002	62.55	8.362
23.7	1.1953	85	1016	63 43	8.479
23.9	1.1976	86	1030	64.30	8.595
24.1	1.1994	87	1043	65.14	8 708
24.3	1.2012	88	1057	65 99	8.821
24.5	1.2028	89	1070	66.83	8.933
24.6	1.2044	90	1084	67.67	9.046
24.8	1.2059	91	1097	68.51	9.158
25.0	1.2078	92	1111	69.37	9.273
25.2	1.2099	93	1125	70.24	9.390
25.3	1.2117	94	1139	71.10	9.505
25.6	1.2140	95	1153	72.00	9.625
25.7	1.2158	96	1167	72.86	9.740
25.9	1.2170	97	1180	73.69	9 851
26.0	1.2183	98	1194	74 53	9 964
26.2	1.2202	99	1208	75.41	10.08
26.3	1.2212	100	1221	76.24	10.19

GLYCEROL

Specific Gravity of Aqueous Glycerol (Glycerin) Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $C_3H_8O_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
....	0.9982	0	......	....	....
0.1	1.0006	1	10.01	0.6246	0.0835
0.4	1 0030	2	20.06	1.252	0.1674
0.8	1.0053	3	30.16	1.883	0.2517
1.1	1 0077	4	40 31	2.516	0.3364
1.5	1 0101	5	50.51	3.153	0.4215
1.8	1 0125	6	60.75	3.792	0.5070
2.1	1 0149	7	71.04	4.435	0.5929
2.5	1.0173	8	81.38	5.081	0.6792
2.8	1.0197	9	91.77	5.729	0.7659
3.1	1.0221	10	102.2	6.381	0.8530
3.5	1 0246	11	112.7	7.036	0 9406
3.8	1.0271	12	123.3	7.694	1.029
4.1	1 0295	13	133.8	8.355	1.117
4.5	1.0320	14	144.5	9.019	1.206
4 8	1.0345	15	155.2	9.687	1.295
5.2	1.0370	16	165.9	10.36	1.385
5.5	1.0395	17	176.7	11.03	1.475
5.8	1.0420	18	187.6	11.71	1.565
6.2	1.0445	19	198.5	12.39	1.656
6 5	1 0470	20	209.4	13.07	1.747
6 8	1 0495	21	220.4	13.76	1.839
7 2	1 0520	22	231.4	14.45	1.931
7.5	1.0545	23	242.5	15.14	2.024
7 8	1.0571	24	253.7	15.84	2.117
8.2	1.0597	25	264.9	16.54	2.211
8.5	1.0622	26	276.2	17.24	2.305
8.8	1.0648	27	287.5	17.95	2.399
9 2	1.0674	28	298.9	18.66	2.494
9.5	1 0700	29	310.3	19.37	2.590
9.8	1 0727	30	321.8	20.09	2.686
10.2	1 0753	31	333.3	20 81	2.782
10 5	1 0780	32	345 0	21.53	2 879
10 8	1 0806	33	356.6	22.26	2.976
11.2	1 0833	34	368.3	22.99	3.074
11.5	1 0860	35	380 1	23.73	3.172
11.8	1 0887	36	391 9	24.47	3.271
12 1	1 0914	37	403 8	25.21	3.370
12.5	1 0941	38	415 8	25 95	3.470
12 8	1.0968	39	427.8	26.70	3.570
13 1	1 0995	40	439 8	27.46	3.670
13.4	1 1022	41	451 9	28.21	3.771
13.8	1.1049	42	464.1	28.97	3.873
14.1	1.1075	43	476.2	29.73	3 974
14 4	1.1102	44	488.5	30.49	4.077
14.7	1 1128	45	500 8	31.26	4.179
15.0	1 1155	46	513.1	32.03	4 282
15.3	1 1182	47	525 6	32 81	4.386
15.6	1.1209	48	538 0	33.59	4.490
16 0	1.1236	49	550 6	34.37	4.595
16.3	1 1263	50	563.2	35.16	4.700
16.6	1.1290	51	575 8	35.94	4.805
16.9	1.1317	52	588.5	36.74	4.911
17.2	1.1344	53	601.2	37.53	5.017
17.5	1.1371	54	614.0	38.33	5.124

GLYCEROL (Continued)

Specific Gravity of Aqueous Glycerol (Glycerin) Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $C_3H_8O_3$	G. per liter	Lbs. per cu. ft.	Lbs per gal
17.8	1.1398	55	626.9	39.13	5.232
18.1	1.1425	56	639.8	39.94	5.339
18.4	1.1452	57	652.8	40.75	5.447
18.7	1.1479	58	665.8	41.56	5.550
19.0	1.1506	59	678.9	42.38	5.665
19.3	1.1533	60	692.0	43.20	5.775
19.6	1.1560	61	705.2	44.02	5.885
19.9	1.1587	62	718.4	44.85	5.995
20.2	1.1614	63	731.7	45.68	6.106
20.5	1.1642	64	745.1	46.51	6.218
20.8	1.1670	65	758.6	47.35	6.330
21.0	1.1697	66	772.0	48.19	6.443
21.3	1.1724	67	785.5	49.04	6.555
21.6	1.1752	68	799.1	49.89	6.669
21.9	1.1780	69	812.8	50.74	6.783
22.2	1.1808	70	826.6	51.60	6.898
22.5	1.1836	71	840.4	52.46	7.013
22.8	1.1863	72	854.1	53.32	7.128
23.1	1.1890	73	868.0	54.18	7.243
23.3	1.1917	74	881.9	55.05	7.359
23.6	1.1944	75	895.8	55.92	7.476
23.9	1.1971	76	909.8	56.80	7.592
24.2	1.1998	77	923.8	57.67	7.710
24.4	1.2025	78	938.0	58.55	7.827
24.7	1.2052	79	952.1	59.44	7.945
25.0	1.2079	80	966.3	60.32	8.064
25.2	1.2106	81	980.6	61.22	8.183
25.5	1.2133	82	994.9	62.11	8.303
25.8	1.2160	83	1009	63.01	8.423
26.0	1.2187	84	1024	63.91	8.543
26.3	1.2214	85	1038	64.81	8.664
26.5	1.2241	86	1053	65.72	8.785
26.8	1.2268	87	1067	66.63	8.907
27.1	1.2294	88	1082	67.54	9.028
27.3	1.2320	89	1096	68.45	9.150
27.6	1.2347	90	1111	69.37	9.273
27.8	1.2374	91	1126	70.29	9.397
28.1	1.2401	92	1141	71.22	9.521
28.3	1.2428	93	1156	72.15	9.645
28.6	1.2455	94	1171	73.09	9.770
28.8	1.2482	95	1186	74.03	9.896
29.1	1.2508	96	1201	74.96	10.02
29.3	1.2534	97	1216	75.90	10.15
29.5	1.2559	98	1231	76.83	10.27
29.8	1.2584	99	1246	77.77	10.40
30.0	1.2609	100	1261	78.71	10.52

HYDROCHLORIC ACID

Specific Gravity of Aqueous Hydrochloric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent HCl	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0032	1	10.03	0.6263	0.0837
1.2	1.0082	2	20.16	1.259	0.1683
2.6	1.0181	4	40.72	2.542	0.3399
3.9	1.0279	6	61.67	3.850	0.5147
5.3	1.0376	8	83.01	5.182	0.6927
6.6	1.0474	10	104 7	6.539	0.8741
7.9	1.0574	12	126.9	7.921	1.059
9.2	1.0675	14	149.5	9.330	1.247
10.4	1.0776	16	172.4	10.76	1.439
11.7	1.0878	18	195.8	12.22	1.634
12 9	1.0980	20	219.6	13.71	1.833
14 2	1.1083	22	243.8	15.22	2.035
15.4	1.1187	24	268.5	16.76	2.241
16.6	1.1290	26	293 5	18.32	2.450
17 7	1.1392	28	319.0	19.91	2.662
18.8	1.1493	30	344.8	21.52	2.877
19 9	1.1593	32	371.0	23.16	3.096
21 0	1.1691	34	397.5	24.81	3.317
22.0	1.1789	36	424.4	26.49	3.542
23 0	1.1885	38	451.6	28.19	3.769
24 0	1.1980	40	479.2	29.92	3.999

HYDROCHLORIC ACID

Authority — W. C. Ferguson

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}$$

Baumé Hydrometers for use with this table must be graduated by the above formula which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

10° – 15° Bé. — 1/40° Bé. or .0002 Sp. Gr. for 1° F.
15° – 22° Bé. — 1/30° Bé. or .0003 " " " 1° F.
22° – 25° Bé. — 1/28° Bé. or .00035 " " " 1° F.

Bé.°	Sp. gr.	Tw.°	Per cent HCl	Bé.°	Sp. gr.	Tw.°	Per cent HCl
1.00	1.0069	1.38	1.40	10.25	1.0761	15.22	15.22
2.00	1.0140	2.80	2.82	10.50	1.0781	15.62	15.62
3.00	1.0211	4.22	4.25	10.75	1.0801	16.02	16.01
4.00	1.0284	5.68	5.69	11.00	1.0821	16.42	16.41
5.00	1.0357	7.14	7.15	11.25	1.0841	16.82	16.81
5.25	1.0375	7.50	7.52	11.50	1.0861	17.22	17.21
5.50	1.0394	7.88	7.89	11.75	1.0881	17.62	17.61
5.75	1.0413	8.26	8.26	12.00	1.0902	18.04	18.01
6.00	1.0432	8.64	8.64	12.25	1.0922	18.44	18.41
6.25	1.0450	9.00	9.02	12.50	1.0943	18.86	18.82
6.50	1.0469	9.38	9.40	12.75	1.0964	19.28	19.22
6.75	1.0488	9.76	9.78	13.00	1.0985	19.70	19.63
7.00	1.0507	10.14	10.17	13.25	1.1006	20.12	20.04
7.25	1.0526	10.52	10.55	13.50	1.1027	20.54	20.45
7.50	1.0545	10.90	10.94	13.75	1.1048	20.96	20.86
7.75	1.0564	11.28	11.32	14.00	1.1069	21.38	21.27
8.00	1.0584	11.68	11.71	14.25	1.1090	21.80	21.68
8.25	1.0603	12.06	12.09	14.50	1.1111	22.22	22.09
8.50	1.0623	12.46	12.48	14.75	1.1132	22.64	22.50
8.75	1.0642	12.84	12.87	15.00	1.1154	23.08	22.92
9.00	1.0662	13.24	13.26	15.25	1.1176	23.52	23.33
9.25	1.0681	13.62	13.65	15.50	1.1197	23.94	23.75
9.50	1.0701	14.02	14.04	15.75	1.1219	24.38	24.16
9.75	1.0721	14.42	14.43	16.0	1.1240	24.80	24.57
10.00	1.0741	14.82	14.83	16.1	1.1248	24.96	24.73

HYDROCHLORIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HCl	Bé.°	Sp. gr.	Tw.°	Per cent HCl
16.2	1.1256	25.12	24.90	20.9	1.1684	33.68	33.12
16.3	1.1265	25.30	25.06	21.0	1.1694	33.88	33.31
16.4	1.1274	25.48	25.23	21.1	1.1703	34.06	33.50
16.5	1.1283	25.66	25.39	21.2	1.1713	34.26	33.69
16.6	1.1292	25.84	25.56	21.3	1.1722	34.44	33.88
16.7	1.1301	26.02	25.72	21.4	1.1732	34.64	34.07
16.8	1.1310	26.20	25.89	21.5	1.1741	34.82	34.26
16.9	1.1319	26.38	26.05	21.6	1.1751	35.02	34.45
17.0	1.1328	26.56	26.22	21.7	1.1760	35.20	34.64
17.1	1.1336	26.72	26.39	21.8	1.1770	35.40	34.83
17.2	1.1345	26.90	26.56	21.9	1.1779	35.58	35.02
17.3	1.1354	27.08	26.73	22.0	1.1789	35.78	35.21
17.4	1.1363	27.26	26.90	22.1	1.1798	35.96	35.40
17.5	1.1372	27.44	27.07	22.2	1.1808	36.16	35.59
17.6	1.1381	27.62	27.24	22.3	1.1817	36.34	35.78
17.7	1.1390	27.80	27.41	22.4	1.1827	36.54	35.97
17.8	1.1399	27.98	27.58	22.5	1.1836	36.72	36.16
17.9	1.1408	28.16	27.75	22.6	1.1846	36.92	36.35
18.0	1.1417	28.34	27.92	22.7	1.1856	37.12	36.54
18.1	1.1426	28.52	28.09	22.8	1.1866	37.32	36.73
18.2	1.1435	28.70	28.26	22.9	1.1875	37.50	36.93
18.3	1.1444	28.88	28.44	23.0	1.1885	37.70	37.14
18.4	1.1453	29.06	28.61	23.1	1.1895	37.90	37.36
18.5	1.1462	29.24	28.78	23.2	1.1904	38.08	37.58
18.6	1.1471	29.42	28.95	23.3	1.1914	38.28	37.80
18.7	1.1480	29.60	29.13	23.4	1.1924	38.48	38.03
18.8	1.1489	29.78	29.30	23.5	1.1934	38.68	38.26
18.9	1.1498	29.96	29.48	23.6	1.1944	38.88	38.49
19.0	1.1508	30.16	29.65	23.7	1.1953	39.06	38.72
19.1	1.1517	30.34	29.83	23.8	1.1963	39.26	38.95
19.2	1.1526	30.52	30.00	23.9	1.1973	39.46	39.18
19.3	1.1535	30.70	30.18	24.0	1.1983	39.66	39.41
19.4	1.1544	30.88	30.35	24.1	1.1993	39.86	39.64
19.5	1.1554	31.08	30.53	24.2	1.2003	40.06	39.86
19.6	1.1563	31.26	30.71	24.3	1.2013	40.26	40.09
19.7	1.1572	31.44	30.90	24.4	1.2023	40.46	40.32
19.8	1.1581	31.62	31.08	24.5	1.2033	40.66	40.55
19.9	1.1590	31.80	31.27	24.6	1.2043	40.86	40.78
20.0	1.1600	32.00	31.45	24.7	1.2053	41.06	41.01
20.1	1.1609	32.18	31.64	24.8	1.2063	41.26	41.24
20.2	1.1619	32.38	31.82	24.9	1.2073	41.46	41.48
20.3	1.1628	32.56	32.01	25.0	1.2083	41.66	41.72
20.4	1.1637	32.74	32.19	25.1	1.2093	41.86	41.99
20.5	1.1647	32.94	32.38	25.2	1.2103	42.06	42.30
20.6	1.1656	33.12	32.56	25.3	1.2114	42.28	42.64
20.7	1.1666	33.32	32.75	25.4	1.2124	42.48	43.01
20.8	1.1675	33.50	32.93	25.5	1.2134	42.68	43.40

HYDROCYANIC ACID

Specific Gravity of Aqueous Hydrocyanic Acid Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent HCN	G. per liter	Lbs. per cu. ft.	Lbs. per gal
54.4	0.759	80	607.2	37.91	5 067
56.2	0.752	82	616.6	38.49	5 146
57.9	0.745	84	625.8	39.07	5 222
59.7	0.738	86	634.7	39.62	5 297
61.5	0.731	88	643.3	40.16	5 368
63.4	0.724	90	651.6	40.68	5.438
65.3	0.717	92	659.6	41.18	5.505
66.9	0.711	94	668.3	41.72	5 577
68.9	0.704	96	675.8	42.19	5 640
70.9	0.697	98	683.1	42.64	5 700
72.6	0.691	100	691.0	43.14	5.767

Specific Gravity of Aqueous Hydrocyanic Acid Solutions at $\frac{15^\circ}{4^\circ}$ C.

Bé.	Sp. gr.	Per cent HCN	G. per liter	Lbs. per cu. ft.	Lbs. per gal
10 3	0.998	1	9 98	0 6230	0 0833
10.6	0.996	2	19 92	1.244	0.1662
11.0	0 993	4	39 72	2 480	0 3315
11.4	0.989	6	59.34	3 704	0 4952
12.3	0.984	8	78.72	4.914	0 6569
13.2	0 978	10	97.80	6 105	0 8162
14.2	0.971	12	116.5	7.274	0 9724
15.2	0 964	14	135.0	8 425	1 126
16.4	0 956	16	153.0	9 549	1 276

HYDROFLUORIC ACID

Specific Gravity of Aqueous Hydrofluoric Acid Solution at $\frac{0°}{4°}$ C.*

Bé.	Sp. gr.	Per cent HF	Grams per liter	Lbs. per cu. ft.	Lbs. per gal.
2.8	1.020	5	51.00	3.184	0.4256
5 6	1 040	10	104.0	6.492	0.8679
8 2	1.060	15	159.0	9.926	1.327
10.7	1 080	20	216.0	13.48	1.803
13.1	1.099	25	274.8	17.15	2.293
15.4	1.119	30	335.7	20.96	2.801
17.7	1.139	35	398.7	24.89	3 327
19.9	1.159	40	463.6	28.94	3.869
21.9	1 178	45	530.1	33.09	4.424
24 0	1 198	50	599.0	37.39	4 999
25.9	1.217	55	669.4	41.78	5.586
27.6	1.235	60	741 0	46.26	6 184
28.8	1 248	65	811.2	50.64	6.770
29.7	1 258	70	880.6	54 97	7 349
30.0	1.261	72	907.9	56.68	7.577
30.1	1 262	74	933.9	58.30	7 793
30.1	1.262	76	959.1	59.87	8 004
30.0	1.261	78	983.6	61.40	8 208
29.8	1 259	80	1007	62.88	8 405
29 5	1.255	82	1029	64.24	8.588
28.6	1.246	84	1047	65.34	8.734
27.4	1.233	86	1060	66.20	8 849
25.5	1.213	88	1067	66.64	8.908
21.9	1.178	90	1060	66.18	8 848
11 9	1.089	95	1035	64.58	8 633
0 07	1.0005	100	1001	62.46	8 349

Specific Gravity of Aqueous Hydrofluoric Acid Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent HF	Grams per liter	Lbs. per cu. ft.	Lbs. per gal.
2.4	1 017	5	50.85	3.174	0.4244
4.9	1.035	10	103.5	6 461	0.8637
7.3	1 053	15	158.0	9.860	1.318
9.5	1.070	20	214.0	13.36	1 786
11.5	1 086	25	271.5	16.95	2.266
13.3	1.101	30	330.3	20.62	2 756
15.1	1.116	35	390.6	24.38	3.260
16.7	1 130	40	452.0	28.22	3 772
18 1	1.143	45	514.4	32.11	4.292
19.5	1.155	50	577.5	36.05	4.819

HYDROFLUOSILICIC ACID

Specific Gravity of Aqueous Hydrofluosilicic Acid Solutions at 17.5° C. (Stolba)

Bé.	Sp. gr.	Per cent H_2SiF_6	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0040	0.5	5.020	0.3134	0 0419
1.2	1.0080	1.0	10.08	0.6293	0.0841
1.7	1.0120	1.5	15.18	0.9476	0.1267
2.3	1.0161	2.0	20.32	1.269	0.1696
2.9	1.0201	2.5	25.50	1.592	0.2128
3.4	1.0242	3.0	30.73	1.918	0.2564
4.0	1.0283	3.5	35.99	2.247	0.3004
4.6	1.0324	4.0	41.30	2.578	0.3446
5.1	1.0366	4.5	46.65	2.912	0.3893
5.7	1.0407	5.0	52.04	3.248	0.4342
6.2	1.0449	5.5	57.47	3.588	0.4796
6.8	1.0491	6.0	62.95	3.930	0 5253
7.3	1.0533	6.5	68.46	4.274	0 5714
7.9	1.0576	7.0	74.03	4.622	0.6178
8.4	1.0618	7.5	79.64	4.971	0.6646
9.0	1.0661	8.0	85.29	5.324	0.7118
9.5	1.0704	8.5	90.98	5.680	0.7593
10.1	1.0747	9.0	96.72	6.038	0 8072
10.6	1.0791	9.5	102.5	6.400	0.8555
11.2	1.0834	10.0	108.3	6.763	0.9041
11.7	1.0878	10 5	114.2	7.130	0.9532
12.2	1.0922	11.0	120.1	7.500	1.003
12.8	1.0966	11.5	126.1	7.873	1.052
13.3	1.1011	12.0	132.1	8.249	1.103
13.8	1.1055	12.5	138.2	8.627	1.153
14.4	1.1100	13.0	144.3	9.008	1.204
14.9	1.1145	13.5	150.5	9.393	1.256
15.4	1.1190	14.0	156.7	9.780	1.307
16.0	1.1236	14.5	162.9	10.17	1.360
16.5	1.1281	15.0	169.2	10.56	1.412
17.0	1.1327	15.5	175.6	10.96	1.465
17.5	1.1373	16.0	182.0	11.36	1.519
18.0	1.1419	16.5	188.4	11.76	1.572
18.5	1.1466	17.0	194.9	12.17	1.627
19.0	1.1512	17.5	201.5	12.58	1.681
19.6	1.1559	18.0	208.1	12.99	1.736
20.1	1.1606	18.5	214.7	13.40	1.792
20.6	1.1653	19.0	221.4	13.82	1.848
21.1	1.1701	19.5	228.2	14.24	1.904
21.6	1.1748	20.0	235.0	14.67	1.961
22.1	1.1796	20.5	241.8	15.10	2.018
22.6	1.1844	21.0	248.7	15.53	2.076

HYDROFLUOSILICIC ACID (Continued)

SPECIFIC GRAVITY OF AQUEOUS HYDROFLUOSILICIC ACID SOLUTIONS AT 17.5° C. (STOLBA)

Bé.	Sp. gr.	Per cent H_2SiF_6	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
23.1	1.1892	21.5	255.7	15.96	2.134
23.6	1.1941	22.0	262.7	16.40	2.192
24.1	1.1989	22.5	269.8	16.84	2.251
24.6	1.2038	23.0	276.9	17.28	2.311
25.0	1.2087	23.5	284.0	17.73	2.370
25.5	1 2136	24.0	291.3	18.18	2.431
26.0	1.2186	24.5	298.6	18.64	2.492
26.5	1 2235	25.0	305.9	19.09	2.553
27.0	1.2285	25.5	313.3	19.56	2.614
27.5	1.2335	26.0	320.7	20.02	2.676
27.9	1.2385	26.5	328.2	20.49	2.739
28.4	1.2436	27.0	335.8	20.96	2.802
28.9	1.2486	27.5	343.4	21.44	2.865
29.3	1.2537	28.0	351.0	21.91	2.929
29.8	1.2588	28.5	358.8	22.40	2.994
30.3	1.2639	29.0	366.5	22.88	3.059
30.7	1.2691	29.5	374.4	23.37	3.124
31.2	1.2742	30.0	382.3	23.86	3.190
31.7	1.2794	30.5	390.2	24.36	3.256
32 1	1.2846	31.0	398.2	24.86	3.323
32.6	1.2898	31.5	406.3	25.36	3.391
33.0	1.2951	32.0	414.4	25.87	3.459
33.5	1 3003	32.5	422.6	26.38	3.527
34.0	1 3056	33.0	430.8	26.90	3.596
34.4	1.3109	33.5	439.2	27.41	3.665
34.8	1 3162	34.0	447.5	27.94	3.735

MAGNESIUM CHLORIDE

Specific Gravity of Aqueous Magnesium Chloride Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $MgCl_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.1	1.0146	2	20.29	1.267	0.1693
4.4	1.0311	4	41.24	2.575	0.3442
6.6	1.0478	6	62.87	3.925	0.5247
8.8	1.0646	8	85.17	5.317	0.7107
10.9	1.0816	10	108.2	6.752	0.9026
13.1	1.0989	12	131.9	8.232	1.100
15.1	1.1164	14	156.3	9.757	1.304
17.2	1.1342	16	181.5	11.33	1.514
19.2	1.1523	18	207.4	12.95	1.731
21.1	1.1706	20	234.1	14.62	1.954
26.0	1.2184	25	304.6	19.02	2.542
30.7	1.2688	30	380.6	23.76	3.177

Bé.	Sp. gr.	Per cent $MgCl_2 + 6H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.1	1.0146	4.270	43.32	2.705	0.3616
4.4	1.0311	8.540	88.06	5.497	0.7349
6.6	1.0478	12.81	134.2	8.380	1.120
8.8	1.0646	17.08	181.8	11.35	1.518
10.9	1.0816	21.35	230.9	14.42	1.927
13.1	1.0989	25.62	281.6	17.58	2.350
15.1	1.1164	29.89	333.7	20.83	2.785
17.2	1.1342	34.16	387.5	24.19	3.233
19.2	1.1523	38 43	442.8	27.65	3.696
21.1	1.1706	42.70	499.9	31 21	4.172
26.0	1.2184	53.38	650.4	40.60	5.427
30.7	1.2688	64.05	812.7	50.73	6.782

MAGNESIUM CHLORIDE

Specific Gravity of Aqueous Magnesium Chloride Solutions at 14° C. (Oudemans)

Bé.	Sp. gr.	Per cent $MgCl_2 + 6H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0033	1	10.03	0.6263	0.0837
1.1	1.0073	2	20.15	1.258	0.1681
1.6	1.0113	3	30.34	1.894	0.2532
2.2	1.0154	4	40.62	2.536	0.3390
2.8	1.0194	5	50.97	3.182	0.4254
3.3	1.0234	6	61.40	3.833	0.5124
3.9	1.0274	7	71.92	4.490	0.6002
4.4	1.0314	8	82.51	5.151	0.6886
5.0	1.0355	9	93.20	5.818	0.7777
5.5	1.0395	10	104.0	6.489	0.8675
6.0	1.0435	11	114.8	7.166	0.9579
6.6	1.0476	12	125.7	7.848	1.049
7.1	1.0517	13	136.7	8.535	1.141
7.7	1.0558	14	147.8	9.227	1.234
8.2	1.0599	15	159.0	9.925	1.327
8.7	1.0641	16	170.3	10.63	1.421
9.3	1.0682	17	181.6	11.34	1.515
9.8	1.0724	18	193.0	12.05	1.611
10.3	1.0765	19	204.5	12.77	1.707
10.8	1.0807	20	216.1	13.49	1.804
11.4	1.0849	21	227.8	14.22	1.901
11.9	1.0891	22	239.6	14.96	2.000
12.4	1.0933	23	251.5	15.70	2.098
12.9	1.0976	24	263.4	16.44	2.198
13.4	1.1018	25	275.5	17.20	2.299
13.9	1.1061	26	287.6	17.95	2.400
14.4	1.1103	27	299.8	18.71	2.502
14.9	1.1146	28	312.1	19.48	2.604
15.4	1.1189	29	324.5	20.26	2.708
15.9	1.1232	30	337.0	21.04	2.812
16.4	1.1275	31	349.5	21.82	2.917
16.9	1.1319	32	362.2	22.61	3.023
17.4	1.1363	33	375.0	23.41	3.129
17.9	1.1407	34	387.8	24.21	3.237
18.4	1.1451	35	400.8	25.02	3.345
18.9	1.1495	36	413.8	25.83	3.453
19.4	1.1540	37	427.0	26.66	3.563
19.8	1.1584	38	440.2	27.48	3.673
20.3	1.1628	39	453.5	28.31	3.784
20.8	1.1673	40	466.9	29.15	3.897
21.3	1.1718	41	480.4	29.99	4.009
21.7	1.1763	42	494.0	30.84	4.123
22.2	1.1809	43	507.8	31.70	4.238
22.7	1.1855	44	521.6	32.56	4.353
23.2	1.1901	45	535.5	33.43	4.469
23.6	1.1948	46	549.6	34.31	4.587
24.1	1.1995	47	563.8	35.19	4.705
24.6	1.2042	48	578.0	36.08	4.824

MAGNESIUM CHLORIDE (Continued)

Specific Gravity of Aqueous Magnesium Chloride Solutions at 14° C. (Oudemans)

Bé.	Sp. gr.	Per cent $MgCl_2$	G. per liter	Lbs. per cu ft.	Lbs. per gal.
0.5	1.0033	0.47	4.699	0.2934	0.0392
1.1	1.0073	0.94	9.436	0.5891	0.0787
1.6	1.0113	1.41	14.21	0.8871	0.1186
2.2	1.0154	1.87	19.02	1.188	0.1588
2.8	1.0194	2.34	23.87	1.490	0.1992
3.3	1.0234	2.81	28.76	1.795	0.2400
3.9	1.0274	3.28	33.68	2.103	0.2811
4.4	1.0314	3.75	38.65	2.413	0.3225
5.0	1.0355	4.22	43.65	2.725	0.3643
5.5	1.0395	4.68	48.69	3.039	0.4063
6.0	1.0435	5.15	53.76	3.356	0 4487
6.6	1.0476	5.62	58.88	3.676	0.4914
7.1	1.0517	6.09	64.04	3.998	0.5344
7.7	1.0558	6.56	69.23	4.322	0.5777
8.2	1.0599	7.03	74.46	4.649	0.6214
8.7	1.0641	7.49	79.74	4.978	0.6655
9.3	1.0682	7.96	85.05	5.310	0 7098
9.8	1.0724	8.43	90.41	5.644	0.7545
10.3	1.0765	8.90	95.80	5.980	0.7995
10.8	1.0807	9.37	101.2	6.320	0.8448
11.4	1.0849	9.84	106.7	6.661	0.8905
11.9	1.0891	10.3	112.2	7.006	0.9365
12.4	1.0933	10.8	117.8	7.352	0.9829
12.9	1.0976	11.2	123.4	7.702	1.030
13.4	1.1018	11.7	129.0	8.054	1.077
13.9	1.1061	12.2	134.7	8.409	1.124
14.4	1.1103	12.6	140.4	8.765	1.172
14.9	1.1146	13.1	146.2	9.125	1.220
15.4	1.1189	13.6	152.0	9.487	1.268
15.9	1.1232	14.1	157.8	9.862	1.317
16.4	1.1275	14.5	163.7	10.22	1.366
16.9	1.1319	15.0	169.6	10.59	1.416
17.4	1.1363	15.5	175.6	10.96	1.466
17.9	1.1407	15.9	181.7	11.34	1.516
18.4	1.1451	16.4	187.7	11.72	1.567
18.9	1.1495	16.9	193.8	12.10	1.617
19.4	1.1540	17 3	200.0	12.48	1.669
19.8	1.1584	17.8	206.2	12.87	1.721
20.3	1.1628	18.3	212.4	13.26	1.773
20.8	1.1673	18.7	218.7	13.65	1.825
21.3	1.1718	19.2	225.0	14.05	1.878
21.7	1.1763	19.7	231.4	14.45	1.931
22.2	1.1809	20.1	237.8	14.85	1.985
22.7	1.1855	20.6	244.3	15.25	2.039
23.2	1.1901	21.1	250 8	15.66	2.093
23.6	1.1948	21.5	257.4	16.07	2.148
24.1	1.1995	22 0	264.1	16.48	2.204
24.6	1.2042	22.5	270 7	16.90	2.259

MAGNESIUM SULFATE

Specific Gravity of Aqueous Magnesium Sulfate Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent $MgSO_4$	G per liter	Lbs. per cu. ft.	Lbs. per gal.
2.6	1.0186	2	20.37	1.272	0.1700
5.5	1.0392	4	41 57	2.595	0.3469
8.2	1.0602	6	63 61	3.971	0.5309
10.9	1.0816	8	86.53	5.402	0.7221
13.6	1.1034	10	110.3	6.889	0.9208
16.2	1.1256	12	135.1	8.432	1.127
18.7	1.1484	14	160.8	10.04	1.342
21 3	1.1717	16	187.5	11.70	1.564
23.3	1.1955	18	215.2	13.43	1.796
26.1	1.2198	20	244.0	15.23	2.036
28 5	1.2447	22	273.8	17.09	2.285
30.8	1.2701	24	304.8	19.03	2.544
33 1	1 2961	26	337.0	21.04	2.812

Bé.	Sp gr.	Per cent $MgSO_4 + 7H_2O$	G. per liter	Lbs. per cu. ft.	Lbs per gal.
2 6	1.0186	4.095	41.71	2.604	0.3481
5 5	1.0392	8.190	85.11	5.314	0.7103
8.2	1.0602	12.29	130.3	8.131	1.087
10.9	1.0816	16 38	177 2	11.06	1.479
13.6	1.1034	20.48	225.9	14.10	1.886
16 2	1 1256	24.57	276.6	17.27	2.308
18.7	1.1484	28 67	329.2	20.55	2.747
21 3	1 1717	32 76	383.9	23.96	3.203
23 3	1.1955	36.86	440 6	27.51	3.677
26.1	1 2198	40.95	499.5	31.18	4.169
28.5	1.2447	45 05	560.7	35.00	4.679
30 8	1.2701	49.14	624.2	38.96	5.209
33.1	1.2961	53.24	690.0	43.08	5.758

NICKEL CHLORIDE

Specific Gravity of Aqueous Nickel Chloride Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent $NiCl_2$	G per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.008	1	10.08	0.6293	0.0841
2.6	1.018	2	20.36	1.271	0.1699
5.2	1.037	4	41.48	2.589	0.3462
7.8	1.057	6	63.42	3.959	0.5293
10.5	1.078	8	86.24	5.384	0.7197
13.1	1.099	10	109.9	6.861	0 9171
15.7	1.121	12	134.5	8.398	1.123
18.1	1.143	14	160.0	9.990	1 335
20.8	1.167	16	186.7	11.66	1.558
23.3	1.191	18	214.4	13.38	1.789
25.7	1.215	20	243.0	15.17	2 028
31.7	1.280	25	320.0	19.98	2.670
37.8	1.353	30	405.9	25.34	3.387

NICKEL NITRATE

Specific Gravity of Aqueous Nickel Nitrate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $Ni(NO_3)_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.1	1.015	2	20.30	1.267	0.1694
4.6	1.033	4	41.32	2.579	0.3448
6.9	1.050	6	63.00	3.933	0.5258
9.4	1.069	8	85.52	5.339	0.7137
11.7	1.088	10	108.8	6.792	0.9080
14.0	1.107	12	132.8	8.293	1.109
16.3	1.127	14	157.8	9.850	1.317
18.7	1.148	16	183.7	11.47	1.533
21.0	1.169	18	210.4	13.14	1.756
23.3	1.191	20	238.2	14.87	1.988
28.9	1.249	25	312.3	19.49	2.606
34.4	1.311	30	393.3	24.55	3.282
39.7	1.377	35	482.0	30.09	4.022

NICKEL SULFATE

Specific Gravity of Aqueous Nickel Sulfate Solutions at $\frac{18°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $NiSO_4$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.3	1.009	1	10.09	0.6299	0.0842
2.8	1.020	2	20.40	1.274	0.1702
5.8	1.042	4	41.68	2.602	0.3478
8.6	1.063	6	63.78	3.982	0 5323
11.4	1.085	8	86.80	5.419	0.7244
14.3	1.109	10	110.9	6.923	0.9255
17.0	1.133	12	136.0	8.488	1.135
19.8	1.158	14	162.1	10.12	1.353
22.4	1.183	16	189.3	11.82	1.580
25.1	1.209	18	217.6	13.59	1.816

NITRIC ACID

Specific Gravity of Aqueous Nitric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent HNO_3	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0036	1	10.04	0.6265	0.0838
1.3	1.0091	2	20.18	1.260	0.1684
2.1	1.0146	3	30.44	1.900	0.2540
2.9	1.0201	4	40.80	2.547	0.3405
3.6	1.0256	5	51.28	3.201	0.4279
4.4	1.0312	6	61.87	3.862	0.5163
5 2	1.0369	7	72.58	4.531	0.6057
5.9	1.0427	8	83.42	5.207	0.6961
6.7	1.0485	9	94.37	5.891	0.7875
7.5	1.0543	10	105.4	6.582	0.8798
8.2	1.0602	11	116.6	7.280	0.9732
9.0	1.0661	12	127.9	7.986	1.068
9.8	1.0721	13	139.4	8.701	1.163
10.5	1.0781	14	150.9	9.422	1.260
11.3	1.0842	15	162.6	10.15	1.357
12.0	1.0903	16	174.4	10.89	1.456
12.8	1.0964	17	186.4	11.64	1.555
13.5	1.1026	18	198.5	12 39	1.656
14.2	1.1088	19	210 7	13.15	1.758
15.0	1.1150	20	223 0	13.92	1.861
15.7	1 1213	21	235.5	14.70	1.965
16.4	1.1276	22	248 1	15.49	2.070
17.1	1.1340	23	260.8	16 28	2.177
17.9	1.1404	24	273.7	17.09	2.284
18.6	1.1469	25	286.7	17.90	2.393
19.4	1.1534	26	299.9	18 72	2.503
20 0	1 1600	27	313.2	19 55	2 614
20.7	1.1666	28	326.6	20.39	2.726
21.4	1.1733	29	340.3	21.24	2.840
22.1	1.1800	30	354 0	22.10	2.954
22.8	1.1867	31	367.9	22.97	3.070
23.5	1.1934	32	381.9	23.84	3.187
24.2	1.2002	33	396.1	24.73	3.305
24.9	1.2071	34	410.4	25.62	3.425
25.6	1.2140	35	424.9	26.53	3.546
26.2	1.2205	36	439.4	27.43	3.667
26.8	1.2270	37	454 0	28.34	3.789
27.5	1.2335	38	468 7	29.26	3.912
28.1	1.2399	39	483 6	30.19	4.035
28.7	1.2463	40	498.5	31.12	4.160
29.3	1.2527	41	513 6	32 06	4.286
29.8	1.2591	42	528.8	33 01	4.413
30.4	1.2655	43	544 2	33.97	4.541
31.0	1.2719	44	559.6	34 94	4.670
31.6	1.2783	45	575 2	35 91	4 800
32.1	1.2847	46	591.0	36.89	4.932
32.7	1.2911	47	606.8	37.88	5.064
33.2	1.2975	48	622.8	38.88	5.197
33.8	1.3040	49	639 0	39 89	5.332
34.3	1.3100	50	655.0	40 89	5.466
34.8	1.3160	51	671.2	41 90	5.601
35.3	1.3219	52	687.4	42.91	5.736
35.8	1.3278	53	703.7	43.93	5.873
36.3	1.3336	54	720.1	44.96	6.010

NITRIC ACID (Continued)

Specific Gravity of Aqueous Nitric Acid Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent HNO_3	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
36.7	1.3393	55	736.6	45.98	6.147
37.2	1.3449	56	753.1	47.02	6.285
37.6	1.3505	57	769.8	48.06	6.424
38.1	1.3560	58	786.5	49.10	6.563
38.5	1.3614	59	803.2	50.14	6.703
38.9	1.3667	60	820.0	51.19	6.843
39.3	1.3719	61	836.9	52.24	6.984
39.7	1.3769	62	853.7	53.29	7.124
40.1	1.3818	63	870.5	54.34	7.265
40.4	1.3866	64	887.4	55.40	7.406
40.8	1.3913	65	904.3	56.46	7.547
41.1	1.3959	66	921.3	57.51	7.688
41.5	1.4004	67	938.3	58.57	7.830
41.8	1.4048	68	955.3	59.63	7.972
42.1	1.4091	69	972.3	60.70	8.114
42.4	1.4134	70	989.4	61.76	8.257
42.7	1.4176	71	1006	62.83	8.399
43.0	1.4218	72	1024	63.91	8.543
43.3	1.4258	73	1041	64.98	8.686
43.6	1.4298	74	1058	66.05	8.830
43.9	1.4337	75	1075	67.13	8.973
44.1	1.4375	76	1093	68.20	9.117
44.4	1.4413	77	1110	69.28	9.262
44.7	1.4450	78	1127	70.36	9.406
44.9	1.4486	79	1144	71.44	9.550
45.1	1.4521	80	1162	72.52	9.694
45.4	1.4555	81	1179	73.60	9.839
45.6	1.4589	82	1196	74.68	9.983
45.8	1.4622	83	1214	75.76	10.13
46.1	1.4655	84	1231	76.85	10.27
46.3	1.4686	85	1248	77.93	10.42
46.5	1.4716	86	1266	79.01	10.56
46.7	1.4745	87	1283	80.08	10.71
46.8	1.4773	88	1300	81.16	10.85
47.0	1.4800	89	1317	82.23	10.99
47.2	1.4826	90	1334	83.30	11.14
47.4	1.4850	91	1351	84.36	11.28
47.5	1.4873	92	1368	85.42	11.42
47.6	1.4892	93	1385	86.46	11.56
47.8	1.4912	94	1402	87.51	11.70
47.9	1.4932	95	1419	88.56	11.84
48.0	1.4952	96	1435	89.61	11.98
48.2	1.4974	97	1452	90.67	12.12
48.4	1.5008	98	1471	91.82	12.27
48.7	1.5056	99	1491	93.05	12.44
49.2	1.5129	100	1513	94.45	12.63

NITRIC ACID

Authority — W. C. Ferguson

This table has been approved and adopted as a Standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

At 10°–20° Bé. — 1/30° Bé. or .00029 Sp. Gr. = 1° F.
20°–30° Bé. — 1/23° Bé. or .00044 " " = 1° F.
30°–40° Bé. — 1/20° Bé. or .00060 " " = 1° F.
40°–48.5° Bé. — 1/17° Bé. or .00084 " " = 1° F.

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
10.00	1.0741	14.82	12.86	15.25	1.1176	23.52	19.70
10.25	1.0761	15.22	13.18	15.50	1.1197	23.94	20.02
10.50	1.0781	15.62	13.49	15.75	1.1219	24.38	20.36
10.75	1.0801	16.02	13.81	16.00	1.1240	24.80	20.69
11.00	1.0821	16.42	14.13	16.25	1.1262	25.24	21.03
11.25	1.0841	16.82	14.44	16.50	1.1284	25.68	21.36
11.50	1.0861	17.22	14.76	16.75	1.1306	26.12	21.70
11.75	1.0881	17.62	15.07	17.00	1.1328	26.56	22.04
12.00	1.0902	18.04	15.41	17.25	1.1350	27.00	22.38
12.25	1.0922	18.44	15.72	17.50	1.1373	27.46	22.74
12.50	1.0943	18.86	16.05	17.75	1.1395	27.90	23.08
12.75	1.0964	19.28	16.39	18.00	1.1417	28.34	23.42
13.00	1.0985	19.70	16.72	18.25	1.1440	28.80	23.77
13.25	1.1006	20.12	17.05	18.50	1.1462	29.24	24.11
13.50	1.1027	20.54	17.38	18.75	1.1485	29.70	24.47
13.75	1.1048	20.96	17.71	19.00	1.1508	30.16	24.82
14.00	1.1069	21.38	18.04	19.25	1.1531	30.62	25.18
14.25	1.1090	21.80	18.37	19.50	1.1554	31.08	25.53
14.50	1.1111	22.22	18.70	19.75	1.1577	31.54	25.88
14.75	1.1132	22.64	19.02	20.00	1.1600	32.00	26.24
15.00	1.1154	23.08	19.36	20.25	1.1624	32.48	26.61

NITRIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HNO₃.	Bé.°	Sp. gr.	Tw.°	Per cent HNO₃.
20.50	1.1647	32.94	26.96	31.50	1.2775	55.50	43.89
20.75	1.1671	33.42	27.33	31.75	1.2804	56.08	44.34
21.00	1.1694	33.88	27.67	32.00	1.2832	56.64	44.78
21.25	1.1718	34.36	28.02	32.25	1.2861	57.22	45.24
21.50	1.1741	34.82	28.36	32.50	1.2889	57.78	45.68
21.75	1.1765	35.30	28.72	32.75	1.2918	58.36	46.14
22.00	1.1789	35.78	29.07	33.00	1.2946	58.92	46.58
22.25	1.1813	36.26	29.43	33.25	1.2975	59.50	47.04
22.50	1.1837	36.74	29.78	33.50	1.3004	60.08	47.49
22.75	1.1861	37.22	30.14	33.75	1.3034	60.68	47.95
23.00	1.1885	37.70	30.49	34.00	1.3063	61.26	48.42
23.25	1.1910	38.20	30.86	34.25	1.3093	61.86	48.90
23.50	1.1934	38.68	31.21	34.50	1.3122	62.44	49.35
23.75	1.1959	39.18	31.58	34.75	1.3152	63.04	49.83
24.00	1.1983	39.66	31.94	35.00	1.3182	63.64	50.32
24.25	1.2008	40.16	32.31	35.25	1.3212	64.24	50.81
24.50	1.2033	40.66	32.68	35.50	1.3242	64.84	51.30
24.75	1.2058	41.16	33.05	35.75	1.3273	65.46	51.80
25.00	1.2083	41.66	33.42	36.00	1.3303	66.06	52.30
25.25	1.2109	42.18	33.80	36.25	1.3334	66.68	52.81
25.50	1.2134	42.68	34.17	36.50	1.3364	67.28	53.32
25.75	1.2160	43.20	34.56	36.75	1.3395	67.90	53.84
26.00	1.2185	43.70	34.94	37.00	1.3426	68.52	54.36
26.25	1.2211	44.22	35.33	37.25	1.3457	69.14	54.89
26.50	1.2236	44.72	35.70	37.50	1.3488	69.76	55.43
26.75	1.2262	45.24	36.09	37.75	1.3520	70.40	55.97
27.00	1.2288	45.76	36.48	38.00	1.3551	71.02	56.52
27.25	1.2314	46.28	36.87	38.25	1.3583	71.66	57.08
27.50	1.2340	46.80	37.26	38.50	1.3615	72.30	57.65
27.75	1.2367	47.34	37.67	38.75	1.3647	72.94	58.23
28.00	1.2393	47.86	38.06	39.00	1.3679	73.58	58.82
28.25	1.2420	48.40	38.46	39.25	1.3712	74.24	59.43
28.50	1.2446	48.92	38.85	39.50	1.3744	74.88	60.06
28.75	1.2473	49.46	39.25	39.75	1.3777	75.54	60.71
29.00	1.2500	50.00	39.66	40.00	1.3810	76.20	61.38
29.25	1.2527	50.54	40.06	40.25	1.3843	76.86	62.07
29.50	1.2554	51.08	40.47	40.50	1.3876	77.52	62.77
29.75	1.2582	51.64	40.89	40.75	1.3909	78.18	63.48
30.00	1.2609	52.18	41.30	41.00	1.3942	78.84	64.20
30.25	1.2637	52.74	41.72	41.25	1.3976	79.52	64.93
30.50	1.2664	53.28	42.14	41.50	1.4010	80.20	65.67
30.75	1.2692	53.84	42.58	41.75	1.4044	80.88	66.42
31.00	1.2719	54.38	43.00	42.00	1.4078	81.96	67.18
31.25	1.2747	54.94	43.44	42.25	1.4112	82.24	67.95

NITRIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
42.50	1.4146	82.92	68.73	45.50	1.4573	91.46	79.03
42.75	1.4181	83.62	69.52	45.75	1.4610	92.20	80.04
43.00	1.4216	84.32	70.33	46.00	1.4646	92.92	81.08
43.25	1.4251	85.02	71.15	46.25	1.4684	93.68	82.18
43.50	1.4286	85.72	71.98	46.50	1.4721	94.42	83.33
43.75	1.4321	86.42	72.82	46.75	1.4758	95.16	84.48
44.00	1.4356	87.12	73.67	47.00	1.4796	95.92	85.70
44.25	1.4392	87.84	74.53	47.25	1.4834	96.68	86.98
44.50	1.4428	88.56	75.40	47.50	1.4872	97.44	88.32
44.75	1.4464	89.28	76.28	47.75	1.4910	98.20	89.76
45.00	1.4500	90.00	77.17	48.00	1.4948	98.96	91.35
45.25	1.4536	90.72	78.07	48.25	1.4987	99.74	93.13
				48.50	1.5026	100.52	95.11

OXALIC ACID

Specific Gravity of Aqueous Oxalic Acid Solutions at 17.5° C. (Gerlach)

Bé.	Sp. gr.	Per cent $H_2C_2O_4 + 2H_2O$	G per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0035	1	10.04	0.6265	0.0837
1.0	1.0070	2	20.14	1.257	0.1681
1.5	1.0105	3	30 32	1.892	0.2530
2.0	1.0140	4	40.56	2.532	0.3385
2.5	1.0175	5	50.88	3.176	0.4246
3.0	1.0210	6	61.26	3.824	0.5112
3.5	1.0245	7	71.72	4.477	0.5985
4.0	1.0280	8	82 24	5.134	0.6863
4.4	1.0315	9	92.84	5.795	0.7747
4.9	1.0350	10	103 5	6.461	0.8637
5.4	1.0385	11	114.2	7.131	0.9533
5.8	1.0420	12	125 0	7.806	1.043
6.3	1.0455	13	135.9	8.485	1.134

Bé.	Sp. gr.	Per cent $H_2C_2O_4$	G per liter	Lbs. per cu. ft.	Lbs. per gal.
0.5	1.0035	0.71	7.166	0.4474	0 0598
1.0	1.0070	1.43	14.38	0.8979	0.1200
1.5	1.0105	2.14	21.65	1.351	0.1807
2.0	1.0140	2.86	28.97	1.808	0.2417
2 5	1.0175	3.57	36.33	2.268	0.3032
3.0	1.0210	4 28	43.75	2.731	0.3651
3.5	1.0245	5.00	51.21	3.197	0.4274
4.0	1.0280	5.71	58.73	3.666	0.4901
4 4	1.0315	6.43	66.30	4.139	0.5533
4.9	1.0350	7.14	73 91	4.614	0.6168
5.4	1.0385	7.86	81 58	5.093	0.6808
5.8	1.0420	8.57	89 30	5.574	0.7452
6.3	1.0455	9.28	97 06	6.059	0.8100

PERCHLORIC ACID

Specific Gravity of Aqueous Perchloric Acid Solutions at $\frac{15°}{4°}$ C.*

Sp. gr.	Per cent $HClO_4$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1 005	1	10 05	6274	.0839
1.011	2	20 22	1.262	.1687
1.023	4	40.91	2.554	.3414
1.035	6	62.09	3.876	.5181
1.047	8	83 77	5.229	.6991
1.060	10	106 0	6.615	.8843
1.073	12	128 7	8.035	1 074
1.086	14	152.0	9.490	1.269
1.100	16	175.9	10.98	1 468
1.114	18	200.4	12.51	1.673
1.128	20	225 6	14.08	1 882
1.143	22	251 4	15.69	2 098
1 158	24	277.9	17.35	2 319
1.174	26	305 2	19.06	2.547
1.190	28	333 2	20 80	2.781
1.207	30	362 0	22.60	3 021
1 224	32	391 6	24.45	3 268
1.242	34	422 2	26.36	3 523
1 260	36	453 7	28 32	3 786
1.279	38	486.2	30.35	4.057
1 299	40	519.6	32 44	4 336
1 352	45	608 4	37 98	5 078
1.410	50	705 2	44 02	5 885
1.473	55	810 3	50 58	6 762
1 539	60	923 3	57 64	7 705
1 606	65	1044	65 16	8 711
1 674	70	1172	73 13	9 777

Specific Gravity of 65 to 75% Solution at $\frac{25°}{4°}$ C.

Based on values reported by G. Frederick Smith and O. E. Goehler, Ind. and Eng. Chem. **3**, 61, 1931

1.597	65 0	1038	64.79	8 661
1.603	65 5	1050	65.56	8 764
1.610	66 0	1063	66.34	8 868
1.617	66.5	1075.	67.12	8 973
1.624	67.0	1088.	67 91	9 078
1.630	67.5	1101	68 70	9 184
1.637	68.0	1113.	69.50	9.290
1.644	68 5	1126	70.30	9 397
1.651	69 0	1139	71.10	9.504
1.657	69 5	1152	71.91	9.613
1.664	70 0	1165	72.72	9.722
1 671	70.5	1178	73 54	9 831
1.678	71.0	1191	74.36	9.940
1.684	71.5	1204	75 18	10.05
1 691	72 0	1218	76.01	10 16
1 698	72.5	1231	76 84	10 27
1.704	73 0	1244.	77 68	10 38
1.711	73.5	1258	78.52	10.50
1.718	74.0	1271.	79 36	10 61
1.725	74 5	1285	80 21	10 72
1.731	75 0	1298	81 06	10 84

PHOSPHORIC ACID

Specific Gravity of Aqueous Phosphoric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent H_3PO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0038	1	10.04	0.6266	0.0838
1.3	1.0092	2	20.18	1.260	0.1684
2.8	1.0200	4	40.80	2.547	0.3405
4.3	1.0309	6	61.85	3.861	0.5162
5.8	1.0420	8	83.36	5.204	0.6957
7.3	1.0532	10	105.3	6.575	0.8789
8.8	1.0647	12	127.8	7.976	1.066
10.3	1.0764	14	150.7	9.408	1.258
11.8	1.0884	16	174.1	10.87	1.453
13.3	1.1008	18	198.1	12.37	1.654
14.8	1.1134	20	222.7	13.90	1.858
16.3	1.1263	22	247.8	15.47	2.068
17.8	1.1395	24	273.5	17.07	2 282
19.2	1.1529	26	299.8	18.71	2.501
20 7	1.1665	28	326.6	20.39	2.726
22.2	1.1805	30	354 2	22.11	2.955
25.8	1.216	35	425.6	26.57	3.552
29.4	1.254	40	501.6	31.31	4.186
32.9	1.293	45	581.9	36.32	4.856
36 4	1.335	50	667.5	41.67	5.570
39 9	1.379	55	758.5	47.35	6.329
43.3	1.426	60	855.6	53.41	7.140
46.7	1.475	65	958.8	59.85	8.001
50.0	1.526	70	1068	66.68	8.914
53.2	1.579	75	1184	73.93	9.883
56.2	1.633	80	1306	81.55	10.90
59.2	1.689	85	1436	89.62	11.98
62.0	1.746	90	1571	98.10	13.11
63.1	1.770	92	1628	101.7	13.59
64.2	1.794	94	1686	105.3	14.07
65.3	1.819	96	1746	109.0	14.57
66.4	1.844	98	1807	112.8	15.08
67.5	1.870	100	1870	116.7	15.61

PHOSPHORIC ACID

Specific Gravity of Aqueous Phosphoric Acid Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent P_2O_5	G per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0038	0.72	7 271	0.4539	0 0607
1.3	1.0092	1.4	14 62	0.9128	0.1220
2 8	1.0200	2.9	29 56	1.845	0 2466
4.3	1.0309	4.3	44 81	2.797	0.3739
5.8	1.0420	5.8	60.39	3.770	0 5039
7.3	1.0532	7.2	76 29	4.763	0 6367
8.8	1.0647	8.7	92.55	5.778	0 7724
10.3	1.0764	10.1	109 2	6.815	0 9110
11.8	1.0884	11.6	126.1	7.875	1.053
13.3	1.1008	13.0	143.5	8.960	1.198
14.8	1.1134	14.5	161.3	10 07	1 346
16.3	1.1263	15.9	179.5	11.21	1.498
17.8	1.1395	17.4	198 1	12.37	1.653
19.2	1.1529	18 8	217 1	13.56	1.812
20.7	1.1665	20.3	236.6	14.77	1.975
22.2	1.1805	21.7	256.5	16.02	2 141
25.8	1.216	25 4	308.3	19.25	2.573
29.4	1.254	29 0	363 4	22.68	3.032
32.9	1.293	32.6	421.5	26.31	3.517
36.4	1.335	36.2	483 5	30.19	4.035
39.9	1.379	39.8	549.4	34.30	4.585
43.3	1.426	43.5	619.8	38.69	5.172
46.7	1.475	47.1	694.5	43 36	5.796
50 0	1.526	50.7	773 8	48 31	6 458
53.2	1.579	54.3	857.9	53.55	7.159
56.2	1.633	58.0	946.4	59.08	7.898
59.2	1.689	61.6	1040	64.92	8.679
62.0	1.746	65 2	1138	71 06	9 500
63.1	1.770	66.6	1180	73.64	9.844
64.2	1.794	68 1	1222	76.26	10 19
65.3	1.819	69.5	1265	78.97	10.56
66.4	1.844	71.0	1309	81.72	10.92
67.5	1.870	72.4	1355	84.57	11.30

POTASSIUM BROMIDE

Specific Gravity of Aqueous Potassium Bromide Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent KBr	G per liter	Lbs. per cu. ft.	Lbs. per gal.
0 8	1 0054	1	10.05	0.6276	0.0839
1.8	1.0127	2	20.25	1.264	0.1690
3.9	1.0275	4	41.10	2.566	0.3430
5.9	1.0426	6	62.56	3.905	0.5220
8.0	1.0581	8	84.65	5.284	0.7064
10.0	1.0740	10	107.4	6.705	0.8963
12.0	1.0903	12	130.8	8.168	1.092
14.0	1.1070	14	155.0	9.675	1.293
16.0	1.1242	16	179.9	11.23	1.501
18.0	1.1419	18	205.5	12.83	1.715
20 0	1.1601	20	232.0	14.48	1.936
22 0	1.1788	22	259.3	16.19	2.164
24.0	1.1980	24	287.5	17.95	2.399
25 9	1.2178	26	316.6	19.77	2 642
27 9	1.2383	28	346.7	21.64	2.893
29 9	1 2593	30	377.8	23.58	3.153
34.7	1.3147	35	460.1	28.73	3.840
39.5	1 3746	40	549.8	34.32	4.589

POTASSIUM CARBONATE

Specific Gravity of Aqueous Potassium Carbonate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent K_2CO_3	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.0072	1	10.07	0.6288	0.0841
2.3	1.0163	2	20 33	1.269	0.1696
4.8	1 0345	4	41 38	2.583	0.3453
7.3	1.0529	6	63.17	3.944	0.5272
9.7	1 0715	8	85.72	5.351	0 7154
12.0	1.0904	10	109 0	6.807	0.9100
14.3	1.1096	12	133.2	8.312	1.111
16.6	1.1291	14	158.1	9.868	1.319
18.8	1.1490	16	183.8	11.48	1.534
21.0	1.1692	18	210.5	13.14	1.756

POTASSIUM CARBONATE (Continued)

Specific Gravity of Aqueous Potassium Carbonate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp gr.	Per cent K_2CO_3	G. per liter	Lbs. per cu. ft	Lbs. per gal.
23.1	1.1898	20	238.0	14.86	1.986
25.2	1.2107	22	266.4	16.63	2 223
27.3	1.2320	24	295.7	18.46	2.468
29.3	1.2536	26	325.9	20.35	2.720
31.3	1.2756	28	357.2	22.30	2.981
33.3	1.2979	30	389.4	24.31	3.249
38.0	1.3548	35	474.2	29.60	3.957
42.5	1.4141	40	565.6	35.31	4.720
46.8	1.4759	45	664.2	41.46	5.543
50.9	1.5404	50	770.2	48.08	6.427

POTASSIUM CHLORIDE

Specific Gravity of Aqueous Potassium Chloride Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr	Per cent KCl	G. per liter	Lbs. per cu. ft.	Lbs per gal
0.7	1.0046	1	10 05	0 6271	0 0838
1.6	1.0110	2	20 22	1.262	0 1687
3.4	1.0239	4	40 96	2.557	0 3418
5.2	1.0369	6	62.21	3.884	0 5192
6.9	1.0500	8	84.00	5.244	0.7010
8.6	1 0633	10	106 3	6 638	0 8874
10.3	1 0768	12	129 2	8.067	1 078
12.0	1 0905	14	152 7	9.531	1.274
13.7	1.1043	16	176.7	11.03	1 475
15.4	1.1185	18	201.3	12 57	1 680
17.0	1.1328	20	226 6	14.14	1 891
18.6	1 1474	22	252.4	15 76	2.107
20 2	1.1623	24	279.0	17.41	2 328

POTASSIUM CHROME ALUM

Specific Gravity of Aqueous Potassium Chrome Alum Solutions at $\frac{15°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $K_2Cr_2(SO_4)_4$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.3	1.016	2	20.32	1.269	0.1696
4.8	1.034	4	41.36	2.582	0.3452
7.2	1.052	6	63.12	3.940	0.5267
9.5	1.070	8	85.60	5.344	0.7143
11.9	1.089	10	108.9	6.798	0.9088
14.3	1.109	12	133.1	8.308	1.111
16.6	1.129	14	158.1	9.867	1.319
18.9	1.150	16	184.0	11.49	1.536
21.2	1.171	18	210.8	13.16	1.759
23.5	1.193	20	238.6	14.90	1.991
25.8	1.216	22	267.5	16.70	2.233
28.0	1 239	24	297.4	18.56	2.482
30.2	1.263	26	328.4	20.50	2.740
32.5	1.289	28	360.9	22.53	3.012
34.7	1.315	30	394.5	24.63	3.292
40.2	1.383	35	484.1	30.22	4 040
45.4	1.456	40	582.4	36.36	4.860
50.4	1.533	45	689.9	43.07	5.757
55.2	1.615	50	807.5	50.41	6.739

Bé.	Sp. gr.	Per cent $K_2Cr_2(SO_4)_4 + 24H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1 007	1.763	17.76	1.108	0 1481
2.3	1 016	3.527	35.83	2.237	0.2991
4.8	1 034	7.053	72.93	4.553	0 6087
7.2	1.052	10.58	111.30	6.948	0.9287
9.5	1.070	14.11	150.9	9.423	1.260
11.9	1.089	17.63	192.0	11.99	1.603
14.3	1.109	21.16	234.7	14.65	1.958
16.6	1.129	24.69	278.7	17.40	2.326
18.9	1.150	28.21	324.4	20.25	2.708
21.2	1.171	31.74	371.7	23.20	3.102
23.5	1.193	35.27	420.7	26.26	3.511
25.8	1.216	38.79	471.7	29.45	3.937
28.0	1.239	42.32	524.3	32.73	4.376
30.2	1.263	45.85	579.0	36.15	4.832
32.5	1.289	49.37	636.4	39.73	5.311
34.7	1.315	52.90	695 3	43.43	5.805
40.2	1.383	61.72	853.5	53.28	7.123
45.4	1.456	70 53	1026.9	64.11	8.570
50.4	1.533	79.35	1216.4	75.94	10.15
55.2	1.615	88.17	1423.9	88.89	11.88

POTASSIUM CHROMATE

Specific Gravity of Aqueous Potassium Chromate Solutions at $\frac{18°}{4°}$ C.*

Bé.	Sp. gr.	Per cent K_2CrO_4	G per liter	Lbs. per cu. ft.	Lbs per gal.
1.0	1.0066	1	10.07	0.6284	0.0840
2.1	1.0147	2	20 29	1.267	0.1694
4.4	1.0311	4	41.24	2.575	0 3442
6.6	1.0477	6	62 86	3.924	0.5246
8.8	1.0647	8	85.18	5.317	0 7108
11.0	1.0821	10	108.2	6.755	0.9030
13.2	1.0999	12	132 0	8.240	1.101
15.3	1.1181	14	156.5	9.772	1.306
17.4	1.1366	16	181 9	11.35	1.518
19.5	1.1555	18	208 0	12.98	1.736
21.6	1.1748	20	235 0	14.67	1.961
23.6	1.1945	22	262.8	16 41	2 193
25.6	1.2147	24	291.5	18.20	2.433
27.6	1 2354	26	321 2	20.05	2.681
29.6	1.2566	28	351.8	21.96	2.936
31.6	1.2784	30	383.5	23.94	3.201

Specific Gravity of Potassium Chromate Solutions at 19.5° C. (Schiff)

Bé	Sp. gr.	Per cent K_2CrO_4	G. per liter	Lbs. per cu. ft.	Lbs per gal.
1.2	1.0080	1	10 08	0.6293	0 0841
2.3	1.0161	2	20.32	1.269	0.1696
3.4	1.0243	3	30 73	1.918	0 2564
4.6	1.0325	4	41 30	2.578	0.3447
5.7	1.0408	5	52 04	3.249	0.4343
6.8	1.0492	6	62 95	3.930	0.5254
7.9	1.0576	7	74 03	4.622	0 6178
9.0	1.0663	8	85.30	5.325	0 7119
10.1	1.0750	9	96.75	6.040	0 8074
11.2	1.0837	10	108 4	6.765	0 9044
12.3	1.0925	11	120 2	7.502	1 003
13.4	1.1014	12	132.2	8.251	1.103
14.4	1.1104	13	144.4	9.011	1 205
15.5	1.1195	14	156.7	9.784	1.308

POTASSIUM CHROMATE (Continued)

SPECIFIC GRAVITY OF POTASSIUM CHROMATE SOLUTIONS AT 19.5° C. (SCHIFF)

Bé.	Sp. gr.	Per cent K_2CrO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
16.5	1.1287	15	169.3	10.57	1.413
17.6	1.1380	16	182.1	11.37	1.519
18.6	1.1474	17	195.1	12.18	1.628
19.7	1.1570	18	208.3	13.00	1.738
20.7	1.1667	19	221.7	13.84	1.850
21.8	1.1765	20	235.3	14.69	1.964
22.8	1.1864	21	249.1	15.55	2.079
23.8	1.1964	22	263.2	16.43	2.197
24.8	1.2066	23	277.5	17.32	2.316
25.8	1.2169	24	292.1	18.23	2.437
26.9	1.2274	25	306.9	19.16	2.561
27.9	1.2379	26	321.9	20.09	2.686
28.9	1.2485	27	337.1	21.04	2.813
29.8	1.2592	28	352.6	22.01	2.942
30.8	1.2700	29	368.3	22.99	3.074
31.8	1.2808	30	384.2	23.99	3.207
32.8	1.2921	31	400.6	25.01	3.343
33.8	1.3035	32	417.1	26.04	3.481
34.7	1.3151	33	434.0	27.09	3.622
35.7	1.3268	34	451.1	28.16	3.765
36.7	1.3386	35	468.5	29.25	3.910
37.6	1.3505	36	486.2	30.35	4.057
38.6	1 3625	37	504.1	31.47	4.207
39.5	1.3746	38	522.3	32.61	4 359
40.4	1.3868	39	540.9	33.76	4.514
41.4	1.3991	40	559.6	34.94	4.670

POTASSIUM DICHROMATE

SPECIFIC GRAVITY OF AQUEOUS POTASSIUM DICHROMATE SOLUTIONS AT $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $K_2Cr_2O_7$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0052	1	10.05	0.6275	0.0839
1.7	1.0122	2	20 24	1.264	0.1689
3.7	1.0264	4	41 06	2.563	0.3426
5.7	1.0408	6	62.45	3.898	0.5211
7.6	1.0554	8	84 43	5.271	0.7046
9.5	1.0703	10	107.0	6.682	0.8932

POTASSIUM HYDROXIDE

Specific Gravity of Aqueous Potassium Hydroxide Solutions at $\frac{15°}{4°}$ C.*

Bé.	Sp. gr.	Per cent KOH	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0083	1	10 08	0.6295	0.0841
2.5	1.0175	2	20.35	1.270	0.1698
3.8	1.0267	3	30 80	1.923	0 2570
5.0	1.0359	4	41.44	2.587	0.3458
6.3	1.0452	5	52.26	3.262	0.4361
7.5	1.0544	6	63.26	3.949	0.5280
8.7	1.0637	7	74.46	4.648	0.6214
9.9	1.0730	8	85.84	5.359	0.7164
11.0	1.0824	9	97.42	6.081	0.8130
12.2	1.0918	10	109.2	6.816	0.9111
13.3	1.1013	11	121.1	7.563	1.011
14.5	1.1108	12	133.3	8.321	1.112
15.6	1.1203	13	145.6	9.092	1.215
16.7	1.1299	14	158 2	9.875	1.320
17.8	1.1396	15	170 9	10.67	1.427
18.8	1.1493	16	183 9	11.48	1.535
19.9	1.1590	17	197 0	12 30	1.644
20.9	1.1688	18	210.4	13.13	1.756
22.0	1.1786	19	223 9	13.98	1.869
23.0	1.1884	20	237.7	14.84	1.983
24.0	1 1984	21	251.7	15 71	2.100
25.0	1.2083	22	265 8	16.59	2.218
26.0	1 2184	23	280.2	17 49	2 339
27.0	1.2285	24	294 8	18.41	2.461
27.9	1 2387	25	309 7	19.33	2.584
28.9	1.2489	26	324 7	20.27	2.710
29.8	1.2592	27	340 0	21 22	2.837
30 8	1.2695	28	355 5	22.19	2.966
31.7	1.2800	29	371 2	23.17	3.098
32 6	1.2905	30	387.2	24 17	3.231
33 6	1.3010	31	403 3	25.18	3.366
34.5	1.3117	32	419 7	26.20	3.503
35.4	1.3224	33	436 4	27.24	3.642
36 2	1 3331	34	453 3	28.30	3 783
37.1	1.3440	35	470 4	29.37	3.926
38 0	1.3549	36	487.8	30.45	4.070
38 8	1 3659	37	505.4	31.55	4 218
39 7	1 3769	38	523.2	32.66	4.366
40 5	1 3879	39	541 3	33 79	4 517
41 4	1.3991	40	559.6	34.94	4 670
42 2	1.4103	41	578 2	36.10	4 825
43 0	1.4215	42	597.0	37.27	4.982
43 8	1.4329	43	616.1	38.46	5 142
44 6	1.4443	44	635 5	39 67	5 303
45.4	1.4558	45	655.1	40 90	5 467
46 2	1.4673	46	675.0	42.14	5.633
47 0	1.4790	47	695.1	43.39	5.801
47.7	1.4907	48	715.5	44.67	5.971
48.5	1.5025	49	736 2	45.96	6.144
49.2	1.5143	50	757.2	47.27	6.319
50.0	1.5262	51	778 4	48.59	6 496
50.7	1.5382	52	799.9	49.93	6.675

POTASSIUM IODIDE

SPECIFIC GRAVITY OF AQUEOUS POTASSIUM IODIDE SOLUTIONS AT $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent KI	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0055	1	10.06	0.6277	0.0839
1.9	1.0130	2	20.26	1.265	0.1691
4.0	1.0281	4	41.12	2.567	0.3432
6.1	1.0437	6	62.62	3.909	0.5226
8 2	1.0597	8	84.78	5.292	0.7075
10.3	1.0761	10	107.6	6.718	0.8980
12.3	1.0930	12	131.2	8.188	1 095
14.4	1.1104	14	155.5	9.705	1.297
16.5	1.1284	16	180.5	11.27	1.507
18.6	1.1469	18	206.4	12.89	1.723
20.6	1.1660	20	233.2	14.56	1.946
23.7	1.1857	22	260.9	16.28	2.177
24 8	1.2060	24	289.4	18.07	2.415
26 8	1.2270	26	319.0	19.92	2 662
28.9	1.2487	28	349.6	21.83	2 918
30 9	1.2712	30	381.4	23.81	3.183
36 0	1.3308	35	465.8	29.08	3 887
41.1	1.3959	40	558.4	34 86	4.660
46 2	1.4672	45	660.2	41.22	5.510
51.2	1.5458	50	772 9	48.25	6.450
56 2	1.6327	55	898 0	56 06	7 494

POTASSIUM NITRATE

Specific Gravity of Aqueous Potassium Nitrate Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent KNO_3	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0045	1	10 05	0.6271	0.0838
1.5	1.0108	2	20.22	1.262	0.1687
3.3	1.0234	4	40.94	2.556	0.3416
5.1	1.0363	6	62.18	3.882	0.5189
6.8	1.0494	8	83.95	5.241	0.7006
8.6	1.0627	10	106.3	6.634	0.8868
10.3	1.0762	12	129.1	8.062	1.078
12.0	1.0899	14	152.6	9.525	1.273
13.7	1.1039	16	176 6	11.03	1.474
15.3	1.1181	18	201.3	12.56	1.680
17.0	1.1326	20	226.5	14.14	1.890
18.6	1.1473	22	252.4	15.76	2.106
20.2	1.1623	24	279 0	17.41	2.328

POTASSIUM SULFATE

Specific Gravity of Aqueous Potassium Sulfate Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent K_2SO_4	G per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.0063	1	10.06	0.6282	0.0840
2.1	1.0145	2	20.29	1.267	0.1693
4 4	1.0310	4	41.24	2.574	0 3442
6.6	1.0477	6	62.86	3.924	0.5246
8.8	1 0646	8	85.17	5.317	0.7107
11.0	1.0817	10	108.17	6.753	0.9027

POTASSIUM TARTRATE

SPECIFIC GRAVITY OF AQUEOUS POTASSIUM TARTRATE SOLUTIONS AT $\frac{20°}{4°}$ C.*

Bé.	Sp gr.	Per cent $K_2C_4H_4O_6$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0048	1	10.05	0.6273	0.0839
1.6	1 0114	2	20.23	1.263	0.1688
3.5	1.0248	4	40.99	2.559	0.3421
5.4	1.0383	6	62.30	3.889	0.5199
7.2	1.0519	8	84.15	5.253	0.7023
8.9	1 0657	10	106 6	6.653	0 8894
10.7	1.0798	12	129.6	8.089	1.081
12.5	1.0941	14	153.2	9.562	1.278
14.2	1.1087	16	177 4	11.07	1.480
16.0	1.1236	18	202 3	12.63	1 688
17.7	1.1387	20	227 7	14.22	1.901
19.4	1.1540	22	253 9	15.85	2.119
21.0	1 1696	24	280 7	17.52	2.343
22.7	1.1855	26	308.2	19.24	2.572
24.3	1.2017	28	336.5	21.01	2.808
26 0	1.2181	30	365.4	22 81	3.050
30.0	1.2606	35	441 2	27.54	3.682
33 9	1.3051	40	522 0	32.59	4 357
37 7	1.3516	45	608.2	37.97	5.076
41 4	1.4001	50	700.1	43 70	5 842

Bé.	Sp. gr.	Per cent $K_2C_4H_4O_6 + \frac{1}{2}H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1 0048	1.040	10 45	0.6522	0 0872
1.6	1 0114	2.080	21.03	1.313	0.1755
3.5	1 0248	4.159	42.62	2.661	0 3557
5.4	1 0383	6.239	64 78	4.044	0 5406
7.2	1.0519	8.319	87.50	5.462	0.7302
8.9	1 0657	10.40	110.8	6.918	0.9247
10 7	1 0798	12.48	134.7	8.411	1 124
12 5	1 0941	14.56	159.3	9 943	1.329
14 2	1 1087	16.64	184 5	11 52	1.539
16.0	1.1236	18 72	210 3	13.13	1.755
17.7	1 1387	20 80	236 8	14.78	1 976
19 4	1.1540	22.88	264 0	16.48	2.203
21.0	1.1696	24.96	291.9	18.22	2.436
22 7	1.1855	27.03	320 5	20 01	2.675
24 3	1.2017	29.12	349 9	21.84	2.920
26 0	1.2181	31 19	380 0	23.72	3 171
30 0	1 2606	36.39	458 8	28.64	3 829
33.9	1.3051	41.59	542 8	33.89	4 530
37.7	1.3516	46.79	632.4	39.48	5.278
41.4	1.4001	51.99	727 9	45.44	6.075

SODIUM ARSENATE

Specific Gravity of Aqueous Di-sodium Arsenate Solutions at $\frac{14°}{4°}$ C.*

Bé.	Sp. gr.	Per cent Na_2HAsO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0083	1	10.08	0.6295	0.0841
2.5	1.0175	2	20.35	1.270	0.1698
5.1	1.0365	4	41.46	2.588	0.3460
7.7	1.0563	6	63 38	3.957	0.5289
10.3	1.0768	8	86.14	5.378	0.7189
12.9	1.0980	10	109.8	6.854	0.9163
15.5	1.1197	12	134.4	8.388	1.121
18.0	1.1419	14	159.9	9.980	1.334
20.5	1.1645	16	186.3	11.63	1 555

Bé.	Sp. gr.	Per cent Na_2HAsO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0083	2.163	21.80	1.361	0 1819
2.5	1.0175	4.325	44.01	2.747	0.3672
5 1	1.0365	8.650	89.66	5.597	0.7482
7.7	1.0563	12.98	137.1	8.556	1.144
10.3	1.0768	17.30	186.3	11.63	1.555
12.9	1.0980	21.63	237.4	14.82	1 982
15.5	1.1197	25.95	290.6	18.14	2.425
18.0	1.1419	30.28	345.7	21.58	2 885
20.5	1.1645	34.60	402.9	25.15	3.363

SODIUM ARSENATE

Specific Gravity of Aqueous Di-sodium Arsenate Solutions at 14° C. (Schiff)

Bé.	Sp. gr.	Per cent $Na_2HAsO_4 + 12H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0042	1	10.04	0.6269	0.0838
1.2	1.0084	2	20.17	1.259	0.1683
1.8	1.0126	3	30.38	1.896	0.2535
2.4	1.0168	4	40.67	2.539	0.3394
3.0	1.0212	5	51.06	3.188	0.4261
3.6	1.0256	6	61.54	3.842	0.5135
4.2	1.0300	7	72.10	4.501	0.6017
4.8	1.0344	8	82.75	5.166	0.6906
5.4	1.0389	9	93.50	5.837	0.7803
6.0	1.0434	10	104.3	6.514	0 8707
6.6	1.0479	11	115.3	7.196	0.9619
7.2	1.0525	12	126.3	7.885	1.054
7.8	1.0571	13	137.4	8.579	1 147
8.4	1.0618	14	148.7	9.280	1 241
9.0	1.0665	15	160.0	9 987	1.335
9.6	1.0712	16	171.4	10.70	1.430
10.2	1.0759	17	182.9	11.42	1.526
10.8	1.0807	18	194.5	12.14	1.623
11.4	1.0855	19	206.2	12 88	1.721
12.0	1.0904	20	218 1	13.61	1.820
12.6	1.0953	21	230.0	14.36	1.920
13.2	1.1002	22	242.0	15.11	2.020
13.8	1.1052	23	254.2	15.87	2.121
14.4	1.1102	24	266.4	16.63	2.224
15.0	1.1153	25	278.8	17.41	2.327
15.6	1.1204	26	291.3	18.19	2.431
16.2	1.1255	27	303.9	18 97	2.536
16.8	1.1306	28	316.6	19.76	2.642
17.3	1.1358	29	329.4	20.56	2.749
17.9	1.1410	30	342.3	21.37	2.857
18.5	1.1463	31	355.4	22.18	2.965
19.1	1.1516	32	368.5	23.01	3.075
19.7	1.1569	33	381.8	23.83	3.186
20.2	1.1623	34	395.2	24.67	3.298
20.8	1.1677	35	408.7	25.51	3.411
21.4	1.1731	36	422.3	26.36	3.524
22.0	1.1786	37	436.1	27.22	3.639
22.5	1.1838	38	449.1	28.03	3.748
23.1	1.1896	39	464.0	28.96	3.872
23.7	1.1952	40	478.1	29.85	3.990

SODIUM ARSENATE

Specific Gravity of Aqueous Tri-sodium Arsenate Solutions at $\frac{17°}{4°}$ C.*

Bé.	Sp. gr.	Per cent Na_3AsO_4	G. per liter	Lbs per cu. ft.	Lbs per gal
1 4	1.0097	1	10.10	0.6303	0.0843
2 9	1.0207	2	20.41	1.274	0.1704
6 0	1.0431	4	41.72	2.605	0.3482
9 0	1.0659	6	63.95	3.992	0.5337
11 9	1.0892	8	87.14	5.440	0.7272
14 7	1.1130	10	111.3	6.948	0.9288
17 5	1 1373	12	136.5	8 520	1.1389

Bé	Sp. gr.	Per cent Na_3AsO_4 $+12H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1 4	1.0097	2 040	20.59	1.286	0.1719
2 9	1.0207	4 079	41.64	2.599	0.3475
6 0	1.0431	8 158	85.10	5.313	0.7102
9.0	1.0659	12 237	130.4	8.143	1 089
11.9	1.0892	16 317	177 7	11.09	1.483
14.7	1.1130	20.396	227.0	14.17	1.894
17.5	1 1373	24 4752	278.4	17 38	2 323

Specific Gravity of Aqueous Tri-sodium Arsenate Solutions at 17° C. (Schiff)

Bé.	Sp. gr.	Per cent Na_3AsO_4 $+12H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0053	1	10.05	0.6276	0.0839
1 5	1.0107	2	20.21	1.262	0.1687
2 3	1.0161	3	30.48	1.903	0.2544
3.1	1.0215	4	40.86	2.551	0.3410
3 8	1.0270	5	51 35	3.206	0.4285
4.6	1 0325	6	61.95	3.867	0.5170
5 3	1 0380	7	72.66	4.536	0.6064

SODIUM ARSENATE (Continued)

Specific Gravity of Aqueous Tri-sodium Arsenate Solutions at 17° C. (Schiff)

Bé.	Sp. gr.	Per cent $Na_3AsO_4 + 12H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
6.0	1.0435	8	83.48	5.211	0.6967
6.8	1.0491	9	94.42	5.894	0.7880
7 5	1 0547	10	105.5	6.584	0.8802
8.3	1.0603	11	116 6	7.281	0.9733
9.0	1.0659	12	127.9	7.985	1.067
9.7	1 0716	13	139.3	8.697	1.163
10 4	1 0773	14	150.8	9.415	1.259
11 1	1.0830	15	162 5	10.14	1.356
11 8	1 0887	16	174.2	10.87	1.454
12 5	1.0945	17	186.1	11.62	1 553
13 2	1.1003	18	198.1	12 36	1.653
13 9	1.1061	19	210 2	13.12	1.754
14 6	1.1120	20	222.4	13 88	1.856
15.3	1.1179	21	234.8	14.66	1 959
16 0	1.1238	22	247 2	15 43	2.063

SODIUM BROMIDE

Specific Gravity of Aqueous Sodium Bromide Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp gr.	Per cent NaBr	G. per liter	Lbs per cu. ft.	Lbs per gal.
0 9	1 0060	1	10 06	0.6280	0 0840
2.0	1.0139	2	20.28	1 266	0.1692
4.2	1.0298	4	41.19	2 571	0 3438
6.4	1.0462	6	62.77	3.919	0 5238
8.6	1 0631	8	85.05	5 309	0 7097
10.8	1.0803	10	108.0	6.744	0 9015
13.0	1.0981	12	131 8	8 226	1.100
15.1	1.1164	14	156.3	9 757	1.304
17.3	1.1352	16	181.6	11.34	1 516
19.4	1.1546	18	207.8	12.97	1.734
21.5	1.1745	20	234.9	14.66	1 960
23.7	1 1951	22	262.9	16.41	2.194
25.8	1 2163	24	291.9	18.22	2.436
27.9	1 2382	26	321.9	20.10	2.687
30.0	1.2608	28	353 0	22.04	2.946
32.1	1.2841	30	385.2	24.05	3.215
37.3	1.3462	35	471.2	29.41	3.932
42.4	1.4138	40	565.5	35.30	4.719

SODIUM CARBONATE

Specific Gravity of Aqueous Sodium Carbonate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent Na_2CO_3	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.2	1.0086	1	10 09	0.6296	0.0842
2.7	1.0190	2	20.38	1.272	0.1701
5.6	1.0398	4	41.59	2.596	0.3471
8.3	1.0606	6	63.64	3.973	0.5311
10.9	1.0816	8	86.53	5.402	0.7221
13.5	1.1029	10	110.3	6.885	0.9204
16.0	1.1244	12	134.9	8.423	1.126
18.5	1.1463	14	160.5	10.02	1.339

Bé.	Sp. gr.	Per cent $Na_2CO_3 + 10H_2O$	G. per liter	Lbs. per cu. ft	Lbs. per gal.
1.2	1.0086	2.70	27 23	1.700	0 2272
2.7	1.0190	5 40	55.02	3.435	0.4592
5 6	1.0398	10.80	112.3	7.010	0.9370
8.3	1.0606	16.20	171.8	10.72	1.434
10.9	1.0816	21 60	233.6	14.58	1.949
13.5	1.1029	27 00	297 7	18.59	2.485
16.0	1.1244	32.40	364 3	22.74	3.040
18.5	1.1463	37 80	433 3	27.05	3.616

SODIUM CHLORIDE

Specific Gravity of Aqueous Sodium Chloride Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent NaCl	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0053	1	10.05	0.6276	0.0839
1.8	1.0125	2	20.25	1.264	0.1690
3.8	1.0268	4	41.07	2.564	0.3428
5.8	1.0413	6	62.48	3.900	0.5214
7.7	1.0559	8	84.47	5.273	0.7049
9.6	1.0707	10	107.1	6.684	0.8935
11.5	1.0857	12	130.3	8.133	1.087
13.3	1.1009	14	154.1	9.622	1 286
15.1	1.1162	16	178.6	11.15	1.490
16.9	1.1319	18	203.7	12.72	1.700
18.7	1.1478	20	229.6	14.33	1.916
20.4	1.1640	22	256.1	15.99	2.137
22.2	1.1804	24	283.3	17.69	2.364
23.9	1.1972	26	311.3	19.43	2.598

SODIUM CHROMATE

Specific Gravity of Aqueous Sodium Chromate Solutions at $\frac{18°}{4°}$ C.*

Bé.	Sp. gr.	Per cent Na_2CrO_4	G per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0074	1	10.07	0.6289	0.0841
2 3	1.0163	2	20 33	1.269	0.1696
4 8	1 0344	4	41.38	2.583	0.3453
7.3	1.0529	6	63.17	3.944	0.5272
9.7	1.0718	8	85.74	5.353	0.7156
12.1	1 0912	10	109.1	6.812	0.9106
14.5	1.1110	12	133 3	8.323	1.113
16.8	1.1312	14	158.4	9.886	1.322
19 1	1 1518	16	184.3	11.50	1.538
21.4	1.1728	18	211.1	13.18	1.762
23 6	1 1942	20	238.8	14.91	1.993
25.8	1.2160	22	267.5	16 70	2.233
27.9	1.2383	24	297.2	18.55	2.480
30.0	1.2611	26	327.9	20.47	2.736

SODIUM DICHROMATE

Specific Gravity of Aqueous Sodium Dichromate Solutions at $\frac{15°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $Na_2Cr_2O_7$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.006	1	10.06	0.6280	0.0840
1.9	1.013	2	20.26	1.265	0.1691
3.8	1.027	4	41.08	2.565	0.3428
5.7	1.041	6	62.46	3.899	0.5212
7.7	1.056	8	84.48	5.274	0.7050
9.5	1.070	10	107.0	6.680	0.8929
11.2	1 084	12	130.1	8.121	1.086
12.9	1.098	14	153.7	9.596	1.283
14.6	1.112	16	177.9	11.11	1.485
16.2	1.126	18	202.7	12.65	1.691
17.8	1.140	20	228.0	14.23	1.903
19.2	1.153	22	253.7	15.84	2.117
20.6	1.166	24	279.8	17.47	2.335
22.0	1.179	26	306.5	19.14	2.558
23.5	1.193	28	334.0	20.85	2.788
24.9	1.207	30	362.1	22.60	3.022
28.4	1.244	35	435.4	27.18	3 634
31.6	1.279	40	511.6	31.94	4.269
34.5	1.312	45	590.4	36.86	4.927
37.0	1.342	50	671.0	41.89	5.600

SODIUM HYDROXIDE

Specific Gravity of Aqueous Sodium Hydroxide Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent NaOH	G. per liter	Lbs. per cu. ft.	Lbs per gal.
1.4	1.0095	1	10.10	0.6302	0.0842
2.9	1 0207	2	20 41	1.274	0.1704
4.5	1.0318	3	30.95	1.932	0.2583
6.0	1 0428	4	41.71	2.604	0.3481
7.4	1.0538	5	52.69	3.289	0.4397
8.8	1.0648	6	63.89	3.988	0.5332
10.2	1 0758	7	75.31	4.701	0 6284
11.6	1.0869	8	86.95	5.428	0 7256
12.9	1 0979	9	98.81	6.168	0.8246
14.2	1 1089	10	110 9	6 923	0.9254
16.8	1 1309	12	135.7	8.472	1.133
19.2	1 1530	14	161.4	10 08	1.347
21 6	1 1751	16	188.0	11.74	1 569
23 9	1 1972	18	215.5	13.45	1.798
26.1	1 2191	20	243.8	15 22	2.035
28.2	1 2411	22	273.0	17 05	2 279
30.2	1 2629	24	303.1	18 92	2 529
32.1	1 2848	26	334.0	20 85	2 788
34 0	1 3064	28	365.8	22 84	3 053
35 8	1 3279	30	398.4	24 87	3 324
37.5	1 3490	32	431.7	26 95	3 602
39 1	1 3696	34	465.7	29 07	3 886
40.7	1.3900	36	500.4	31.24	4 176
42 2	1.4101	38	535.8	33 45	4.472
43 6	1.4300	40	572.0	35.71	4 773
45 0	1.4494	42	608.7	38 00	5.080
46 3	1.4685	44	646.1	40 34	5 392
47 5	1.4873	46	684.2	42.71	5.709
48 8	1.5065	48	723.1	45.14	6.035
49 9	1 5253	50	762.7	47.61	6.364

SODIUM NITRATE

Specific Gravity of Aqueous Sodium Nitrate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $NaNO_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0049	1	10 05	0.6273	0.0839
1.7	1.0117	2	20.23	1.263	0.1689
3.6	1.0254	4	41.02	2.561	0.3423
5.5	1.0392	6	62.35	3.892	0.5203
7.3	1.0532	8	84.26	5.260	0.7031
9.2	1.0674	10	106.7	6.663	0.8908
11.0	1.0819	12	129.8	8.105	1.083
12.8	1.0967	14	153.5	9.585	1.281
14.6	1.1118	16	177.9	11 11	1.485
16.4	1.1272	18	202 9	12 67	1.693
18.1	1.1429	20	228.6	14 27	1.908
19.9	1.1589	22	255 0	15 92	2.128
21.6	1.1752	24	282 0	17 61	2.354
23.3	1.1917	26	309.8	19.34	2.586
25.0	1 2085	28	338.4	21.12	2.824
26.7	1.2256	30	367.7	22.95	3.068
30 8	1.2701	35	444 5	27.75	3.710
34 9	1.3175	40	527.0	32.90	4.398
39 0	1 3683	45	615.7	38.44	5.138

SODIUM NITRITE

Specific Gravity of Aqueous Sodium Nitrite Solutions at $\frac{15°}{4°}$ C.*

Bé.	Sp gr	Per cent $NaNO_2$	G per liter	Lbs. per cu. ft.	Lbs per gal.
0 8	1.0058	1	10 06	0.6279	0 0839
1.8	1.0125	2	20 25	1.264	0 1690
3.7	1.0260	4	41.04	2.562	0 3425
5 5	1.0397	6	62 38	3.894	0 5206
7.4	1.0535	8	84.28	5.261	0 7033
9.2	1 0675	10	106 8	6.664	0 8909
10 9	1.0816	12	129 8	8.103	1 083
12 7	1.0959	14	153 4	9 578	1 280
14.4	1.1103	16	177 6	11.09	1.483
16.1	1.1248	18	202.5	12.64	1.690
17 7	1 1394	20	227 9	14.23	1.902

SODIUM POTASSIUM TARTRATE

Specific Gravity of Aqueous Sodium Potassium Tartrate (Rochelle Salt) Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $NaKC_4H_4O_6$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0049	1	10.05	0.6273	0.0839
1.7	1.0116	2	20.23	1.263	0.1688
3.6	1.0252	4	41.01	2.560	0.3422
5.4	1.0390	6	62.34	3.892	0.5202
7.3	1.0530	8	84.24	5.259	0.7030
9.1	1.0673	10	106.7	6.663	0.8907
11.0	1.0818	12	129.8	8.104	1.083
12.8	1.0965	14	153.5	9.583	1.281
14.5	1.1114	16	177.8	11.10	1.484
16 3	1.1265	18	202.8	12.66	1.692
18.0	1.1419	20	228.4	14.26	1.906
19 7	1 1576	22	254.7	15.90	2.125
21.4	1 1735	24	281.6	17.58	2.350
23.1	1 1896	26	309.3	19.31	2.581
24.8	1 2059	28	337.7	21.08	2.818
26.4	1.2225	30	366.8	22.90	3.061
28 0	1.2394	32	396.6	24.76	3.310
29.6	1 2566	34	427.2	26.67	3 565
31.2	1.2742	36	458.7	28.64	3.828

Bé	Sp. gr.	Per cent $NaKC_4H_4O_6 + 4H_2O$	G. per liter	Lbs. per cu ft.	Lb per gal.
0 7	1.0049	1 343	13.50	0.8425	0.1127
1.7	1.0116	2 686	27 17	1.696	0.2267
3.6	1.0252	5.372	55.07	3.438	0.4596
5.4	1.0390	8.058	83.72	5.227	0.6986
7.3	1.0530	10.74	113.1	7.063	0.9441
9.1	1.0673	13.43	143.3	8.948	1.196
11.0	1.0818	16.12	174.3	10.88	1.455
12.8	1.0965	18.80	206.2	12.87	1.721
14 5	1.1114	21 49	238.8	14.91	1.993
16.3	1.1265	24.17	272.3	17.00	2.273
18.0	1.1419	26.86	306.7	19.15	2.560
19 7	1.1576	29.55	342.0	21.35	2.854
21.4	1.1735	32 23	378.2	23.61	3.157
23 1	1.1896	34 92	415.4	25.93	3.466
24.8	1.2059	37.60	453.5	28.31	3.784
26.4	1.2225	40.29	492.5	30.75	4.110
28.0	1.2394	42.98	532 6	33.25	4.445
29 6	1.2566	45.66	573.8	35.82	4.788
31.2	1 2742	48 35	616.1	38.46	5.141

SODIUM SILICATE

Specific Gravity of Aqueous Sodium Silicate Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent $Na_2O + 3.9SiO_2$	G per liter	Lbs per cu ft	Lbs per gal.
0.9	1.006	1	10.06	0.6280	0.0840
2.0	1.014	2	20.28	1.266	0.1692
4.2	1.030	4	41.20	2.572	0.3438
6.4	1.046	6	62.76	3.918	0.5237
8.6	1.063	8	85.04	5.309	0.7097
10.7	1.080	10	108.0	6.742	0.9013
12.9	1.098	12	131.8	8.225	1.100
14.6	1.116	14	156.2	9.754	1.304
17.1	1.134	16	181.4	11.33	1.514
19.2	1.153	18	207.5	12.96	1.732
21.3	1.172	20	234.4	14.63	1.956
23.3	1.191	22	262.0	16.36	2.187
25.3	1.211	24	290.6	18.14	2.425
27.3	1.232	26	320.3	20.00	2.673
29.3	1.253	28	350.8	21.90	2.928
31.3	1.275	30	382.5	23.88	3.192
33.3	1.298	32	415.4	25.93	3.466

Bé	Sp. gr.	Per cent $Na_2O + 3.36SiO_2$	G per liter	Lbs. per cu ft	Lbs per gal.
0.9	1.006	1	10.06	0.6280	0.0840
2.0	1.014	2	20.28	1.266	0.1692
4.2	1.030	4	41.20	2.572	0.3438
6.5	1.047	6	62.82	3.922	0.5243
8.9	1.065	8	85.20	5.319	0.7110
11.1	1.083	10	108.3	6.761	0.9038
13.3	1.101	12	132.1	8.248	1.103
15.5	1.120	14	156.8	9.789	1.309
17.7	1.139	16	182.2	11.38	1.521
19.9	1.159	18	208.6	13.02	1.741
22.0	1.179	20	235.8	14.72	1.968
24.2	1.200	22	264.0	16.48	2.203
26.3	1.222	24	293.3	18.31	2.447
28.4	1.244	26	323.4	20.19	2.699
30.6	1.267	28	354.8	22.15	2.961
32.6	1.290	30	387.0	24.16	3.230
34.7	1.314	32	420.5	26.25	3.509
36.7	1.339	34	455.3	28.42	3.799
38.8	1.365	36	491.4	30.68	4.101
40.9	1.393	38	529.3	33.05	4.417

SODIUM SILICATE

Specific Gravity of Aqueous Sodium Silicate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr	Per cent $Na_2O + 2.40SiO_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.3	1.016	2	20.32	1.269	0.1696
4.8	1.034	4	41.36	2.582	0.3452
7.2	1.052	6	63.12	3.940	0.5268
9.6	1.071	8	85.68	5.349	0.7150
12.0	1.090	10	109.0	6.805	0.9096
14.4	1.110	12	133.2	8.315	1.112
16.7	1.130	14	158.2	9.876	1.320
19.0	1.151	16	184.2	11.50	1.537

Bé.	Sp. gr	Per cent $Na_2O + 2.44SiO_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
32.2	1.285	28	359.8	22.46	3.003
34.2	1.309	30	392.7	24.52	3.277
36.3	1.334	32	426.9	26.65	3.562
38.4	1.360	34	462.4	28.87	3.859
40.5	1.387	36	499.3	31.17	4.167
42.5	1.415	38	537.7	33.57	4.487
44.7	1.445	40	578.0	36.08	4.824

Bé.	Sp. gr	Per cent $Na_2O + 2.06SiO_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.3	1.016	2	20.32	1.269	0.1696
4.9	1.035	4	41.40	2.584	0.3455
7.4	1.054	6	63.24	3.948	0.5278
9.9	1.073	8	85.84	5.359	0.7164
12.3	1.093	10	109.3	6.823	0.9121
14.7	1.113	12	133.6	8.338	1.115
17.1	1.134	14	158.8	9.911	1.325
19.6	1.156	16	185.0	11.55	1.544
21.9	1.178	18	212.0	13.24	1.770
24.2	1.200	20	240.0	14.98	2.003

SODIUM SILICATE (Continued)

SPECIFIC GRAVITY OF AQUEOUS SODIUM SILICATE SOLUTIONS AT $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent Na_2O + $2.06SiO_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
26.4	1.223	22	269.1	16.80	2.245
28.7	1.247	24	299.3	18.68	2.498
30.9	1.271	26	330.5	20.63	2.758
33.1	1.296	28	362.9	22.65	3.028
35.2	1.321	30	396.3	24.74	3.307
37.3	1.346	32	430.7	26.89	3.594
39.2	1.371	34	466.1	29.10	3.890
41.2	1.397	36	502.9	31.40	4.197
43.1	1.423	38	540.7	33.76	4.513
45.0	1.450	40	580.0	36.21	4.840
49.6	1.520	45	684.0	42.70	5.708
54.0	1.594	50	797.0	49.75	6.651
58.3	1.673	55	920.2	57.44	7.679

Bé.	Sp. gr.	Per cent Na_2O + $1.69SiO_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.4	1.017	2	20.34	1.270	0.1697
5.0	1.036	4	41.44	2.587	0.3458
7.7	1.056	6	63.36	3.955	0.5288
10.4	1.077	8	86.16	5.379	0.7190
12.9	1.098	10	109.8	6.854	0.9163
15.4	1.119	12	134.3	8.383	1.121
17.9	1.141	14	159.7	9.972	1.333
20.3	1.163	16	186.1	11.62	1.553
22.7	1.186	18	213.5	13.33	1.782
25.2	1.210	20	242.0	15.11	2.020
27.5	1.234	22	271.5	16.95	2.266
29.8	1.259	24	302.2	18.86	2.522
32.1	1.284	26	333.8	20.84	2.786
34.3	1.310	28	366.8	22.90	3.061
36.6	1.337	30	401.1	25.04	3.347
38.8	1.365	32	436.8	27.27	3.645
41.0	1.394	34	474.0	29.59	3.955
43.2	1.424	36	512.6	32.00	4.278
45.4	1.456	38	553.3	34.54	4.617

SODIUM SULFATE

Specific Gravity of Aqueous Sodium Sulfate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent Na_2SO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0073	1	10.07	0.6288	0.0841
2.3	1.0164	2	20.33	1.269	0.1696
4.9	1.0348	4	41.39	2.584	0.3454
7.4	1.0535	6	63.21	3.946	0.5275
9.8	1.0724	8	85.79	5.356	0.7160
12.2	1.0915	10	109.2	6.814	0.9109
14.5	1.1109	12	133.3	8.322	1.112
16.8	1.1306	14	158.3	9.881	1.321
19.0	1.1506	16	184.1	11.49	1.536
21.2	1.1709	18	210.8	13.16	1.759
23.3	1.1915	20	238.3	14.88	1.989
25.4	1.2124	22	266.7	16.65	2.226
27.5	1.2336	24	296.1	18.48	2.471

Bé.	Sp. gr.	Per cent $Na_2SO_4 + 10H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1 0073	2.268	22.85	1.426	0.1907
2.3	1.0164	4.536	46.11	2.878	0.3848
4.9	1.0348	9.073	93.88	5.861	0.7835
7.4	1.0535	13.61	143.4	8.950	1.197
9.8	1.0724	18.15	194.6	12.15	1.624
12.2	1.0915	22.68	247.6	15.46	2.066
14.5	1.1109	27.22	302.4	18.88	2.523
16.8	1.1306	31.75	359.0	22.41	2.996
19.0	1.1506	36.29	417.6	26.07	3.485
21.2	1.1709	40.83	478.1	29.84	3.989
23.3	1.1915	45.36	540.5	33.74	4.511
25.4	1.2124	49.90	605.0	37.77	5.049
27.5	1.2336	54.44	671.5	41.92	5.604

SODIUM SULFATE

Specific Gravity of Aqueous Sodium Sulfate Solutions at 15° C. (Gerlach)

Bé.	Sp. gr.	Per cent $Na_2SO_4 + 10H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.004	1	10.04	0.6268	0 0838
1.2	1.008	2	20.16	1.259	0.1682
1.9	1.013	3	30.39	1.897	0 2536
2.3	1.016	4	40 64	2.537	0 3392
2.8	1.020	5	51.00	3.184	0.4256
3.4	1.024	6	61.44	3.836	0.5127
4.0	1.028	7	71.96	4.492	0.6005
4.5	1.032	8	82 56	5.154	0 6890
5.0	1.036	9	93.24	5.821	0 7781
5.6	1.040	10	104.0	6.492	0.8679
6.1	1.044	11	114.8	7.169	0 9584
6.5	1.047	12	125 6	7.843	1.048
7.2	1.052	13	136.8	8.538	1.141
7.7	1.056	14	147 8	9 229	1 234
8.2	1.060	15	159.0	9.926	1.327
8.7	1.064	16	170.2	10.63	1.421
9.4	1.069	17	181 7	11.34	1.517
9.9	1.073	18	193.1	12 06	1 612
10.4	1.077	19	204.6	12.77	1 708
11.0	1.082	20	216 4	13.51	1.806
11.5	1.086	21	228 1	14 24	1 903
12.0	1.090	22	239 8	14.97	2.001
12.5	1.094	23	251.6	15.71	2.100
12.9	1.098	24	263 5	16.45	2.199
13 5	1.103	25	275.8	17.21	2 301
14.0	1.107	26	287 8	17.97	2.402
14.5	1.111	27	300 0	18.73	2.503
15.1	1.116	28	312.5	19.51	2 608
15.5	1.120	29	324 8	20.28	2.711
16.1	1.125	30	337 5	21.07	2.817

SODIUM SULFATE

Specific Gravity of Aqueous Sodium Sulfate Solutions at 15° C. (Gerlach)

Bé.	Sp. gr.	Per cent Na_2SO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.004	0 44	4.440	0.2772	0.0371
1.2	1.008	0.88	8.916	0.5566	0.0744
1.9	1.013	1 33	13.44	0.8390	0.1122
2.3	1.016	1.77	17.97	1.122	0.1500
2.8	1 020	2 21	22.55	1.408	0.1882
3.4	1.024	2 65	27.17	1.696	0.2268
4.0	1.028	3.10	31.82	1 987	0.2656
4.5	1.032	3 54	36.51	2.279	0.3047
5.0	1.036	3 98	41.24	2 574	0.3441
5.6	1.040	4.42	45.99	2.871	0.3838
6.1	1.044	4.86	50.79	3.171	0.4238
6.5	1 047	5.31	55 56	3.469	0.4637
7.2	1 052	5.75	60.48	3 776	0 5047
7.7	1 056	6.19	65.38	4 082	0.5456
8.2	1.060	6.63	70.32	4 390	0.5868
8.7	1.064	7.08	75 29	4 700	0.6283
9.4	1.069	7.52	80.37	5.017	0.6707
9.9	1.073	7 96	85.42	5 332	0.7128
10.4	1.077	8 40	90 50	5.650	0.7552
11.0	1.082	8.85	95.70	5.974	0 7987
11.5	1.086	9 29	100.9	6.296	0.8417
12 0	1 090	9 73	106 1	6.620	0 8850
12.5	1 094	10 2	111.3	6 947	0.9287
12.9	1 098	10.6	116.5	7.275	0 9726
13.5	1.103	11 1	122 0	7.613	1.018
14.0	1 107	11 5	127.3	7.946	1 062
14.5	1.111	11 9	132.7	8.282	1.107
15.1	1.116	12 4	138.2	8.627	1.153
15.5	1.120	12.8	143.6	8.967	1.199
16.1	1.125	13 3	149.3	9.318	1.246

SODIUM SULFIDE

Specific Gravity of Aqueous Sodium Sulfide Solutions at $\frac{18°}{4°}$ C.*

Bé	Sp. gr.	Per cent Na_2S	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.4	1.0098	1	10 10	0.6304	0.0843
3.0	1.0211	2	20.42	1.275	0.1704
6.1	1.0440	4	41.76	2.607	0.3485
9.1	1.0672	6	64.03	3.997	0.5344
12.1	1.0907	8	87.26	5.447	0.7282
14.9	1.1146	10	111.5	6.958	0.9302
17.7	1.1388	12	136.7	8.531	1.140
20.4	1.1634	14	162.9	10.17	1.359
23.0	1.1885	16	190.2	11.87	1.587
25.6	1.2140	18	218.5	13.64	1.824

SODIUM SULFITE

Specific Gravity of Aqueous Sodium Sulfite Solutions at $\frac{19°}{4°}$ C.*

Bé.	Sp. gr.	Per cent Na_2SO_3	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.1	1.0078	1	10.08	0.6291	0 0841
2.5	1.0172	2	20.34	1 270	0.1698
5.1	1 0363	4	41.45	2 588	0.3459
7 6	1.0556	6	63.34	3 954	0.5286
10.1	1.0751	8	86.01	5 369	0 7178
12 6	1 0948	10	109.5	6 835	0.9136
14.9	1.1146	12	133.8	8.350	1.116
17.2	1.1346	14	158.8	9 916	1 326
19.4	1.1549	16	184.8	11.54	1 542
21.7	1.1755	18	211.6	13.21	1.766

SODIUM SULFITE, ACID (BISULFITE)

Specific Gravity of Aqueous Sodium Bisulfite and Proportion of $NaHSO_3$ at $\frac{15.6°}{15.6°}$ C.

Bé.	Sp. gr.	Per cent $NaHSO_3$	Grams per liter	Lbs. per cu. ft.	Lbs. per gal.
0	1.0000	0.00	0.00	0.0000	0 0000
1	1.0069	1.02	10.27	0.6411	0.0857
2	1 0140	2.04	20.69	1.291	0.1726
3	1.0211	3.06	31.25	1.951	0.2607
4	1.0284	4.08	41.96	2.619	0.3502
5	1.0357	5.11	52.92	3.304	0.4417
6	1.0432	6.15	64.16	4.005	0 5354
7	1 0507	7.19	75.55	4.716	0.6304
8	1 0584	8 24	87.21	5.444	0.7278
9	1 0662	9 30	99.16	6.190	0.8275
10	1 0741	10.36	111.3	6.947	0.9286
11	1 0821	11.42	123.6	7.714	1.031
12	1 0902	12.48	136.1	8.493	1.135
13	1.0985	13 56	149.0	9.299	1.243
14	1 1069	14.65	162.2	10.12	1.353
15	1.1154	15 75	175.7	10.97	1.466
16	1 1240	16 85	189.4	11.82	1.581
17	1 1328	17.96	203.5	12.70	1.698
18	1.1417	19.08	217.8	13.60	1 818
19	1.1508	20.20	232.5	14.51	1.940
20	1.1600	21.32	247 3	15.44	2.064
21	1.1694	22.44	262.4	16.38	2.190
22	1 1789	23.57	277.9	17.35	2.319
23	1 1885	24 71	293.7	18.33	2.451
24	1 1983	25 85	309.8	19.34	2.585
25	1.2083	26 99	326.1	20.36	2.722
26	1 2185	28.13	342 8	21.40	2.860
27	1 2288	29.27	359.7	22.45	3.001
28	1.2393	30.43	377.1	23.54	3.147
29	1.2500	31.57	394.6	24.63	3.293
30	1 2609	32.71	412.4	25.75	3.442
31	1 2719	33.86	430.7	26.88	3 594
32	1.2832	35.01	449.2	28.04	3.749
33	1.2946	36.25	469.3	29.30	3.916
34	1.3063	37.51	490.0	30.59	4 089
35	1.3182	38.78	511.2	31.91	4.266
36	1.3303	40.06	532.9	33.27	4.447
37	1.3426	41.30	554.5	34 61	4.627
38	1.3551	42.52	576.2	35.97	4.808
39	1.3680	43.72	598.1	37.34	4.991

SODIUM SULFITE, ACID (BISULFITE) (Continued)

Specific Gravity of Aqueous Sodium Bisulfite and Proportion of SO_2 at $\frac{15.6°}{15.6°}$ C.

Bé.	Sp. gr.	Per cent SO_2	Grams per liter	Lbs. per cu. ft.	Lbs. per gal.
0	1.0000	0.00	0.000	0.0000	0.0000
1	1.0069	0.63	6 323	0.3947	0.0528
2	1.0140	1.26	12.78	0.7976	0.1066
3	1.0211	1.88	19.20	1.198	0.1602
4	1.0284	2.51	25.81	1.611	0.2154
5	1.0357	3.15	32.62	2.037	0.2723
6	1.0432	3.79	39.54	2.468	0.3299
7	1.0507	4.43	46 55	2.906	0.3884
8	1.0584	5.07	53.66	3.350	0.4478
9	1.0662	5.72	60.99	3.807	0.5089
10	1.0741	6.38	68.53	4.278	0.5719
11	1.0821	7.03	76.07	4.749	0.6348
12	1.0902	7.68	83.73	5.227	0 6987
13	1.0985	8.35	91.72	5 726	0.7655
14	1.1069	9.02	99.84	6 233	0.8332
15	1.1154	9.70	108.2	6 754	0 9029
16	1 1240	10.37	116.6	7.276	0 9727
17	1.1328	11.06	125.3	7.821	1.046
18	1.1417	11.75	134.1	8.374	1.119
19	1.1508	12.43	143.0	8.930	1.194
20	1.1600	13.12	152.2	9.501	1.270
21	1.1694	13.81	161.5	10.08	1.348
22	1.1789	14.51	171.1	10.68	1.428
23	1 1885	15.21	180.8	11.28	1 509
24	1.1983	15.91	190.6	11.90	1.591
25	1.2083	16.61	200.7	12.53	1.675
26	1.2185	17.32	211 0	13.17	1.761
27	1.2288	18.02	221.4	13.82	1.848
28	1.2393	18.73	232.1	14.49	1.937
29	1 2500	19.43	242.9	15.16	2.027
30	1.2609	20.14	253.9	15.85	2.119
31	1.2719	20.84	265.1	16.55	2.212
32	1.2832	21.55	276.5	17.26	2.308
33	1.2946	22.31	288.8	18.03	2.410
34	1.3063	23.09	301.6	18.83	2.517
35	1.3182	23.87	314.7	19.64	2 626
36	1.3303	24.66	328.1	20.48	2.738
37	1.3426	25.42	341.3	21.31	2.848
38	1.3551	26.17	354.6	22.14	2.959
39	1.3680	26.91	368.1	22.98	3.072

SODIUM TARTRATE

Specific Gravity of Aqueous Sodium Tartrate Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr	Per cent $Na_2C_4H_4O_6$	G per liter	Lbs. per cu. ft.	Lbs. per gal
0.8	1.0052	1	10.05	0.6275	0.0839
1.8	1.0123	2	20.25	1.264	0.1690
3.8	1.0266	4	41.06	2.564	0.3427
5.7	1.0410	6	62.46	3.899	0.5212
7.6	1.0555	8	84.44	5.271	0.7047
9.5	1.0702	10	107.0	6.681	0.8931
11.4	1.0851	12	130.2	8.129	1.087
13.2	1.1002	14	154.0	9.616	1.285
15.0	1.1156	16	178.5	11.14	1.490
16.8	1.1313	18	203.6	12.71	1.699
18.6	1.1471	20	229.4	14.32	1.915
20.4	1.1633	22	255.9	15.98	2.136
22.1	1.1797	24	283.1	17.67	2.363
23.8	1.1963	26	311.0	19.42	2.596
25.5	1.2132	28	339.7	21.21	2.835

Bé.	Sp. gr.	Per cent $Na_2C_4H_4O_6 + 2H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0052	1.186	11.92	0.7441	0.0995
1.8	1.0123	2.371	24.01	1.499	0.2003
3.8	1.0266	4.743	48.69	3.040	0.4063
5.7	1.0410	7.114	74.06	5.623	0.6180
7.6	1.0555	9.486	100.1	6.250	0.8355
9.5	1.0702	11.86	126.9	7.922	1.059
11.4	1.0851	14.23	154.4	9.638	1.288
13.2	1.1002	16.60	182.6	11.40	1.524
15.0	1.1156	18.97	211.6	13.21	1.766
16.8	1.1313	21.34	241.4	15.07	2.015
18.6	1.1471	23.71	272.0	16.98	2.270
20.4	1.1633	26.09	303.5	18.94	2.532
22.2	1.1797	28.46	335.7	20.96	2.802
23.8	1.1963	30.83	368.8	23.02	3.078
25.5	1.2132	33.20	402.8	25.14	3.361

SODIUM THIOSULFATE

Specific Gravity of Aqueous Sodium Thiosulfate (Hypo) Solutions at $\frac{20°}{4°}$ C.*

Bé	Sp gr.	Per cent $Na_2S_2O_3$	G per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.0065	1	10.07	0.6283	0.0840
2.1	1.0148	2	20.30	1.267	0.1694
4.4	1.0315	4	41.26	2.576	0.3443
6.7	1.0483	6	62.90	3.927	0.5249
8.9	1.0654	8	85.23	5.321	0.7113
11.1	1.0827	10	108.3	6.759	0.9035
13.2	1.1003	12	132.0	8.243	1.102
15.3	1.1182	14	156.5	9.773	1.306
17.4	1.1365	16	181.8	11.35	1.517
19.5	1.1551	18	207.9	12.98	1.735
21.5	1.1740	20	234.8	14.66	1.959
23.5	1.1932	22	262.5	16.39	2.191
25.4	1.2128	24	291.1	18.17	2.429
27.4	1.2328	26	320.5	20.01	2.675
29.3	1.2532	28	350.9	21.91	2.928
31.2	1.2739	30	382.2	23.86	3.189
35.8	1.3273	35	464.6	29.00	3.877
40.1	1.3827	40	553.1	34.53	4.616

Bé.	Sp. gr.	Per cent $Na_2S_2O_3 + 5H_2O$	G per liter	Lbs. per cu ft.	Lbs per gal.
0.9	1.0065	1.570	15 80	0.9863	0.1318
2 1	1.0148	3 139	31.86	1.989	0.2659
4.4	1.0315	6.279	64.77	4.043	0.5405
6.7	1.0483	9.418	98.73	6.164	0.8239
8.9	1.0654	12.56	133.8	8.352	1.117
11.1	1.0827	15.70	170.0	10.61	1.418
13.2	1.1003	18.84	207.3	12.94	1.730
15.3	1.1182	21.98	245.7	15.34	2.051
17.4	1.1365	25.12	285.4	17.82	2.382
19.5	1.1551	28 25	326.4	20 37	2.724
21.5	1.1740	31 39	368.6	23.01	3.076
23.5	1.1932	34.53	412.1	25.72	3.439
25 4	1.2128	37 67	456.9	28.52	3.813
27.4	1.2328	40.81	503.1	31.41	4.199
29 3	1.2532	43 95	550.8	34.38	4.597
31.2	1.2739	47.09	599.9	37.45	5.006
35.8	1.3273	54.94	729.2	45.52	6.085
40 1	1.3827	62 79	868.2	54.20	7.245

SODIUM THIOSULFATE

Specific Gravity of Aqueous Sodium Thiosulfate (Hypo) Solutions at 19° C. (Schiff)

Bé.	Sp. gr.	Per cent $Na_2S_2O_3$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.8	1.0052	0.637	6.404	0.3998	0.0534
1.5	1.0105	1.27	12.88	0.8038	0.1075
2.3	1.0158	1.91	19.41	1.212	0.1620
3.0	1.0211	2.55	26.02	1.624	0.2172
3.7	1.0264	3.19	32.69	2.041	0.2728
4.5	1.0317	3.82	39.44	2.462	0.3291
5.2	1.0370	4.46	46.24	2.887	0.3859
5.9	1.0423	5.10	53.12	3.316	0.4433
6.6	1.0476	5.73	60.07	3.750	0.5013
7.3	1.0529	6.37	67.08	4.187	0.5598
8.0	1.0584	7.01	74.17	4.630	0.6190
8.7	1.0639	7 65	81.33	5.077	0.6787
9.4	1.0695	8.28	88 58	5.529	0.7392
10.1	1.0751	8.92	95.89	5.986	0.8002
10.8	1.0807	9.56	103.3	6.447	0.8618
11.5	1.0863	10.2	110.7	6.912	0.9240
12.2	1.0919	10.8	118.3	7.382	0.9869
12.9	1.0975	11.5	125.9	7.857	1.050
13.6	1.1031	12.1	133.5	8.335	1.114
14.2	1.1087	12.7	141 3	8.819	1.179
14.9	1.1145	13.4	149.1	9.308	1.244
15.6	1.1204	14.0	157.0	9.803	1.310
16.3	1.1263	14.7	165.0	10.30	1.377
16.9	1.1322	15.3	173.1	10.81	1.445
17.6	1.1381	15.9	181.3	11.32	1.513
18.3	1.1440	16.6	189.5	11.83	1.581
18.9	1.1499	17.2	197.8	12.35	1.651
19.5	1.1558	17.8	206.2	12.87	1.721
20.2	1.1617	18.5	214.6	13.40	1.791
20.8	1.1676	19.1	223.2	13.93	1.862
21.5	1.1738	19.7	231.8	14.47	1.935
22.1	1.1800	20.4	240.6	15.02	2.008
22.8	1.1862	21.0	249.4	15.57	2.081
23.4	1.1924	21.7	258.3	16.12	2.155
24.0	1.1986	22.3	267.3	16.68	2.230
24.7	1.2048	22.9	276.3	17.25	2.306
25.3	1.2110	23.6	285.5	17.82	2.382
25.9	1.2172	24.2	294.7	18.40	2.459
26.5	1.2234	24.8	304.0	18 98	2.537
27.1	1.2297	25.5	313.4	19.56	2.615
27.7	1.2362	26.1	322 9	20.16	2.695
28 3	1.2427	26.8	332.5	20.76	2.775
28.9	1.2492	27.4	342.2	21.36	2.856
29.5	1.2558	28.0	352 0	21.98	2.938
30.1	1.2624	28 7	361.9	22.59	3.020
30.7	1.2690	29 3	371.9	23.22	3.103
31.3	1.2756	29.9	381.9	23.84	3.187
31.9	1.2822	30.6	392.1	24.48	3.272
32.5	1.2888	31.2	402.3	25.12	3.357
33.1	1.2954	31.9	412.6	25.76	3.443

SODIUM THIOSULFATE

Specific Gravity of Aqueous Sodium Thiosulfate Solutions at 19° C. (Schiff)

Bé.	Sp. gr.	Per cent $Na_2S_2O_3 + 5H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0 8	1.0052	1	10.05	0.6275	0.0839
1 5	1.0105	2	20.21	1.262	0.1687
2 3	1.0158	3	30.47	1.902	0.2543
3 0	1 0211	4	40.84	2.550	0.3409
3 7	1.0264	5	51.32	3.204	0.4283
4.5	1.0317	6	61.90	3.864	0.5166
5 2	1.0370	7	72.59	4.532	0 6058
5.9	1.0423	8	83.38	5.205	0 6959
6.6	1.0476	9	94.28	5.886	0.7868
7 3	1.0529	10	105.3	6.573	0.8787
8 0	1.0584	11	116.4	7.268	0.9716
8.7	1.0639	12	127.7	7.970	1 065
9.4	1 0695	13	139.0	8 680	1 160
10 1	1.0751	14	150.5	9.396	1 256
10 8	1.0807	15	162.1	10 12	1.353
11.5	1.0863	16	173 8	10 85	1.450
12 2	1.0919	17	185 6	11.59	1.549
12.9	1.0975	18	197.6	12.33	1 649
13.6	1.1031	19	209.6	13.08	1.749
14.2	1 1087	20	221.7	13.84	1.850
14.9	1.1145	21	234.0	14.61	1.953
15.6	1.1204	22	246.5	15.39	2.057
16.3	1.1263	23	259.0	16.17	2.162
16 9	1.1322	24	271.7	16 96	2 268
17.6	1.1381	25	284 5	17.76	2.374
18.3	1.1440	26	297.4	18.57	2.482
18.9	1.1499	27	310.4	19.38	2.591
19 5	1.1558	28	323.6	20 20	2.701
20.2	1.1617	29	336.9	21.03	2.811
20.8	1.1676	30	350.3	21.87	2.923
21.5	1.1738	31	363.9	22.72	3.037
22.1	1.1800	32	377.6	23.57	3.151
22.8	1.1862	33	391.4	24 44	3.267
23.4	1 1924	34	405 4	25.31	3.383
24.0	1 1986	35	419.5	26.19	3.501
24.7	1 2048	36	433.7	27.08	3.620
25.3	1 2110	37	448 1	27.97	3.739
25 9	1.2172	38	462 5	28 87	3.860
26 5	1.2234	39	477 1	29.79	3.982
27.1	1.2297	40	491 9	30.71	4.105
27.7	1.2362	41	506.8	31.64	4.230
28.3	1.2427	42	521.9	32.58	4.356
28.9	1 2492	43	537.2	33.53	4.483
29.5	1 2558	44	552 6	34.49	4.611
30.1	1 2624	45	568 1	35.46	4 741
30 7	1.2690	46	583 7	36.44	4 871
31.3	1.2756	47	599.5	37.43	5 003
31.9	1.2822	48	615.5	38.42	5.136
32.5	1.2888	49	631.5	39.42	5.270
33.1	1.2954	50	647.7	40.43	5.405

STANNIC CHLORIDE

Specific Gravity of Aqueous Stannic Chloride Solutions at $\frac{15°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $SnCl_4$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.007	1	10.07	0.6286	0.0840
2.1	1.015	2	20.30	1.267	0.1694
4.4	1.031	4	41.24	2.574	0.3442
6.5	1.047	6	62.82	3.922	0.5243
8.7	1.064	8	85.12	5.314	0.7103
10.9	1.081	10	108.1	6.748	0.9021
13.1	1.099	12	131 9	8.233	1.101
15.2	1 117	14	156 4	9.762	1.305
17.2	1.135	16	181 6	11.34	1.515
19.4	1 154	18	207.7	12.97	1.733
21.4	1 173	20	234.6	14 65	1.958
23.4	1 192	22	262.2	16.37	2.188
25.4	1 212	24	290 9	18.16	2.427
27.4	1 233	26	320.6	20 01	2.675
29.5	1 255	28	351.4	21.94	2.933
31.5	1 278	30	383.4	23.93	3.200
36.6	1 337	35	468.0	29.21	3 905
41.7	1.403	40	561.2	35.03	4.683
46.7	1.475	45	663.8	41.44	5.539
51.8	1.555	50	777.5	48 54	6 488
56.8	1.644	55	904.2	56.45	7.546
61.8	1.742	60	1045	65.25	8.722
66.7	1 851	65	1203	75 11	10 04
71 4	1 971	70	1380	86 13	11.51

Bé.	Sp. gr.	Per cent $SnCl_4 + 5H_2O$	G. per liter	Lbs. per cu. ft	Lbs. per gal.
1.0	1 007	1 35	13 55	0.8460	0 1131
2.1	1 015	2 69	27 32	1 705	0.2280
4.4	1 031	5 38	55.50	3.465	0.4632
6.5	1.047	8 07	84.54	5.278	0.7055
8.7	1.064	10 8	114.5	7.151	0.9560
10 9	1 081	13.5	145.5	9 082	1.214
13.1	1 099	16 1	177.5	11.08	1.481
15.2	1.117	18 8	210.4	13.14	1.756
17.2	1.135	21.5	244 4	15 26	2.039
19.4	1.154	24.2	279.5	17 45	2.333
21.4	1 173	26 9	315.8	19.71	2.635
23.4	1 192	29.6	352.9	22.03	2.945
25.4	1 212	32.3	391.5	24.44	3.267
27.4	1 233	35.0	431.4	26.93	3.600
29.5	1 255	37 7	472.9	29.52	3.946
31.5	1.278	40.4	516.0	32 21	4.306
36.6	1.337	47.1	629 7	39.31	5.255
41.7	1 403	53.8	755 2	47.15	6.303
46.7	1.475	60 6	893.2	55 78	7.454
51.8	1 555	67.3	1046	65 32	8 732
56.8	1 644	74.0	1217	75.96	10.15
61.8	1 742	80.7	1407	87 81	11 74
66.7	1.851	87.5	1619	101.1	13.51
71.4	1.971	94.2	1857	115 9	15.49

STANNOUS CHLORIDE

Specific Gravity of Aqueous Stannous Chloride Solutions at $\frac{15^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent $SnCl_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal
1.0	1.0068	1	10.07	0.6285	0.0840
2.1	1.0146	2	20.29	1.267	0.1693
4.3	1.0306	4	41.22	2.573	0.3440
6.5	1.0470	6	62.82	3.922	0.5243
8.7	1.0638	8	85.10	5.313	0.7102
10.9	1.0810	10	108.1	6.748	0.9021
13.0	1.0986	12	131.8	8.230	1.100
15.2	1.1167	14	156.3	9.760	1.305
17.3	1.1353	16	181.6	11.34	1.516
19.4	1.1545	18	207.8	12.97	1.734
21.5	1.1743	20	234.9	14.66	1.960
23.6	1.1948	22	262.9	16.41	2.194
25.8	1.2159	24	291.8	18.22	2.435
27.8	1.2377	26	321.8	20.09	2.686
29.9	1.2603	28	352.9	22.03	2.945
32.0	1.2837	30	385.1	24.04	3.214
37.3	1.3461	35	471.1	29.41	3.932
42.5	1.4145	40	565.8	35.32	4.722
47.7	1.4897	45	670.4	41.85	5.594
52.8	1.5729	50	786.5	49.10	6.563
57.9	1.6656	55	916.1	57.19	7.645
63.1	1.7695	60	1062	66.28	8.860
68.1	1.8865	65	1226	76.55	10.23

Bé.	Sp. gr.	Per cent $SnCl_2 + 2H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.0	1.0068	1.19	11.98	0 7480	0 1000
2.1	1.0146	2.38	24.15	1.508	0 2015
4.3	1.0306	4.76	49.06	3.063	0 4094
6.5	1.0470	7.14	74.76	4.667	0.6239
8.7	1.0638	9.52	101.3	6.322	0.8452
10.9	1.0810	11.9	128.6	8 031	1.074
13.0	1.0986	14 3	156.9	9.794	1.309
15.2	1.1167	16.7	186.0	11.61	1.553
17.3	1.1353	19.0	216.2	13.49	1.804
19.4	1.1545	21.4	247.3	15.44	2.064
21.5	1.1743	23 8	279.5	17.45	2.332
23.6	1.1948	26 2	312.8	19.53	2.610
25.8	1.2159	28.6	347.3	21 68	2.898
27.8	1.2377	30.9	383.0	23.91	3.196
29.9	1.2603	33.3	419.9	26.22	3.505
32.0	1.2837	35.7	458.3	28.61	3.825
37.3	1.3461	41 7	560 7	35.00	4.679
42.5	1.4145	47.6	673.3	42.03	5.619
47.7	1.4897	53.6	797.8	49 80	6.657
52.8	1.5729	59.5	935.9	58.43	7.810
57.9	1.6656	65.5	1090	68.06	9.098
63.1	1.7695	71.4	1263	78.87	10.54
68.1	1.8865	77.4	1459	91.10	12.18

SUCROSE (CANE SUGAR)

Specific Gravity of Aqueous Sugar Solutions at $\frac{20^\circ}{4^\circ}$ C.

Bé	Sp. gr.	Per cent $C_{12}H_{22}O_{11}$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
	0.9982	0			
0.3	1.0021	1	10.02	0.6256	0.0836
0.9	1.0060	2	20.12	1.256	0.1679
1.4	1.0099	3	30.30	1.891	0.2528
2.0	1.0139	4	40.56	2.532	0.3384
2.5	1.0179	5	50.89	3.177	0.4247
3.1	1.0219	6	61.31	3.827	0.5117
3.6	1.0259	7	71.81	4.483	0.5993
4.1	1.0299	8	82.40	5.144	0.6876
4.7	1.0340	9	93.06	5.810	0.7766
5.3	1.0381	10	103.8	6.481	0.8664
5.8	1.0423	11	114.7	7.157	0.9568
6.4	1.0465	12	125.6	7.839	1.048
7.0	1.0507	13	136.6	8.527	1.140
7.5	1.0549	14	147.7	9.220	1.232
8.1	1.0592	15	158.9	9.918	1.326
8.7	1.0635	16	170.2	10.62	1.420
9.2	1.0678	17	181.5	11.33	1.515
9.8	1.0721	18	193.0	12.05	1.611
10.3	1.0765	19	204.5	12.77	1.707
10.8	1.0810	20	216.2	13.50	1.804
11.4	1.0854	21	227.9	14.23	1.902
12.0	1.0899	22	239.8	14.97	2.001
12.5	1.0944	23	251.7	15.71	2.101
13.1	1.0990	24	263.8	16.47	2.201
13.6	1.1036	25	275.9	17.22	2.302
14.2	1.1082	26	288.1	17.99	2.404
14.7	1.1128	27	300.5	18.76	2.507
15.3	1.1175	28	312.9	19.53	2.611
15.8	1.1222	29	325.4	20.32	2.716
16.3	1.1270	30	338.1	21.11	2.821
16.9	1.1318	31	350.8	21.90	2.928
17.5	1.1366	32	363.7	22.71	3.035
18.0	1.1415	33	376.7	23.51	3.143
18.6	1.1463	34	389.8	24.33	3.253
19.1	1.1513	35	402.9	25.15	3.363
19.6	1.1562	36	416.2	25.98	3.474
20.1	1.1612	37	429.7	26.82	3.586
20.7	1.1663	38	443.2	27.67	3.698
21.2	1.1713	39	456.8	28.52	3.812
21.7	1.1764	40	470.6	29.38	3.927
22.3	1.1816	41	484.5	30.24	4.043
22.8	1.1868	42	498.4	31.12	4.160
23.3	1.1920	43	512.6	32.00	4.277
23.9	1.1972	44	526.8	32.89	4.396
24.4	1.2025	45	541.1	33.78	4.516
25.0	1.2079	46	555.6	34.69	4.637
25.5	1.2132	47	570.2	35.60	4.759
26.0	1.2186	48	584.9	36.52	4.882
26.5	1.2241	49	599.8	37.44	5.005
27.1	1.2296	50	614.8	38.38	5.131
27.6	1.2351	51	629.9	39.32	5.257
28.1	1.2406	52	645.1	40.27	5.384
28.7	1.2462	53	660.5	41.23	5.512
29.2	1.2519	54	676.0	42.20	5.641
29.7	1.2575	55	691.6	43.18	5.772
30.3	1.2632	56	707.4	44.16	5.904

SUCROSE (CANE SUGAR) (Continued)

Specific Gravity of Aqueous Sugar Solutions at $\frac{20^\circ}{4^\circ}$ C.

Bé	Sp. gr.	Per cent $C_{12}H_{22}O_{11}$	G. per liter	Lbs. per cu. ft.	Lbs per gal.
30.8	1.2690	57	723.3	45.15	6.036
31.3	1.2748	58	739.4	46.16	6.170
31.8	1.2806	59	755.6	47.17	6.305
32.3	1.2865	60	771.9	48.19	6.441
32.8	1.2924	61	788.3	49.21	6.579
33.4	1.2983	62	804.9	50.25	6.717
33.9	1.3043	63	821.7	51.30	6.857
34.4	1.3103	64	838.6	52.35	6.998
34.8	1.3163	65	855.6	53.41	7.140
35.4	1.3224	66	872.8	54.49	7.284
35.9	1.3286	67	890.1	55.57	7.428
36.4	1.3347	68	907.6	56.66	7.574
36.9	1.3409	69	925.2	57.76	7.721
37.4	1.3472	70	943.0	58.87	7.870
37.9	1.3535	71	961.0	59.99	8.019
38.4	1.3598	72	979.0	61.12	8.170
38.9	1.3661	73	997.3	62.26	8.323
39.4	1.3725	74	1016	63.41	8.476
39.9	1.3790	75	1034	64.56	8.631
40.4	1.3854	76	1053	65.73	8.787
40.9	1.3920	77	1072	66.91	8.944
41.4	1.3985	78	1091	68.10	9.103
41.8	1.4051	79	1110	69.29	9.263
42.2	1.4117	80	1129	70.50	9.425
42.7	1.4184	81	1149	71.72	9.588
43.2	1.4251	82	1169	72.95	9.752
43.7	1.4318	83	1188	74.19	9.917
44.2	1.4386	84	1208	75.44	10.08
44.7	1.4454	85	1229	76.70	10.25
45.2	1.4522	86	1249	77.97	10.42
45.6	1.4591	87	1269	79.25	10.59
46.1	1.4660	88	1290	80.54	10.77
46.6	1.4730	89	1311	81.85	10.94

SULFURIC ACID

Specific Gravity of Aqueous Sulfuric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent H_2SO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.7	1.0051	1	10.05	0.6275	0.0839
1.7	1.0118	2	20 24	1.263	0.1689
2.6	1.0184	3	30.55	1.907	0.2550
3.5	1.0250	4	41.00	2 560	0.3422
4.5	1.0317	5	51.59	3.220	0.4305
5.4	1.0385	6	62.31	3.890	0.5200
6.3	1.0453	7	73.17	4.568	0.6106
7.2	1.0522	8	84.18	5 255	0.7025
8 1	1.0591	9	95.32	5.950	0.7955
9 0	1.0661	10	106 6	6.655	0.8897
9 9	1 0731	11	118.0	7.369	0.9851
10 8	1 0802	12	129.6	8.092	1.082
11 7	1.0874	13	141.4	8.825	1.180
12 5	1 0947	14	153.3	9.567	1.279
13 4	1 1020	15	165.3	10.32	1.379
14 3	1 1094	16	177.5	11.08	1.481
15.2	1 1168	17	189 9	11.85	1.584
16.0	1.1243	18	202 4	12.63	1.689
16.9	1.1318	19	215.0	13.42	1.795
17 7	1.1394	20	227.9	14.23	1.902
18 6	1.1471	21	240.9	15.04	2.010
19 4	1 1548	22	254.1	15.86	2.120
20.3	1 1626	23	267.4	16 69	2.231
21.1	1 1704	24	280.9	17.54	2.344
21.9	1 1783	25	294.6	18.39	2.458
22 8	1 1862	26	308.4	19.25	2.574
23.6	1 1942	27	322.4	20.13	2.691
24.4	1 2023	28	336 6	21 02	2.809
25.2	1.2104	29	351.0	21.91	2.929
26.0	1.2185	30	365.6	22.82	3.051
26.8	1.2267	31	380.3	23.74	3.173
27.6	1 2349	32	395.2	24 67	3.298
28.4	1.2432	33	410.3	25.61	3.424
29.1	1.2515	34	425.5	26.56	3.551
29.9	1.2599	35	441.0	27.53	3.680
30.7	1.2684	36	456.6	28 51	3.811
31.4	1.2769	37	472.5	29.49	3.943
32.2	1.2855	38	488.5	30.49	4.077
33.0	1.2941	39	504 7	31.51	4.212
33.7	1.3028	40	521 1	32.53	4.349
34.5	1.3116	41	537 8	33.57	4.488
35 2	1 3205	42	554.6	34.62	4.628
35.9	1 3294	43	571 6	35.69	4.770
36 7	1.3384	44	588 9	36 76	4.914
37.4	1 3476	45	606 4	37.86	5.061
38.1	1.3569	46	624 2	38.97	5.209
38.9	1.3663	47	642 2	40.09	5.359
39.6	1 3758	48	660 4	41.23	5.511
40.3	1.3854	49	678 8	42.38	5.665
41.1	1 3951	50	697.6	43.55	5.821
41.8	1.4049	51	716 5	44.73	5.979
42.5	1.4148	52	735 7	45.93	6.140
43.2	1.4248	53	755.1	47.14	6.302
44.0	1.4350	54	774.9	48.37	6.467

SULFURIC ACID (Continued)

Specific Gravity of Aqueous Sulfuric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent H_2SO_4	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
44.7	1.4453	55	794.9	49.62	6.634
45.4	1.4557	56	815.2	50.89	6.803
46.1	1.4662	57	835.7	52.17	6.974
46.8	1.4768	58	856.5	53.47	7.148
47.5	1.4875	59	877.6	54.79	7.324
48.2	1.4983	60	899.0	56.12	7.502
48.9	1.5091	61	920.6	57.47	7.682
49.6	1.5200	62	942.4	58.83	7.865
50.3	1.5310	63	964.5	60.21	8.049
51.0	1.5421	64	986.9	61.61	8.236
51.7	1.5533	65	1010	63.03	8.426
52.3	1.5646	66	1033	64.46	8.618
53.0	1.5760	67	1056	65.92	8.812
53.7	1.5874	68	1079	67.39	9.008
54.3	1.5989	69	1103	68.87	9.207
55.0	1.6105	70	1127	70.38	9.408
55.6	1.6221	71	1152	71.90	9.611
56.3	1.6338	72	1176	73.44	9.817
56.9	1.6456	73	1201	74.99	10.02
57.5	1.6574	74	1226	76.57	10.24
58.1	1.6692	75	1252	78.15	10.45
58.7	1.6810	76	1278	79.75	10.66
59.3	1.6927	77	1303	81.37	10.88
59.9	1.7043	78	1329	82.99	11.09
60.5	1.7158	79	1355	84.62	11.31
61.1	1.7272	80	1382	86.26	11.53
61.6	1.7383	81	1408	87.90	11.75
62.1	1.7491	82	1434	89.54	11.97
62.6	1.7594	83	1460	91.16	12.19
63.0	1.7693	84	1486	92.78	12.40
63.5	1.7786	85	1512	94.38	12.62
63.9	1.7872	86	1537	95.95	12.83
64.2	1.7951	87	1562	97.49	13.03
64.5	1.8022	88	1586	99.01	13.23
64.8	1.8087	89	1610	100.5	13.43
65.1	1.8144	90	1633	101.9	13.63
65.3	1.8195	91	1656	103.4	13.82
65.5	1.8240	92	1678	104.8	14.00
65.7	1.8279	93	1700	106.1	14.19
65.8	1.8312	94	1721	107.5	14.36
65.9	1.8337	95	1742	108.7	14.54
66.0	1.8355	96	1762	110.0	14.70
66.0	1.8364	97	1781	111.2	14.87
66.0	1.8361	98	1799	112.3	15.02
65.9	1.8342	99	1816	113.4	15.15
65.8	1.8305	100	1831	114.3	15.28

TABLES OF THE MANUFACTURING CHEMISTS' ASSOCIATION

SULFURIC ACID

Authorities — W. C. FERGUSON; H. P. TALBOT

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should always be printed on the scale.

66° Baumé = Sp. Gr. 1.8354.

1 cu. ft. water at 60° F. weighs 62.37 lbs. av.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

H_2SO_4 = 100 per cent.

	H_2SO_4	O. V.	60°
O. V.	93.19	100.00	119.98
60°	77.67	83.35	100.00
50°	62.18	66.72	80.06

Acids stronger than 66° Bé. should have their percentage compositions determined by chemical analysis.

Bé.°	Sp. gr	Tw.°	Per cent H_2SO	Weight of 1 cu. ft. in lbs. av	Per cent O. V.	Pounds O. V. in 1 cu. ft.	* Freezing (melting) point.
0	1.0000	0.0	0.00	62.37	0.00	0.00	32.0° F.
1	1.0069	1.4	1.02	62.80	1.09	.68	31.2 "
2	1.0140	2.8	2.08	63.24	2.23	1.41	30.5 "
3	1.0211	4.2	3.13	63.69	3.36	2.14	29.8 "
4	1.0284	5.7	4.21	64.14	4.52	2.90	28.9 "
5	1.0357	7.1	5.28	64.60	5.67	3.66	28.1 "
6	1.0432	8.6	6.37	65.06	6.84	4.45	27.2 "
7	1.0507	10.1	7.45	65.53	7.99	5.24	26.3 "
8	1.0584	11.7	8.55	66.01	9.17	6.06	25.1 "
9	1.0662	13.2	9.66	66.50	10.37	6.89	24.0 "
10	1.0741	14.8	10.77	66.99	11.56	7.74	22.8 "
11	1.0821	16.4	11.89	67.49	12.76	8.61	21.5 "
12	1.0902	18.0	13.01	68.00	13.96	9.49	20.0 "
13	1.0985	19.7	14.13	68.51	15.16	10.39	18.3 "
14	1.1069	21.4	15.25	69.04	16.36	11.30	16.6 "

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

SULFURIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent H_2SO_4	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu.ft.	* Freezing (melting) point.
15	1.1154	23.1	16.38	69.57	17.58	12.23	14.7 F.
16	1.1240	24.8	17.53	70.10	18.81	13.19	12.6 "
17	1.1328	26.6	18.71	70.65	20.08	14.18	10.2 "
18	1.1417	28.3	19.89	71.21	21.34	15.20	7.7 "
19	1.1508	30.2	21.07	71.78	22.61	16.23	4.8 "
20	1.1600	32.0	22.25	72.35	23.87	17.27	+ 1.6 "
21	1.1694	33.9	23.43	72.94	25.14	18.34	− 1.8 "
22	1.1789	35.8	24.61	73.53	26.41	19.42	− 6.0 "
23	1.1885	37.7	25.81	74.13	27.69	20.53	−11 "
24	1.1983	39.7	27.03	74.74	29.00	21.68	−16 "
25	1.2083	41.7	28.28	75.36	30.34	22.87	−23 "
26	1.2185	43.7	29.53	76.00	31.69	24.08	−30 "
27	1.2288	45.8	30.79	76.64	33.04	25.32	−39 "
28	1.2393	47.9	32.05	77.30	34.39	26.58	−49 "
29	1.2500	50.0	33.33	77.96	35.76	27.88	−61 "
30	1.2609	52.2	34.63	78.64	37.16	29.22	−74 "
31	1.2719	54.4	35.93	79.33	38.55	30.58	−82 "
32	1.2832	56.6	37.26	80.03	39.98	32.00	−96 "
33	1.2946	58.9	38.58	80.74	41.40	33.42	−97 "
34	1.3063	61.3	39.92	81 47	42.83	34.90	−91 "
35	1.3182	63.6	41.27	82 22	44.28	36.41	−81 "
36	1.3303	66.1	42.63	82.97	45.74	37.95	−70 "
37	1.3426	68.5	43.99	83.74	47.20	39.53	−60 "
38	1.3551	71.0	45.35	84.52	48.66	41.13	−53 "
39	1.3679	73.6	46.72	85.32	50.13	42.77	−47 "
40	1.3810	76.2	48.10	86.13	51.61	44.45	−41 "
41	1.3942	78.8	49.47	86.96	53.08	46.16	−35 "
42	1.4078	81.6	50.87	87.80	54.58	47.92	−31 "
43	1.4216	84.3	52.26	88.67	56.07	49.72	−27 "
44	1.4356	87.1	53.66	89.54	57.58	51.56	−23 "
45	1.4500	90.0	55.07	90.44	59.09	53.44	−20 "
46	1.4646	92.9	56.48	91.35	60.60	55.36	−14 "
47	1.4796	95.9	57.90	92.28	62.13	57.33	−15 "
48	1.4948	99.0	59.32	93.23	63.65	59.34	−18 "
49	1.5104	102.1	60.75	94.20	65.18	61.40	−22 "

* Calculated from Pickering's results. Journal of London Chemical Society Vol. 57, p. 363.

SULFURIC ACID (Continued)

Bé.°	Sp gr.	Tw.°	Per cent H_2SO_4	Weight of 1 cu. ft in lbs. av	Per cent O. V.	Pounds O. V. in 1 cu.ft.	*Freezing (melting) point.
50	1.5263	105.3	62.18	95.20	66.72	63.52	−27 F
51	1.5426	108.5	63.66	96.21	68.31	65.72	−33 "
52	1.5591	111.8	65.13	97.24	69.89	67.96	−39 "
53	1.5761	115.2	66.63	98.30	71.50	70.28	−49 "
54	1.5934	118.7	68.13	99.38	73.11	72.66	−59 "
55	1.6111	122.2	69.65	100.48	74.74	75.10	..
56	1.6292	125.8	71.17	101.61	76.37	77.60	..
57	1.6477	129.5	72.75	102.77	78.07	80.23	.. Below −40
58	1.6667	133.3	74.36	103.95	79.79	82.95	..
59	1.6860	137.2	75.99	105.16	81.54	85.75	− 7
60	1.7059	141.2	77.67	106.40	83.35	88.68	+12.6 F
61	1.7262	145.2	79.43	107.66	85.23	91.76	27.3 "
62	1.7470	149.4	81.30	108.96	87.24	95.06	39.1 "
63	1.7683	153.7	83.34	110.29	89.43	98.63	46.1 "
64	1.7901	158.0	85.66	111.65	91.92	102.63	46.4 "
64¼	1.7957	159.1	86.33	112.00	92.64	103.75	43.6 "
64½	1.8012	160.2	87.04	112.34	93.40	104.93	41.1 "
64¾	1.8068	161.4	87.81	112.69	94.23	106.19	37.9 "
65	1.8125	162.5	88.65	113.05	95.13	107.54	33.1 "
65¼	1.8182	163.6	89.55	113.40	96.10	108.97	24.6 "
65½	1.8239	164.8	90.60	113.76	97.22	110.60	13.4 "
65¾	1.8297	165.9	91.80	114.12	98.51	112.42	− 1 "
66	1.8354	167.1	93.19	114.47	100.0	114.47	−29 "

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

APPROXIMATE BOILING POINTS

50° Bé. 295 F.
60° " 386 "
61° " 400 "
62° " 415 "
63° " 432 "
64° " 451 "
65° " 485 "
66° " 538 "

Per cent 60°	Pounds 60° in 1 cu ft	Per cent 50°	Pounds 50° in 1 cu. ft
61.93	53.34	77.36	66.63
63.69	55.39	79.56	69.19
65.50	57.50	81.81	71.83
67.28	59.66	84.05	74.53
69.09	61.86	86.30	77.27
70.90	64.12	88.56	80.10
72.72	66.43	90.83	82.98
74.55	68.79	93.12	85.93
76.37	71.20	95.40	88.94
78.22	73.68	97.70	92.03

FIXED POINTS

Sp. gr.	Per cent H_2SO_4	Sp. gr.	Per cent H_2SO_4
1.0000	.00	1.5281	62.34
1.0048	.71	1.5440	63.79
1.0347	5.14	1.5748	66.51
1.0649	9.48	1.6272	71.00
1.0992	14.22	1.6679	74.46
1.1353	19.04	1.7044	77.54
1.1736	23.94	1.7258	79.40
1.2105	28.55	1.7472	81.32
1.2513	33.49	1.7700	83.47
1.2951	38.64	1.7959	86.36
1.3441	44.15	1.8117	88.53
1.3947	49.52	1.8194	89.75
1.4307	53.17	1.8275	91.32
1.4667	56.68	1.8354	93.19
1.4822	58.14		

Per cent 60°	Pounds 60° in 1 cu. ft.	Per cent 50°	Pounds 50° in 1 cu. ft
80.06	76.21	100.00	95.20
81.96	78.85	102.38	98.50
83.86	81.54	104.74	101.85
85.79	84.33	107.15	105.33
87.72	87.17	109.57	108.89
89.67	90.10	112.01	112.55
91.63	93.11	114.46	116.30
93.67	96.26	117.00	120.24
95.74	99.52	119.59	124.31
97.84	102.89	122.21	128.52
100.00	106.40	124.91	132.91
102.27	110.10	127.74	137.52
104.67	114.05	130.75	142.47
107.30	118.34	134.03	147.82
110.29	123.14	137.76	153.81
111.15	124.49	138.84	155.50
112.06	125.89	139.98	157.25
113.05	127.40	141.22	159.14
114.14	129.03	142.57	161.17
115.30	130.75	144.02	163.32
116.65	132.70	145.71	165.76
118.19	134.88	147.63	168.48
119.98	137.34	149.87	171.56

ALLOWANCE FOR TEMPERATURE

At 10° Bé. .029° Bé. or .00023 Sp. Gr. = 1° F.
At 20° Bé .036° Bé. or .00034 Sp. Gr = 1° F.
At 30° Bé .035° Bé or .00039 Sp. Gr = 1° F.
At 40° Bé. .031° Bé. or .00041 Sp. Gr. = 1° F.
At 50° Bé. .028° Bé. or .00045 Sp. Gr. = 1° F.
At 60° Bé. .026° Bé. or .00053 Sp. Gr = 1° F.
At 63° Bé .026° Bé. or .00057 Sp. Gr. = 1° F.
At 66° Bé. .0235° Bé. or .00054 Sp. Gr. = 1° F.

SULFURIC ACID, SO_3

Specific Gravity of Aqueous Sulfuric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C. Giving SO_3 Content

Bé.	Sp. gr.	Per cent SO_3	G. per liter SO_3	Lbs. per cu. ft. SO_3	Lbs per gal. SO_3
0.7	1.0051	.8163	8.204	.5122	0.0685
1.7	1.0118	1.633	16.52	1.030	.1379
2.6	1.0184	2.449	24.94	1.557	.2082
3.5	1.0250	3.265	33.47	2.090	.2793
4.5	1 0317	4.082	42.11	2.628	.3514
5.4	1.0385	4.898	50.86	3.175	.4245
6.3	1.0453	5.714	59.73	3.729	.4984
7.2	1.0522	6.531	68.72	4.290	.5735
8.1	1.0591	7.347	77.81	4.857	.6494
9.0	1.0661	8.163	87.02	5.433	.7263
9.9	1.0731	8.979	96.32	6.015	.8042
10.8	1.0802	9.796	105.8	6.606	.8833
11.7	1.0874	10.612	115.4	7.204	.9633
12.5	1.0947	11.43	125.1	7.810	1.044
13.4	1.1020	12.24	134.9	8.424	1.126
14.3	1.1094	13.06	144.9	9.045	1.209
15.2	1.1168	13.88	155.0	9.673	1.293
16.0	1.1243	14.69	165.2	10.31	1.379
16 9	1.1318	15 51	175.5	10.95	1.465
17.7	1.1394	16.33	186.0	11.62	1.553
18.6	1.1471	17 14	196.6	12.28	1.641
19.4	1.1548	17 96	207.4	12.95	1.731
20.3	1.1626	18.78	218.3	13.62	1.821
21.1	1.1704	19.59	229.3	14.32	1.913
21.9	1.1783	20.41	240.5	15.01	2.007
22.8	1.1862	21 22	251.8	15.71	2.101
23.6	1.1942	22 04	263.2	16.43	2.197
24.4	1.2023	22.86	274.8	17.16	2.293
25.2	1.2104	23.67	286.5	17.89	2.391
26.0	1.2185	24.49	298.4	18.63	2.491
26.8	1.2267	25.31	310.4	19.38	2.590
27.6	1.2349	26.12	322.6	20.14	2.692
28.4	1.2432	26.94	334.9	20.91	2.795
29.1	1.2515	27.75	347.3	21.68	2.899
29.9	1.2599	28.57	360.0	22.47	3.003
30.7	1.2684	29.39	372.7	23.27	3.111
31.4	1.2769	30.20	385.7	24.07	3.219
32 2	1.2855	31.02	398.8	24.89	3.328
33.0	1.2941	31.84	412.0	25.72	3.438
33.7	1.3028	32.65	425.4	26.45	3.550
34.5	1.3116	33.47	439.0	27.40	3.664
35.2	1.3205	34.29	452.7	28.26	3.778
35.9	1.3294	35.10	466.6	29.13	3.894
36.7	1.3384	35.92	480.7	30.01	4.011
37.4	1.3476	36.73	495.0	30.91	4.131
38.1	1.3569	37.55	509.5	31.81	4.252
38 9	1.3663	38.37	524.2	32.73	4.375
39 6	1.3758	39.18	539.1	33.66	4.499
40.3	1.3854	40.00	554.1	34.50	4.624
41.1	1.3951	40 82	569.5	35.55	4.752
41.8	1.4049	41.63	584.9	36.51	4.881
42.5	1.4148	42.45	600.6	37.49	5.012
43.2	1.4248	43 26	616.4	38.48	5.144
44.0	1.4350	44.08	632.6	39.49	5.279
44.7	1.4453	44.90	648.9	40.51	5.415
45 4	1.4557	45.71	665.5	41.54	5.553

SULFURIC ACID SO_3 (Continued)

Specific Gravity of Aqueous Sulfuric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C. Giving SO_3 Content

·Bé.	Sp gr	Per cent SO_3	G per liter SO_3	Lbs per cu ft SO_3	Lbs per gal. SO_3
46.1	1.4662	46.53	682.2	42.59	5.693
46.8	1.4768	47.35	699.2	43.65	5.835
47.5	1.4875	48.16	716.4	44.73	5.979
48.2	1.4983	48.98	733.9	45.81	6.124
48.9	1.5091	49.80	751.5	46.91	6.271
49.6	1.5200	50.61	769.3	48.02	6.420
50.3	1.5310	51.43	787.3	49.15	6.571
51.0	1.5421	52.24	805.6	50.29	6.723
51.7	1.5533	53.06	824.5	51.45	6.878
52.3	1.5646	53.88	843.3	52.62	7.035
53.0	1.5760	54.69	862.0	53.81	7.193
53.7	1.5874	55.51	880.8	55.01	7.353
54.3	1.5989	56.33	900.4	56.22	7.516
55.0	1.6105	57.14	920.0	57.45	7.680
55.6	1.6221	57.96	940.4	58.69	7.846
56.3	1.6338	58.77	960.0	59.95	8.014
56.9	1.6456	59.59	980.4	61.22	8.180
57.5	1.6574	60.41	1001	62.51	8.359
58.1	1.6692	61.22	1022	63.80	8.530
58.7	1.6810	62.04	1043	65.10	8.702
59.3	1.6927	62.86	1064	66.42	8.882
59.9	1.7043	63.67	1085	67.75	9.053
60.5	1.7158	64.49	1106	69.08	9.233
61.1	1.7272	65.31	1128	70.42	9.412
61.6	1.7383	66.12	1149	71.75	9.592
62.1	1.7491	66.94	1171	73.09	9.771
62.6	1.7594	67.75	1192	74.42	9.951
63.0	1.7693	68.57	1213	75.74	10.12
63.5	1.7786	69.39	1234	77.04	10.30
63.9	1.7872	70.20	1255	78.33	10.47
64.2	1.7951	71.02	1275	79.58	10.64
64.5	1.8022	71.84	1295	80.82	10.80
64.8	1.8087	72.65	1314	82.04	10.96
65.1	1.8144	73.47	1333	83.18	11.13
65.3	1.8195	74.28	1352	84.41	11.28
65.5	1.8240	75.10	1370	85.55	11.43
65.7	1.8279	75.92	1388	86.61	11.58
65.8	1.8312	76.73	1405	87.75	11.72
65.9	1.8337	77.55	1422	88.73	11.87
66.0	1.8355	78.37	1438	89.79	12.00
66.0	1.8364	79.18	1454	90.77	12.14
66.0	1.8361	80.00	1468	91.67	12.26
65.9	1.8342	80.82	1482	92.57	12.37
65.8	1.8305	81.63	1495	93.31	12.47

TANNIC ACID

Specific Gravity of Aqueous Tannic Acid Solutions at 15° C. (Trammer)

Bé.	Sp. gr.	Per cent $C_{14}H_{10}O_9$	G per liter	Lbs. per cu. ft.	Lbs. per gal.
0.6	1.0040	1 0	10 04	0.6268	0.0838
0.6	1.0044	1 0	11.05	0.6897	0.0922
0.7	1.0048	1.2	12.06	0.7527	0.1006
0.8	1.0052	1.3	13 07	0.8158	0.1091
0.8	1.0056	1.4	14.08	0.8789	0.1175
0.9	1.0060	1.5	15 09	0.9420	0.1259
0.9	1 0064	1.6	16.10	1.005	0.1344
1 0	1.0068	1.7	17.12	1.068	0.1428
1.0	1.0072	1.8	18.13	1.132	0.1513
1.1	1.0076	1.9	19 14	1.195	0.1598
1.2	1.0080	2 0	20.16	1.259	0.1682
1 2	1.0084	2.1	21.18	1 322	0.1767
1.3	1.0088	2.2	22 19	1.385	0 1852
1.3	1 0092	2 3	23 21	1.449	0.1937
1.4	1.0096	2.4	24 23	1.513	0.2022
1 4	1.0100	2.5	25 25	1.576	0.2107
1 5	1 0104	2 6	26 27	1.640	0 2192
1.5	1.0108	2.7	27 29	1.704	0 2278
1 6	1.0112	2.8	28.31	1.768	0.2363
1 7	1.0116	2.9	29.34	1 831	0.2448
1.7	1.0120	3.0	30 36	1 895	0 2534
1 8	1.0124	3.1	31.38	1.959	0 2619
1 8	1.0128	3.2	32 41	2 023	0 2705
1 9	1.0132	3 3	33.44	2 087	0 2790
1 9	1 0136	3 4	34 46	2 151	0 2876
2.0	1.0140	3 5	35.49	2 216	0 2962
2.1	1.0144	3.6	36.52	2 280	0 3048
2.1	1 0148	3.7	37.55	2.344	0.3133
2.2	1 0152	3.8	38 58	2 408	0.3219
2.2	1.0156	3.9	39.61	2 473	0.3305
2.3	1.0160	4.0	40 64	2 537	0 3392
2.3	1 0164	4.1	41.67	2.601	0.3478
2 4	1 0168	4.2	42 71	2 666	0.3564
2.5	1.0172	4.3	43.74	2 731	0.3650
2.5	1.0176	4 4	44.77	2 795	0 3737
2.6	1.0180	4.5	45.81	2 860	0.3823
2.6	1.0184	4.6	46 85	2.924	0.3909
2.7	1.0188	4.7	47.88	2.989	0.3996
2.7	1 0192	4.8	48.92	3.054	0.4083
2.8	1 0196	4.9	49 96	3.119	0.4169
2.8	1.0200	5.0	51.00	3.184	0.4256
5.6	1.0401	10.0	104.0	6.493	0.8680

TARTARIC ACID

SPECIFIC GRAVITY OF AQUEOUS TARTARIC ACID (D) SOLUTIONS AT 15° C. (GERLACH)

Bé.	Sp gr	Per cent $H_2C_4H_4O_6$	G. per liter	Lbs. per cu. ft	Lbs per gal
0 6	1 0045	1	10 05	0.6271	0 0838
1.3	1 0090	2	20 18	1.260	0.1684
2 6	1.0179	4	40.72	2.542	0.3398
3.9	1.0273	6	61 64	3.848	0.5144
5 2	1 0371	8	82 97	5.179	0.6924
6 5	1 0469	10	104 7	6 535	0 8737
7 8	1.0565	12	126 8	7.915	1.058
9.0	1 0661	14	149.3	9.317	1.246
10 3	1.0761	16	172 2	10 75	1.437
11 5	1.0865	18	195 6	12.21	1 632
12 8	1.0969	20	219 4	13.70	1 831
14 0	1.1072	22	243 6	15 21	2 033
15.2	1.1175	24	268 2	16.74	2 238
16.5	1 1282	26	293 3	18 31	2 448
17 7	1 1393	28	319 0	19 91	2 662
19 0	1.1505	30	345 2	21 55	2 880
20.2	1.1615	32	371.7	23.20	3.102
21.3	1.1726	34	398.7	24 89	3 327
22 5	1.1840	36	426 2	26.61	3.557
23 8	1.1959	38	454 4	28 37	3 792
25 0	1 2078	40	483 1	30 16	4 032
26 1	1 2198	42	512 3	31 98	4 275
27.3	1 2317	44	541.9	33 83	4 523
28.5	1.2441	46	572 3	35 73	4 776
29.6	1 2568	48	603.3	37 66	5 034
30 8	1 2696	50	634 8	39 63	5.298
32 0	1.2828	52	667 1	41 64	5 567
33 1	1.2961	54	699.9	43.69	5 841
34 3	1.3093	56	733 2	45.77	6 119

ZINC CHLORIDE

Specific Gravity of Aqueous Zinc Chloride Solutions at $\frac{20°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $ZnCl_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
2.4	1.0167	2	20.33	1.269	0.1697
4.9	1.0350	4	41.40	2.584	0.3455
7.3	1.0532	6	63.19	3.945	0.5274
9.7	1.0715	8	85.72	5.351	0.7154
11.0	1.0819	10	108.2	6.754	0.9029
14.2	1.1085	12	133.0	8.304	1.110
16.4	1.1275	14	157.9	9.854	1.317
18 6	1.1468	16	183.5	11.45	1.531
20 7	1.1665	18	210.0	13.11	1.752
22 8	1.1866	20	237.3	14.82	1.980
27.9	1.2380	25	309.5	19.32	2.583
32 8	1.2928	30	387.8	24.21	3.237
37.8	1.3522	35	473.3	29.54	3.950
42.7	1.4173	40	566.9	35.39	4.731
47.6	1.4890	45	670.1	41.83	5.592
52.5	1.5681	50	784.1	48.95	6.543
57.4	1.655	55	910.3	56.82	7.596
62.1	1.749	60	1049	65.51	8.757
66.7	1.851	65	1203	75.11	10.05
71.1	1.962	70	1373	85.74	11.46

ZINC CHLORIDE

Specific Gravity of Aqueous Zinc Chloride Solutions at $\frac{60°}{60°}$ F. (Whitney, Hartle, Sakryd)

Bé.	Sp. gr.	Per cent $ZnCl_2$	Weight of 1 cu. ft. in lbs.	Lbs. $ZnCl_2$ in 1 cu. ft.	Per cent 50 per cent $ZnCl_2$	Lbs. 50 per cent $ZnCl_2$ in 1 cu. ft.
0	1.0000	0	62.37	0	0	0
1	1.0069	.76	62.80	.4773	1.52	.9546
2	1.0140	1.53	63.24	.9676	3.06	1.9352
3	1.0211	2.29	63.69	1.4585	4.58	2.9170
4	1.0284	3 05	64.14	1.9563	6.10	3.9126
5	1.0357	3 81	64.60	2.4613	7.62	4.9226
6	1.0432	4.63	65.06	3.0123	9.26	6.0246
7	1.0507	5.45	65.53	3.5714	10.90	7.1428
8	1.0584	6.27	66.01	4.1388	12.54	8.2776
9	1.0662	7.09	66.50	4.7149	14.18	9.4298
10	1.0741	7.91	66.99	5.2980	15.82	10.5978
11	1.0821	8.78	67 49	5.9256	17.56	11.8512
12	1.0902	9.65	68.00	6.5620	19.30	13.1240
13	1.0985	10.52	68.51	7.2073	21.04	14.4146
14	1.1069	11.39	69.04	7.8637	22.78	15.7274
15	1.1154	12.26	69.57	8.5293	24.52	17.0586
16	1.1240	13.21	70.10	9.2602	26.42	18.5204
17	1.1328	14.15	70.65	9.9970	28.30	19.9940
18	1.1417	15.10	71.21	10.7527	30.20	21.5054
19	1.1508	16 04	71.78	11 5135	32.08	23.0270
20	1.1600	16 98	72.35	12.2850	33.96	24.5700
21	1.1694	17.96	72.94	13.1000	35.92	26.2000
22	1.1789	18.94	73.53	13.9266	37.88	27.8532
23	1.1885	19.92	74.13	14.7667	39.84	29.5334
24	1 1983	20.90	74.74	15.6207	41.80	31.2414
25	1.2083	21.88	75.36	16.4888	43.76	32.9776
26	1.2185	22.88	76.00	17.3888	45.76	34.7776
27	1.2288	23 88	76 64	18.3016	47.76	36.6032
28	1 2393	24 89	77.30	19.2400	49.78	38.4800
29	1.2500	25 89	77.96	20.1838	51.78	40.3676
30	1.2609	26 90	78.64	21.1542	53.80	42.3084
31	1.2719	27.91	79.33	22.1410	55.82	44.2820
32	1.2832	28 91	80.03	23.1367	57 82	46 2734
33	1 2946	29.92	80.74	24.1574	59.84	48.3148
34	1.3063	30 93	81.47	25.1987	61.86	50.3974
35	1 3182	31 93	82.22	26.2528	63.86	52.5056
36	1.3303	32.94	82 97	27.3303	65.88	54.6606
37	1.3426	33.95	83.74	28 4297	67 90	56.8594
38	1.3551	34 96	84.52	29.5482	69.92	59.0964
39	1.3679	35.97	85.32	30.6896	71.94	61.3792
40	1.3810	36.98	86.13	31.8509	73.96	63.7018
41	1.3942	38.02	86.96	33.0622	76.04	66.1244
42	1.4078	39.05	87.80	34.2859	78.10	68.5718
43	1.4216	40.09	88.67	35.5478	80.18	71.0956
44	1 4356	41.12	89.54	36.8188	82.24	73.6376
45	1.4500	42.16	90.44	38.1295	84.32	76.2590
46	1.4646	43.21	91.35	39.4723	86.42	78.9446
47	1.4796	44.26	92.28	40 8431	88.52	81.6862
48	1.4948	45.32	93.23	42 2518	90.64	84.5036
49	1.5104	46.37	94.20	43.6805	92.74	87.3610
50	1.5263	47.43	95.20	45.1534	94.86	90.3068
51	1.5426	48.48	96.21	46.6426	96 96	93.2852
52	1.5591	49.54	97.24	48.1727	99.08	96.3454

ZINC CHLORIDE (Continued)

SPECIFIC GRAVITY OF AQUEOUS ZINC CHLORIDE SOLUTIONS AT $\frac{60^\circ}{60^\circ}$ F. (WHITNEY, HARTLE, SAKRYD)

Bé.	Sp. gr.	Per cent $ZnCl_2$	Weight of 1 cu. ft. in lbs.	Lbs. $ZnCl_2$ in 1 cu. ft.	Per cent 50 per cent $ZnCl_2$	Lbs. 50 per cent $ZnCl_2$ in 1 cu. ft.
53	1.5761	50.60	98 30	49.7398	101 20	99.4796
54	1.5934	51.66	99 38	51 3397	103.32	102.6794
55	1.6111	52.72	100.48	52.9731	105.44	105.9462
56	1.6292	53.80	101.61	54.6662	107.60	109.3324
57	1.6477	54.88	102.77	56.4002	109.76	112.8004
58	1.6667	55.97	103.95	58.1808	111.94	116.3616
59	1.6860	57.06	105.16	60.0043	114.12	120.0086
60	1.7059	58.15	106.40	61.8716	116.30	123.7432
61	1.7262	59.23	107.66	63.7670	118.46	127.5340
62	1.7470	60.30	108.96	65.7029	120.60	131 4058
63	1.7683	61.37	110.29	67.6850	122.74	135.3700
64	1.7901	62.44	111.65	69.7143	124.88	139.4286
65	1.8125	63.52	113 05	71.8094	127.04	143.6188
66	1.8354	64.68	114.47	74.0392	129.36	148 0784
67	1.8590	65 85	115.95	76 3531	131.70	152.7062
68	1.8831	67.02	117.45	78 7150	134.04	157.4300
69	1.9079	68 19	119.90	81.1461	136.38	162.2922
70	1.9333	69 36	120.58	83.6343	138.72	167.2696

FIXED POINTS*

Bé.	Sp. gr	Per cent $ZnCl_2$
5.08	1.0363	3 88
10 16	1.0754	8 05
15 35	1.1184	12.59
20 35	1 1633	17.32
25 14	1 1707	22.02
30 00	1.2609	26.90
35.07	1 3190	32.00
40.15	1 3829	37.14
44.99	1.4499	42.15
50.14	1.5285	47.58
55.05	1.6120	52.77
60.13	1.7085	58.29
65.11	1.8150	63.65
70.05	1.9345	69.42

APPROXIMATE ALLOWANCE FOR TEMPERATURE

		For each 1° Fahrenheit
At 5° Bé.	= 0 024° Bé.	
" 10° "	= 0 029° "	
" 15° "	= 0 029° "	
" 20° "	= 0 033° "	
" 25° "	= 0 033° "	
" 30° "	= 0 033° "	
" 35° "	= 0 033° "	
" 40° "	= 0 033° "	
" 45° "	= 0 033° "	
" 50° "	= 0 030° "	
" 55° "	= 0 028° "	
" 60° "	= 0 027° "	
" 65° "	= 0.027° "	
" 70° "	= 0.024° "	

* The percentage composition on all fixed points were determined by actual chemical analysis, both Zinc and Chlorine being determined.

ZINC NITRATE

Specific Gravity of Aqueous Zinc Nitrate Solutions at $\frac{18°}{4°}$ C.*

Bé.	Sp. gr.	Per cent $Zn(NO_3)_2$	G. per liter	Lbs per cu. ft.	Lbs. per gal.
2.2	1.0154	2	20.31	1.268	0.1695
4 5	1.0322	4	41.29	2.577	0 3446
6.9	1.0496	6	62.98	3.931	0.5256
9.2	1.0675	8	85.40	5 331	0 7127
11.5	1.0859	10	108.6	6.779	0.9062
13.8	1.1048	12	132.6	8 276	1.106
16.0	1.1244	14	157.4	9.827	1.314
18.3	1.1445	16	183.1	11.43	1.528
20.6	1.1652	18	209 7	13.09	1.750
22.8	1.1865	20	237 3	14 81	1.980
28.3	1.2427	25	310 7	19.39	2.593
33 7	1 3029	30	390 9	24 40	3.262
39 0	1.3678	35	478 7	29 89	3 995
44.2	1.4378	40	575.1	35 90	4.799
49.2	1.5134	45	681.0	42 51	5.683
54 1	1.5944	50	797.2	49 77	6.653

ZINC NITRATE

Specific Gravity of Aqueous Zinc Nitrate Solutions at 17.5° (Franz)

Bé.	Sp. gr.	Per cent $Zn(NO_3)_2$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
1.4	1.0099	1	10.10	0.6305	0.0843
2.8	1.0198	2	20.40	1.273	0.1702
4.2	1.0297	3	30.89	1.928	0.2578
5.5	1.0396	4	41.58	2.596	0.3470
6.9	1.0496	5	52.48	3.276	0.4380
8.1	1.0590	6	63.54	3.967	0.5303
9.3	1.0684	7	74.79	4.669	0.6241
10.5	1.0778	8	86.22	5.383	0.7196
11.6	1.0872	9	97.85	6.108	0.8166
12.8	1.0968	10	109.7	6.847	0.9153
14.0	1.1070	11	121.8	7.602	1.016
15.2	1.1172	12	134.1	8.369	1.119
16.4	1.1274	13	146 6	9.149	1.223
17.5	1.1376	14	159.3	9.942	1.329
18.6	1.1476	15	172.1	10.75	1.437
19.9	1.1586	16	185.4	11.57	1.547
21.0	1.1696	17	198 8	12.41	1.659
22.2	1.1806	18	212.5	13.27	1.773
23.3	1.1916	19	226.4	14.13	1.889
24.4	1.2024	20	240.5	15.01	2.007
25.6	1.2147	21	255.1	15.92	2.129
26.8	1.2270	22	269.9	16.85	2.253
28.0	1.2393	23	285.0	17.79	2.379
29.1	1.2516	24	300.4	18.75	2.507
30.3	1.2640	25	316.0	19.73	2.637
31.4	1.2766	26	331.9	20.72	2.770
32.5	1.2892	27	348.1	21.73	2.905
33.6	1.3018	28	364.5	22.75	3.042
34.7	1.3144	29	381.2	23.80	3.181
35.7	1.3268	30	398.0	24.85	3.322
36.8	1.3396	31	415.3	25.92	3.466
37.8	1.3524	32	432.8	27.02	3.612
38.8	1.3652	33	450.5	28.12	3.760
39.8	1.3780	34	468.5	29.25	3.910
40.7	1.3906	35	486.7	30.38	4.062
41.7	1.4039	36	505.4	31.55	4.218
42.7	1.4172	37	524.4	32.73	4.376
43.6	1.4305	38	543.6	33.93	4.536
44.6	1.4438	39	563.1	35.15	4.699
45.5	1.4572	40	582.9	36.39	4.864
46.4	1.4707	41	603.0	37.64	5.032
47.3	1.4844	42	623.4	38.92	5 203
48.2	1.4981	43	644.2	40.21	5.376
49.1	1.5118	44	665.2	41.53	5.551
50.0	1.5258	45	686.6	42.86	5 730
50.9	1.5403	46	708.5	44.23	5 913
51.7	1.5548	47	730.8	45.62	6.098
52.6	1.5693	48	753.3	47.02	6 286
53 4	1.5838	49	776.1	48.45	6 476
54.3	1.5984	50	799.2	49.89	6.669

ZINC SULFATE

Specific Gravity of Aqueous Zinc Sulfate Solutions at $\frac{20^\circ}{4^\circ}$ C.*

Bé.	Sp. gr.	Per cent $ZnSO_4$	G. per liter	Lbs. per cu. ft.	Lbs per gal
2.7	1.0190	2	20.38	1.272	0.1701
5.6	1.0403	4	41.61	2.598	0.3473
8.5	1.0620	6	63 72	3.978	0 5318
11.3	1.0842	8	86.74	5.415	0.7238
14.0	1.1071	10	110.7	6.911	0.9239
16.8	1.1308	12	135.7	8.471	1.132
19 5	1.1553	14	161.7	10.10	1 350
22.2	1.1806	16	188 9	11.79	1 576

Bé.	Sp. gr.	Per cent $ZnSO_4 + 7H_2O$	G per liter	Lbs. per cu. ft.	Lbs. per gal.
2 7	1 0190	3 562	36 30	2 266	0 3030
5.6	1 0403	7 125	74.12	4 627	0 6185
8 5	1 0620	10 69	113.5	7.085	0 9472
11 3	1.0842	14 25	154 5	9 645	1.289
14.0	1.1071	17 81	197 2	12 31	1 646
16 8	1.1308	21 37	241.7	15 09	2 017
19 5	1.1533	24 94	288.1	17.99	2.404
22 2	1.1806	28.50	336 5	21.00	2 808

ZINC SULFATE

Specific Gravity of Aqueous Zinc Sulfate Solutions at 15° C. (Gerlach)

Bé.	Sp. gr.	Per cent $ZnSO_4 + 7H_2O$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.006	1	10.06	0.6280	0.0840
1.9	1.013	2	20.26	1.265	0.1691
2.7	1.019	3	30.57	1.908	0.2551
3.4	1.024	4	40.96	2.557	0.3418
4.1	1.029	5	51.45	3.212	0.4294
4.9	1.035	6	62.10	3.877	0.5182
5.7	1.041	7	72.87	4.549	0.6081
6.5	1.047	8	83.76	5.229	0.6990
7.3	1.053	9	94.77	5.916	0.7909
8.1	1.059	10	105.9	6.611	0.8838
9.0	1.066	11	117.3	7.320	0.9786
9.9	1.073	12	128.8	8.038	1.075
10.6	1.079	13	140.3	8.757	1.171
11.4	1.085	14	151.9	9.483	1.268
12.1	1.091	15	163.7	10.22	1.366
12.8	1.097	16	175.5	10.96	1.465
13 5	1.103	17	187.5	11.71	1.565
14.4	1.110	18	199.8	12.47	1.667
15 1	1.116	19	212.0	13.24	1.770
16.0	1.124	20	224.8	14.03	1.876
16.7	1 130	21	237.3	14.81	1.980
17.5	1.137	22	250.1	15.62	2.087
18.1	1.143	23	262.9	16.41	2.194
18.9	1.150	24	276.0	17.23	2.303
19.7	1.157	25	289.3	18.06	2.414
20 4	1.164	26	302.6	18.89	2.526
21.2	1 171	27	316.2	19.74	2.639
22.0	1.179	28	330.1	20.61	2 755
22.6	1.185	29	343.7	21.45	2.868
23.5	1.193	30	357.9	22.34	2.987
24.2	1.200	31	372.0	23.22	3.104
25.1	1.209	32	386.9	24.15	3.229
25.8	1.216	33	401.3	25.05	3.349
26.5	1.224	34	416.2	25.98	3.473
27.2	1.231	35	430.9	26.90	3 560
28.1	1.240	36	446.4	27.87	3.725
28.6	1.246	37	461.0	28.78	3 847
29.5	1.255	38	476.9	29.77	3.980
30.2	1.263	39	492.6	30 75	4.111
30.9	1.271	40	508.4	31.74	4.243
31.7	1.280	41	524.8	32.76	4.380
32.4	1.288	42	541.0	33.77	4.514
33.0	1.295	43	556.9	34.76	4.647
33.8	1 304	44	573.8	35.82	4.788
34.3	1.310	45	589.5	36.80	4.920
35.2	1 320	46	607.2	37.91	5.067
36.0	1 330	47	625.1	39.02	5.217
36.6	1.337	48	641.8	40.06	5.356
37.3	1.346	49	659.5	41.17	5.504
37.8	1 353	50	676.5	42.23	5.646
38.5	1.362	51	694.6	43.36	5.797
39.2	1.370	52	712 4	44 47	5.945
39.9	1.380	53	731.4	45.66	6.104
40.7	1.390	54	750.6	46 86	6.264
41.4	1 399	55	769 5	48.03	6 421
41.9	1.406	56	787.4	49.15	6.571
42.6	1.416	57	807.1	50.39	6 736
43.2	1.425	58	826.5	51.60	6.897
44.0	1.435	59	846.7	52.85	7.065
44.7	1.445	60	867.0	54.12	7.235

ZINC SULFATE (Continued)

Specific Gravity of Aqueous Zinc Sulfate Solutions at 15° C. (Gerlach)

Bé.	Sp. gr.	Per cent $ZnSO_4$	G. per liter	Lbs. per cu. ft.	Lbs. per gal.
0.9	1.006	0.56	5.648	0 3526	0.0471
1.9	1.013	1.12	11 37	0 7101	0.0949
2.7	1.019	1.68	17 16	1 071	0.1432
3.4	1.024	2.25	23 00	1.436	0 1919
4.1	1.029	2.81	28.89	1.803	0 2411
4.9	1.035	3.37	34 86	2.177	0 2910
5.7	1.041	3.93	40.91	2 554	0 3414
6.5	1 047	4 49	47 03	2 936	0 3924
7.3	1.053	5 05	53 21	3.322	0.4440
8.1	1.059	5.61	59.46	3.712	0 4962
9.0	1 066	6.18	65 83	4.110	0 5494
9.9	1.073	6.74	72 29	4.513	0.6033
10.6	1.079	7.30	78 75	4.916	0 6572
11.4	1 085	7.86	85 28	5 324	0 7117
12.0	1 091	8 42	91 88	5 736	0 7667
12.8	1.097	8 98	98 54	6.152	0 8224
13.5	1.103	9.54	105 3	6 572	0 8786
14.4	1.110	10 1	112 2	7.003	0 9361
15.1	1 116	10 7	119 0	7 432	0 9935
16.0	1.124	11 2	126 2	7.879	1 053
16.7	1.130	11.8	133 2	8 317	1.112
17.5	1.137	12 4	140 4	8 767	1.172
18.1	1 143	12 9	147.6	9 214	1 232
18.9	1.150	13.5	155 0	9.673	1 293
19 7	1.157	14 0	162.4	10.14	1 355
20 4	1.164	14.6	169 9	10 61	1 418
21.2	1.171	15 2	177.5	11 08	1 481
22 0	1.179	15.7	185 3	11 57	1 547
22 6	1.185	16.3	192.9	12.04	1 610
23 5	1.193	16.8	200 9	12 54	1 677
24.2	1 200	17 4	208.9	13 04	1 743
25 1	1.209	18 0	217.2	13 56	1 813
25.8	1 216	18 5	225.3	14 06	1.880
26.5	1.224	19.1	233.6	14 59	1 950
27.2	1 231	19.7	241.9	15 10	2 019
28 1	1 240	20 2	250.6	15 65	2 092
28 6	1 246	20 8	258.8	16 16	2.160
29.5	1 255	21.3	267.7	16 71	2 234
30 2	1.263	21.9	276 5	17 26	2 308
30.9	1.271	22 5	285.4	17 82	2 382
31.7	1.280	23 0	294.6	18 39	2.459
32 4	1.288	23.6	303.7	18.96	2 535
33.0	1 295	24.1	312.6	19.52	2.609
33.8	1.304	24.7	322.1	20 11	2.688
34.3	1 310	25 3	331.0	20.66	2 762
35.2	1.320	25 8	340.9	21.28	2.845
36.0	1.330	26 4	350.9	21.91	2.929
36.6	1.337	26 9	360.3	22 49	3.007
37.3	1.346	27.5	370.3	23.12	3.090
37.8	1.353	28.1	379 8	23.71	3 170
38.5	1.362	28.6	390.0	24.35	3.254
39.2	1.370	29 2	400.0	24.97	3.338
39.9	1.380	29 8	410.6	25.63	3.427
40.7	1.390	30.3	421 4	26.31	3 517
41.4	1.399	30.9	432.0	26.97	3 605
41.9	1.406	31.4	442.0	27.60	3.689
42.6	1.416	32.0	453.1	28.29	3.782
43.2	1.425	32.6	464.0	28.97	3.872
44.0	1.435	33.1	475.3	29.67	3.967
44.7	1 445	33.7	486.8	30.39	4.062

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

THE SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS EXPRESSED IN GRAMS OF THE SUBSTANCE SHOWN BY THE FORMULA PER 100 GRAMS OF THE AQUEOUS SOLUTION

Per cent by weight	$AgNO_3$ $20° \mid 4°$ C.	$Al(NO_3)_3$ $18° \mid 4°$ C.	$AuCl_3$ $15° \mid 4°$ C.	$Ba(C_2H_3O_2)_2$ $18° \mid 4°$ C.	$BaBr_2$ $20° \mid 4°$ C.
1	1.0070	1.0065	1.0060	1.0059	......
2	1.0154	1.0144	1.0132	1.0133	1.0156
3	......	......	......	......	......
4	1.0327	1.0305	1.0281	1.0282	1.0335
5	......	......	......	......	......
6	1.0506	1.0469	1.0434	1.0433	1.0519
7	......	......	......	......	......
8	1.0690	1.0638	1.0591	1.0587	1.0710
9	......	......	......	......	......
10	1.0882	1.0811	1.0750	1.0745	1.0907
11	......	......	......	......	......
12	1.1080	1.0989	......	1.0908	1.1111
13	......	......	......	......	......
14	1.1284	1.1171	......	1.1075	1.1323
15	......	......	......	......	......
16	1.1495	1.1357	......	1.1246	1.1543
17	......	......	......	......	......
18	1.1715	1.1549	......	1.1421	1.1770
19	......	......	......	......	......
20	1.1942	1.1745	......	1.1599	1.2006
21	......	......	......	......	......
22	......	1.1946	......	1.1782	......
23		......	......	......	......
24	......	1.2153	......	1.1970	......
25	1.2545	......		......	1.2634
26	......	1.2365	......	1.2161	......
27	......	......	......	......	......
28	......	1.2582	......	1.2356	......
29		......	......	......	......
30	1.3205	1.2805		1.2554	1.3325
31	......	......	......	......	......
32	......	1.3036	......	......	......
33	......	......		......	......
34	......	......	......	......	......
35	1.3931	......		1.3069	1.4087
36	......	......	......	......	......
37	......	......	......	......	......
38	......	......	......	......	......
39	......	......	......	......	......
40	1.4743	......	......	1.3608	1.4926
42	......		......	......	......
44	......	......	......	......	......
45	1.565	......	......	......	......
46	......	......	......	......	......
48	......	......	......	......	......
50	1.668	......	......	......	......
55	1.786	......	......	......	......
60	1.916	......	......	......	......
65	......	......	......	......	......
70	2.2333	......	......	......	......
75	......	......	......	......	......
80	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	BaI_2 $\frac{20° C.}{4°}$	$Ba(NO_3)_2$ $\frac{18° C.}{4°}$	$C_{12}H_{22}O_{11}$ Sucrose $\frac{20° C.}{4°}$	$CaBr_2$ $\frac{20° C.}{4°}$	$Ca(C_2H_3O_2)_2$ $\frac{18° C.}{4°}$
1	......	......	1.0021	......	1.0043
2	1.0154	1.0151	1.0060	1.0152	1.0100
3	......	......	1.0099	......	......
4	1.0331	1.0320	1.0139	1.0326	1.0215
5	......	......	1.0179	......	......
6	1.0513	1.0494	1.0219	1.0504	1.0331
7	......	......	1.0259	......	......
8	1.0701	1.0674	1.0299	1.0688	1.0447
9	......	......	1.0340	......	......
10	1.0896	......	1.0381	1.0877	1.0563
11	......	......	1.0423	......	......
12	1.1099	......	1.0465	1.1071	1.0679
13	......	......	1.0507	......	......
14	1.1308	......	1.0549	1.1272	1.0795
15	......	......	1.0592	......	......
16	1.1525	......	1.0635	1.1480	1.0912
17	......	......	1.0678	......	......
18	1.1750	......	1.0722	1.1696	1.1029
19	......	......	1.0765	......	......
20	1.1984	......	1.0810	1.1919	1.1146
21	......	......	1.0854	......	......
22	......	......	1.0899	......	1.1263
23	......	......	1.0944	......	......
24	......	......	1.0990	......	......
25	1.2610	......	1.1036	1.2499	......
26	......	......	1.1082	......	......
27	......	......	1.1128	......	......
28	......	......	1.1175	......	......
29	......	......	1.1222	......	......
30	1.3289	......	1.1270	1.3125	......
31	......	......	1.1317	......	......
32	......	......	1.1366	......	......
33	......	......	1.1415	......	......
34	......	......	1.1464	......	......
35	1.404	......	1.1513	1.381	......
36	......	......	1.1563	......	......
37	......	......	1.1612	......	......
38	......	......	1.1663	......	......
39	......	......	1.1713	......	......
40	1.490	......	1.1765	1.457	......
42	......	......	1.1868	......	......
44	......	......	1.1973	......	......
45	1.587	......	1.2025	1.541	......
46	......	......	1.2079	......	......
48	......	......	1.2186	......	......
50	1.698	......	1.2296	1.635	......
55	1.825	......	1.2575	......	......
60	1.970	......	1.2865	......	......
65	......	......	1.3163	......	......
70	......	......	1.3472	......	......
75	......	......	1.3790	......	......
80	......	......	1.4117	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	CaI_2 $\frac{20°}{4°}$ C	$Ca(NO_3)_2$ $\frac{18°}{4°}$ C	$CdBr_2$ $\frac{20°}{4°}$ C.	$CdCl_2$ $\frac{20°}{4°}$ C.	CdI_2 $\frac{20°}{4°}$ C.
1					
2	1.0150	1.0137	1.0158	1.0159	1.0153
3					
4	1.0323	1.0291	1.0339	1.0339	1.0328
5					
6	1.0500	1.0448	1.0524	1.0524	1.0507
7					
8	1.0683	1.0608	1.0714	1.0715	1.0690
9					
10	1.0873	1.0771	1.0910	1.0912	1.0879
11					
12	1.1069	1.0937	1.1112	1.1115	1.1075
13					
14	1.1273	1.1106	1.1322	1.1324	1.1278
15					
16	1.1485	1.1279	1.1540	1.1540	1.1489
17					
18	1.1703	1.1455	1.1766	1.1762	1.1709
19					
20	1.1928	1.1636	1.2000	1.1992	1.1937
21					
22					
23					
24					
25	1.2530	1.2106	1.2605	1.2604	1.2546
26					
27					
28					
29					
30	1.3195	1.260	1.3286	1.3273	1.3219
31					
32					
33					
34					
35	1.3928	1.311	1.4049	1.4010	1.3967
36					
37					
38					
39					
40	1.4734	1.365	1.4902	1.4833	1.4801
42					
44					
45		1.422		1.5748	1.5726
46					
48					
50				1.6762	
55					
60					
65					
70					
75					
80					

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	$CdSO_4$ $\frac{18°}{4°}$ C.	$CoCl_2$ $\frac{20°}{4°}$ C.	$Co(NO_3)_2$ $\frac{20°}{4°}$ C.	HBr $\frac{20°}{4°}$ C.	$HClO_4$ $\frac{15°}{4°}$ C.
1	1.0086	1.0073	1.0064	1.0053	1.0050
2	1.0182	1.0165	1.0145	1.0124	1.0109
3	......	......	......	......	......
4	1.0383	1.0350	1.0315	1.0269	1.0228
5	......	......	......	......	......
6	1.0590	1.0538	1.0485	1.0417	1.0348
7	......	......	......	......	......
8	1.0803	1.0735	1.0660	1.0568	1.0471
9	......	......	......	......	......
10	1.1023	1.0940	1.084	1.0723	1.0597
11	......	......	......	......	......
12	1.1250	1.1150	1.103	1.0883	1.0726
13	......	......	......	......	......
14	1.1485	1.1365	1.122	1.1048	1.0859
15	......	......	......	......	......
16	1.1729	1.1585	1.142	1.1219	1.0995
17	......	......	......	......	......
18	1.1982	1.1815	1.163	1.1396	1.1135
19	......	......	......	......	......
20	1.2243	1.2050	1.184	1.1579	1.1279
21	......	......	......	......	......
22	......	......	......	1.1767	1.1428
23	......	......	......	......	......
24	......	......	......	1.1961	1.1581
25	1.2940	......	1.239	......	......
26	......	......	......	1.2161	1.1738
27	......	......	......	......	......
28	......	......	......	1.2367	1.1900
29	......	......		......	......
30	1.3714	......	1.299	1.2580	1.2067
31	......	......		......	......
32	......			......	1.2239
33	......	......		......	......
34	......		......	......	1.2418
35	1.4551	......		1.3150	......
36	......			......	1.2603
37	......			......	......
38	......	......		......	1.2794
39	......	......		......	......
40	1.5470	......		1.3772	1.299[illegible]
42	......	......		......	......
44	......	......		......	......
45	......	......	......	1.4446	1.3521
46	......	......	......	......	......
48	......	......		......	......
50	......	......		1.5173	1.4103
55	......	......	......	1.5953	1.4733
60	......	......		1.6787	1.5389
65	......	......	......	1.7675	1.6059
70	......	......	......	......	1.6736
75	......	......	......	......	......
80	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	HF $20° \| 4°$ C.	HI $20° \| 4°$ C.	HIO_3 $18° \| 4°$ C.	HIO_4 $17° \| 4°$ C.	H_2O_2 $18° \| 4°$ C.
1	......	1.0054	1.0071	1.0076	1.0022
2	......	1.0127	1.0157	1.0165	1.0058
3	......	......	......	......	......
4	......	1.0277	1.0334	1.0349	1.0131
5	1.017	......	......	......	......
6	......	1.0431	1.0517	1.0539	1.0204
7	......	......	......	......	......
8	......	1.0589	1.0706	1.0737	1.0277
9	......	......	......	......	......
10	1.035	1.0751	1.0900	1.0944	1.0351
11	......	......	......	......	......
12	......	1.0918	1.1100	1.1161	1.0425
13	......	......	......	......	......
14	......	1.1091	1.1306	1.1388	1.0499
15	1.053	......	......	......	......
16	......	1.1270	1.1519	1.1623	1.0574
17	......	......	......	......	......
18	......	1.1456	1.1740	1.1865	1.0649
19	......	......	......	......	......
20	1.070	1.1649	1.1969	1.2116	1.0725
21	......	......	......	......	......
22	......	1.1850	1.2206	1.2376	1.0802
23	......	......	......	......	......
24	......	1.2059	1.2450	1.2647	1.0880
25	1.086	......	......	......	......
26	......	1.2277	1.2700	1.2931	1.0959
27	......	......	......	......	......
28	......	1.2503	1.2956	1.3230	1.1040
29	......	......	......	......	......
30	1.101	1.2737	1.3218	1.3545	1.1122
31	......		......	......	......
32	......		......	1.3875	......
33	......	......	......	......	......
34	......	......	......	......	......
35	1.116	1.3357	1.3900	......	1.1327
36	......		......	......	......
37	......		......	......	......
38	......		......	......	......
39	......	......	......	......	......
40	1.130	1.4029	1.4640	......	1.1536
42	......	......	......	......	......
44	......	......	......	......	......
45	1.143	1.4755	......	......	1.1749
46	......	......	......	......	......
48	......	......	......	......	......
50	1.155	......	......	......	1.1966
55	......	......	......	......	1.2188
60	......	......	......	......	1.2416
65	......	......	......	......	1.2652
70	......	......	......	......	1.2897
75	......	......	......	......	1.3149
80	......	......	......	......	1.3406

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	H_2SeO_4 $\frac{20°}{4°}$ C.	$HgCl_2$ $\frac{20°}{4°}$ C.	$KC_2H_3O_2$ $\frac{18°}{4°}$ C.	$KBrO_3$ $\frac{20°}{4°}$ C.	$KClO_3$ $\frac{20°}{4°}$ C.
1	1.0059	1.0065	1.0038	1.0056	1.0045
2	1.0136	1 0150	1.0089	1.0131	1.0109
3	.....	1.0236	......	1.0206	1.0174
4	1.0291	1.0323	1.0191	1.0282	1.0241
5	.....	1.0411	.....	1.0359	......
6	1.0447	......	1.0293	......	......
7	......	......	......	......	......
8	1.0605	......	1.0395	......	......
9	......	......	......	......	......
10	1.0766	......	1.0497	......	......
11	......	......	......	......	......
12	1.0931	......	1.0599	......	......
13	.....	......	.....	......	......
14	1.1101		1.0703	......	......
15	.....	...	...	......	......
16	1.1276	......	1.0808	......	......
17	.....	......	......	......	......
18	1.1455	......	1.0914	......	......
19	.....	...	.....	......	......
20	1.1639	...	1.1022	......	......
21	....	...	.....	......	......
22	1.1829	...	1.1131	......	......
23	...		...	......	......
24	1.2026	...	1.1241	......	......
25	.....	...	...	......	......
26	1.2229	...	1.1353	......	......
27	...		...	......	......
28	1.2438	...	1 1466	......	......
29	...			......	......
30	1.2653	...	1.1579	......	......
31	..	...	...	......	......
32	1.2874			......	......
33	.....	...	..	......	......
34	1.3101	...	...	......	......
35	.....		1 1868	......	......
36	1.3334	...		......	......
37	...		...	......	......
38	1.3573	...	...	......	......
39	...	...		......	......
40	1.3819		1.2162	......	......
42	.....		......	......	......
44	1.4073		.....	......	......
45	1.4336		1.2460	......	......
46	1.4609	...	......	......	......
48	1.4892	...	......	......	......
50	1.5186	...	1.2761	......	......
55	...	...	1.3065	......	......
60	1.6850	...	1.3372	......	......
65	.....	......	......	......	......
70	1.8870	......	......	......	......
75	.....	......	......	......	......
80	2.1220	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	KF $\frac{18^\circ}{4^\circ}$ C.	$KHSO_4$ $\frac{20^\circ}{4^\circ}$ C.	$K_3Fe(CN)_6$ $\frac{20^\circ}{4^\circ}$ C.	$K_4Fe(CN)_6$ $\frac{20^\circ}{4^\circ}$ C.	KIO_3 $\frac{20^\circ}{4^\circ}$ C.
1	1.0072	1.0051	1.0034	1.0051	1.0068
2	1.0159	1.0120	1.0090	1.0119	1.0155
3					1.0243
4	1.0334	1.0260	1.0201	1.0256	
5					
6	1.0512	1.0403	1.0314	1.0395	
7					
8	1.0693	1.0549	1.0427	1.0536	
9					
10	1.0877	1.0698	1.0542	1.0678	
11					
12	1.1064	1.0850	1.0656	1.0823	
13					
14	1.1254	1.1004	1.0774	1.0971	
15					
16	1.1448	1.1161	1.0890	1.1120	
17					
18	1.1646		1.1010		
19					
20	1.1847		1.1130		
21					
22	1.2052				
23					
24	1.2260				
25					
26	1.2471				
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
42					
44					
45					
46					
48					
50					
55					
60					
65					
70					
75					
80					

Per cent by weight	$LiBr$ $\frac{20°}{4°}$ C.	$LiCl$ $\frac{20°}{4°}$ C.	LiI $\frac{20°}{4°}$ C.	Li_2SO_4 $\frac{20°}{4°}$ C.	$MgBr_2$ $\frac{20°}{4°}$ C.
1	1.0055	1.0041	1.0056	1.0068	......
2	1.0128	1.0099	1.0131	1.0155	1.0151
3	......	......	......	......	......
4	1.0277	1.0215	1.0284	1.0329	1.0324
5	......	......	......	......	......
6	1.0429	1.0330	1.0442	1.0505	1.0501
7	......	......	......	......	......
8	1.0585	1.0444	1.0604	1.0684	1.0683
9	......	......	......	......	......
10	1.0746	1.0559	1.0771	1.0863	1.0871
11	......	......	......	......	......
12	1.0910	1.0675	1.0943	1.1044	1.1065
13	......	......	......	......	......
14	1.1079	1.0792	1.1120	1.1228	1.1265
15	......	......	......	......	......
16	1.1253	1.0910	1.1303	1.1411	1.1471
17	......	......	......	......	......
18	1.1432	1.1029	1.1492	1.1599	1.1683
19	......	......	......	......	......
20	1.1616	1.1150	1.1688	1.1789	1.1903
21	......	......	......	......	......
22	1.1806	1.1274	1.1890	1.1984	......
23	......	......	......	......	......
24	1.2002	1.1399	1.2099	1.2182	......
25	......	......	......	......	1.2482
26	1.2205	1.1527	1.2315	......	......
27	......	......	......	......	......
28	1.2414	1.1658	1.2540	......	......
29	......	......	......	......	......
30	1.2629	1.1791	1.2772	......	1.3110
31	......	......	.	......	......
32	.	......	.	......	......
33	......	......	......	......	......
34		......	......	......	......
35	1.3204	......	1.3393	......	1.3790
36	......		......	......	......
37	......	......	......	......	......
38	......	......	......	......	......
39	......	......	......	......	......
40	1.3836	......	1.4078	......	1.452
42	......	......	......	......	......
44	......	......	......	......	......
45	1.4535	......	1.4840	......	1.5320
46	......	......	......	......	......
48	......	......	......	......	......
50	......	......	1.5692	......	......
55	......	......	1.6654	......	......
60	......	......	1.7748	......	......
65	......	......	......	......	......
70	......	......	......	......	......
75	......	......	......	......	......
80	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	MgI_2 $\frac{20°}{4°}$ C.	$Mg(NO_3)_2$ $\frac{20°}{4°}$ C.	$MnBr_2$ $\frac{18°}{4°}$ C.	$MnCl_2$ $\frac{18°}{4°}$ C.
1	......	......	1.0071	1.0069
2	1.0149	1.0132	1.0157	1.0153
3	......	......	......	......
4	1.0321	1.0285	1.0332	1.0324
5	......	......	......	......
6	1.0498	1.0441	1.0511	1.0498
7	......	......	......	......
8	1.0680	1.0600	1.0695	1.0676
9	......	......	......	......
10	1.0869	1.0762	1.0886	1.0859
11	......	......	......	......
12	1.1065	1.0928	1.1083	1.1046
13	......	......	......	......
14	1.1268	1.1098	1.1287	1.1238
15	......	......	......	......
16	1.1478	1.1272	1.1498	1.1435
17	......	......	......	......
18	1.1695	1.1449	1.1716	1.1638
19	......	......	......	......
20	1.1920	1.1630	1.1942	1.1846
21	......	......	......	......
22	......	1.1815	1.2176	1.2061
23	......	......	......	......
24	......	1.2004	1.2419	1.2283
25	1.2519	......	......	......
26	......	......	1.2672	1.2511
27	......	......	......	......
28	......	......	1.2934	1.2746
29	......	......	......	......
30	1.3180	......	1.3206	1.2988
31	......	......	......	......
32	......	......	1.3489	......
33	......	......	......	......
34	......	......	......	......
35	1.3911	......	......	......
36	......	......	......	......
37	......	......	......	......
38	......	......	......	......
39	......	......	......	......
40	1.4730	......	......	......
42	......	......	......	......
44	......	......	......	......
45	......	......	......	......
46	......	......	......	......
48	......	......	......	......
50	......	......	......	......
55	......	......	......	......
60	......	......	......	......
65	......	......	......	......
70	......	......	......	......
75	......	......	......	......
80	......	......	......	......

Per cent by weight	$Mn(NO_3)_2$ $\frac{18°}{4°}$ C.	$MnSO_4$ $\frac{20°}{4°}$ C.	NH_4Br $\frac{25°}{4°}$ C.	$NH_4C_2H_3O_2$ $\frac{25°}{4°}$ C.
1	1.0063	1.0080	1.0027	0.9992
2	1.0140	1.0178	1.0084	1.0013
3				
4	1.0298	1.0378	1.0198	1.0055
5				
6	1.0459	1.0583	1.0314	1.0096
7				
8	1.0624	1.0794	1.0432	1.0136
9				
10	1.0794	1.1012	1.0552	1.0176
11				
12	1.0969	1.1236	1.0674	1.0216
13				
14	1.1149	1.1467	1.0799	1.0255
15				
16	1.1333	1.1705	1.0927	1.0294
17				
18	1.1522	1.1950	1.1058	1.0331
19				
20	1.1717		1.1191	1.0368
21				
22	1.1918		1.1327	1.0404
23				
24	1.2125		1.1466	1.0439
25				
26	1.2338		1.1608	1.0473
27				
28	1.2557		1.1753	1.0507
29				
30	1.2781		1.1901	1.0540
31				
32			1.2053	
33				
34			1.2209	
35	1.3367			1.0618
36			1.2369	
37				
38			1.2533	
39				
40	1.3993		1.2702	1.0691
42				
44				
45	1.4662			1.0760
46				
48				
50	1.5378			
55	1.6146			
60				
65				
70				
75				
80				

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	NH_4I $\frac{18°}{4°}$ C.	N_2H_4 $\frac{15°}{4°}$ C.	NH_2OH $\frac{20°}{4°}$ C.	$NaBrO_3$ $\frac{18°}{4°}$ C.
1	1.0050	1.0002	1.0002	1.0064
2	1.0114	1.0013	1.0023	1.0143
3	.....	.....	.....	.....
4	1.0244	1.0034	1.0065	1.0305
5	.....	.....	.....	.....
6	1.0377	1.0056	1.0107	1.0471
7	.....	.....	.....	.....
8	1.0513	1.0077	1.0149	1.0641
9	.....	.....	.....	.....
10	1.0652	1.0099	1.0192	1.0816
11	.....	.....	.....	.....
12	1.0795	1.0121	1.0235	1.0996
13	.....	.....	.....	.....
14	1.0942	1.0143	1.0278	1.1182
15	.....	.....	.....	.....
16	1.1093	1.0164	1.0322	1.1373
17	.....	.....	.....	.....
18	1.1248	1.0186	1.0366	1.1569
19	.....	.....	.....	.....
20	1.1407	1.0207	1.0410	1.1771
21	.....	.....	.....	.....
22	1.1570	1.0228	1.0454	1.1979
23	.....	.....	.....	.....
24	1.1737	1.0248	1.0499	1.2193
25	.....	.....	.....	.....
26	1.1908	1.0267	1.0545	.....
27	.....	.....	.....	.....
28	1.2084	1.0286	1.0591	.....
29	.....	.....	.....	.....
30	1.2265	1.0305	1.0637	.....
31	.....	.....	.....	.....
32	.....	.....	.....	.....
33	.....	.....	.....	.....
34	.....	.....	.....	.....
35	1.2745	1.0350	1.0755	.....
36	.....	.....	.....	.....
37	.....	.....	.....	.....
38	.....	.....	.....	.....
39	.....	.....	.....	.....
40	1.3264	1.0380	1.0875	.....
42	.....	.....	.....	.....
44	.....	.....	.....	.....
45	1.3823	1.0420	1.0997	.....
46	.....	.....	.....	.....
48	.....	.....	.....	.....
50	.....	1.0440	1.1122	.....
55	.....	1.0460	1.1249	.....
60	.....	1.0470	.....	.....
65	.....	1.0470	.....	.....
70	.....	1.0460	.....	.....
75	.....	1.0430	.....	.....
80	.....	1.0400	.....	.....

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	$NaC_2H_3O_2$ $\frac{20°}{4°}$ C.	$NaClO_4$ $\frac{18°}{4°}$ C.	$Ni(NO_3)_2$ $\frac{18°}{4°}$ C.	$Pb(C_2H_3O_2)_2$ $\frac{18°}{4°}$ C.
1	1.0033	1.0051	1.0070	1.0061
2	1.0084	1.0116	1.0155	1.0137
3	......	......	......	......
4	1.0186	1.0247	1.0330	1.0290
5	......	......	......	......
6	1.0289	1.0381	1.0508	1.0446
7	......	......	......	......
8	1.0392	1.0517	1.0693	1.0605
9	......	......	......	......
10	1.0495	1.0656	1.0882	1.0768
11	......	......	......	......
12	1.0598	1.0798	1.1076	1.0936
13	......	......	......	......
14	1.0702	1.0943	1.1277	1.1109
15	......	......	......	......
16	1.0807	1.1090	1.1484	1.1283
17	......	......	......	......
18	1.0913	1.1241	1.1696	1.1473
19	......	......	......	......
20	1.1021	1.1396	1.1914	1.1663
21	......	......	......	......
22	1.1130	1.1554	......	1.1860
23	......	......	......	......
24	1.1240	1.1717	......	1.2063
25	......	......	1.2493	......
26	1.1351	1.1883	......	1.2273
27	......	......	......	......
28	1.1462	1.2053	......	1.2489
29	......	......	......	......
30	......	1.2227	1.3114	1.2711
31	......	......	......	......
32	......	1.2407	......	......
33	......	......	......	......
34	......	1.2591	......	......
35	......	......	1.3777	1.3304
36	......	1.2779	......	......
37	......	......	......	......
38	......	1.2969	......	......
39	......	......	......	......
40	......	......	......	1.3994
42	......	......	......	......
44	......	......	......	......
45	......	......	......	......
46	......	......	......	......
48	......	......	......	......
50	......	......	......	......
55	......	......	......	......
60	......	......	......	......
65	......	......	......	......
70	......	......	......	......
75	......	......	......	......
80	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	$Pb(NO_3)_2$ $\frac{18°}{4°}$ C.	SO_2 $\frac{15.5°}{4°}$ C	$SrBr_2$ $\frac{20°}{4°}$ C.	$SrCl_2$ $\frac{20°}{4°}$ C.
1	1.0074	1.0040	......	......
2	1.0163	1.0091	1.0157	1.0161
3	......	......	......	......
4	1.0344	1.0191	1.0337	1.0344
5	......	......	......	......
6	1.0529	1.0292	1.0522	1.0532
7	......	......	......	......
8	1.0720	1.0393	1.0712	1.0726
9	......	......	......	......
10	1.0918	1.0493	1.0907	1.0925
11	......	......	......	......
12	1.1123	......	1.1109	1.1130
13	......	......	......	......
14	1.1336	......	1.1317	1.1341
15	......	......	......	......
16	1.1557	......	1.1532	1.1558
17	......	......	......	......
18	1.1789	......	1.1757	1.1781
19	......	......	......	......
20	1.2030	......	1.1992	1.2010
21	......	......	......	......
22	1.2277	......	......	......
23	......	......	......	......
24	1.2529	......	......	......
25	......	......	1.2620	1.2600
26	1.2783	......	......	......
27	......	......	......	......
28	1.3037	......	......	......
29	......	......	......	......
30	1.3289	......	1.3300	1.3250
31	......	......	......	......
32	......	......	......	......
33	......	......	......	......
34	......	......	......	......
35	......	......	1.4050	1.3960
36	......	......	......	......
37	......	......	......	......
38	......	......	......	......
39	......	......	......	......
40	......	......	1.4890	......
42	......	......	......	......
44	......	......	......	......
45	......	......	1.5830	......
46	......	......	......	......
48	......	......	......	......
50	......	......	1.6860	......
55	......	......	......	......
60	......	......	......	......
65	......	......	......	......
70	......	......	......	......
75	......	......	......	......
80	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS
(Continued)

Per cent by weight	SrI_2 $\frac{20°}{4°}$ C.	$Sr(NO_3)_2$ $\frac{20°}{4°}$ C.	$ZnBr_2$ $\frac{20°}{4°}$ C.	ZnI_2 $\frac{20°}{4°}$ C.
1	......	......	......	......
2	1.0154	1.0150	1.0167	1.016
3	......	......	......	......
4	1.0331	1.0310	1.0354	1.034
5	......	......	......	......
6	1.0513	1.0480	1.0544	1.053
7	......	......	......	......
8	1.0701	1.0650	1.0738	1.072
9	......	......	......	......
10	1.0896	1.0830	1.0935	1.091
11	......	......	......	......
12	1.1099	1.1010	1.1135	1.111
13	......	......	......	......
14	1.1308	1.1190	1.1338	1.131
15	......	......	......	......
16	1.1526	1.1380	1.1544	1.152
17	......	......	......	......
18	1.1753	1.1580	1.1753	1.174
19	......	......	......	......
20	1.1990	1.179	1.1965	1.197
21	......	......	......	......
22	......	......	......	......
23	......	......	......	......
24	......	......	......	......
25	1.2608	1.233	1.2543	1.258
26	......	......	......	......
27	......	......	......	......
28	......	......	......	......
29	......	......	......	......
30	1.3295	1.290	1.3170	1.325
31	......	......		......
32	......	......	......	......
33	......	......	......	......
34	......	......	......	......
35	1.4058	1.352	1.3859	1.398
36	......	......	......	......
37	......	......	......	......
38	......	......	......	......
39	......	......	......	......
40	1.4901	1.419	1.4620	1.478
42	......	......	......	......
44	......	......	......	......
45	1.5844	......	1.5470	1.566
46	......	......	......	......
48	......	......	......	......
50	......	......	1.6430	1.663
55	......	......	1.7500	1.770
60	......	......	1.8690	1.893
65	......	......	2.0020	2.036
70	......	......	......	2.202
75	......	......	......	2.393
80	......	......	......	....

ETHYL ALCOHOL

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Giving the specific gravity at 15.56° C. referred to water at the same temperature. To reduce to specific gravity referred to water at 4° C. multiply by 0.99908.

(U. S. Department of Agriculture.)

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
1.00000	0.00	0.00	0.00	0.99431	3.90	3.12	3.10
0.99984	0.10	0.08	0.08	0.99417	4.00	3.20	3.18
0.99968	0.20	0.16	0.16	0.99403	4.10	3.28	3.26
0.99953	0.30	0.24	0.24	0.99390	4.20	3.36	3.34
0 99937	0.40	0.32	0.32	0.99376	4.30	3.44	3.42
0 99923	0.50	0.40	0.40	0.99363	4.40	3.52	3.50
0 99907	0.60	0.48	0.48	0.99349	4.50	3 60	3 58
0.99892	0.70	0.56	0.56	0.99335	4.60	3.68	3.66
0.99877	0.80	0.64	0.64	0.99322	4.70	3.76	3.74
0.99861	0.90	0.71	0.71	0.99308	4.80	3.84	3 81
0 99849	1.00	0.79	0.79	0.99295	4.90	3.92	3 89
0.99834	1.10	0.87	0.87	0.99281	5.00	4 00	3 97
0.99819	1.20	0.95	0.95	0.99268	5.10	4.08	4 05
0.99805	1.30	1.03	1.03	0.99255	5.20	4.16	4 13
0.99790	1.40	1.11	1.11	0.99241	5.30	4.24	4 21
0 99775	1.50	1.19	1.19	0.99228	5.40	4.32	4.29
0.99760	1.60	1.27	1.27	0.99215	5.50	4.40	4 37
0.99745	1.70	1.35	1.35	0 99202	5.60	4.48	4 44
0 99731	1.80	1.43	1.43	0.99189	5.70	4.56	4.52
0 99716	1.90	1.51	1.51	0.99175	5.80	4 64	4 60
0 99701	2.00	1.59	1.59	0.99162	5.90	4 72	4 68
0 99687	2.10	1.67	1.66	0.99149	6.00	4.80	4.76
0.99672	2.20	1.75	1.74	0.99136	6.10	4 88	4 84
0 99658	2.30	1.83	1.82	0.99123	6.20	4.96	4 92
0 99643	2.40	1.91	1.90	0.99111	6.30	5 05	5 00
0.99629	2.50	1.99	1.98	0.99098	6.40	5.13	5 08
0.99615	2.60	2.07	2.06	0.99085	6.50	5 21	5.16
0.99600	2.70	2.15	2.14	0.99072	6.60	5.29	5.24
0.99586	2.80	2.23	2.22	0.99059	6.70	5.37	5.32
0 99571	2.90	2 31	2.30	0 99047	6.80	5.45	5.40
0 99557	3.00	2.39	2.38	0 99034	6.90	5.53	5.48
0.99543	3.10	2 47	2.46	0 99021	7 00	5.61	5.56
0.99529	3.20	2.55	2 54	0.99009	7.10	5.69	5.64
0.99515	3.30	2 64	2 62	0 98996	7.20	5.77	5.72
0.99501	3.40	2 72	2 70	0 98984	7.30	5.86	5.80
0.99487	3.50	2.80	2 78	0 98971	7.40	5.94	5.88
0.99473	3.60	2.88	2.86	0.98959	7.50	6.02	5.96
0 99459	3.70	2.96	2.94	0.98947	7.60	6.10	6.04
0.99445	3.80	3.04	3.02	0.98934	7.70	6.18	6.11

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.98922	7.80	6.26	6.19	0.98435	12.00	9.67	9.52
0.98909	7.90	6.34	6.27	0.98424	12.10	9.75	9.60
0 98897	8.00	6.42	6.35	0.98413	12.20	9.83	9.68
0 98885	8.10	6.50	6.43	0.98402	12.30	9.92	9.76
0.98873	8 20	6.58	6.51	0.98391	12.40	10.00	9.84
0.98861	8.30	6.67	6.59	0.98381	12.50	10 08	9.92
0.98849	8.40	6.75	6.67	0.98370	12.60	10.16	10.00
0 98837	8 50	6.83	6.75	0.98359	12.70	10.24	10 07
0 98825	8 60	6.91	6.83	0.98348	12.80	10.33	10.15
0.98813	8.70	6.99	6.91	0.98337	12.90	10.41	10.23
0.98801	8.80	7.07	6.99	0.98326	13 00	10 49	10.31
0.98789	8 90	7.15	7.07	0.98315	13.10	10 57	10.39
0.98777	9 00	7.23	7.14	0.98305	13.20	10 65	10.47
0.98765	9 10	7.31	7.22	0.98294	13.30	10.74	10.55
0.98754	9.20	7.39	7.30	0.98283	13.40	10.82	10.63
0.98742	9.30	7.48	7.38	0.98273	13.50	10.90	10 71
0.98730	9.40	7.56	7.46	0.98262	13.60	10.98	10.79
0 98719	9.50	7.64	7.54	0.98251	13.70	11.06	10.87
0 98707	9.60	7.72	7.62	0.98240	13.80	11.15	10.95
0.98695	9.70	7.80	7.70	0.98230	13.90	11.23	11.03
0.98683	9.80	7.88	7.78	0.98219	14.00	11.31	11.11
0.98672	9.90	7.96	7.85	0.98209	14.10	11.39	11.19
0.98660	10.00	8.04	7.93	0.98198	14.20	11.47	11.27
0.98649	10.10	8.12	8.01	0.98188	14.30	11.56	11.35
0.98637	10.20	8.20	8.09	0.98177	14.40	11.64	11.43
0 98626	10.30	8.29	8.17	0.98167	14.50	11.72	11.51
0.98614	10.40	8.37	8.25	0.98156	14.60	11.80	11.59
0.98603	10.50	8.45	8.33	0.98146	14.70	11.88	11.67
0.98592	10.60	8.53	8.41	0.98135	14.80	11.97	11.75
0.98580	10.70	8.61	8.49	0.98125	14.90	12.05	11.82
0.98569	10.80	8.70	8.57	0.98114	15.00	12.13	11.90
0.98557	10.90	8.78	8.65	0.98104	15.10	12.21	11.98
0.98546	11.00	8.86	8.73	0.98093	15.20	12.29	12.06
0.98535	11.10	8.94	8.81	0.98083	15.30	12.38	12.14
0.98524	11.20	9.02	8.89	0.98073	15.40	12.46	12.22
0.98513	11.30	9.11	8.97	0.98063	15.50	12.54	12.30
0.98502	11.40	9.19	9.05	0.98052	15.60	12.62	12.37
0.98491	11.50	9.27	9.13	0.98042	15.70	12.70	12.45
0.98479	11.60	9.35	9 21	0 98032	15.80	12.79	12.53
0.98468	11.70	9.43	9.29	0.98021	15.90	12.87	12.61
0.98457	11.80	9.51	9.36	0.98011	16.00	12.95	12.69
0.98446	11.90	9.59	9.44	0.98001	16.10	13.03	12.77

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.97991	16.20	13.12	12.85	0.97568	20.40	16.59	16.18
0.97980	16.30	13.20	12.93	0.97558	20.50	16.67	16.26
0.97970	16.40	13.29	13.01	0.97547	20.60	16.75	16.34
0.97960	16.50	13.37	13.09	0.97537	20.70	16.84	16.42
0.97950	16.60	13.45	13.17	0.97527	20.80	16.92	16.50
0.97940	16.70	13.53	13.25	0.97517	20.90	17.01	16.58
0.97929	16.80	13.62	13.33	0.97507	21.00	17.09	16.66
0.97917	16.90	13.70	13.41	0.97497	21.10	17.17	16.74
0.97909	17.00	13.78	13.49	0.97487	21.20	17.26	16.82
0.97899	17.10	13.86	13.57	0.97477	21.30	17.34	16.90
0.97889	17.20	13.94	13.65	0.97467	21.40	17.43	16.98
0.97879	17.30	14.03	13.73	0.97457	21.50	17.51	17.06
0.97869	17.40	14.11	13.81	0.97446	21.60	17.59	17.14
0.97859	17.50	14.19	13.89	0.97436	21.70	17.67	17.22
0.97848	17.60	14.27	13.96	0.97426	21.80	17.76	17.30
0.97838	17.70	14.35	14.04	0.97416	21.90	17.84	17.38
0.97828	17.80	14.44	14.12	0.97406	22.00	17.92	17.46
0.97818	17.90	14.52	14.20	0.97396	22.10	18.00	17.54
0.97808	18.00	14.60	14.28	0.97386	22.20	18.09	17.62
0.97798	18.10	14.68	14.36	0.97375	22.30	18.17	17.70
0.97788	18.20	14.77	14.44	0.97365	22.40	18.26	17.78
0.97778	18.30	14.85	14.52	0.97355	22.50	18.34	17.86
0.97768	18.40	14.94	14.60	0.97345	22.60	18.42	17.94
0.97758	18.50	15.02	14.68	0.97335	22.70	18.51	18.02
0.97748	18.60	15.10	14.76	0.97324	22.80	18.59	18.10
0.97738	18.70	15.18	14.84	0.97314	22.90	18.68	18.18
0.97728	18.80	15.27	14.92	0.97304	23.00	18.76	18.26
0.97718	18.90	15.38	15.00	0.97294	23.10	18.84	18.33
0.97708	19.00	15.43	15.08	0.97283	23.20	18.92	18.41
0.97698	19.10	15.51	15.15	0.97273	23.30	19.01	18.49
0.97688	19.20	15.59	15.23	0.97263	23.40	19.09	18.57
0.97678	19.30	15.68	15.31	0.97253	23.50	19.17	18.65
0.97668	19.40	15.76	15.39	0.97242	23.60	19.25	18.73
0.97658	19.50	15.84	15.47	0.97232	23.70	19.34	18.18
0.97648	19.60	15.93	15.55	0.97222	23.80	19.42	18.88
0.97638	19.70	16.01	15.63	0.97211	23.90	19.51	18.96
0.97628	19.80	16.09	15.71	0.97201	24.00	19.59	19.04
0.97618	19.90	16.18	15.79	0.97191	24.10	19.67	19.12
0.97608	20.00	16.26	15.87	0.97180	24.20	19.76	19.20
0.97598	20.10	16.34	15.95	0.97170	24.30	19.84	19.28
0.97588	20.20	16.42	16.03	0.97159	24.40	19.93	19.36
0.97578	20.30	16.51	16.10	0.97149	24.50	20.01	19.44

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.97139	24.60	20.09	19.52	0.96681	28.80	23.64	22.85
0.97128	24.70	20.18	19.60	0.96669	28.90	23.72	22.93
0.97118	24.80	20.26	19.68	0.96658	29.00	23.81	23.01
0.97107	24.90	20.35	19.76	0.96646	29.10	23.89	23.09
0.97097	25.00	20.43	19.84	0.96635	29.20	23.98	23.17
0.97086	25.10	20.51	19.92	0.96623	29.30	24.06	23.25
0.97076	25.20	20.60	20.00	0.96611	29.40	24.15	23.33
0.97065	25.30	20.68	20.08	0.96600	29.50	24.23	23.41
0.97055	25.40	20.77	20.16	0.96587	29.60	24.32	23.49
0.97044	25.50	20.85	20.24	0.96576	29.70	24.40	23.57
0.97033	25.60	20.93	20.32	0.96564	29.80	24.49	23.65
0.97023	25.70	21.02	20.40	0.96553	29.90	24.57	23.73
0.97012	25.80	21.10	20.47	0.96541	30.00	24.66	23.81
0.97001	25.90	21.19	20.55	0.96529	30.10	24.74	23.89
0.96991	26.00	21.27	20.63	0.96517	30.20	24.83	23.97
0.96980	26.10	21.35	20.71	0.96505	30.30	24.91	24.04
0.96969	26.20	21.44	20.79	0.96493	30.40	25.00	24.12
0.96959	26.30	21.52	20.87	0.96481	30.50	25.08	24.20
0.96949	26.40	21.61	20.95	0.96469	30.60	25.17	24.28
0.96937	26.50	21.69	21.03	0.96457	30.70	25.25	24.36
0.96926	26.60	21.77	21.11	0.96445	30.80	25.34	24.44
0.96915	26.70	21.86	21.19	0.96433	30.90	25.42	24.52
0.96905	26.80	21.94	21.27	0.96421	31.00	25.51	24.60
0.96894	26.90	22.03	21.35	0.96409	31.10	25.60	24.68
0.96883	27.00	22.11	21.43	0.96396	31.20	25.68	24.76
0.96872	27.10	22.20	21.51	0.96384	31.30	25.77	24.84
0.96861	27.20	22.28	21.59	0.96372	31.40	25.85	24.92
0.96850	27.30	22.37	21.67	0.96360	31.50	25.94	25.00
0.96839	27.40	22.45	21.75	0.96347	31.60	26.03	25.08
0.96828	27.50	22.54	21.83	0.96335	31.70	26.11	25.16
0.96816	27.60	22.62	21.90	0.96323	31.80	26.20	25.24
0.96805	27.70	22.71	21.98	0.96310	31.90	26.28	25.32
0.96794	27.80	22.79	22.06	0.96298	32.00	26.37	25.40
0.96783	27.90	22.88	22.14	0.96285	32.10	26.46	25.48
0.96772	28.00	22.96	22.22	0.96273	32.20	26.54	25.56
0.96761	28.10	23.04	22.30	0.96260	32.30	26.63	25.64
0.96749	28.20	23.13	22.38	0.96248	32.40	26.71	25.71
0.96738	28.30	23.21	22.45	0.96235	32.50	26.80	25.79
0.96726	28.40	23.30	22.53	0.96222	32.60	26.89	25.87
0.96715	28.50	23.38	22.61	0.96210	32.70	26.97	25.95
0.96704	28.60	23.47	22.69	0.96197	32.80	27.06	26.03
0.96692	28.70	23.55	22.77	0.96185	32.90	27.14	26.11

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.96172	33.00	27.23	26.19	0.95603	37.20	30.88	29.52
0.96159	33.10	27.32	26.27	0.95589	37.30	30.96	29.60
0.96146	33.20	27.40	26.35	0.95574	37.40	31.05	29.68
0.96133	33.30	27.49	26.43	0.95560	37.50	31.14	29.76
0.96120	33.40	27.57	26.51	0.95545	37.60	31.23	29.84
0.96108	33.50	27.66	26.59	0.95531	37.70	31.32	29.92
0.96095	33.60	27.75	26.67	0.95516	37.80	31.40	30.00
0.96082	33.70	27.83	26.75	0.95502	37.90	31.49	30.08
0.96069	33.80	27.92	26.82	0.95487	38.00	31.58	30.16
0.96056	33.90	28.00	26.90	0.95472	38.10	31.67	30.24
0.96043	34.00	28.09	26.98	0.95457	38.20	31.76	30.32
0.96030	34.10	28.18	27.06	0.95442	38.30	31.85	30.40
0.96016	34.20	28.26	27.14	0.95427	38.40	31.94	30.48
0.96003	34.30	28.35	27.22	0.95413	38.50	32.03	30.56
0.95990	34.40	28.43	27.30	0.95398	38.60	32.12	30.64
0.95977	34.50	28.52	27.38	0.95383	38.70	32.20	30.72
0.95963	34.60	28.61	27.46	0.95368	38.80	32.29	30.79
0.95950	34.70	28.70	27.54	0.95353	38.90	32.37	30.87
0.95937	34.80	28.78	27.62	0.95338	39.00	32.46	30.95
0.95923	34.90	28.87	27.70	0.95323	39.10	32.55	31.03
0.95910	35.00	28.96	27.78	0.95307	39.20	32.64	31.11
0.95896	35.10	29.05	27.86	0.95292	39.30	32.72	31.18
0.95883	35.20	29.13	27.94	0.95277	39.40	32.81	31.26
0.95869	35.30	29.22	28.02	0.95262	39.50	32.90	31.34
0.95855	35.40	29.30	28.09	0.95246	39.60	32.99	31.42
0.95842	35.50	29.38	28.17	0.95231	39.70	33.08	31.50
0.95828	35.60	29.48	28.25	0.95216	39.80	33.17	31.58
0.95814	35.70	29.57	28.33	0.95200	39.90	33.27	31.66
0.95800	35.80	29.65	28.41	0.95185	40.00	33.35	31.74
0.95787	35.90	29.74	28.49	0.95169	40.10	33.44	31.82
0.95773	36.00	29.83	28.57	0.95154	40.20	33.53	31.90
0.95759	36.10	29.92	28.65	0.95138	40.30	33.61	31.98
0.95745	36.20	30.00	28.73	0.95122	40.40	33.70	32.06
0.95731	36.30	30.09	28.81	0.95107	40.50	33.79	32.14
0.95717	36.40	30.17	28.88	0.95091	40.60	33.88	32.22
0.95703	36.50	30.26	28.96	0.95075	40.70	33.97	32.30
0.95688	36.60	30.35	29.04	0.95059	40.80	34.06	32.38
0.95674	36.70	30.44	29.12	0.95044	40.90	34.15	32.46
0.95660	36.80	30.52	29.20	0.95028	41.00	34.24	32.54
0.95646	36.90	30.61	29.29	0.95012	41.10	34.33	32.62
0.95632	37.00	30.70	29.36	0.94996	41.20	34.42	32.70
0.95618	37.10	30.79	29.44	0.94980	41.30	34.50	32.78

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.94964	41.40	34.59	32.86	0.94258	45.60	38.39	36.19
0.94948	41.50	34.68	32.93	0.94241	45.70	38.48	36.26
0.94932	41.60	34.77	33.01	0.94223	45.80	38.57	36.34
0.94916	41.70	34.86	33.09	0.94206	45.90	38.66	36.42
0.94900	41.80	34.95	33.17	0.94188	46.00	38.75	36.50
0.94884	41.90	35.04	33.25	0.94170	46.10	38.84	36.58
0.94868	42.00	35.13	33.33	0.94152	46.20	38.93	36.66
0.94852	42.10	35.22	33.41	0.94134	46.30	39.03	36.74
0.94835	42.20	35.31	33.49	0.94116	46.40	39.12	36.82
0.94810	42.30	35.40	33.57	0.94098	46.50	39.21	36.90
0.94802	42.40	35.49	33.65	0.94080	46.60	39.30	36.98
0.94786	42.50	35.58	33.73	0.94062	46.70	39.39	37.06
0.94770	42.60	35.67	33.81	0.94044	46.80	39.49	37.13
0.94753	42.70	35.76	33.89	0.94026	46.90	39.58	37.21
0.94737	42.80	35.85	33.97	0.94008	47.00	39.67	37.29
0.94720	42.90	35.94	34.04	0.93990	47.10	39.76	37.37
0.94704	43.00	36.03	34.12	0.93971	47.20	39.85	37.45
0.94687	43.10	36.12	34.20	0.93953	47.30	39.95	37.53
0.94670	43.20	36.21	34.28	0.93934	47.40	40.04	37.61
0.94654	43.30	36.30	34.36	0.93916	47.50	40.13	37.69
0.94637	43.40	36.39	34.44	0.93898	47.60	40.22	37.77
0.94620	43.50	36.48	34.52	0.93879	47.70	40.32	37.85
0.94603	43.60	36.57	34.60	0.93861	47.80	40.41	37.93
0.94586	43.70	36.66	34.68	0.93842	47.90	40.51	38.01
0.94570	43.80	36.75	34.76	0.93824	48.00	40.60	38.09
0.94553	43.90	36.84	34.84	0.93805	48.10	40.69	38.17
0.94536	44.00	36.93	34.91	0.93786	48.20	40.78	38.25
0.94519	44.10	37.02	34.99	0.93768	48.30	40.88	38.33
0.94502	44.20	37.11	35.07	0.93749	48.40	40.97	38.41
0.94484	44.30	37.21	35.15	0.93730	48.50	41.06	38.49
0.94467	44.40	37.30	35.23	0.93711	48.60	41.15	38.57
0.94450	44.50	37.39	35.31	0.93692	48.70	41.24	38.65
0.94433	44.60	37.48	35.39	0.93679	48.80	41.34	38.72
0.94416	44.70	37.57	35.47	0.93655	48.90	41.43	38.80
0.94398	44.80	37.66	35.55	0.93636	49.00	41.52	38.88
0.94381	44.90	37.76	35.63	0.93617	49.10	41.61	38.96
0.94364	45.00	37.84	35.71	0.93598	49.20	41.71	39.04
0.94346	45.10	37.93	35.79	0.93578	49.30	41.80	39.12
0.94329	45.20	38.02	35.87	0.93559	49.40	41.90	39.20
0.94311	45.30	38.12	35.95	0.93540	49.50	41.99	39.28
0.94294	45.40	38.21	36.03	0.93521	49.60	42.08	39.36
0.94276	45.50	38.30	36.11	0.93502	49.70	42.18	39.44

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.93482	49.80	42.27	39.52	0 8773	75.00	....	....
0 93463	49.90	42.37	39.60	0.8747	76.00	....	....
0 9344	50 00	...*	....	0 8721	77 00	....	....
0.9325	51 00	....	....	0.8694	78.00	....	....
0.9305	52.00	....	....	0.8667	79.00	....	....
0.9285	53 00	....	....	0.8639	80.00	....	....
0.9264	54 00	....	....	0.8611	81.00	....	....
0.9244	55 00	....	....	0.8583	82 00	....	....
0.9222	56.00	....	....	0.8554	83.00	....	....
0 9201	57.00	....	....	0.8525	84.00	....	....
0 9180	58.00	....	....	0 8496	85 00	....	....
0.9158	59 00	....	....	0 8465	86 00	....	....
0 9136	60.00	....	....	0 8435	87 00	....	....
0.9113	61.00	....	....	0 8404	88.00	....	....
0.9091	62.00	....	....	0.8372	89.00	....	....
0.9068	63.00	....	....	0.8339	90.00	....	....
0.9044	64 00	....	....	0 8306	91.00	....	....
0.9021	65.00	....	....	0.8272	92 00	....	....
0.8997	66.00	....	....	0.8236	93.00	....	....
0.8974	67 00	....	....	0 8199	94.00	....	....
0 8949	68 00	....	....	0 8161	95.00	....	....
0 8925	69.00	....	....	0 8121	96 00	....	....
0.8900	70.00	....	....	0 8079	97 00	....	....
0.8876	71 00	....	....	0.8035	98 00	....	....
0.8850	72.00	....	....	0 7989	99.00	....	....
0.8825	73 00	....	....	0 7939	100 00	....	....
0.8799	74 00	....	....	.....	......	....	....

* For specific gravity of mixtures by weight see following table.

ETHYL ALCOHOL

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Weight

The table gives the specific gravity at the temperature indicated referred to water at 4° C.

(U. S. Bureau of Standards.)

Per cent alcohol by weight.	15° C.	20° C.	25° C.	Per cent alcohol by weight.	15° C.	20° C.	25° C.
0	0.99913	0 99824	0 99708	51	0 91566	0 91164	0 90758
1	0 99725	0 99636	0 99521	52	0 91344	0 90940	0 90533
2	0 99543	0 99453	0 99338	53	0 91120	0 90715	0 90307
3	0 99366	0 99274	0 99159	54	0 90895	0 90488	0 90079
4	0 99197	0 99102	0 98984	55	0 90670	0 90262	0 89851
5	0 99033	0 98936	0 98815	56	0 90443	0.90034	0 89622
6	0 98877	0 98776	0 98651	57	0 90215	0 89805	0 89392
7	0 98726	0 98620	0 98491	58	0 89987	0 89576	0 89162
8	0 98581	0 98470	0 98336	59	0 89758	0 89346	0 88931
9	0 98442	0 98325	0 98185	60	0 89528	0 89115	0 88700
10	0 98307	0 98185	0 98038	61	0 89297	0 88883	0 88467
11	0 98176	0 98047	0 97893	62	0 89066	0 88651	0 88234
12	0 98049	0 97913	0 97752	63	0 88834	0 88418	0 88000
13	0 97925	0 97781	0 97612	64	0 88601	0 88185	0 87766
14	0 97803	0 97651	0 97474	65	0 88368	0 87950	0 87530
15	0 97683	0 97522	0 97336	66	0 88134	0 87716	0 87295
16	0 97563	0 97393	0 97199	67	0 87899	0 87480	0 87058
17	0 97444	0 97264	0 97061	68	0 87664	0 87244	0 86821
18	0 97324	0 97134	0 96922	69	0 87428	0 87008	0 86583
19	0 97203	0 97003	0 96782	70	0 87192	0 86770	0 86344
20	0 97080	0 96870	0 96640	71	0 86954	0 86532	0 86105
21	0 96956	0 96736	0 96497	72	0 86716	0 86292	0 85864
22	0 96829	0 96599	0 96352	73	0 86477	0 86052	0 85622
23	0 96699	0 96459	0 96203	74	0 86237	0 85812	0 85380
24	0 96566	0.96317	0 96052	75	0 85997	0 85570	0 85137
25	0 96430	0 96171	0 95897	76	0 85755	0 85328	0 84893
26	0 96289	0 96021	0 95739	77	0 85513	0 85084	0 84648
27	0 96145	0 95868	0 95577	78	0 85270	0 84840	0 84403
28	0 95997	0 95711	0 95412	79	0 85026	0 84595	0 84157
29	0 95845	0 95550	0 95244	80	0 84781	0 84349	0 83909
30	0 95688	0 95385	0 95071	81	0 84534	0 84101	0 83660
31	0 95526	0 95215	0 94894	82	0 84286	0.83852	0 83410
32	0 95360	0 95042	0 94713	83	0 84037	0 83602	0 83159
33	0 95191	0 94865	0 94529	84	0 83786	0.83350	0 82906
34	0 95017	0 94684	0 94342	85	0 83534	0 83097	0 82652
35	0 94839	0 94499	0 94152	86	0 83279	0 82842	0 82396
36	0 94657	0 94311	0 93957	87	0 83022	0.82583	0 82137
37	0 94471	0 94119	0 93760	88	0 82762	0 82323	0 81876
38	0 94282	0 93924	0 93560	89	0 82500	0 82060	0 81613
39	0 94089	0 93725	0 93356	90	0 82235	0 81795	0 81348
40	0 93893	0 93524	0 93151	91	0 81966	0 81527	0 81080
41	0 93694	0.93320	0 92943	92	0 81694	0 81255	0.80809
42	0 93491	0 93113	0 92732	93	0 81418	0 80979	0.80534
43	0.93286	0 92904	0 92519	94	0 81138	0 80700	0 80256
44	0 93078	0.92693	0 92305	95	0 80854	0 80417	0 79974
45	0 92868	0.92480	0 92088	96	0 80564	0 80129	0 79689
46	0 92655	0 92264	0 91870	97	0 80271	0 79838	0 79400
47	0.92441	0.92047	0 91650	98	0 79972	0 79541	0 79106
48	0.92225	0 91828	0 91429	99	0 79668	0 79240	0 78809
49	0 92006	0.91608	0 91207	100	0 79358	0.78933	0.78507
50	0.91787	0 91386	0.90983	.....	....	....	....

ETHYL ALCOHOL

Specific Gravity of Aqueous Solutions Referred to Water at the Same Temperature

Per cent alcohol	Sp. gr. $\frac{15^\circ}{15^\circ}$ C.	Sp. gr. $\frac{20^\circ}{20^\circ}$ C.	Sp. gr. $\frac{25^\circ}{25^\circ}$ C.	Per cent alcohol	Sp. gr. $\frac{15^\circ}{15^\circ}$ C.	Sp. gr. $\frac{20^\circ}{20^\circ}$ C.	Sp. gr. $\frac{25^\circ}{25^\circ}$ C.
0	1.00000	1.00000	1.00000	51	0.91635	0.91322	0.91026
1	0.99812	0.99813	0.99811	52	0.91412	0.91097	0.90799
2	0.99629	0.99629	0.99627	53	0.91189	0.90872	0.90571
3	0.99451	0.99451	0.99447	54	0.90964	0.90645	0.90343
4	0.99281	0.99279	0.99274	55	0.90738	0.90418	0.90113
5	0.99118	0.99113	0.99106	56	0.90512	0.90191	0.89883
6	0.98963	0.98955	0.98945	57	0.90285	0.89962	0.89654
7	0.98815	0.98802	0.98788	58	0.90058	0.89733	0.89423
8	0.98670	0.98653	0.98634	59	0.89830	0.89502	0.89191
9	0.98528	0.98505	0.98481	60	0.89601	0.89271	0.88959
10	0.98390	0.98361	0.98330	61	0.89371	0.89040	0.88725
11	0.98256	0.98221	0.98184	62	0.89139	0.88807	0.88491
12	0.98126	0.98084	0.98039	63	0.88907	0.88574	0.88256
13	0.97999	0.97948	0.97897	64	0.88674	0.88339	0.88020
14	0.97875	0.97816	0.97757	65	0.88441	0.88104	0.87783
15	0.97754	0.97687	0.97619	66	0.88207	0.87869	0.87547
16	0.97637	0.97560	0.97484	67	0.87971	0.87632	0.87309
17	0.97518	0.97431	0.97346	68	0.87736	0.87396	0.87071
18	0.97398	0.97301	0.97207	69	0.87500	0.87158	0.86833
19	0.97276	0.97169	0.97065	70	0.87263	0.86920	0.86593
20	0.97152	0.97036	0.96922	71	0.87025	0.86680	0.86352
21	0.97028	0.96901	0.96778	72	0.86785	0.86440	0.86110
22	0.96902	0.96763	0.96630	73	0.86545	0.86200	0.85869
23	0.96773	0.96624	0.96481	74	0.86304	0.85958	0.85626
24	0.96642	0.96483	0.96329	75	0.86063	0.85716	0.85383
25	0.96508	0.96339	0.96176	76	0.85822	0.85473	0.85140
26	0.96371	0.96190	0.96018	77	0.85579	0.85230	0.84895
27	0.96228	0.96037	0.95856	78	0.85336	0.84985	0.84650
28	0.96080	0.95880	0.95689	79	0.85092	0.84740	0.84404
29	0.95927	0.95717	0.95520	80	0.84846	0.84494	0.84157
30	0.95769	0.95551	0.95345	81	0.84599	0.84245	0.83909
31	0.95607	0.95381	0.95168	82	0.84350	0.83997	0.83659
32	0.95440	0.95207	0.94986	83	0.84101	0.83747	0.83408
33	0.95269	0.95028	0.94802	84	0.83850	0.83496	0.83156
34	0.95094	0.94847	0.94613	85	0.83598	0.83242	0.82902
35	0.94915	0.94662	0.94422	86	0.83343	0.82987	0.82646
36	0.94732	0.94473	0.94227	87	0.83086	0.82729	0.82389
37	0.94546	0.94281	0.94031	88	0.82826	0.82469	0.82128
38	0.94355	0.94086	0.93830	89	0.82564	0.82207	0.81865
39	0.94161	0.93886	0.93626	90	0.82299	0.81942	0.81600
40	0.93964	0.93684	0.93421	91	0.82030	0.81674	0.81331
41	0.93764	0.93479	0.93212	92	0.81759	0.81401	0.81060
42	0.93559	0.93272	0.93001	93	0.81484	0.81127	0.80785
43	0.93352	0.93062	0.92787	94	0.81205	0.80848	0.80507
44	0.93143	0.92849	0.92571	95	0.80922	0.80567	0.80225
45	0.92933	0.92636	0.92355	96	0.80636	0.80280	0.79939
46	0.92721	0.92421	0.92137	97	0.80344	0.79988	0.79648
47	0.92506	0.92204	0.91917	98	0.80045	0.79688	0.79349
48	0.92291	0.91986	0.91697	99	0.79739	0.79383	0.79045
49	0.92075	0.91766	0.91475	100	0.79429	0.79074	0.78736
50	0.91856	0.91546	0.91251	... ...	....	....	....

ETHYL ALCOHOL

Density of aqueous solutions at 20°C in g/ml. The concentration is expressed as per cent by weight

Per cent		0	.1	2	3	4	5	6	7	8	9
0	0 99	823	804	785	766	748	729	710	692	673	655
1		636	618	599	581	562	544	525	507	489	471
2		453	435	417	399	381	363	345	327	310	292
3		275	257	240	222	205	188	171	154	137	120
4		103	087	070	053	037	020	003	*987	*971	*954
5	0 98	938	922	906	890	874	859	843	827	811	796
6		780	765	749	734	718	703	688	673	658	642
7		627	612	597	582	567	553	538	523	508	493
8		478	463	449	434	419	404	389	374	360	345
9		331	316	301	287	273	258	244	229	215	201
10		187	172	158	144	130	117	103	089	075	061
11		047	033	019	006	*992	*978	*964	*951	*937	*923
12	0 97	910	896	883	869	855	842	828	815	801	788
13		775	761	748	735	722	709	696	683	670	657
14		643	630	617	604	591	578	565	552	539	526
15		514	501	488	475	462	450	438	425	412	400
16		387	374	361	349	336	323	310	297	284	272
17		259	246	233	220	207	194	181	168	155	142
18		129	116	103	089	076	063	050	037	024	010
19	0 96	997	984	971	957	944	931	917	904	891	877
20		864	850	837	823	810	796	783	769	756	742
21		729	716	702	688	675	661	647	634	620	606
22		592	578	564	551	537	523	509	495	481	467
23		453	439	425	411	396	382	368	354	340	326
24		312	297	283	269	254	240	225	211	196	182
25		168	153	139	124	109	094	080	065	050	035
26		020	005	*990	*975	*959	*944	*929	*914	*898	*883
27	0 95	867	851	836	820	805	789	773	757	742	726
28		710	694	678	662	646	630	613	597	581	565
29		548	532	516	499	483	466	450	433	416	400
30		382	365	349	332	315	298	281	264	247	230
31		212	195	178	161	143	126	108	091	074	056
32		038	020	003	*985	*967	*950	*932	*914	*896	*878
33	0 94	860	842	824	806	788	770	752	734	715	697
34		679	660	642	624	605	587	568	550	531	512
35		494	475	456	438	419	400	382	363	344	325
36		306	287	268	249	230	211	192	172	153	134
37		114	095	075	056	036	017	*997	*978	*958	*939
38	0 93	919	899	879	859	840	820	800	780	760	740
39		720	700	680	660	640	620	599	579	559	539
40		518	498	478	458	437	417	396	376	356	335
41		314	294	273	253	232	212	191	170	149	129
42		107	086	065	044	023	002	*981	*960	*939	*918
43	0 92	897	876	855	834	812	791	770	749	728	707
44		685	664	642	621	600	579	557	536	515	493
45		472	450	429	408	386	365	343	322	300	279
46		257	236	214	193	171	150	128	106	085	063
47		041	019	*997	*976	*954	*932	*910	*889	*867	*845
48	0 91	823	801	780	758	736	714	692	670	648	626
49		604	582	560	538	516	494	472	450	428	406
50		384	361	339	317	295	272	250	228	206	183

Per cent		.0	1	2	3	4	5	6	.7	8	9
50	0 91	384	361	339	317	295	272	250	228	206	183
51		160	138	116	093	071	049	026	004	*981	*959
52	0 90	936	914	891	869	846	824	801	779	756	734
53		711	689	666	644	621	598	576	553	531	508
54		485	463	440	417	395	372	349	327	304	281
55		258	236	213	190	167	145	122	099	076	054
56		031	008	*985	*962	*939	*917	*894	*871	*848	*825
57	0 89	803	780	757	734	711	688	665	643	620	597
58		574	551	528	505	482	459	436	413	390	367
59		344	321	298	275	252	229	206	183	160	137
60		113	090	067	044	021	*998	*975	*951	*928	*905
61	0 88	882	859	836	812	789	766	743	720	696	673
62		650	626	603	580	557	533	510	487	463	440
63		417	393	370	347	323	300	277	253	230	206
64		183	160	136	113	089	066	042	019	*995	*972
65	0 87	948	925	901	878	854	831	807	784	760	737
66		713	689	666	642	619	595	572	548	524	501
67		477	454	430	406	383	359	336	312	288	265
68		241	218	194	170	147	123	099	075	052	028
69		004	*981	*957	*933	*909	*885	*862	*838	*814	*790
70	0 86	766	742	718	694	671	647	623	599	575	551
71		527	503	479	455	431	407	383	359	335	311
72		287	263	239	215	191	167	143	119	095	071
73		047	022	*998	*974	*950	*926	*902	*878	*854	*830
74	0 85	806	781	757	733	709	685	661	636	612	588
75		564	540	515	491	467	443	419	394	370	346
76		322	297	273	249	225	200	176	152	128	103
77		079	055	031	006	*982	*958	*933	*909	*884	*860
78	0 84	835	811	787	762	738	713	689	664	640	615
79		590	566	541	517	492	467	443	418	393	369
80		344	319	294	270	245	220	196	171	146	121
81		096	072	047	022	*997	*972	*947	*923	*898	*873
82	0 83	848	823	798	773	748	723	698	674	649	624
83		599	574	549	523	498	473	448	423	398	373
84		348	323	297	272	247	222	196	171	146	120
85		095	070	044	019	*994	*968	*943	*917	*892	*866
86	0 82	840	815	789	763	738	712	686	660	635	609
87		583	557	531	505	479	453	427	401	375	349
88		323	297	271	245	219	193	167	140	114	088
89		062	035	009	*983	*956	*930	*903	*877	*850	*824
90	0 81	797	770	744	717	690	664	637	610	583	556
91		529	502	475	448	421	394	366	339	312	285
92		257	230	203	175	148	120	093	066	038	010
93	0 80	983	955	928	900	872	844	817	789	761	733
94		705	677	649	621	593	565	537	509	480	452
95		424	395	367	338	310	281	253	224	195	166
96		138	109	080	051	022	*993	*963	*934	*905	*875
97	0 79	846	816	787	757	727	698	668	638	608	578
98		547	517	487	456	426	396	365	335	305	274
99		243	213	182	151	120	089	059	028	*997	*966
100	0.78	934									

METHYL ALCOHOL

Specific Gravity of Mixtures of Methyl Alcohol and Water by Volume and by Weight

Giving the specific gravity at 15°C referred to water at 4°C.

(Calculated from values by Doroshevski and Rozhdestvenski, Dittmar and Fawsitt.)

Per cent alcohol by weight	Per cent alcohol by volume	Specific gravity	Per cent alcohol by weight	Per cent alcohol by volume	Specific gravity
1	1 25	0 99727	51	58.74	0 91653
2	2.50	0.99543	52	59.76	0.91451
3	3.75	0.99370	53	60 77	0.91248
4	4 99	0 99198	54	61 78	0.91044
5	6.22	0.99029	55	62.78	0.90839
6	7.45	0.98864	56	63.78	0.90631
7	8.68	0.98701	57	64.77	0.90421
8	9.91	0.98547	58	65.75	0.90210
9	11.13	0.98394	59	66.73	0.89996
10	12.35	0 98241	60	67 69	0 89781
11	13.56	0.98093	61	68.65	0.89563
12	14.77	0.97945	62	69.61	0.89341
13	15.98	0.97802	63	70.55	0.89117
14	17.18	0.97660	64	71.49	0 88890
15	18.38	0.97518	65	72.42	0.88662
16	19.58	0.97377	66	73.34	0 88433
17	20.77	0.97237	67	74.26	0.88203
18	21.96	0.97096	68	75.17	0 87971
19	23.15	0.96955	69	76.08	0.87739
20	24.33	0.96814	70	76.98	0 87507
21	25.51	0.96673	71	77.86	0.87271
22	26.69	0.96533	72	78.75	0.87033
23	27.86	0.96392	73	79 62	0.86792
24	29.03	0 96251	74	80.48	0.86546
25	30.19	0.96108	75	81.34	0.86300
26	31.35	0.95963	76	82.18	0 86051
27	32.51	0.95817	77	83.02	0 85801
28	33.66	0.95668	78	83.86	0 85551
29	34.81	0.95518	79	84.68	0.85300
30	35.95	0.95366	80	85.50	0.85048
31	37.09	0.95213	81	86.31	0.84794
32	38.22	0.95056	82	87.11	0.84536
33	39.35	0.94896	83	87.90	0.84274
34	40.48	0.94734	84	88 68	0.84009
35	41.59	0.94570	85	89.45	0.83742
36	42.71	0.94404	86	90.21	0.83475
37	43.82	0.94237	87	90.97	0.83207
38	44.92	0.94067	88	91.72	0.82937
39	46.02	0.93894	89	92.46	0.82667
40	47.11	0.93720	90	93.19	0.82396
41	48.20	0 93543	91	93.92	0.82124
42	49.28	0.93365	92	94.63	0.81849
43	50.35	0.93185	93	95.33	0.81568
44	51.42	0.93001	94	96.02	0.81285
45	52.49	0.92815	95	96 70	0.80999
46	53.54	0.92627	96	97.37	0.80713
47	54.60	0.92436	97	98.04	0.80428
48	55.64	0 92242	98	98.70	0.80143
49	56.68	0.92048	99	99.35	0.79859
50	57.71	0.91852	100	100.00	0.79577

METHYL ALCOHOL

Specific Gravity of Mixtures of Methyl Alcohol and Water by Volume and by Weight

Giving the specific gravity at 15 6° C. referred to water at the same temperature. To reduce to specific gravity of water at 4°C. multiply by 0.99908.

(Techn. Hogskolan, Stockholm.)

Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.
1.0000	0.00	0.00	0.9950	2.72	3.48	0.9900	5.72	7.13
0.9999	0.06	0.07	0.9949	2.78	3.55	0.9899	5.78	7.21
0.9998	0.11	0.13	0.9948	2.84	3.62	0.9898	5.85	7.28
0.9997	0.17	0.20	0.9947	2.89	3.70	0.9897	5.91	7.36
0.9996	0.22	0.27	0.9946	2.95	3.77	0.9896	5.97	7.44
0.9995	0.28	0.33	0.9945	3.01	3.84	0.9895	6.04	7.52
0.9994	0.33	0.40	0.9944	3.07	3.91	0.9894	6.10	7.59
0.9993	0.39	0.47	0.9943	3.13	3.98	0.9893	6.16	7.67
0.9992	0.44	0.53	0.9942	3.18	4.06	0.9892	6.23	7.75
0.9991	0.50	0.60	0.9941	3.24	4.13	0.9891	6.29	7.82
0.9990	0.55	0.67	0.9940	3.30	4.20	0.9890	6.36	7.90
0.9989	0.61	0.73	0.9939	3.36	4.27	0.9889	6.42	7.98
0.9988	0.66	0.80	0.9938	3.42	4.35	0.9888	6.48	8.05
0.9987	0.72	0.86	0.9937	3.48	4.42	0.9887	6.55	8.13
0.9986	0.77	0.93	0.9936	3.53	4.49	0.9886	6.61	8.21
0.9985	0.83	1.00	0.9935	3.59	4.57	0.9885	6.67	8.29
0.9984	0.88	1.06	0.9934	3.65	4.64	0.9884	6.74	8.36
0.9983	0.94	1.13	0.9933	3.71	4.71	0.9883	6.80	8.44
0.9982	0.99	1.20	0.9932	3.77	4.79	0.9882	6.86	8.52
0.9981	1.05	1.26	0.9931	3.83	4.89	0.9881	6.93	8.59
0.9980	1.10	1.33	0.9930	3.89	4.94	0.9880	6.99	8.67
0.9979	1.15	1.40	0.9929	3.94	5.01	0.9879	7.06	8.75
0.9978	1.20	1.47	0.9928	4.00	5.08	0.9878	7.12	8.83
0.9977	1.26	1.54	0.9927	4.06	5.16	0.9877	7.19	8.90
0.9976	1.31	1.62	0.9926	4.12	5.23	0.9876	7.25	8.98
0.9975	1.36	1.69	0.9925	4.18	5.30	0.9875	7.32	9.06
0.9974	1.41	1.76	0.9924	4.24	5.38	0.9874	7.38	9.14
0.9973	1.46	1.83	0.9923	4.29	5.45	0.9873	7.45	9.22
0.9972	1.52	1.90	0.9922	4.35	5.52	0.9872	7.51	9.29
0.9971	1.57	1.97	0.9921	4.41	5.60	0.9871	7.58	9.37
0.9970	1.62	2.05	0.9920	4.47	5.67	0.9870	7.64	9.45
0.9969	1.67	2.12	0.9919	4.53	5.74	0.9869	7.71	9.53
0.9968	1.72	2.19	0.9918	4.60	5.82	0.9868	7.77	9.61
0.9967	1.78	2.26	0.9917	4.66	5.89	0.9867	7.84	9.68
0.9966	1.83	2.33	0.9916	4.72	5.96	0.9866	7.90	9.76
0.9965	1.88	2.40	0.9915	4.78	6.04	0.9865	7.97	9.84
0.9964	1.93	2.47	0.9914	4.85	6.11	0.9864	8.03	9.92
0.9963	1.98	2.55	0.9913	4.91	6.18	0.9863	8.10	10.00
0.9962	2.04	2.62	0.9912	4.97	6.25	0.9862	8.16	10.07
0.9961	2.09	2.69	0.9911	5.03	6.33	0.9861	8.23	10.15
0.9960	2.14	2.76	0.9910	5.10	6.40	0.9860	8.29	10.23
0.9959	2.20	2.83	0.9909	5.16	6.47	0.9859	8.35	10.31
0.9958	2.26	2.90	0.9908	5.22	6.55	0.9858	8.42	10.38
0.9957	2.31	2.98	0.9907	5.28	6.62	0.9857	8.48	10.47
0.9956	2.37	3.05	0.9906	5.35	6.69	0.9856	8.55	10.55
0.9955	2.43	3.12	0.9905	5.41	6.77	0.9855	8.61	10.63
0.9954	2.49	3.19	0.9904	5.47	6.84	0.9854	8.68	10.71
0.9953	2.55	3.26	0.9903	5.53	6.91	0.9853	8.74	10.79
0.9952	2.60	3.34	0.9902	5.60	6.98	0.9852	8.81	10.87
0.9951	2.66	3.41	0.9901	5.66	7.06	0.9851	8.87	10.95

METHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Methyl Alcohol and Water by Volume and by Weight

Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.
0.9850	8.94	11.03	0.9796	12.55	15.46	0.9742	16.43	20.09
0.9849	9.00	11.10	0.9795	12.62	15.55	0.9741	16.51	20.17
0.9848	9.06	11.18	0.9794	12.69	15.63	0.9740	16.58	20.26
0.9847	9.13	11.26	0.9793	12.76	15.72	0.9739	16.65	20.35
0.9846	9.19	11.34	0.9792	12.83	15.80	0.9738	16.72	20.43
0.9845	9.26	11.42	0.9791	12.90	15.89	0.9737	16.79	20.52
0.9844	9.32	11.50	0.9790	12.97	15.97	0.9736	16.86	20.60
0.9843	9.39	11.58	0.9789	13.04	16.06	0.9735	16.93	20.69
0.9842	9.45	11.66	0.9788	13.11	16.14	0.9734	17.00	20.77
0.9841	9.52	11.74	0.9787	13.18	16.23	0.9733	17.07	20.86
0.9840	9.58	11.82	0.9786	13.25	16.31	0.9732	17.14	20.94
0.9839	9.65	11.90	0.9785	13.32	16.40	0.9731	17.21	21.03
0.9838	9.72	11.98	0.9784	13.39	16.48	0.9730	17.28	21.11
0.9837	9.78	12.06	0.9783	13.46	16.57	0.9729	17.35	21.20
0.9836	9.85	12.14	0.9782	13.53	16.65	0.9728	17.42	21.28
0.9835	9.92	12.23	0.9781	13.60	16.74	0.9727	17.49	21.37
0.9834	9.99	12.31	0.9780	13.67	16.82	0.9726	17.56	21.45
0.9833	10.06	12.39	0.9779	13.74	16.91	0.9725	17.63	21.54
0.9832	10.12	12.47	0.9778	13.82	16.99	0.9724	17.70	21.62
0.9831	10.19	12.55	0.9777	13.89	17.08	0.9723	17.77	21.71
0.9830	10.26	12.63	0.9776	13.96	17.16	0.9722	17.84	21.79
0.9829	10.33	12.71	0.9775	14.03	17.25	0.9721	17.91	21.88
0.9828	10.40	12.79	0.9774	14.11	17.33	0.9720	17.98	21.96
0.9827	10.46	12.87	0.9773	14.18	17.42	0.9719	18.05	22.05
0.9826	10.53	12.95	0.9772	14.25	17.50	0.9718	18.12	22.13
0.9825	10.60	13.04	0.9771	14.32	17.59	0.9717	18.19	22.22
0.9824	10.67	13.12	0.9770	14.40	17.68	0.9716	18.26	22.30
0.9823	10.74	13.20	0.9769	14.47	17.76	0.9715	18.33	22.39
0.9822	10.80	13.28	0.9768	14.54	17.85	0.9714	18.40	22.47
0.9821	10.87	13.36	0.9767	14.61	17.93	0.9713	18.47	22.56
0.9820	10.94	13.44	0.9766	14.69	18.02	0.9712	18.54	22.64
0.9819	11.01	13.52	0.9765	14.76	18.10	0.9711	18.61	22.73
0.9818	11.07	13.61	0.9764	14.83	18.19	0.9710	18.68	22.82
0.9817	11.14	13.69	0.9763	14.90	18.27	0.9709	18.75	22.90
0.9816	11.21	13.78	0.9762	14.98	18.36	0.9708	18.82	22.99
0.9815	11.27	13.86	0.9761	15.05	18.44	0.9707	18.89	23.07
0.9814	11.34	13.94	0.9760	15.12	18.53	0.9706	18.96	23.16
0.9813	11.41	14.03	0.9759	15.19	18.62	0.9705	19.03	23.24
0.9812	11.47	14.11	0.9758	15.27	18.70	0.9704	19.10	23.33
0.9811	11.54	14.20	0.9757	15.34	18.79	0.9703	19.17	23.41
0.9810	11.61	14.28	0.9756	15.41	18.88	0.9702	19.24	23.50
0.9809	11.67	14.36	0.9755	15.49	18.96	0.9701	19.31	23.58
0.9808	11.74	14.45	0.9754	15.56	19.05	0.9700	19.38	23.67
0.9807	11.80	14.53	0.9753	15.63	19.14	0.9699	19.45	23.75
0.9806	11.87	14.62	0.9752	15.70	19.22	0.9698	19.52	23.84
0.9805	11.94	14.70	0.9751	15.78	19.31	0.9697	19.59	23.92
0.9804	12.00	14.78	0.9750	15.95	19.40	0.9696	19.66	24.00
0.9803	12.07	14.87	0.9749	15.92	19.48	0.9695	19.73	24.09
0.9802	12.14	14.95	0.9748	16.00	19.56	0.9694	19.80	24.17
0.9801	12.20	15.04	0.9747	16.07	19.65	0.9693	19.87	24.25
0.9800	12.27	15.12	0.9746	16.14	19.74	0.9692	19.94	24.34
0.9799	12.34	15.21	0.9745	16.22	19.83	0.9691	20.01	24.42
0.9798	12.41	15.29	0.9744	16.29	19.91	0.9690	20.09	24.51
0.9797	12.48	15.38	0.9743	16.36	20.00	0.9689	20.16	24.59

METHYL ALCOHOL (Continued)

SPECIFIC GRAVITY OF MIXTURES OF METHYL ALCOHOL AND WATER BY VOLUME AND BY WEIGHT

Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.	Specific gravity	Per cent alcohol by wt.	Per cent alcohol by vol.
0.9688	20.23	24.67	0.9668	21.63	26.35	0.9648	23.03	27.99
0.9687	20.30	24.76	0.9667	21.70	26.43	0.9647	23.10	28.07
0.9686	20.37	24.84	0.9666	21.77	26.52	0.9646	23.17	28.18
0.9685	20.44	24.92	0.9665	21.84	26.60	0.9645	23.24	28.24
0.9684	20.51	25.01	0.9664	21.91	26.68	0.9644	23.31	28.32
0.9683	20.58	25.09	0.9663	21.98	26.77	0.9643	23.38	28.40
0.9682	20.65	25.17	0.9662	22.05	26.85	0.9642	23.45	28.48
0.9681	20.72	25.26	0.9661	22.12	26.94	0.9641	23.52	28.56
0.9680	20.79	25.34	0.9660	22.19	27.02	0.9640	23.59	28.64
0.9679	20.86	25.42	0.9659	22.26	27.10	0.9639	23.66	28.72
0.9678	20.93	25.51	0.9658	22.33	27.18	0.9638	23.75	28.80
0.9677	21.00	25.59	0.9657	22.40	27.26	0.9637	23.80	28.88
0.9676	21.07	25.68	0.9656	22.47	27.34	0.9636	23.88	28.96
0.9675	21.14	25.76	0.9655	22.54	27.43	0.9635	23.95	29.04
0.9674	21.21	25.84	0.9654	22.61	27.51	0.9634	24.02	29.11
0.9673	21.28	25.95	0.9653	22.68	27.59	0.9633	24.09	29.19
0.9672	21.33	26.01	0.9652	22.75	27.67	0.9632	24.16	29.27
0.9671	21.42	26.10	0.9651	22.82	27.75	0.9631	24.23	29.36
0.9670	21.49	26.18	0.9650	22.89	27.83	0.9630	24.31	29.43
0.9669	21.56	26.26	0.9649	22.96	27.91	0.9629	24.38	29.51

IMMERSION REFRACTOMETER READINGS OF METHYL AND ETHYL ALCOHOLS AT 20°C

By Leach and Lythgoe. Jour. Am. Chem. Soc. 27, 964 (1905)

% Alcohol by Weight	Methyl Alcohol	Ethyl Alcohol	% Alcohol by Weight	Methyl Alcohol	Ethyl Alcohol	% Alcohol by Weight	Methyl Alcohol	Ethyl Alcohol
0	14.5	14.5	35	35.8	75.8	70	33.0	100.0
1	14.8	16.0	36	36.3	76.9	71	32.3	100.2
2	15.4	17.6	37	36.8	78.0	72	31.7	100.4
3	16.0	19.1	38	37.3	79.1	73	31.1	100.6
4	16.6	20.7	39	37.7	80.2	74	30.4	100.8
5	17.2	22.3	40	38.1	81.3	75	29.7	101.0
6	17.8	24.1	41	38.4	82.3	76	29.0	101.0
7	18.4	25.9	42	38.8	83.3	77	28.3	100.9
8	19.0	27.8	43	39.2	84.2	78	27.6	100.9
9	19.6	29.6	44	39.3	85.2	79	26.8	100.8
10	20.2	31.4	45	39.4	86.2	80	26.0	100.7
11	20.8	33.2	46	39.5	87.0	81	25.1	100.6
12	21.4	35.0	47	39.6	87.8	82	24.3	100.5
13	22.0	36.9	48	39.7	88.7	83	23.6	100.4
14	22.6	38.7	49	39.8	89.5	84	22.8	100.3
15	23.2	40.5	50	39.8	90.3	85	21.8	100.1
16	23.9	42.5	51	39.7	91.1	86	20.8	99.8
17	24.5	44.5	52	39.6	91.8	87	19.7	99.5
18	25.2	46.5	53	39.6	92.4	88	18.6	99.2
19	25.8	48.5	54	39.5	93.0	89	17.3	98.9
20	26.5	50.5	55	39.4	93.6	90	16.1	98.6
21	27.1	52.4	56	39.2	94.1	91	14.9	98.3
22	27.8	54.3	57	39.0	94.7	92	13.7	97.8
23	28.4	56.3	58	38.6	95.2	93	12.4	97.2
24	29.1	58.2	59	38.3	95.7	94	11.0	96.4
25	29.7	60.1	60	37.9	96.2	95	9.6	95.7
26	30.3	61.9	61	37.5	96.7	96	8.2	94.9
27	30.9	63.7	62	37.0	97.1	97	6.7	94.0
28	31.6	65.5	63	36.5	97.5	98	5.1	93.0
29	32.2	67.2	64	36.0	98.0	99	3.5	92.0
30	32.8	69.0	65	35.5	98.3	100	2.0	91.0
31	33.5	70.4	66	35.0	98.7			
32	34.1	71.7	67	34.5	99.1			
33	34.7	73.1	68	34.0	99.4			
34	35.2	74.4	69	33.5	99.7			

Calculation of the percentage of ethyl and methyl alcohols in a mixture with water, assuming a distillate to have a sp. gr of 0.97917 $\frac{15.56°}{15.56°}$ and a refraction of 30.0 at 20° on the immersion refractometer. — From the tables of sp. gr for these alcohols the density is found to correspond to 13.70% and 12.83% by weight of ethyl and methyl alcohol respectively; from the table above, the refractometer readings corresponding to 13.70% ethyl and methyl alcohol are 38.16 and 22.42 respectively. Then $(38.16 - 30.0) / (38.16 - 22.42) \times 100 = 51.8\%$, or 51.8% of the alcohol in the distillate is methyl alcohol.

$(12.83 \times 0.518) + 13.70 \times (1 - 0.518) = 13.25$ which is the % by weight of the mixed alcohols in the distillate, of which 13.25×0.518 or 6.86% is methyl alcohol and $13.25 \times (1 - 0.518)$ or 6.39% is ethyl alcohol.

DENSITY AND SPECIFIC GRAVITY OF GASES AND VAPORS

Name	Formula	Density g/l 0°C 760 mm	Density lbs./ft.^{3} 32°F, 1 atm.	Specific gravity Air = 1	Specific gravity O_2 = 1
Acetylene	C_2H_2	1.173	0.07323	0.9073	0.8208
Air		1.2929	.08071	1.0000	0.9047
Ammonia	NH_3	0.7710	.04813	0.5963	0.5395
Argon	A	1.7837	.11135	1.3796	1.2482
Arsenic fluoride	AsF_5	7.71*	.481*	5.96*	5.40*
Arsenic hydride	AsH_3	3.484*	.2175*	2.695*	2.438*
Boron fluoride	BF_3	2.99*	.187*	2.31*	2.09*
Butane (*n*)	C_4H_{10}	2.5190†	.15725†	2.0854†	1.8868†
Butane, *iso*-	C_4H_{10}	2 673	.1669	2.067	1.870
Carbon dioxide	CO_2	1 9769	.12341	1 5290	1.3834
Carbon monoxide	CO	1.2504	.07806	0.9671	0.8750
Carbon oxysulfide	COS	2 72	.170	2.10	1.90
Chlorine	Cl_2	3 214	.2006	2.486	2.249
Chlorine dioxide	ClO_2	3.09[11]	.193[11]	2.39[11]	2.16[11]
Chlorine monoxide	Cl_2O	3.89	.243	3.01	2.72
Cyanogen	C_2N_2	2.335*	.1458*	1.806*	1.634*
Dimethylamine	$(CH_3)_2NH$	1 966[17]	.1227[17]	1.521[17]	1.376[17]
Ethane	C_2H_6	1 3566	.08469	1 0493	0.9493
Ethylene	C_2H_4	1 2604	.07868	0.9749	0.8820
Fluorine	F_2	1 696	.1059	1.312	1.187
Germanium hydride (digermane)	Ge_2H_6	6 74[20]	.421[20]	5.21[20]	4 72[20]
Germanium tetrahydride	GeH_4	3.420	.2135	2.645	2.393
Helium	He	0 17847	.01114	0.13804	0.12489
Hydrogen	H_2	0 08988	005611	0 06952	0.06290
Hydrogen bromide	HBr	3 6445	.2275	2.8189	2.5503
Hydrogen chloride	HCl	1 6392	10233	1 2678	1 1471
Hydrogen iodide	HI	5 7891	.3614	4 4776	4 0510
Hydrogen selenide	H_2Se	3.670	.229	2.839	2.568
Hydrogen sulfide	H_2S	1 539	.09608	1.190	1 077
Hydrogen telluride	H_2Te	5.81	.363	4.49	4 07
Krypton	Kr	3.708	2315	2.868	2.595
Methane	CH_4	0 7168	04475	0.5544	0.5016
Methylamine	CH_3NH_2	1 396	.08715	1 080	0.9769
Methyl chloride	CH_3Cl	2.3076	.1441	1.7848	1.6148
Methyl ether	$(CH_3)_2O$	2.1098	1317	1.6318	1.4764
Methyl fluoride	CH_3F	1.5452	.09646	1.1951	1 0813
Neon	Ne	0.90035	.05621	0.69638	0.63004
Nitric oxide	NO	1.3402	.08367	1.0366	0.9378
Nitrogen	N_2	1 25055	.07807	0.96724	0.87510
Nitrogen (atm.)		1 2568	.07846	0.9721	0 8795
Nitrosyl chloride	NOCl	2.992	.1868	2.314	2.094
Nitrosyl fluoride	NOF	2.176*	.1358*	1.683*	1.523*
Nitrous oxide	N_2O	1.9778	.1235	1.5297	1.3840
Nitroxyl chloride	NO_2Cl	2 57*	.160*	1.99*	1.798*
Nitroxyl fluoride	NO_2F	2.90	.181	2.24	2 03
Oxygen	O_2	1.42904	.08921	1.10527	1.0000
Ozone	O_3	2.144	.1338	1.658	1.500
Phosphine	PH_3	1.5294	.09548	1.1829	1 0702
Phosphorus fluoride	PF_3	3.907*	.2439*	3.022*	2.734*
Phosphorus oxyfluoride	POF_3	4.8	.30	3.7	3 4
Phosphorus pentafluoride	PF_5	5.81	.363	4.494	4 066
Propane	C_3H_8	2.020	.1261	1.562	1.414

* Temperature not stated, probably 20°C.
† Both butane and air at 710 mm.

DENSITY AND SPECIFIC GRAVITY OF GASES AND VAPORS (Continued)

Name	Formula	Density g/l 0°C 760 mm	Density lbs./ft.^{3} 32°F, 1 atm.	Specific gravity Air = 1	Specific gravity O_2 = 1
Radon	Ra	9 73	.607	7 526	6 809
Silicane, chloro- ...	SiH_3Cl	3.03	.189	2.34	2 12
Silicane, chloromethyl. . .	SiH_2ClCH_3	3.64	.227	2.82	2.55
Silicane, dichloromethyl. .	$SiHCl_2CH_3$	5.3	.33	4.1	3.7
Silicane, dimethyl......	$SiH_2(CH_3)_2$	2.73	.170	2.11	1.91
Silicane, methyl . .	SiH_3CH_3	2.08	.130	1.61	1.46
Silicane, trifluoro-..	$SiHF_3$	3 86	.241	2.99	2.70
Silicon fluoride.. ...	SiF_4	4.684	.2924	3 623	3.278
Silicon hexahydride... .	Si_2H_6	2.85	.178	2.204	1.994
Silicon tetrahydride ..	SiH_4	1 44	.0899	1 114	1 008
Stibine (15°C, 754 mm).	SbH_3	5.30	.331	4 10	3 71
Sulfur dioxide...	SO_2	2 9269	.1827	2 2638	2.0482
Sulfur fluoride . . .	SF_6	6 50*	.406*	5 03*	4 55*
Sulfuric oxyfluoride .	SO_2F_2	3.72*	.232*	2.88*	2 60*
Trimethylamine.	$(CH_3)_3N$	2.580	.1611	1.996	1.805
Trimethyl boron	$(CH_3)_3B$	2 52	157	1 95	1 76
Tungsten fluoride. .	WF_6	12 9	.805	9.98	9.03
Xenon.......... . .	Xe	5.851	.3653	4 525	4.094

* Temperature not stated, probably 20°C.

*

DENSITY OF ELEMENTS

The density is given in grams per cubic centimeter and pounds per cubic foot at the temperature stated. Where no temperature is given ordinary atmospheric temperature is understood.

Element	Temp. °C.	Density gm./c.c.	Lbs. per cu. ft.	Observer
Aluminum, hard drawn	20	2.699	168 5	Edwards, 1925
liquid	659	2 382	148.7	Moorman, 1921
Antimony, vacuo-distilled	20	6 618	413.1	Kahlbaum, 1902
compressed	20	6 691	417 7	Kahlbaum, 1902
amorphous	....	6.22	388 3	Herard
Argon, liquid	−183	1.3845	86.4	Baly-Donnan
	−189	1.4233	88 9	Baly-Donnan
Arsenic, metallic	15	5.73	357.7	Lashchenko, 1922
amorphous, brown—black	...	3.70	231.0	Guenther [1908
yellow	18	2.0	124.9	Erdmann & Reppert,
Barium	...	3 78	236 0	Guntz
	25	3 5	218.5	Biltz & Huttig, 1920
Bismuth, electrolytic	...	9 747	608.5	Classen, 1890 [1912
	20	9.80	611.8	Johnston & Adams,
vacuo-distilled	20	9 781	610 6	Kahlbaum, 1902
liquid	271	10 00	624 3	Vincentini-Omodei
	271	10.24	639 25	Plüss, 1915
solid	271	9.67	603.7	Vincentini-Omodei
Boron, crystal		2.535	158.3	Wigand
amorphous		2.45	152.9	Moissan
Bromine, liquid		3 12	194 8	Richards-Stull
Cadmium, cast	20	8 648	539.9	Egerton & Lee, 1923
wrought		8 67	541 2	
vacuo-distilled	20	8 648	539.9	Kahlbaum, 1902
solid	318	8.37	522.5	Vincentini-Omodei
liquid	318	7 99	498.8	Vincentini-Omodei
	349	7 94	495.7	Arpi, 1914
Caesium	20	1 873	116 9	Richards-Brink
Calcium		1.54	96.1	Brink
Carbon, crystal		3.52	219.7	Wigand
graphite		2.25	140 5	Wigand
Cerium, electrolytic		6.79	423 9	Muthmann-Weiss
pure		6.9	430.7	Muthmann-Weiss
Chlorine, liquid	−33 6	1.507	94.1	Drugman-Ramsay
Chromium		6.52–73	407.0–420.1	
pure	20	6.92	432.0	Moissan
	...	7 1	443.2	Richards, 1907
Cobalt	21	8 71	543.7	Tilden [1915
		8 9	555 6	Kalmus & Harper,
Columbium	15	8.4	524.4	Muthmann-Weiss
Copper, cast	.....	8.30–95	518.1–558.7	
annealed	20	8.89	555.0	Dellinger, 1911
wrought	.....	8.85–95	552.5–558.7	
hard-drawn	20	8.89	555.0	Dellinger, 1911
vacuo-distilled	20	8.9326	557.6	Kahlbaum, 1902
compressed	20	8.9376	558.0	Kahlbaum, 1902

Element	Temp. °C.	Density gm./c.c.	Lbs. per cu. ft.	Observer
liquid	.	8.217	513 0	Roberts-Wrightson
Erbium		4.77(?)	298 0	St. Meyer
Fluorine, liquid	−200	1.14	71 2	Moissan-Dewar
Gallium.	25	5.903	369 1	Bur. of Stand., 1934
Germanium	20	5.46	340 9	Winkler [1913
Glucinum (Beryllium)	20	1 84	114 9	Fichter & Jablczynski,
Gold, cast.	...	19.3	1204.8	
cold rolled	20	19 296	1204.6	Rose, 1912
wrought	.	19.33	1206 7	[1905
drawn annealed	20	19.26	1202.3	Kahlbaum & Sturm,
vacuo-distilled	20	18 88	1178.6	Kahlbaum, 1902
compressed	20	19 27	1203 0	Kahlbaum, 1902
Helium, liquid	−269	0.15	9 4	Onnes
Hydrogen, liquid	−252	0.07	4 4	Dewar, 1904
Indium		7 28	454 5	Richards
Iridium	17	22.42	1399 6	Deville-Debray
Iodine	20	4.94	308.4	Richards-Stull
Iron, pure	. .	7 85–88	490 1–491 9	[1924
electrolytic, rolled	20	7.90	493 2	Tritton & Hanson,
gray cast	.	7.03–13	438 9–445 1	
white cast		7 58–73	473 2–482 6	
wrought		7.80–90	486 9–493.2	
liquid	.	6.88	429 5	Roberts-Austen
steel		7.60–80	474 4–486.9	
Krypton, liquid	−146	2 16	134.8	Ramsay-Travers
Lanthanum	..	6 15	383 9	Muthmann-Weiss
Lead, vacuo-distilled	20	11 342	708 0	Kahlbaum, 1902
compressed	20	11.347	708 4	Kahlbaum, 1902
solid	325	11 005	687 0	Vincentini-Omodei
liquid	325	10.645	664 5	Vincentini-Omodei
	400	10 597	661 5	Day, Sosman, 1914
	850	10 078	629 1	Day, Sosman, 1914
Lithium	20	0 534	33 3	Richards-Brink, 1907
Magnesium		1.741	108 7	Voigt
Manganese	...	7.42	463 2	Prelinger
Mercury, liquid	0	13.596	848.8	Regnault, Volkmann
	20	13.546	845 6	
	−38.8	13.690	854 6	Vincentini-Omodei
solid	−38.8	14.193	886 0	Vincentini-Omodei
	−188	14.383	897 9	Dewar, 1902
Molybdenum	..	9 01	562 5	Moissan
	.	10.2	636 8	Fink, 1910
Neodymium	.	6 96	434 5	Muthmann-Weiss
Nickel		8 60–90	536 9–555 6	
Nitrogen, liquid	−195	0 81	50 6	Baly-Donnan, 1902
	−205	0 854	53 3	Baly-Donnan, 1902
Osmium	....	22 5	1404 6	Deville-Debray
Oxygen, liquid	−184	1 14	71 2	
Palladium	.	12 16	759.1	Richards-Stull
Phosphorus, white	.	1.83	114.2	
red	..	2.20	137 3	
metallic	15	2 34	146.1	Hittorf
Platinum	20	21.37	1334.1	Richards-Stull
Potassium	20	0 87	54.3	Richards-Brink, 1907
solid	62 1	0 851	53.1	Vincentini-Omodei
liquid	62 1	0 83	51 8	Vincentini-Omodei
Praesodymium	..	6.475	404.2	Muthmann-Weiss
Rhodium	.....	12.44	776.6	Holborn-Henning
Rubidium	20	1.532	95.6	Richards-Brink, 1907
Ruthenium	0	12.06	752.9	Toby
Samarium	..	7.7–8	480.7–486 9	Muthmann-Weiss

DENSITY OF ELEMENTS (Continued)

Element	Temp. °C.	Density gm./c.c.	Lbs. per cu. ft.	Observer
Selenium	.....	4.3–8	268.4–299.6	
Silicon, crystal	20	2.42	151.1	Richards-Stull-Brink
amorphous	15	2.35	146 7	Vigoroux
Silver, cast	...	10.42–53	650.5–657.4	
wrought	...	10.6	661.7	
vacuo-distilled	20	10.492	655.0	Kahlbaum, 1902
compressed	20	10.503	655.7	Kahlbaum, 1902
liquid	...	9.51	593.7	Wrightson
Sodium	20	0.9712	60.6	Richards-Brink, 1907
solid	97.6	0.9519	59.4	Vincentini-Omodei
liquid	97.6	0.9287	58.0	Vincentini-Omodei
solid	−188	1.0066	62.8	Dewar
Strontium	...	2.50–58	156.1–161.1	Matthiessen
Sulfur	..	2.0–1	124.9–131.1	
liquid	.....	1.811	112.1	Vincentini-Omodei
Tantalum	.....	16.6	1036.3	
Tellurium, crystal	...	6.25	390.2	
amorphous	20	6.02	375 8	Beljankin
Thallium	.....	11.86	740.4	Richards-Stull [1925
Thorium		11.3–11.7	705.4–730 4	Rentschler, Marden,
Tin, white cast	...	7.29	455.1	Matthiessen
wrought	...	7 30	455.7	
crystallized	.	6.97–7.18	435.1–448 2	
solid	226	7.184	448 5	Vincentini-Omodei
liquid	226	6 99	436.4	Vincentini-Omodei
gray	.	5.8	362.1	
Titanium	18	4.5	280.9	Mixter
Tungsten	..	18.6–19.1	1161.1–1192 4	
Uranium	13	18.7	1167.4	Zimmermann
Vanadium	....	5.69	355.3	Ruff-Martin
	20	5.96	372.1	Hull, 1922
Xenon, liquid	−109	3.52	219.7	Ramsay-Travers
Yttrium	...	3.80	237.2	St. Meyer
Zinc, cast	.	7.04–16	439.5–447 0	
wrought	...	7.19	448.9	
vacuo-distilled	20	6.92	432.0	Kahlbaum, 1902
compressed	20	7 13	445.1	Kahlbaum, 1902
liquid	..	6 48	404.5	Roberts-Wrightson
Zirconium	....	6.44	402 0	

DENSITY OF ALLOYS

The density is given in grams per cubic centimeter at ordinary atmospheric temperatures.

Alloy.	Composition.	g./cm.³	Pounds per cu. ft.
Aluminum and copper	10 Al, 90 Cu	7.69	480.06
	5 Al, 95 Cu	8.37	522.51
	3 Al, 97 Cu	8.69	542.49
Aluminum and zinc	91 Al, 9 Zn	2.80	174.80
Bell metal	78 Cu, 22 Zn	8.70	543.11
Bismuth, lead and tin	53 Bi, 40 Pb, 7 Sn	10.56	659.23

DENSITY OF ALLOYS (Continued)

Alloy.	Composition.	g/cm.³	Pounds per cu. ft.
Brass, yellow....	70 Cu, 30 Zn cast	8.44	526.88
	rolled	8.56	534.38
	drawn	8.70	543.11
red.........	90 Cu, 10 Zn..............	8.60	536.87
white........	50 Cu, 50 Zn..............	8.20	511.01
Bronze.......	90 Cu, 10 Sn(gun metal)	8.78	548.11
	85 Cu, 15 Sn	8.89	554.98
	80 Cu, 20 Sn	8.74	545.61
	75 Cu, 25 Sn	8.83	551.23
Cadmium and tin	32 Cd, 68 Sn	7.70	480.69
Constantan......	60 Cu, 40 Ni	8.88	554.35
German silver...	26.3 Cu, 36.6 Zn, 36.8 Ni	8.30	518.14
	52 Cu, 26 Zn, 22 Ni	8.45	527.51
	59 Cu, 30 Zn, 11 Ni	8.34	520.64
	63 Cu, 30 Zn, 6 Ni	8.30	518.14
Gold and copper	98 Au, 2 Cu	18.84	1176.12
	96 Au, 4 Cu	18.36	1146.16
	94 Au, 6 Cu	17.95	1120.56
	92 Au, 8 Cu	17.52	1093.72
	90 Au, 10 Cu	17.16	1071.25
	88 Au, 12 Cu	16.81	1049.40
	86 Au, 14 Cu	16.47	1028.17
Invar...........	63.8 Fe, 36 Ni, 0.2 C	8.00	499.42
Lead and tin.....	87.5 Pb, 12.5 Sn	10.60	661.73
	84 Pb, 16 Sn	10.33	644.87
	77.8 Pb, 22.2 Sn	10.05	627.39
	63.7 Pb, 36.3 Sn	9.43	588.69
	46.7 Pb, 53.3 Sn	8.73	544.98
	30.5 Pb, 69.5 Sn	8.24	514.40
Magnalium......	90 Al, 10 Mg	2.50	156.07
	70 Al, 30 Mg	2.00	124.85
Manganese bronze	95 Cu, 5 Mn	8.80	549.36
Manganin.......	84 Cu, 12 Mn, 4 Ni	8.50	530.63
Monel metal.....	71 Ni, 27 Cu, 2 Fe	8.90	555.60
Nickelin	....	8.77	547.48
Phosphor bronze	79.7 Cu, 10 Sn, 9.5 Sb, 0.8 P	8.80	549.36
Platinum and iridium.......	90 Pt, 10 Ir	21.62	1349.67
	85 Pt, 15 Ir	21.62	1349.67
	66.67 Pt, 33.33 Ir	21.87	1365.28
	5 Pt, 95 Ir	22.38	1397.12
Speculum metal..	67 Cu, 33 Sn	8.60	536.87
Steel...........	99 Fe, 1 C	7.83	488.80
manganese.....	86 Fe, 13 Mn, 1 C	7.81	487.55
Wood's metal....	50 Bi, 25 Pb, 12.5 Cd, 12.5 Sn	10.56	659.23

DENSITY OF VARIOUS SOLIDS

The approximate density of various solids at ordinary atmospheric temperature.

In the case of substances with voids such as paper or leather the bulk density is indicated rather than the density of the solid portion.

(Selected principally from the Smithsonian Tables.)

Substance	Grams per cu. cm	Pounds per cu. ft.	Substance	Grams per cu. cm	Pounds per cu. ft.
Agate	2.5–2.7	156–168	Garnet	3.15–4.3	197–268
Alabaster, carbon-			Gas carbon	1.88	117
ate	2.69–2.78	168–173	Gelatin	1.27	79
sulfate	2.26–2.32	141–145	Glass, common	2.4–2.8	150–175
Albite	2.62–2.65	163–165	flint	2.9–5.9	180–370
Amber	1.06–1.11	66–69	Glue	1.27	79
Amphiboles	2.9–3.2	180–200	Granite	2.64–2.76	165–172
Anorthite	2.74–2.76	171–172	Graphite	2.30–2.72	144–170
Asbestos	2.0–2.8	125–175	Gum arabic	1.3–1.4	81–87
Asbestos slate	1.8	112	Gypsum	2.31–2.33	144–145
Asphalt	1.1–1.5	69–94	Hematite	4.9–5.3	306–330
Basalt	2.4–3.1	150–190	Hornblende	3.0	187
Beeswax	0.96–0.97	60–61	Ice	0.917	57.2
Beryl	2.69–2.7	168–169	Ivory	1.83–1.92	114–120
Biotite	2.7–3.1	170–190	Leather, dry	0.86	54
Bone	1.7–2.0	106–125	Lime, slaked	1.3–1.4	81–87
Brick	1.4–2.2	87–137	Limestone	2.68–2.76	167–171
Butter	0.86–0.87	53–54	Linoleum	1.18	74
Calamine	4.1–4.5	255–280	Magnetite	4.9–5.2	306–324
Calcspar	2.6–2.8	162–175	Malachite	3.7–4.1	231–256
Camphor	0.99	62	Marble	2.6–2.84	160–177
Caoutchouc	0.92–0.99	57–62	Meerschaum	0.99–1.28	62–80
Cardboard	0.69	43	Mica	2.6–3.2	165–200
Celluloid	1.4	87	Muscovite	2.76–3.00	172–187
Cement, set	2.7–3.0	170–190	Ochre	3.5	218
Chalk	1.9–2.8	118–175	Opal	2.2	137
Charcoal, oak	0.57	35	Paper	0.7–1.15	44–72
pine	0.28–0.44	18–28	Paraffin	0.87–0.91	54–57
Cinnabar	8.12	507	Peat blocks	0.84	52
Clay	1.8–2.6	112–162	Pitch	1.07	67
Coal, anthracite	1.4–1.8	87–112	Porcelain	2.3–2.5	143–156
bituminous	1.2–1.5	75–94	Porphyry	2.6–2.9	162–181
Cocoa butter	0.89–0.91	56–57	Pressed wood pulp		
Coke	1.0–1.7	62–105	board	0.19	12
Copal	1.04–1.14	65–71	Pyrite	4.95–5.1	309–318
Cork	0.22–0.26	14–16	Quartz	2.65	165
Cork linoleum	0.54	34	Resin	1.07	67
Corundum	3.9–4.0	245–250	Rock salt	2.18	136
Diamond	3.01–3.52	188–220	Rubber, hard	1.19	74
Dolomite	2.84	177	Rubber, soft		
Ebonite	1.15	72	commercial	1.1	69
Emery	4.0	250	pure gum	0.91–0.93	57–58
Epidote	3.25–3.50	203–218	Sandstone	2.14–2.36	134–147
Feldspar	2.55–2.75	159–172	Serpentine	2.50–2.65	156–165
Flint	2.63	164	Silica, fused trans-		
Fluorite	3.18	198	parent	2.21	138
Galena	7.3–7.6	460–470	translucent	2.07	129
Gamboge	1.2	75	Slag	2.0–3.9	125–240

DENSITY OF VARIOUS SOLIDS (Continued)

Substance	Grams per cu cm	Pounds per cu. ft.	Substance	Grams per cu. cm	Pounds per cu. ft.
Slate	2.6–3.3	162–205	elm	0.54–0.60	34–37
Soapstone	2.6–2.8	162–175	hickory	0.60–0.93	37–58
Spermaceti	0.95	59	holly	0.76	47
Starch	1.53	95	juniper	0.56	35
Sugar	1.59	99	larch	0.50–0.56	31–35
Talc	2.7–2.8	168–174	lignum vitae	1.17–1.33	73–83
Tallow, beef	0.94	59	locust	0.67–0.71	42–44
mutton	0.94	59	logwood	0.91	57
Tar	1.02	66	mahogany		
Topaz	3.5–3.6	219–223	Honduras	0.66	41
Tourmaline	3.0–3.2	190–200	Spanish	0.85	53
Wax, sealing	1.8	112	maple	0.62–0.75	39–47
Wood (seasoned)			oak	0.60–0.90	37–56
alder	0.42–0.68	26–42	pear	0.61–0.73	38–45
apple	0.66–0.84	41–52	pine, pitch	0.83–0.85	52–53
ash	0.65–0.85	40–53	white	0.35–0.50	22–31
balsa	0.11–0.14	7–9	yellow	0.37–0.60	23–37
bamboo	0.31–0.40	19–25	plum	0.66–0.78	41–49
basswood	0.32–0.59	20–37	poplar	0.35–0.5	22–31
beech	0.70–0.90	43–56	satinwood	0.95	59
birch	0.51–0.77	32–48	spruce	0.48–0.70	30–44
blue gum	1.00	62	sycamore	0.40–0.60	24–37
box	0.95–1.16	59–72	teak, Indian	0.66–0.88	41–55
butternut	0.38	24	African	0.98	61
cedar	0.49–0.57	30–35	walnut	0.64–0.70	40–43
cherry	0.70–0.90	43–56	water gum	1.00	62
dogwood	0.76	47	willow	0.40–0.60	24–37
ebony	1.11–1.33	69–83			

For the specific gravity of other substances the reader is referred to the following tables:

Physical Constants of Inorganic and Metal-Organic Compounds

Physical Constants of Organic Compounds

Constants of Vegetable and Animal Oils, Fats and Waxes

Physical and Chemical Constants of Resins, Oleo-Resins and Gum-Resins

Physical Constants of Minerals

Composition and Physical Properties of Alloys

Properties of Commercial Plastics

Physical Properties of Common Woods

DENSITY OF WATER

The temperature of maximum density for pure water, **free** from air = **3.98**°C.

The density at this temperature = **0.999973** g/cm³.

The density of water at 3.98° C is 1.000000 g/ml.

(International Bureau of Weights and Measures, 1910.)

DENSITY OF VARIOUS LIQUIDS

(Selected from Smithsonian Tables.)

Liquid	Grams per cu. cm	Pounds per cu. ft.	Temp. °C
Acetone	0.792	49.4	20°
Alcohol, ethyl	0.791	49.4	20
methyl	0.810	50.5	0
Benzene	0.899	56.1	0
Carbolic acid	0.950–0.965	59.2–60.2	15
Carbon disulfide	1 293	80.7	0
tetrachloride	1.595	99 6	20
Chloroform	1.489	93 0	20
Ether	0.736	45.9	0
Gasoline	0 66–0.69	41 0–43.0	.
Glycerin	1.260	78.6	0
Kerosene	0.82	51.2	.
Mercury	13.6	849 0	..
Milk	1.028–1.035	64 2 64 6	
Naphtha, petroleum ether	0.665	41 5	15
wood	0.848–0 810	52.9–50.5	0
Oils:			
castor	0 969	60.5	15
cocoanut	0 925	57.7	15
cotton seed	0.926	57.8	16
creosote	1.040–1.100	64.9–68 6	15
linseed, boiled	0.942	58.8	15
olive	0.918	57.3	15
Sea water	1 025	63 99	15
Turpentine (spirits)	0 87	54 3	..
Water	1 00	62 43	4

DENSITY OF ALCOHOL

Density of Ethyl Alcohol in Grams Per Cubic Centimeter, Computed from Mendeleeff's Formula

(Selected from Smithsonian Tables.)

Temp. °C	0	1	2	3	4
0	.80625	80541	.80457	.80374	80290
10	.79788	79704	79620	.79535	79451
20	.78945	.78860	.78775	.78691	78606
30	.78097	78012	.77927	.77841	.77756

Temp. °C	5	6	7	8	9
0	.80207	80123	.80039	.79956	79872
10	79367	79283	.79198	.79114	.79029
20	78522	78437	78352	.78267	78182
30	.77671	.77585	77500	.77414	.77329

HYDROMETERS AND DENSITY UNITS

Alcoholometer. — For testing alcoholic solutions; the scale shows the per cent of alcohol by volume; 0°–100° is the per cent.

Ammoniameter. — For testing ammonia solutions; scale 0°–40°; to convert to sp. gr. multiply by 3 and deduct from 1000.

Barktrometer or *Barkometer.* — For testing tanning liquor; scale 0°–80° Bk; the number to the right of the decimal point of the sp. gr. is the degree Bk; thus, 1.025 sp. gr. is 25° Bk.

Baumé. — There are two kinds in use; heavy Bé, for liquids heavier than water and light Bé for liquids lighter than water. In the former, 0° corresponds to a sp. gr. 1.000 (water at 4°C.) and 66° corresponds to a sp. gr. 1.842; in the lighter than water scale, 0° Bé is equivalent to the gravity of a 10% solution of sodium chloride and 60° Bé corresponds to a sp. gr. of 0.745. For Baumé degrees on the scale of densities greater than unity, the following equation gives the means of conversion:

$$\text{Sp. gr.} = \frac{m}{m - d} \quad \text{where } \begin{array}{l} m = 145 \text{ (in the United States)} \\ m = 144 \text{ (old scale used in Holland)} \\ m = 146.78 \text{ (New scale or Gerlach scale)} \\ d = \text{Baumé reading} \end{array}$$

Beck's Hydrometer has 0° corresponding to sp. gr. 1.000 and 30° to sp. gr. 0.850; equal divisions on the scale are continued as far as required in both directions.

Brix Saccharometer or *Balling Saccharometer* shows directly the per cent of sugar (sucrose) by weight at the temperature indicated on the instrument, usually 17.5°C.; i.e., degrees Brix is the per cent sugar.

Cartier's Hydrometer floats in water at the 10° scale division and at 30° corresponds to 32° Bé.

Oleometer.—For vegetable and sperm oils; scale 50°–0° corresponds to sp. gr. 0.870–0.970.

Soxhlet's Lactometer, for determining the density of milk, has a scale from 25° (sp. gr. 1.025) to 35° (sp. gr. 1.035) divided into suitable scale divisions.

Twaddell Hydrometers have the scale so arranged that the reading multiplied by 5 and added to 1000 gives the sp. gr. with reference to water as 1000; it is always used for densities greater than water.

HYDROMETER CONVERSION TABLES

Showing the Relation between Density (C. G. S.) and Degrees Baumé for Densities less than Unity.

Density.	Degrees Baumé.				
	.00	.01	.02	.03	.04
0.60	103.33	99.51	95.81	92.22	88.75
.70	70.00	67.18	64.44	61.78	59.19
.80	45.00	42.84	40.73	38.68	36.67
.90	25.56	23.85	22.17	20.54	18.94
1.00	10.00	.....	.....	.....	...

Density.	Degrees Baumé.				
	.05	.06	.07	.08	.09
0.60	85.38	82.12	78.95	75.88	72.90
.70	56.67	54.21	51.82	49.49	47.22
.80	34.71	32.79	30.92	29.09	27.30
.90	17.37	15.83	14.33	12.86	11.41
1.00	......	.....	.....	.....	.....

HYDROMETER CONVERSION TABLES
(Continued)

SHOWING THE RELATION BETWEEN DENSITY (C. G. S.) AND THE BAUMÉ AND TWADDELL SCALES FOR DENSITIES ABOVE UNITY.

Density.	Degrees Baumé.	Degrees Twaddell.	Density.	Degrees Baumé.	Degrees Twaddell.
1.00	0.00	0	1.41	42.16	82
1.01	1.44	2	1.42	42.89	84
1.02	2.84	4	1.43	43.60	86
1.03	4.22	6	1.44	44.31	88
1.04	5.58	8	1.45	45.00	90
1.05	6.91	10	1.46	45.68	92
1.06	8.21	12	1.47	46.36	94
1.07	9.49	14	1.48	47.03	96
1.08	10.74	16	1.49	47.68	98
1.09	11.97	18	1.50	48.33	100
1.10	13.18	20	1.51	48.97	102
1.11	14.37	22	1.52	49.60	104
1.12	15.54	24	1.53	50.23	106
1.13	16.68	26	1.54	50.84	108
1.14	17.81	28	1.55	51.45	110
1.15	18.91	30	1.56	52.05	112
1.16	20.00	32	1.57	52.64	114
1.17	21.07	34	1.58	53.23	116
1.18	22.12	36	1.59	53.80	118
1.19	23.15	38	1.60	54.38	120
1.20	24.17	40	1.61	54.94	122
1.21	25.16	42	1.62	55.49	124
1.22	26.15	44	1.63	56.04	126
1.23	27.11	46	1.64	56.58	128
1.24	28.06	48	1.65	57.12	130
1.25	29.00	50	1.66	57.65	132
1.26	29.92	52	1.67	58.17	134
1.27	30.83	54	1.68	58.69	136
1.28	31.72	56	1.69	59.20	138
1.29	32.60	58	1.70	59.71	140
1.30	33.46	60	1.71	60.20	142
1.31	34.31	62	1.72	60.70	144
1.32	35.15	64	1.73	61.18	146
1.33	35.98	66	1.74	61.67	148
1.34	36.79	68	1.75	62.14	150
1.35	37.59	70	1.76	62.61	152
1.36	38.38	72	1.77	63.08	154
1.37	39.16	74	1.78	63.54	156
1.38	39.93	76	1.79	63.99	158
1.39	40.68	78	1.80	64.44	160
1.40	41.43	80	....	.....	...

ABSOLUTE DENSITY OF WATER

DENSITY IN GRAMS PER CUBIC CENTIMETER, COMPUTED FROM THE RELATIVE VALUES BY THIESEN, SCHEEL AND DISSELHORST (1900), AND THE ABSOLUTE VALUE AT 3.98° C. BY THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES (1910).

Degrees	0	1	2	3	4	5	6	7	8	9
0	0.999841	847	854	860	866	872	878	884	889	895
1	900	905	909	914	918	923	927	930	934	938
2	941	944	947	950	953	955	958	960	962	964
3	965	967	968	969	970	971	972	972	973	973
4	973	973	973	972	972	972	970	969	968	966
5	965	963	961	959	957	955	952	950	947	944
6	941	938	935	931	927	924	920	916	911	907
7	902	898	893	888	883	877	872	866	861	855
8	849	843	837	830	824	817	810	803	796	789
9	781	774	766	758	751	742	734	726	717	709
10	700	691	682	673	664	654	645	635	625	615
11	605	595	585	574	564	553	542	531	520	509
12	498	486	475	463	451	439	427	415	402	390
13	377	364	352	339	326	312	299	285	272	258
14	244	230	216	202	188	173	159	144	129	114
15	099	084	069	054	038	023	007	*991	*975	*959
16	0.998943	926	910	893	877	860	843	826	809	792
17	774	757	739	722	704	686	668	650	632	613
18	595	576	558	539	520	501	482	463	444	424
19	405	385	365	345	325	305	285	265	244	224
20	203	183	162	141	120	099	078	056	035	013
21	0.997992	970	948	926	904	882	860	837	815	792
22	770	747	724	701	678	655	632	608	585	561
23	538	514	490	466	442	418	394	369	345	320
24	296	271	246	221	196	171	146	120	095	069
25	044	018	*992	*967	*941	*914	*888	*862	*836	*809
26	0.996783	756	729	703	676	649	621	594	567	540
27	512	485	457	429	401	373	345	317	289	261
28	232	204	175	147	118	089	060	031	002	*973
29	0.995944	914	885	855	826	796	766	736	706	676
30	646	616	586	555	525	494	464	433	402	371

RELATIVE DENSITY AND VOLUME OF WATER

The mass of one cubic centimeter of water at 4° C is taken as unity. The values given are numerically equal to the absolute density in grams per milliliter.

(Smithsonian Tables, compiled from Various Authors.)

Temp. ° C.	Density.	Volume.	Temp. ° C	Density.	Volume
−10	0.99815	1.00186	+35	0.99406	1.00598
−9	843	157	36	371	633
−8	869	131	37	336	669
−7	892	108	38	299	706
−6	912	088	39	262	743
−5	0.99930	1.00070	40	0.99224	1.00782
−4	945	055	41	186	821
−3	958	042	42	147	861
−2	970	031	43	107	901
−1	979	021	44	066	943
+0	0.99987	1.00013	45	0.99025	1.00985
1	993	007	46	0.98982	1.01028
2	997	003	47	940	072
3	999	001	48	896	116
4	1.00000	1.00000	49	852	162
5	0.99999	1.00001	50	0.98807	1.01207
6	997	003	51	762	254
7	993	007	52	715	301
8	988	012	53	669	349
9	981	019	54	621	398
10	0.99973	1.00027	55	0.98573	1.01448
11	963	037	60	324	705
12	952	048	65	059	979
13	940	060	70	0.97781	1.02270
14	927	073	75	489	576
15	0.99913	1.00087	80	0.97183	1.02899
16	897	103	85	0.96865	1.03237
17	880	120	90	534	590
18	862	138	95	192	959
19	843	157	100	0.95838	1.04343
20	0.99823	1.00177	110	0.9510	1.0515
21	802	198	120	0.9434	1.0601
22	780	221	130	0 9352	1.0693
23	756	244	140	0.9264	1.0794
24	732	268	150	0.9173	1.0902
25	0.99707	1.00294	160	0 9075	1.1019
26	681	320	170	0.8973	1.1145
27	654	347	180	0 8866	1.1279
28	626	375	190	0.8750	1.1429
29	597	405	200	0.8628	1.1590
30	0.99567	1.00435	210	0 850	1.177
31	537	466	220	0 837	1.195
32	505	497	230	0.823	1.215
33	473	530	240	0.809	1.236
34	440	563	250	0.794	1.259

DENSITY AND VOLUME OF MERCURY

Based on the Density of Mercury at 0° C. by Thiesen and Scheel (1898)

(Selected from Smithsonian Tables.)

Temp. ° C.	Mass in gr. per cu.cm.	Vol. of 1 gr. in cu.cms.	Temp. ° C.	Mass in gr. per cu.cm.	Vol. in 1 gr. in cu.cms.
−10	13.6202	0.0734205	30°	13.5217	0.0739552
−9	6177	4338	31	5193	9686
−8	6152	4472	32	5168	9820
−7	6128	4606	33	5144	9953
−6	6103	4739	34	5119	40087
−5	13.6078	0.0734873	35	13.5095	0.0740221
−4	6053	5006	36	5070	0354
−3	6029	5140	37	5046	0488
−2	6004	5273	38	5021	0622
−1	5979	5407	39	4997	0756
0	13.5955	0.0735540	40	13.4973	0.0740891
1	5930	5674	50	4729	2229
2	5906	5808	60	4486	3569
3	5881	5941	70	4244	4910
4	5856	6075	80	4003	6252
5	13.5832	0.0736209	90	13.3762	0.0747594
6	5807	6342	100	3522	8939
7	5782	6476	110	3283	50285
8	5758	6610	120	3044	1633
9	5733	6744	130	2805	2982
10	13.5708	0.0736877	140	13.2567	0.0754334
11	5684	7011	150	2330	5688
12	5659	7145	160	2093	7044
13	5634	7278	170	1856	8402
14	5610	7412	180	1620	9764
15	13 5585	0.0737546	190	13.1384	0.0761128
16	5561	7680	200	1148	2495
17	5536	7813	210	0913	3865
18	5512	7947	220	0678	5239
19	5487	8081	230	0443	6616
20	13.5462	0 0738215	240	13.0209	0.0767996
21	5438	8348	250	12.9975	9381
22	5413	8482	260	9741	70769
23	5389	8616	270	9507	2161
24	5364	8750	280	9273	3558
25	13.5340	0.0738883	290	12.9039	0.0774958
26	5315	9017	300	8806	6364
27	5291	9151	310	8572	7774
28	5266	9285	320	8339	9189
29	5242	9419	330	8105	80609
30	13.5217	0.0739552	340	12.7872	0.0782033
			350	7638	3464
			360	7405	4900

DENSITY OF MOIST AIR

The density of dry air may be determined by computation from the general relation $D = D_0(T_0/T)(P/P_0)$ where D_0 represents a known density at absolute temperature T_0 and pressure P_0 and D, the density at absolute temperature T and pressure P.

The density of **moist** air may be determined by a similar relation:

$D = 1.2929\ (273.13/T)\ [(B - 0.3783e)/760]$ where T is the absolute temperature; B, the barometric pressure in mm, and e the vapor pressure of the moisture in the air in mm. The density will then be the product of two terms, each of which may be found by use of the tables which follow.

The **first factor,** $1.2929\ (273.13/T)$, may be found directly in Table I for various temperatures. For convenience, temperatures are given in the table in °C although the values of the factor have been computed with absolute temperatures. The tabular values actually represent the density of dry air at various temperatures and 760 mm pressure.

The **second factor,** $[(B - 0.3783e)/760]$, must be obtained in two steps: **First**—the numerator of the expression is obtained by subtracting $0.3783e$ from the barometric pressure. The quantity $0.3783e$ may be found directly from the dew point in Table II. If the wet and dry bulb thermometer readings are known e may be found in the table Reduction of Psychrometric Observations given in the section Hygrometric and Barometric Tables. $0.3783e$ may then be found by calculation or read from the table. **Second**—the value of the whole factor for any value of $B - 0.3783e$ may be obtained from Table III.

The product of the above two factors will give the required density in g/l.

To facilitate obtaining **approximate values** of the density for ordinary pressures and temperatures, a table of products is given which may be entered with the temperature in °C and the corrected (for moisture) value of the barometric pressure in mm to obtain density

As an illustration of the use of the tables, let it be desired to find the density of air for a barometric pressure of 750 mm, a dew point of 10° C, and air temperature of 20° C.

From the dew point, the value of $0.3783e$ is found in Table II to be 3.48 mm. $750 - 3.48 = 746.52$, the corrected pressure. The pressure factor for this value found in Table III by interpolation is 0.98226.

The temperature factor from Table I is 1.2047.

$$1.2047 \times 0.98224 = 1.1833 \text{ g/l.}$$

To obtain the value directly from Table IV, enter it for 20° C and 746.5 mm which gives by interpolation 1.183 g/l.

TABLE I

$(1.2929 \times 273.13/T)$

(Besides being a necessary part of the determination of the density of moist air, the values in this table are actually the density of dry air in g/l at 760 mm pressure for various temperatures.)

Temp. °C	0	1	2	3	4	5	6	7	8	9
−50	1 5 826	897	969	*042	*115	*189	*264	*339	*415	*491
−40	1 5 147	213	278	345	412	479	547	616	686	756
−30	1.4 524	584	645	706	767	829	892	955	*019	*083
−20	1.3 951	*006	*062	*118	*175	*232	*289	*347	*406	*465
−10	1 3 420	472	523	575	628	680	734	787	841	896
− 0	1 2 929	977	*024	*073	*121	*170	*219	*269	*319	*370
+ 0	1 2 929	882	835	789	742	697	651	606	561	517
10	1 2 472	428	385	342	299	256	214	171	130	088
20	1 2 047	006	*965	*925	*885	*845	*805	*766	*727	*688
30	1 1 649	611	573	535	498	460	423	387	350	314
40	1.1 277	242	206	170	135	100	065	031	*996	*962
50	1.0 928	895	861	828	795	762	729	697	664	632
60	1 0 600	569	537	506	475	444	413	382	352	322

DENSITY OF MOIST AIR (Continued)

TABLE II

Vapor Pressure—Value of $0.3783e$

Dew point °C	Vap. press. e mm (ice)	$0.3783e$	Dew point °C	Vap. press. e mm (water)	$0.3783e$	Dew point °C	Vap. press. e mm (water)	$0.3783e$
−50	0.029	0.01	**0**	4.58	1 73	**30**	31.86	12.05
−45	.054	.02	1	4.92	1.86	31	33.74	12.76
−40	096	.04	2	5.29	2.00	32	35.70	13.51
−35	.169	.06	3	5.68	2.15	33	37.78	14 29
−30	.288	.11	4	6.10	2.31	34	39.95	15.11
−25	0.480	0.18	**5**	6.54	2.47	**35**	42.23	15.98
−24	.530	.20	6	7.01	2.65	36	44.62	16.88
−23	.585	.22	7	7.51	2.84	37	47.13	17.83
−22	.646	.24	8	8.04	3 04	38	49.76	18.82
−21	.712	.27	9	8.61	3.26	39	52.51	19.86
−20	0.783	0.30	**10**	9.21	3 48	**40**	55.40	20.96
−19	.862	.33	11	9.85	3.73	41	58.42	22.10
−18	.947	.36	12	10.52	3 98	42	61.58	23.30
−17	1.041	.39	13	11.24	4.25	43	64.89	24 55
−16	1 142	.43	14	11 99	4.54	44	68.35	25.86
−15	1 252	0.47	**15**	12.79	4.84	**45**	71.97	27 23
−14	1.373	.52	16	13 64	5 16	46	75 75	28 66
−13	1.503	.57	17	14.54	5 50	47	79 70	30 15
−12	1.644	.62	18	15.49	5 86	48	83.83	31.71
−11	1 798	.68	19	16.49	6 24	49	88.14	33.34
−10	1 964	0.74	**20**	17.55	6.64	**50**	92.6	35.03
− 9	2 144	.81	21	18 66	7 06	51	97 3	36.81
− 8	2.340	.89	22	19 84	7.51	52	102.2	38.66
− 7	2 550	.96	23	21.09	7.98	53	107.3	40.59
− 6	2 778	1.05	24	22.40	8.47	54	112 7	42 63
− 5	3 025	1.14	**25**	23 78	9.00	**55**	118 2	44 72
− 4	3 291	1.24	26	25 24	9.55	56	124.0	46.91
− 3	3.578	1.35	27	26.77	10.13	57	130.0	49.18
− 2	3 887	1 47	28	28.38	10.74	58	136.3	51 56
− 1	4.220	1.60	29	30.08	11.38	59	142.8	54.02
0	4.580	1 73	**30**	31 86	12.05	**60**	149 6	56.59

DENSITY OF MOIST AIR (Continued)

TABLE III

Pressure Factor.—[$(B - 0.3783e)/760$]

The figures in the body of the table give values of the whole term $(B - 0.3783e)/760$] for various values of the numerator $(B - 0.3783e)$ expressed at the left and top.

Press. mm corr.	0	1	2	3	4	5	6	7	8	9
80	.10526	.10658	.10789	.10921	.11053	.11184	.11316	.11447	.11579	.11711
90	.11842	.11974	.12105	.12237	.12368	.12500	.12632	.12763	.12895	.13026
100	.13158	.13289	.13421	.13553	.13684	.13816	.13947	.14079	.14211	.14342
110	.14474	.14605	.14737	.14868	.15000	.15132	·15263	.15395	.15526	.15658
120	.15789	.15921	.16053	.16184	.16316	.16447	.16579	.16711	.16842	.16974
130	.17105	.17237	.17368	.17500	.17632	.17763	.17895	.18026	.18158	.18289
140	.18421	.18553	.18684	.18816	.18947	.19079	.19211	·19342	.19474	.19605
150	.19737	.19868	.20000	.20132	.20263	.20395	.20526	.20658	.20789	.20921
160	.21053	.21184	.21316	.21447	.21579	.21711	.21842	.21974	.22105	.22237
170	.22368	.22500	.22632	.22763	.22895	.23026	.23158	.23289	.23421	.23553
180	.23684	.23816	.23947	.24079	.24211	.24342	.24474	.24605	.24737	.24868
190	.25000	.25132	.25263	.25395	.25526	.25658	.25789	.25921	.26053	.26184
200	.26316	.26447	.26579	.26711	.26842	.26974	.27105	.27237	.27368	.27500
210	.27632	.27763	.27895	.28026	.28158	.28289	.28421	.28553	.28684	.28816
220	.28947	.29079	.29211	.29342	.29474	.29605	.29737	.29868	.30000	.30132
230	.30263	.30395	.30526	.30658	.30789	.30921	.31053	.31184	.31316	.31447
240	.31579	.31711	.31842	.31974	.32105	.32237	.32368	.32500	.32632	.32763
250	.32895	.33026	.33158	.33289	.33421	.33553	.33684	.33816	.33947	.34079
260	.34211	.34342	.34474	.34605	.34737	.34868	.35000	.35132	.35263	.35395
270	.35526	.35658	.35789	.35921	.36053	.36184	.36316	.36447	.36579	.36711
280	.36842	.36974	.37105	.37237	.37368	.37500	.37632	.37763	.37895	.38026
290	.38158	.38289	.38421	.38553	.38684	.38816	.38947	.39079	.39211	.39342
300	.39474	.39605	.39737	.39868	.40000	.40132	.40263	.40395	.40526	.40658
310	.40789	.40921	.41053	.41184	.41316	.41447	.41579	.41711	.41842	.41974
320	.42105	.42237	.42368	.42500	.42632	.42763	.42895	.43026	.43158	.43289
330	.43421	.43553	.43684	.43816	.43947	.44079	.44211	.44342	.44474	.44605
340	.44737	.44868	.45000	.45132	.45263	.45395	.45526	.45658	.45789	.45921
350	.46053	.46184	.46316	.46447	.46579	.46711	.46842	.46974	.47105	.47237
360	.47368	.47500	.47632	.47763	.47895	.48026	.48158	.48289	.48421	.48553
370	.48684	.48816	.48947	.49079	.49211	.49342	.49474	.49605	.49737	.49868
380	.50000	.50132	.50263	.50395	.50526	.50658	.50789	.50921	.51053	.51184
390	.51316	.51447	.51579	.51711	.51842	.51974	.52105	.52237	.52368	.52500
400	.52632	.52763	.52895	.53026	.53158	.53289	.53421	.53553	.53684	.53816
410	.53947	.54079	.54211	.54342	.54474	.54605	.54737	.54868	.55000	.55132
420	.55263	.55395	.55526	.55658	.55789	.55921	.56053	.56184	.56316	.56447
430	.56579	.56711	.56842	.56974	.57105	.57237	.57368	.57500	.57632	.57763
440	.57895	.58026	.58158	.58289	.58421	.58553	.58684	.58816	.58947	.59079
450	.59211	.59342	.59474	.59605	.59737	.59868	.60000	.60132	.60263	.60395
460	.60526	.60658	.60789	.60921	.61053	.61184	.61316	.61447	.61579	.61711
470	.61842	.61974	.62105	.62237	.62368	.62500	.62632	.62763	.62895	.63026
480	.63158	.63289	.63421	.63553	.63684	.63816	.63947	.64079	.64211	.64342
490	.64474	.64605	.64737	.64868	.65000	.65132	.65263	.65395	.65526	.65658
500	.65790	.65921	.66053	.66184	.66316	.66447	.66579	.66711	.66842	.66974
510	.67105	.67237	.67368	.67500	.67632	.67763	.67895	.68026	.68158	.68290
520	.68421	.68553	.68684	.68816	.68947	.69079	.69211	.69342	.69474	.69605
530	.69737	.69868	.70000	·70132	.70263	.70395	·70526	.70658	.70790	.70921
540	.71053	.71184	.71316	.71447	.71579	.71711	.71842	.71974	.72105	.72237

DENSITY OF MOIST AIR (Continued)

TABLE III (Continued)

Press. mm corr.	0	1	2	3	4	5	6	7	8	9
550	.72368	.72500	.72632	.72763	.72895	.73026	.73158	.73290	.73421	.73553
560	73684	.73816	.73947	.74079	.74211	.74342	.74474	.74605	.74737	.74868
570	.75000	.75132	.75263	.75395	.75526	.75658	.75790	.75921	.76053	.76184
580	.76316	.76447	.76579	.76711	.76842	.76974	.77105	.77237	.77368	.77500
590	.77632	.77763	.77895	.78026	.78158	.78290	.78421	.78553	.78684	.78816
600	.78947	.79079	.79211	.79342	.79474	.79605	.79737	.79868	.80000	.80132
610	.80263	80395	.80526	.80658	.80790	.80921	.81053	.81184	.81316	.81447
620	.81579	.81711	.81842	.81974	.82105	.82237	.82368	.82500	.82632	.82763
630	.82895	.83026	.83158	.83290	.83421	.83553	.83684	.83816	.83947	.84079
640	.84211	.84342	.84474	.84605	.84737	.84868	.85000	.85132	.85263	.85395
650	.85526	.85658	.85790	.85921	.86053	.86184	.86316	.86447	.86579	.86711
660	.86842	.86974	.87105	.87237	.87368	.87500	.87632	.87763	.87895	.88026
670	.88158	.88290	.88421	.88553	.88684	.88816	.88947	.89079	.89211	.89342
680	.89474	.89605	.89737	.89868	.90000	.90132	.90263	.90395	.90526	.90658
690	.90790	.90921	.91053	.91184	.91316	.91447	.91579	.91711	.91842	.91974
700	.92105	.92237	.92368	.92500	.92632	.92763	.92895	.93026	.93158	.93290
710	.93421	.93553	.93684	.93816	.93947	.94079	.94211	.94342	.94474	.94605
720	.94737	.94868	.95000	.95132	.95263	.95395	.95526	.95658	.95790	.95921
730	.96053	.96184	.96316	.96447	.96579	.96711	.96842	.96974	.97105	.97237
740	.97368	.97500	.97632	.97763	.97895	.98026	.98158	.98290	.98421	.98553
750	.98684	.98816	.98947	.99079	.99211	.99342	.99474	.99605	.99737	.99868
760	1.0000	1.0013	1.0026	1.0039	1 0053	1.0066	1.0079	1.0092	1.0105	1.0118
770	1.0132	1.0145	1.0158	1.0171	1.0184	1.0197	1.0211	1.0224	1.0237	1.0250
780	1.0263	1.0276	1.0289	1 0303	1.0316	1.0329	1.0342	1.0355	1.0368	1 0382
790	1.0395	1.0408	1.0421	1.0434	1.0447	1.0461	1.0474	1.0487	1.0500	1.0513

TABLE IV

Density of Moist Air

Values in the body of the table give the density of moist air in g/l for a limited range of temperatures and corrected pressure values ($B - 0.3783e$) The latter may be obtained by use of Table II.

°C	600	610	620	630	640	650	660	670	680	690
5	1.0024	1.0191	1.0358	1.0525	1.0692	1.0859	1.1026	1.1193	1.1361	1.1528
6	.99876	1.0154	1.0321	1.0487	1.0654	1.0820	1.0986	1.1153	1.1319	1.1486
7	.99521	1.0118	1.0284	1.0450	1.0616	1.0781	1.0947	1.1113	1.1279	1.1445
8	.99165	1.0082	1.0247	1.0412	1.0578	1.0743	1.0908	1.1074	1.1239	1.1404
9	.98818	1.0047	1.0211	1.0376	1.0541	1.0705	1.0870	1 1035	1.1199	1.1364
10	.98463	1.0010	1.0175	1.0339	1.0503	1.0667	1.0831	1.0995	1.1159	1.1323
11	.98115	.99751	1.0139	1.0302	1.0466	1.0629	1.0793	1.0956	1.1120	1 1283
12	.97776	.99406	1.0104	1.0267	1.0430	1.0592	1.0755	1.0918	1.1081	1.1244
13	.97436	.99061	1.0068	1.0231	1.0393	1.0556	1.0718	1.0880	1.1043	1.1205
14	.97097	.98715	1.0033	1.0195	1.0357	1.0519	1.0681	1.0843	1.1004	1.1166
15	.96757	.98370	.99983	1.0160	1.0321	1.0482	1.0643	1.0805	1.0966	1.1127
16	.96426	.98033	.99641	1.0125	1.0286	1.0446	1.0607	1.0768	1.0928	1.1089
17	.96086	.97688	.99290	1.0089	1.0249	1.0409	1.0570	1.0730	1.0890	1.1050
18	.95763	.97359	.98955	1.0055	1.0215	1.0374	1.0534	1.0694	1.0853	1.1013
19	.95431	.97022	.98613	1.0020	1.0179	1.0338	1.0497	1.0656	1.0816	1.0975

DENSITY OF MOIST AIR (Continued)

TABLE IV (Continued)

°C	600	610	620	630	640	650	660	670	680	690
20	.95107	.96693	.98278	.99864	1.0145	1.0303	1.0462	1.0620	1.0779	1.0937
21	.94784	.96364	.97944	.99524	1.0110	1.0294	1.0426	1.0584	1.0742	1.0900
22	.94460	.96035	.97609	.99184	1.0076	1.0233	1.0391	1.0548	1.0706	1.0863
23	.94144	.95714	.97283	.98852	1.0042	1.0199	1.0356	1.0513	1.0670	1.0827
24	.93829	.95393	.96957	.98521	1.0008	1.0165	1.0321	1.0478	1.0634	1.0790
25	.93513	.95072	.96630	.98189	.99748	1.0131	1.0286	1.0442	1.0598	1.0754
26	.93197	.94750	.96304	.97858	.99411	1.0096	1.0252	1.0407	1.0562	1.0718
27	.92889	.94437	.95986	.97534	.99083	1.0063	1.0218	1.0373	1.0528	1.0682
28	.92581	.94124	.95668	.97211	.98754	1.0030	1.0184	1.0338	1.0493	1.0647
29	.92273	.93811	.95350	.96888	.98426	.99963	1.0150	1.0304	1.0458	1.0612
30	.91965	.93498	.95031	.96564	.98097	.99629	1.0116	1.0270	1.0423	1.0576
31	.91665	.93193	.94721	.96249	.97777	.99304	1.0083	1.0236	1.0389	1.0542
32	.91365	.92888	.94411	.95934	.97457	.98979	1.0050	1.0203	1.0355	1.0507
33	.91065	.92583	.94101	.95619	.97137	.98654	1.0017	1.0169	1.0321	1.0473
34	.90773	.92286	.93800	.95313	.96826	.98338	.99851	1.0136	1.0288	1.0439
35	.90473	.91981	.93490	.94998	.96506	.98013	.99521	1.0103	1.0254	1.0405

°C	700	710	720	730	740	750	760	770	780	790
5	1.1695	1.1862	1.2029	1.2196	1.2363	1.2530	1.2697	1.2864	1.3031	1.3198
6	1.1652	1.1819	1.1985	1.2152	1.2318	1.2485	1.2651	1.2817	1.2984	1.3150
7	1.1611	1.1777	1.1943	1.2108	1.2274	1.2440	1.2606	1.2772	1.2938	1.3104
8	1.1569	1.1735	1.1900	1.2065	1.2230	1.2396	1.2561	1.2726	1.2892	1.3057
9	1.1529	1.1694	1.1858	1.2023	1.2188	1.2352	1.2517	1.2682	1.2846	1.3011
10	1.1487	1.1651	1.1816	1.1980	1.2144	1.2308	1.2472	1.2636	1.2800	1.2964
11	1.1447	1.1610	1.1774	1.1937	1.2101	1.2264	1.2428	1.2592	1.2755	1.2919
12	1.1407	1.1570	1.1733	1.1896	1.2059	1.2222	1.2385	1.2548	1.2711	1.2874
13	1.1368	1.1530	1.1692	1.1855	1.2017	1.2180	1.2342	1.2504	1.2667	1.2829
14	1.1328	1.1490	1.1652	1.1814	1.1975	1.2137	1.2299	1.2461	1.2623	1.2784
15	1.1288	1.1450	1.1611	1.1772	1.1933	1.2095	1.2256	1.2417	1.2579	1.2740
16	1.1250	1.1410	1.1571	1.1732	1.1893	1.2053	1.2214	1.2375	1.2535	1.2696
17	1.1210	1.1370	1.1530	1.1691	1.1851	1.2011	1.2171	1.2331	1.2491	1.2651
18	1.1172	1.1332	1.1492	1.1651	1.1811	1.1970	1.2130	1.2290	1.2449	1.2609
19	1.1134	1.1293	1.1452	1.1611	1.1770	1.1929	1.2088	1.2247	1.2406	1.2565
20	1.1096	1.1254	1.1413	1.1572	1.1730	1.1888	1.2047	1.2206	1.2364	1.2522
21	1.1058	1.1216	1.1374	1.1532	1.1690	1.1848	1.2006	1.2164	1.2322	1.2480
22	1.1020	1.1178	1.1335	1.1493	1.1650	1.1808	1.1965	1.2122	1.2280	1.2437
23	1.0984	1.1140	1.1297	1.1454	1.1611	1.1768	1.1925	1.2082	1.2239	1.2396
24	1.0947	1.1103	1.1259	1.1416	1.1572	1.1729	1.1885	1.2041	1.2198	1.2354
25	1.0910	1.1066	1.1222	1.1377	1.1533	1.1689	1.1845	1.2001	1.2157	1.2313
26	1.0873	1.1028	1.1184	1.1339	1.1494	1.1650	1.1805	1.1960	1.2116	1.2271
27	1.0837	1.0992	1.1147	1.1302	1.1456	1.1611	1.1766	1.1921	1.2076	1.2230
28	1.0801	1.0955	1.1110	1.1264	1.1418	1.1573	1.1727	1.1881	1.2036	1.2190
29	1.0765	1.0919	1.1073	1.1227	1.1380	1.1534	1.1688	1.1842	1.1996	1.2149
30	1.0729	1.0883	1.1036	1.1189	1.1342	1.1496	1.1649	1.1802	1.1956	1.2109
31	1.0694	1.0847	1.1000	1.1153	1.1305	1.1458	1.1611	1.1764	1.1917	1.2069
32	1.0659	1.0812	1.0964	1.1116	1.1268	1.1421	1.1573	1.1725	1.1878	1.2030
33	1.0624	1.0776	1.0928	1.1080	1.1231	1.1383	1.1535	1.1687	1.1839	1.1990
34	1.0590	1.0742	1.0893	1.1044	1.1195	1.1347	1.1498	1.1649	1.1801	1.1952
35	1.0555	1.0706	1.0857	1.1008	1.1158	1.1309	1.1460	1.1611	1.1762	1.1912

DENSITY OF DRY AIR

At the Temperature t, and under the Pressure H cm of Mercury the Density of Air

$$=\frac{0.001293}{1+0.00367\,t}\,\frac{H}{76}$$

(From Miller's Laboratory Physics, Ginn & Co, publishers, by permission.)

t	Pressure H in Centimeters					
	72.0	73.0	74.0	75.0	76.0	77.0
°						
10	0.001182	0.001198	0.001215	0.001231	0.001247	0.001264
11	178	193	210	227	243	259
12	173	190	206	222	239	255
13	169	186	202	218	234	251
14	165	181	198	214	230	246
15	0.001161	0.001177	0.001193	0.001210	0.001226	0.001242
16	157	173	189	205	221	238
17	153	169	185	201	217	233
18	149	165	181	197	213	229
19	145	161	177	193	209	225
20	0.001141	0.001157	0.001173	0.001189	0.001205	0.001221
21	137	153	169	185	201	216
22	134	149	165	181	197	212
23	130	145	161	177	193	208
24	126	142	157	173	189	204
25	0.001122	0.001138	0.001153	0.001169	0.001185	0.001200
26	118	134	149	165	181	196
27	115	130	146	161	177	192
28	111	126	142	157	173	188
29	107	123	138	153	169	184
30	0.001104	0.001119	0.001134	0.001150	0.001165	0.001180

Proportional Parts

cm	17	16	15
0.1	2	2	1
0.2	3	3	3
0.3	5	5	4
0.4	7	6	6
0.5	8	8	7
0.6	10	10	9
0.7	12	11	10
0.8	14	13	12
0.9	15	14	13

DENSITY OF SATURATED VAPORS AT THE TEMPERATURE OF NORMAL EBULLITION

Vapor	Temp. ° C	Density
Acetic acid	118.5	0.00315
Benzene	80.2	0.00275
Chloroform	61.2	0.00443
Ether	34.6	0.00311
Ethyl alcohol	78.3	0.00164
Methyl alcohol	64.7	0.00121
Water	100.0	0.000596

DENSITY OF GASES IN LIQUID AND SOLID FORM

Temperatures marked * are the temperatures of normal ebullition

Gas	Liquid Temp. °C	Liquid D g/cm³	Solid Temp. °C	Solid D g/cm³	Observer
Acetylene	−23.5	0.52			Mathias, 1909
	+30.3	0.40			
Air (20.9 % oxygen)	−147	0.92			
Ammonia	−10.7	0.65			Andreeff, 1859
	+16.3	0.61			Andreeff, 1859
Argon	−187*	1.41	−233	1.65	Baly & Donnan, 1902
Carbon dioxide	−60	1.19	−79	1.53	Behn, 1910
	+20	0.77			Amagat
Carbon monoxide	−190*	0.79			
	−68	0.86			Baly & Donnan
Chlorine	−33.6*	1.56		1.9	Knietsch, 1890
Chlorine	+20	1.41			Knietsch, 1890
Ethane	−88	0.546			
Ethylene	−102	0.566			
Ethylene	−21	0.41			Cailletet & Mathias, 1886
Ethylene	+10	0.21			
Fluorine	−187*	1.11		1.3	
Helium	−269*	0.122			Kamerling-Onnes & Perrier, 1910
Hydrogen	−253*	0.07	−260	0.076	Dewar, 1904
Hydrogen chloride	−85.8	1.194			
Hydrogen fluoride	+13.6	0.988			
Hydrogen phosphide (phosphine)	−90	0.746			
Hydrogen sulfide	−61	0.86			
Krypton	−146	2.6		2 (?)	
Methane	−164	0.415			
Methyl chloride	+18	0.920			
Neon	−245.9*	1.204		1.0	
Nitrogen	−196*	0.804	−253	1.03	Dewar, 1904
Nitrous oxide	−20	1.0			Cailletet & Mathias
Nitrous oxide	+17	0.80			Villard, 1897
Oxygen	−123	0.89			Cailletet & Hautefeuille, 1881
	−182.7*	1.14	−253	−1.41	Kamerling-Onnes & Perrier, 1910
	−205	1.25			Baly & Donnan
Ozone, O_3	−183	1.71			
Sulfur dioxide	−10*	1.46			Pierre
	+20	1.38			Cailletet & Mathias
Xenon	−109.1*	3.06		2.7(?)	

ELASTIC CONSTANTS FOR SOLIDS

The following table gives values for the yield point (or elastic limit, indicated by e), ultimate tensile strength Young's modulus and the modulus of rigidity in kg/mm². The Brinell hardness number is also given, representing the ratio of load in kilograms on a sphere used to indent material to the spherical area of the indentation in square millimeters.

YIELD POINT, TENSILE STRENGTH, BRINELL HARDNESS

Material	Yield point Kg/mm²	Yield point Lbs./in.²	Ultimate tensile strength Kg/mm²	Ultimate tensile strength Lbs./in.²	Brinell hardness number
		×10³		×10³	
Aluminum 99.97, annealed			5.96	8.48	16
99.5, cast			7.95	11.31	
hot rolled	10.2	14.51	11.34	16.13	
cold "	13.2	18.77	14.71	20.92	
99.3, rolled			19.7–24.6	28.02–34.99	39

Yield Point, Tensile Strength, Brinell Hardness (Continued)

Material	Yield point Kg/mm²	Yield point Lbs./in.²	Ultimate tensile strength Kg/mm²	Ultimate tensile strength Lbs./in.²	Brinell hardness number
		$\times 10^3$		$\times 10^3$	
Aluminum-copper					
Cu .93, cold rolled	18 1	25 74	20 4	29 01	
Cu 1.9 " drawn.	22 1	31 43	23 62	33.59	
Cu 4.97 cast	8 2	11 66	10 6	15 08	
cold drawn	25	35 6	27 9	39 68	
Cu 8.08, cast	10 2	14 51	11 65	16 57	
cold drawn.	24 3	34 56	25 9	36 84	
Aluminum-iron Fe 11, rolled			12 6	17 92	44
Aluminum-magnesium Mg 6, rolled			28 4	40 39	69
Aluminum-manganese Mn 8, rolled			15	21 33	50
Aluminum-nickel Ni 10, rolled			16 5	23 47	53
Aluminum-zinc					
Zn 11%, hard drawn	14 3	20 34	15 4	21 90	
20.15% " "	24 8	35 27	40 4	57 46	
26 05% " "	34 7	49 35	42 2	60 02	
Aluminum-zinc-copper Zn 23.48, Cu 2 67	31 7	45 09	46 6	66 28	
Ambrac Ni 20, Zn 5	53 e.	75 4 e.	60	85 3	160
"30%" Ni 30, Zn 5	67 e.	95 3 e.	74	105 3	190
Antimony (wire)			1 1	1 56	
Arsenic					147
Brass, *see* Cu-Zn					
Bronze, *see* Cu-Sn					
Cadmium, cast			8 5	12 09	21-24
Calcium, cast			6	8 5	42
Cerium					28
Chromel A, rolled hot Ni 82.5, Cr 15, Fe 1	42-56	59 7- 79 7	74-88	105 3-125 2	175-210
Chromel B, rolled hot Ni 77.5, Cr 20, Fe 1	49-63	69 7- 89 6	77-91	109 5-129 4	180-220
Chromel C, Ni 61, Cr 12, Fe 25, cast	28-42	39 8- 59 7	35-49	49 8- 69 7	130-180
rolled hot	35-49	49 8- 69 7	63-77	89 6-109 5	180-200
Chromium					91
Cobalt, annealed			26 0	37	48
cast			24	34 1	124
drawn			68	96 7	
electrolytic					270-311
Constantan, Ni 55, Cu 43.9, Mn 1, C .1, annealed	14-21 e	19 9- 29 9e.	42-49	59 7- 69 7	100-120
cold rolled	21-88 e.	29 9-125 2e.	49-99	69 7-140 8	120-300
Copper, rolled			22 77	32 39	
99 5 sheet "hard"			28 1	39 97	
wire, hard drawn			34 5-47 1	49-67	
" annealed			22.5-24 6	32-35	
Copper-aluminum (aluminum bronze)					
Al 1.06, hard rolled	10 9	15 50	25	35 6	
Al 4.05 " "	17 8	25 32	37 5	53 34	
Al 9.9 " "	23 3	33 14	30 0	85 34	210
quenched	65 9	93 73	85 4	121 46	
Al 11.73, hard rolled	19.9	28.30	53 3	75,81	269

ELASTIC CONSTANTS FOR SOLIDS (Continued)

Yield Point, Tensile Strength, Brinell Hardness (Continued)

Material	Yield point		Ultimate tensile strength		Brinell hard-ness num-ber
	Kg/mm²	Lbs./in.²	Kg/mm²	Lbs./in.²	
Copper-aluminum-nickel					
Al 5.34, Ni 7.34, cold rolled	81.1	×10³ 115.35	84.1	×10³ 119.62	180
Al 6.93, Ni 5.62, cold rolled	87.2	124.02	89.0	126.58	..
Copper-nickel (nickel-silver)					
Ni 10, Zn 25, hard			63	89.6	..
Ni 15, Zn 28 "			67	95.3	
Ni 25, Zn 20 "			77	109.5	208
Copper-tin					
Sn 4, cast and annealed			22.9	32.57	
Sn 10 " " "			30.4	43.24	
Sn 19 " " "			38.7	55.04	
Sn 25 " " "			17.7	25.17	
Copper-zinc (brass)					
Zn 10, rolled hard			39	55.5	120
Zn 20 " "			47	66.8	145
Zn 30 " "	47	66.8	47	66.8	145
Zn 40	39	55.5	47	66.8	150
Zn 50			16	22.8	95
Cupro-nickel Ni 15, hard			49	69.7	
soft			32	45.5	
Ni 25 "	13 e	18.5 e.	37	52.6	
Delta metal	14.1 e.	20 e.	36.6	52	
Duralumin, cold rolled					
Al + Cu 3.5–5.5, Mn .5–.8, Mg .5	54	76.8	62.0	88.18	125
Gold, cast			17.6	25	
pure, hard drawn			25	35.6	
Au 90, Cu 10			45.8	65.1	
Gun metal			17.6–35.2	25–50	
Indium					1
Iridium, cast					172
Iron, cast	3.5–4.2e	5–6 e.	10.5–12.7	15–18	
electrolytic, annealed	143	203.4	29.5	41.96	77
drawn	78	110.9	80.0	113.78	
wrought	14.8–18.3e.	21–26e	29.5–36.6	42–52	
Lanthanum					37
Lead, cast			1.25	1.78	4.2
rolled			2.1	3.0	
Lead-antimony Sb 4.5			4.50	6.4	
Sb 9.9			5.39	7.67	
Lead-tin Sn 33.3			7.63	10.85	
Sn 50 (soft solder)			7.1	10.1	18
Magnesium, cast			10.7–14	15.22–19.9	
drawn, annealed	8–13	11.4–18.5	18–22	25.6–31.3	29.4
Magnesium-aluminum					
Al 8 Dowmetal A, cast			21.8	31.01	60
Magnesium-Al-Cu-Cd					
Al 8.3, Cu 2, Cd 1, Zn .5, Mn .2, Dowmetal D			15.5	22.05	58
Al 8, Cu 1, Cd 1, Dowmetal R			16.5	23.47	54
Magnesium-cadmium					
Cd 5.5, drawn	12.4	17.64	20.6	29.30	51.9
Magnesium-copper					
Cu 12.7, drawn	21.9	31.2	24.6	34.99	

ELASTIC CONSTANTS FOR SOLIDS (Continued)

Yield Point, Tensile Strength, Brinell Hardness (Continued)

Material	Yield point		Ultimate tensile strength		Brinell hard-ness num-ber
	Kg/mm²	Lbs./in.²	Kg/mm²	Lbs./in.²	
Magnesium-silicon		$\times 10^3$		$\times 10^3$	
Si 1.2, drawn..	22 2	31 58	29	41 3	. .
Magnesium-zinc-Al					
Zn 3, Al .5, cold drawn ..		.	32	45 5	.
Manganese-bronze . .	21 1e.	30e.	45 7–59.8	65–85	
Molybdenum, drawn.			180–222	256 0–315 8	147
Monel metal, Ni 68.4, Cu 29, Fe 2, Mn .3, C .2, Si .1, cast . .	21– 28e.	29 9– 39 8e.	46– 56	65 4– 79 6	110–130
cold drawn or rolled .	28–105e.	39 8–149 3e.	53–120	75 4–170.7	130–300
Nickel 99%, cast ..	14– 21	19 9– 29 9	35–49	49 8– 69 7	90–110
rolled cold .. .	25–105	35 6–149 3	53–120	75 4–170 7	110–300
Nickel-iron C<.01					
Ni 1			42 1	59 88	.
Ni 5			51	72 5	
Ni 10.			62 8	89 32	
Ni 18.			127 7	181 63	
Ni 25			73 3	104 25	
Ni 50			76 3	108 52	
Nickel-manganese Mn 3			52 1	74 10	
Mn 9.24			58 9	83 77	
Palladium, drawn			38	54 0	49
Phosphor-bronze					
Cu + Sn 3 77, P.16, drawn	41 7	59 31	56	79 6	.
Platinum, annealed			24 6	35	
pure, drawn			34	48 4	64
Platinum-iridium, hard-worked					
Ir 10					220
Ir 20			100	142 2	330
Ir 30 .			140	199 1	400
Platinum-rhodium Rh 10					90
Potassium					037
Praseodymium					25
Rhodium, cast. .					139
Ruthenium, cast					220
Silver, cast. .			28 1	40	
hard drawn .			31–36	44 1–51 2	
Silver-copper					
Cu 7.5 (sterling silver) cast . .	12 8	18 21	22 2	31 58	60
hard drawn .	..	.	43	61 2	
Ag 75, Cu 25, hard drawn			91 4	130	.
Sodium				. . .	07
Steel, castings..	25 3– 27 4e.	36– 39e.	50 6– 54 8	72– 78	.
forgings	26 0– 31 6e.	37– 45e.	52 7– 63 3	75– 90	
hard.	24 6– 28 1e.	35– 40e	49 2– 56 2	70– 80	
medium..	21 1– 24 6e.	30– 35e.	42 2– 49 2	60– 70	
mild .	17 6– 21 1e.	25– 30e.	35 2– 42 2	50– 60	16 0
spring, tempered	77 3–119 5e.	110–170e.	91 4–140 6	130–200	.
" untempered	35 2– 47 1e.	50– 67e.	71.0– 94 9	101–135	.
Steel-C					
C .08, annealed			32 5	46 22	120
quenched .			49 0	69.69	. .
.38, annealed.	28 1	39 97	50 6	71.97	
.49 "			49	69.7	.
.71 " .	...	.. . .	78 4	111 51	217
quenched		...	129	183 5	

ELASTIC CONSTANTS FOR SOLIDS (Continued)

YIELD POINT, TENSILE STRENGTH, BRINELL HARDNESS (Continued)

Material	Yield point		Ultimate tensile strength		Brinell hardness number
	Kg/mm²	Lbs./in.²	Kg/mm²	Lbs./in.²	
Steel-C (Continued)		$\times 10^3$		$\times 10^3$	
C 1.00, quenched			150	213.3	402
1.40, annealed			68.6	97.57	202
quenched			131.9	187.60	460
Steel-Cr, quenched Cr 2, C .5, Mn .24			176.6	251.18	454
Steel-Cr-U, quenched, Cr .78, U .17, C .36, Mn .53, Si .25	143.4	203.96	170	241.8	...
—Cr-V, quenched Cr 1.45, V .19, C .46, Mn .45, Si .18	140.9	200.40	169	240.4	444
—Cu, cold drawn, Cu .3, C .72, Mn .83, Si .03			207.6	295.27	..
—Mn, forged Mn 8.68, C 1.27, Si .19			123.4	175.51	
—Ni, Ni 1.76, C .26, cast			67.5	96.01	..
Ni 2.73, C .37, cast and forged			66.3	94.30	...
Ni 3.59, C .20, quenched			138	196.2	354
—Ni-Cr, quenched, Ni 3.7–4.1, Cr .9, C .38, Mn .7, Si .15	106.5	151.47	194	275.9	...
—Ni-Cr-U, quenched, Ni 1.63, Cr .61, U .20, C .36, Mn .78, Si .47	150	213.3	175	248.9	...
—Ni-Cu, quenched, Ni 2.55, Cu .6, C .46, Mn .82, Si 1.3	196	278.8	230.5	327.84	555
—Ni-U, quenched, Ni 3.15, U .40, C .57, Mn .62, Si 58.	183	260.3	209	297.3	...
—Ni-V, quenched, Ni 3.15, V .32, C .6, Mn .79, Si 1.3	194.2	276.21	241.3	343.20	627
—Ti, low carbon, quenched, Ti 2.57, C .135, Mn .31, P .01, S .017, Si .14	45.2	64.29	66.2	94.16	143
—Ti, high carbon, quenched, Ti 8.71, C .65, Mn .45, P .016, S .011, Si .163	80.3	114.21	132.5	188.45	477
—U, quenched, U 2.20, C .25, Mn .65, Si .30	145	206.2	160.6	228.42	...
—U, quenched, tempered, U .29, C .54, Mn .61	181	257.4	197	280.2	...
—U, quenched, U .53, C .72, Mn .54, Si .75	197	280.2	233	331.4	...
—V, rolled, V .8, C 1.04, Mn .05, Si .1	92.6	131.70	132.2	188.03	...
Tantalum	..	.	93	132.3	...
Thorium			56.3	80.08	...
Tin, hard drawn			7.0	10	...
rolled	...	...	2.5	3.56	...
Tin-antimony-copper bearing alloy Sb 11, Cu 11	...	...	11.5	16.36	37
Tobin bronze	35.9–39.4e.	51–56e.	46.4–56.2	66–80	...
Tungsten, drawn	...	...	420	597.4	...
Zinc, rolled	9	12.8	12–30	17.1–42.7	...

ELASTIC CONSTANTS FOR SOLIDS (Continued)

Young's Modulus and Modulus of Rigidity (Torsional)

Material	Young's modulus		Modulus of rigidity	
	Dynes/cm²	Lbs./in.²	Dynes/cm²	Lbs./in.²
	× 10^{11}	× 10^{6}	× 10^{11}	× 10^{6}
Aluminum, cast	5.6–7.7	8–11		
rolled	6.82–7.0	9.7–10		
99.3, rolled	6.96	10.10	2.37	3.44
Aluminum-bronze, forged Cu 90, Al 10	11.81	16.8		
Aluminum-iron Fe 11, rolled	6.67	9.67		
Aluminum-magnesium Mg 6, rolled	6.18	8.96		
Aluminum-manganese Mn 8, rolled	6.47	9.39		
Aluminum-nickel Ni 10, rolled	6.47	9.39		
Ambrac (Ni 20)	13.14	19.06		
Antimony (wire)	7.80	11.31	1.98	2.87
Brass, cold rolled	9.02	13.09	3.53	5.12
Cadmium, cast	6.93	10.06	2.40	3.48
Constantan	14.51–15.89	21.05–23.04		
Copper, rolled	12.06–12.85	17.49–18.63	4.24	6.14
wire, hard drawn	10.19–12.0	14.5–17		
Cupro-nickel	8.24	11.95		
Delta metal	7.73	11		
Duralumin, cold rolled Al + Cu 3.5–5.5, Mn .5–.8, Mg .5	6.89	10.00	2.75	3.98
Gold, pure, hard drawn	7.85	11.38		
Gun metal	7.0	10		
Iridium, cast	5.17 (d)	7.50 (d)		
Iron, cast	8.4–9.8	12–14		
electrolytic	20.6	29.9		
wrought	18.3–20.4	26–29		
Iron-cobalt Fe 70, Co 30	21.33	30.94		
Lead, rolled	1.47–1.67	2.13–2.42	0.54	0.78
Magnesium, drawn, annealed	4.18	6.06	1.67	2.42
Magnesium-aluminum Al 8 Dowmetal A, cast	4.18	6.06		
Monel metal	16.48–17.95	23.89–26.03	6.18–6.86	8.96–9.96
Nickel	20.01–21.38	29.01–31.01	7.06–7.55	10.24–10.95
Nickel-iron C <.01 Ni 5	21.28	30.86		
Ni 19	17.36 (19% Ni)	25.17		
Ni 25	18.14 (26% Ni)	26.31		
Palladium, drawn	11.77	17.07	4.41	6.40
Platinum, pure, drawn	16.67	24.18	6.42	9.32
Platinum-rhodium Rh 10			6.47	9.39
Rhodium, cast	29.42 (d)	42.67 (d)		
Silver, hard drawn	7.75	11.24	2.60	3.77
Steel-C C .08 annealed			7.79	11.31
drawn	19.22	27.88		
.38 annealed	20.01	29.01	8.11	11.76
.67 "	19.61	28.45	8.04	11.66
Tantalum	18.6	27.0		
Tin, rolled	3.92–5.39	5.69–7.82	1.67	2.42
Tobin bronze	3.2	4.5		
Tungsten, drawn	35.5	51.49	14.81	21.48
Zinc, rolled	7.8–10.20	11.4–14.79	2.9–3.73	4.3–5.40

COMPRESSIBILITY OF LIQUIDS

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Acetone	0.	1–500	82×10^{-6}	Amagat, 1893
	0.	500–1000	59.	"
	0.	1000–1500	47.	"
	99.5	8.94–36.5	276.	"
Amyl alcohol	17.7	8	90.5	Röntgen, 1891
Benzene C_6H_6	12.9	0.4–18	87.	Suchodski, 1910
	34.9	2–18	100.	"
	99.9	4.5–19	190.	"
Butyl alcohol	17.4	8	90.	Röntgen
Carbon disulphide	0.	1–500	66.	Amagat, 1893
	49.2	1000–1500	51.	"
Carbon tetrachloride	20.	100–200	90.7	Richards, 1907
Chlorobenzene	13.	0.4–18	67.	Suchodski, 1910
	35.	0.4–18	77.	"
	100.	0.4–18	127.	"
Chloroform	0.	....	101.	Grimaldi, 1887
	20.	....	128.	"
	40.	....	162.	"
	60.	....	204.	"
	100.	8–9	211.	Amagat
	100.	19–34	206.	"
	20.	1–98	94.	Richards&Stall, 1904
	20.	98.7–197.4	89.	Richards&Stall, 1904
	20.	197.4–296.1	80.	Richards&Stall, 1904
Ether	12.2	0.4–17.5	163.	Suchodski, 1910
	34.8	2–19	207.	"
	63.	8.6–34.3	293.	Amagat, 1893
	78.5	8.6–34.3	363.	"
	99.	8.6–36.5	523.	"
Ethyl acetate	13.3	8.1–37.4	104.	"
Ethyl alcohol	28.	150–400	81.	Barus, 1890
	65.	150–400	100.	"
	100.	150–400	132.	"
	185.	150–400	245.	"
	310.	150–400	1530.	"
	28.	150–200	86.	"
	100.	150–200	168.	"
	310.	150–200	4200.	"

COMPRESSIBILITY OF LIQUIDS (Continued)

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Ethyl alcohol:				
	0.	1–50	$96. \times 10^{-6}$	Amagat, 1893
	20.	1–50	112.	"
	40.	1–50	125.	"
	0.	100–200	85.	"
	0.	300–400	73.	"
	0.	500–600	64.	"
	0.	900–1000	52.	"
Ethyl bromide.	10.1	1–500	89.6	Amagat
	10.1	500–1000	63.4	"
	13.7	0.4–18.5	113.	Suchodski, 1910
	35.	2–19	138.	"
Ethyl chloride.	0.	1–500	103.	Amagat, 1893
	0.	500–1000	69.2	"
	11.	8.5–34.2	138.	"
	62.	12.7–32.8	255.	"
	99.	12.8–34.5	495.	"
Ethyl iodide...	10.6	1–500	73.8	Amagat
		500–1000	56.2	"
Fluor-benzene.	13.9	0.4–18	88.	Suchodski, 1910
	35.3	0.4–18	103.	"
	99.7	4.3–18.5	190.	"
Glycerine.....	14.9	1–10	22.	De Metz, 1890
Mercury......	0.	....	3.92	Amagat
	15.	100–200	3.76	Richards, 1907
Methyl acetate	14.3	8.1–37.5	97.	Amagat
	99.	8.3–37	250.	"
Methyl alcohol	0.	1–500	79.4	"
	0.	500–1000	58.3	"
	14.7	8.5–371	104.	"
	100.	8.7–37.3	221.	"
Nitric acid....	20.3	1–32	338.	....
Palmitic acid..	65.	20–100	88.	Barus, 1890
	100.	20–100	99.	"
Paraffine......	64.	20–100	84.	"
	100.	20–100	107.	"
Oil, almond...	17.	....	55.	Quincke
olive.......	20.5	....	63.	"
turpentine..	19.7	....	79.	"
Toluene....	10.	1–5.25	79.	DeHeen, 1885
	100.	1–5.25	150.	" "
Xylene.......	10.	1–5.25	74.	" "
	100.	1–5.25	132.	" "

COMPRESSIBILITY OF LIQUIDS (Continued)

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Water........	0.	1–25	52.5×10^{-6}	Amagat, 1893
	10.	1–25	50.0	"
	20.	1–25	49.1	"
	0.	25–50	51.6	"
	10.	25–50	49.2	"
	20.	25–50	47.6	"
	0.	100–200	49.2	"
	10.	100–200	46.1	"
	20.	100–200	44.2	"
	50.	100–200	42.5	"
	100.	100–200	46.8	"
	0.	500–1000	41.6	"
	0.	1000–1500	35.8	"
	0.	1500–2000	32.4	"
	0.	2000–2500	29.2	"
	0.	2500–3000	26.1	"

ELASTIC CONSTANTS FOR GASES

For short ranges of pressure, at a constant temperature, the volume of a gas is inversely proportional to the pressure or pressure × volume = a constant. (Boyle's Law.)

For high pressures, the table below shows the relative volumes at various temperatures. The volume at 0° C. and 76 cm. pressure (1 atmosphere) being taken as 1,000,000.

(From Smithsonian Tables.)

Atm.	Oxygen.			Air.		
	0°	99°.5	199°.5	0°	99°.4	200°.4
100	9265	......	......	9730		
200	4570	7000	9095	5050	7360	9430
300	3208	4843	6283	3658	5170	6622
400	2629	3830	4900	3036	4170	5240
500	2312	3244	4100	2680	3565	4422
600	2115	2867	3570	2450	3180	3883
700	1979	2610	3202	2288	2904	3502
800	1879	2417	2929	2168	2699	3219
900	1800	2268	2718	2070	2544	3000
1000	1735	2151	......	1992	2415	2828

Atm.	Nitrogen.			Hydrogen.		
	0°	99°.5	199°.6	0°	99°.3	200°.5
100	9910					
200	5195	7445	9532	5690	7567	9420
300	3786	5301	6715	4030	5286	6520
400	3142	4265	5331	3207	4147	5075
500	2780	3655	4515	2713	3462	4210
600	2543	3258	3973	2387	3006	3627
700	2374	2980	3589	2149	2680	3212
800	2240	2775	3300	1972	2444	2900
900	2149	2616	3085	1832	2244	2657
1000	2068	..	.	1720	2093	

COEFFICIENT OF FRICTION

(From Rankine's Compilation, 1858; Smithsonian Tables.)

Materials.	Coefficient of friction.	Angle of repose in degrees.
Wood on wood, dry	.25–.50	14.0–26.5
Wood on wood, soapy	.20	11.5
Metals on oak, dry	.50–.60	26.5–31.0
Metals on oak, wet	.24–.26	13.5–14.5
Metals on oak, soapy	.20	11.5
Metals on elm, dry	.20–.25	11.5–14.0
Hemp on oak, dry	.53	28.0
Hemp on oak, wet	.33	18.5
Leather on oak	.27–.38	15.0–19.5
Leather on metals, dry	.56	29.5
Leather on metals, wet	.36	20.0
Leather on metals, greasy	.23	13.0
Leather on metals, oily	.15	8.5
Metals on metals, dry	.15–.20	8.5–11.5
Metals on metals, wet	.3	16.5
Smooth surfaces occasionally greased	.07–.08	4.0–4.5
Smooth surfaces continually greased	.05	3.0
Smooth surfaces, best results	.03–.036	1.75–2.0
Steel on agate, dry	.20	11.5
Steel on agate, oiled	.107	6.1
Iron on stone	.30–.70	16.7–35.0
Wood on stone	about .40	22.0
Masonry and brick work, dry	.60–.70	33.0–35.0
Masonry and brick work, damp mortar	.74	36.5
Masonry on dry clay	51	27.0
Masonry on moist clay	.33	18.25
Earth on earth	.25–1.00	14.0–45.0
Earth on earth, dry sand, clay and mixed earth	38–.75	21.0–37.0
Earth on earth, damp clay	1 00	45.0
Earth on earth, wet clay	.31	17 0
Earth on earth, shingle and gravel	.81–1 11	39.0–48.0

RESISTANCE TO CRUSHING FOR VARIOUS MATERIALS

Approximate values in pounds per square inch.

Material.	Resistance to crushing in lbs. per sq. in.	Material.	Resistance to crushing in lbs. per sq.in.
Brick:		Granite	9700–34000
soft burned	3000–6000	Limestone	6000–25000
hard burned	4500–6500	Marble	7600–20700
vitrified	8500–25000	Sandstone	2400–29300
Brownstone	7300–23600	Tufa	7700–11600
Concrete	800–3800		

TENSILE STRENGTH OF METALS

(Selected from Smithsonian Tables.)

Given in pounds per square inch. The values can be considered only as approximations.

Metal.	Tensile Strength in lbs. per sq. in.
Aluminum wire	30000–40000
Brass wire	50000–150000
Bronze wire, phosphor, hard drawn	110000–140000
Bronze wire, silicon, hard drawn	95000–115000
Bronze	60000–75000
Cobalt, cast	33000
Copper wire, hard drawn	60000–70000
German silver	40000–50000
Gold wire	20000
Iron, cast	13000–33000
Iron wire, hard drawn	80000–120000
Iron wire, annealed	50000–60000
Lead, cast or drawn	2600–3300
Magnesium, hard drawn	33000
Monel metal, cold drawn	80000–100000
Nickel, hard drawn	155000
Palladium	39000
Platinum wire	50000
Silver wire	42000
Steel	80000–330000
Steel wire, maximum	460000
Steel, specially treated nickel steel	250000
Steel, piano wire, 0.033 in. diam.	357000–390000
Steel, piano wire, 0.051 in. diam.	325000–337000
Tantalum	130000
Tin, cast or drawn	4000–5000
Tungsten, hard drawn	590000
Zinc, cast	7000–13000
Zinc, drawn	22000–30000

HARDNESS

Scale of Hardness

1 Talc	4 Fluorite	8 Topaz
2 Rock salt or gypsum	5 Apatite	9 Corundum
3 Calcite	6 Feldspar	10 Diamond
	7 Quartz	

Hardness of Materials

Agate	6 7	Indium	1.2
Alabaster	1.7	Iridium	6-6 5
Alum	2 2.5	Iridosmium	7
Aluminum	2-2.9	Iron	4-5
Alundum	9+	Kaolinite	2.0-2.5
Amber	2-2.5	Lead	1.5
Andalusite	7.5	Lithium	0.6
Anthracite	2.2	Loess (0°)	0.3
Antimony	3.0-3.3	Magnesium	2 0
Apatite	5	Magnetite	6
Aragonite	3 5	Manganese	5 0
Arsenic	3.5	Marble	3-4
Asbestos	5	Meerschaum	2-3
Asphalt	1-2	Mica	2 8
Augite	6	Opal	4-6
Barite	3.3	Orthoclase	6
Bell-metal	4	Osmium	7.0
Beryl	7.8	Palladium	4.8
Bismuth	2 5	Phosphorus	0 5
Boric acid	3	Phosphorbronze	4
Boron	9.5	Platinum	4.3
Brass	3-4	Plat-iridium	6.5
Cadmium	2.0	Potassium	0.5
Calamine	5	Pumice	6
Calcite	3	Pyrite	6.3
Calcium	1.5	Quartz	7
Carbon	10.0	Rock salt (halite)	2
Carborundum	9-10	Ross' metal	2 5-3 0
Cesium	0.2	Rubidium	0 3
Chromium	9 0	Ruthenium	6 5
Copper	2.5-3	Selenium	2.0
Corundum	9	Serpentine	3-4
Diamond	10	Silicon	7.0
Diatomaceous earth	1-1.5	Silver	2 5-7
Dolomite	3.5-4	Silver chloride	1 3
Emery	7-9	Sodium	0 4
Feldspar	6	Steel	5-8 5
Flint	7	Stibnite	2
Fluorite	4	Strontium	1 8
Galena	2.5	Sulfur	1 5-2 5
Gallium	1 5	Talc	1
Garnet	6 5 7	Tellurium	2.3
Glass	4.5-6.5	Tin	1.5-1 8
Gold	2 5-3	Topaz	8
Graphite	0 5-1	Tourmaline	7.3
Gypsum	1 6-2	Wax (0°)	0.2
Hematite	6	Wood's metal	3
Hornblende	5.5	Zinc	2.5

SURFACE TENSION

Compiled by T. Fraser Young and William D. Harkins

Meaning of Symbols

γ = the surface tension in dynes per centimeter.

$\Delta\gamma$ = the surface tension of a solution minus the surface tension of the pure solvent.

-- air, means that the liquid was in contact with air (saturated with its own vapor).

-- vapor, means that the liquid was in contact with its own vapor.

-- N_2 and -- H_2 have corresponding meanings.

-- also designates the surface between a pair of liquids at which the interfacial tension was determined.

% = weight % of the solute (i. e. the organic substance).

f = gram formula weights per 1000 grams of solvent (i. e. water).

°C = degrees Centigrade.

°K = degrees Kelvin or Absolute. Temperature in °C = Temperature in °K − 273.1.

M.P., at the melting point.

k_E = the Eötvös Constant, in erg mole$^{-\frac{2}{3}}$ degree^{-1}.

$$-k_E = \frac{d\,\Gamma}{d\,t} = \frac{d\,(M/d)^{\frac{2}{3}}\,\gamma}{d\,t}$$

where $\Gamma = \gamma\,(M/d)^{\frac{2}{3}}$

M = mass of one gram formula weight of the substance

d = density of the substance.

SURFACE TENSION (Continued)

LIQUIDS AGAINST AIR

Substance	°C	Surface tension, γ	°C	Surface tension, γ	k_E
Acetic acid	20	27.6	50	24.7	
Acetone	20	23 7	60	18.6	1.9
Benzene	20	28 88	50	25.0	2 22
Benzophenone	20	45 1	50	41.8	2 9
n-Butyric acid	20	26 8	50	24.0	..
Carbon tetrachloride	20	26 8	50	23.1	2.21
Chlorobenzene	20	33 2	50	29.6	2 2
Chloroform	20	27 1	60	21.7	2 1
Cyclohexane	20	25 3	...	..	.
Ethyl acetate	20	23 9	50	20 2	2 3
Ethyl alcohol	20	22 3	50	19.8	...
Ethyl ether	20	17 0		...	2 25
n-Hexane	20	18 4	40	16 3	
Methyl alcohol	20	22 6	50	20 1	.. .
n-Octane	20	21 8	60	17.9	2 3
n-Octyl alcohol	20	27 5	..	..	.
Phenol	20	40 9	50	37.7	1 85
n-Propylamine	20	22 4	45	19.4	1.9
Toluene	20	28.43	50	25.0	2 2
Triphenyl-phosphine	45 7	42.0	95.9	36.9	3.3
Tristearin	60	29 6	130	24 7	5 5

Water.—See special table below.

LIQUIDS AGAINST THEIR VAPORS

Formula	°C	γ	°C	γ	k_E
Cl_2 - -vapor	20.	18.	50.	13.	......
CO_2 - -vapor	-25.	9 1	20.	1.2	......
N_2O_4 - -vapor	1 6	31	19.8	28.	2.2
NH_3 - -vapor	11 1	23	59.0	13.	1.3
PCl_3 - -vapor	20.	29 1	50.	25.2	2 2
Substance	**°K**	**γ**	**°K**	**γ**	**k_E**
Hydrogen - -vapor	14.68	2.882	20.40	1.912	1.36
Neon - -vapor	24	5.90	28	4.45	2 0
Nitrogen - -vapor	70.0	10.5	90.0	6.2	2 0
Oxygen - -vapor	70.0	18.3	90.0	13.2	1.9

AQUEOUS SOLUTIONS AGAINST AIR

INORGANIC

(f = gram formula weights per 1000 grams of solvent.)

For the following aqueous solutions the values of $\Delta\gamma$ are given. $\Delta\gamma$ is the difference between the surface tension of the solution and that of the solvent at the same temperature. Positive values of $\Delta\gamma$ mean that the surface tension of the solution is greater than that of the solvent. Negative values, the reverse. For convenience in computing the surface tension, the current accepted value for the surface tension of water at the stated temperature is given in the second column.

Formula	°C (γH_2O)		$\Delta\gamma$ for concentrations indicated							
$CaCl_2$	25	f	1	.5	1.0	2.0	3.0	5.0	11.2	
	(71.97)	$\Delta\gamma$	35	1.5	3.2	6.9	11.0	18.4	35	
HCl	20	f		.5	1.0	2.0	4.0	6.0	9.0	17.7
	(72.75)	$\Delta\gamma$		−.2	−.3	−.5	−9	−1.3	−2.2	−7.
NH_4OH	18	f		5	1.0	1.5	3.0	6.0	15.0	34.0
	(73.05)	$\Delta\gamma$		−1.4	−2.4	−3.1	−5.2	−7.8	−12.0	−16.0
HNO_3	20	f		7	1.5	2.8			8.5	
	(72.75)	$\Delta\gamma$		−6	−1.1	−1.8			−4.	
KCl	20	f	.1	5	1.0	2.0	3.0	4.0	4.4	
	(72.75)	$\Delta\gamma$	.16	70	1.4	2.8	4.2	5.5	6.0	

Formula	°C (γH_2O)		$\Delta\gamma$ for concentrations indicated							
KOH	18	f		.5	1.0	2.0	3.8			
	(73.05)	$\Delta\gamma$		.9	1.8	3.5	6.7			
$MgCl_2$	20	f	.1	.5	1.0	2.0	3.0	3.65		
	(72.75)	$\Delta\gamma$	.32	1.52	3.0	6.4	10.2	13.0		
$MgSO_4$	20	f	.1	.5	1.0	2.0	2.7			
	(72.75)	$\Delta\gamma$	.26	1.03	2.1	4.6	6.5			
NaBr	20	f		.5	1.0	1.5	2.9			
	(72.75)	$\Delta\gamma$		.7	1.3	2.0	3.8			
NaCl	20	f	.1	.5	1.0	2.0	3.0	5.0	6.0	
	(72.75)	$\Delta\gamma$	.17	.82	1.64	3.3	4.9	8.2	9.8	
Na_2CO_3	20	f	.25	.5	1.0	1.5				
	(72.75)	$\Delta\gamma$	.7	1.3	2.7	4.0				
$NaNO_3$	20	f	.1	.5	1.0	2.0	3.0	5.0	7.0	12.2
	(72.75)	$\Delta\gamma$	.12	.60	1.2	2.4	3.5	5.6	7.5	11.3
NaOH	18	f		.7	1.5			5.0	11.0	14.0
	(73.05)	$\Delta\gamma$		1.3	2.8			10.0	23.	28.
Na_2SO_4	20	f	.2	.5	1.0					
	(72.75)	$\Delta\gamma$	.5	1.4	2.7					

AQUEOUS SOLUTIONS AGAINST AIR

ORGANIC

Substance	°C		Surface tension for concentrations indicated							
Acetic acid...	30	%	1 000	2 475	5 001	10.01	30.09	49.96	69 91	100.00
		γ	68 0	64 4	60 1	54 6	43 6	38.4	34.3	26.6
Acetone.. .	25	%	5 00	10 00	20 00	25 00	50.00	75 0	95 0	100 00
		γ	55 5	48 9	41 1	38 3	30 4	26 8	24 2	23.0
n-Butyric acid	25	%	14	31	1 05	3 83	8 6	25.	79.	100.
		γ	69	65.	56	42	33	28.	27.	26.
Ethyl alcohol	30	%	979	2 143	4 994	10 39	25 00	50 00	75 06	100 00
		γ	66 1	61.6	54 2	45 9	34 1	27 5	24 7	21 5
Glycerol	18	%	5 0	10 0	15 0	20 0	30 0	50 0	85 0	100.0
		γ	72 9	72 9	72 7	72 4	72.	70.	66	63.
Methyl alcohol	30	%	1 011	2 500	4 997	9 994	25 00	50 00	75 00	100.00
		γ	68 4	65 3	61.0	54.6	43 0	32 9	27 1	21 8
Phenol.. . .	20	%	024	047	118	.471	941	1 881	3 76	5 62
		γ	72 6	72 2	71.3	66.5	61.1	54 0	46.0	42.3
Propionic acid.	25	%	988	1.91	5 84	9.8	21 7	49 8	73 9	100 0
		γ	64.	60.	49	44.	36.	32	30.	26
Sucrose.	25	%	10 0	20 0	30 0	40 0	55 0			
		γ	72 5	73 0	73 4	74 1	75 7			

SURFACE TENSION (Continued)

WATER AGAINST AIR

Temperature °C	Surface tension dynes/cm.	Temperature °C	Surface tension dynes/cm.	Temperature dynes/cm.	Surface tension dynes/cm.
−8	77.0	15	73.49	40	69.56
−5	76.4	18	73.05	50	67.91
0	75.6	20	72.75	60	66.18
5	74.9	25	71.97	70	64.4
10	74.22	30	71.18	80	62.6
				100	58.9

INTERFACIAL TENSION

Surface Tension at the Interface Between Two Liquids
(Each liquid saturated with the other)

Liquids	Temperature °C	γ	Liquids	Temperature °C	γ
Benzene- -Mercury	20	357	Water- -Heptylic acid	20	7.0
Ethyl ether- -Mercury	20	379	Water- -n-Hexane	20	51.1
Water- -Benzene. .	20	35.00	Water- -Mercury.	20	375.
Water- -Carbon tetrachloride	20	45.	Water-n-Octane	20	50.8
			Water-n-Octyl alcohol	20	8.5
Water- -Ethyl ether. .	20	10.7			

SURFACE TENSION OF METALS

Substance		Gas	Temperature °C	Surface tension	References
Name	Symbol				
Aluminum . . .	Al	- -air	700	840	CR(2)
Antimony	Sb	- -H_2	750	368	ZA(4)
" . .	Sb	- -H_2	640	350	PM(1)
Bismuth .	Bi	- -H_2	300	388	PM(1)
" . .	Bi.	- -H_2	583	354	ZA(1)
" .	Bi	- -CO	700–800	346	AdP(2)
Cadmium .	Cd	- -H_2	320	630	AC(1)
Columbium. .	Cb	- -H_2	1131	1103	ZA(4)
Gallium .	Ga	- -CO_2	30	358	AC(4)
Gold.	Au	- -air	1070	580–1000	AdP(1)
Lead.	Pb	- -H_2	350	454	PM(1)
" . .	Pb	- -H_2	750	423	ZA(4)
Mercury	Hg	- -vac.	0	480.3	AC(2)
" . .	Hg.	- -air	15	487	AC(3)
" . .	Hg	- -H_2	19	470	PM(1)
"	Hg	- -vac.	60	467.1	AC(2)
Platinum. . . .	Pt .	- -air	2000	1819	AdP(3)
Potassium. .	K .	- -CO_2	62	1411	AJ(1)
Silver. . . .	Ag.	- -air	970	800	AdP(5)
Sodium .	Na	- -CO_2	90	294	AdP(4)
" .	Na	- -vac.	100	206.4	PR(1)
" . .	Na	- -vac.	250	199.5	PR(1)
Tin.	Sn.	- -H_2	253	526	PM(1)
"	Sn. .	- -H_2	878	508	ZA(4)
Zinc. .	Zn. . .	- -H_2	477	753	AC(1)
"	Zn.	- -air	590	708	JI(1)

SURFACE TENSION OF FUSED SALTS

Substance Name	Formula	Gas	Temperature °C	Surface tension γ	References
Barium chloride	$BaCl_2$	air	M.P.	171	ZA(2)
Bismuth tribromide	$BiBr_3$	nitrogen	442	46.2	ZA(1)
" "	$BiBr_3$	nitrogen	250	66.5	ZA(1)
" trichloride	$BiCl_3$	nitrogen	382	52.0	ZA(1)
" "	$BiCl_3$	nitrogen	271	66.2	ZA(1)
Calcium chloride	$CaCl_2$	air	M.P.	152	ZA(2)
Cesium bromide	CsBr	nitrogen	658	81.8	ZA(1)
" chloride	CsCl	nitrogen	664	89.2	ZA(1)
" fluoride	CsF	nitrogen	723	104.5	ZA(1)
" iodide	CsI	nitrogen	654	73.1	ZA(1)
" nitrate	CsNO	nitrogen	426	91.8	ZA(1)
" sulfate	Cs_2SO_4	nitrogen	1036	111.3	ZA(1)
Lead chloride	$PbCl_2$	air	490	138	BD(1)
" "	$PbCl_2$	air	539	131	BD(1)
Lithium chloride	LiCl	nitrogen	614	137.8	ZA(1)
" "	LiCl	nitrogen	1075	104.8	ZA(1)
" fluoride	LiF	nitrogen	868.5	249.5	ZA(1)
" "	LiF	nitrogen	1270	200.1	ZA(1)
" nitrate	$LiNO_3$	nitrogen	359	111.5	ZA(1)
" "	$LiNO_3$	nitrogen	609	96.2	ZA(1)
" sulfate	$LiSO_4$	nitrogen	860	223.8	ZA(1)
" "	$LiSO_4$	nitrogen	1214	200.3	ZA(1)
Potassium *meta*borate	KBr	nitrogen	992	123.5	ZA(1)
" bromide	KBr	nitrogen	775	85.7	ZA(1)
" "	KBr	air	M.P.	83.5	ZA(1)
" "	KBr	nitrogen	887	77.8	ZA(1)
" chloride	KCl	nitrogen	909	88.0	ZA(1)
" "	KCl	nitrogen	1054	77.2	ZA(1)
" "	KCl	nitrogen	1167	69.6	ZA(1)
" "	KCl	air	M.P.	98.4	ZA(1)
" cyanide	KCN	air	M.P.	96.1	ZA(2)
" dichromate	$K_2Cr_2O_7$	nitrogen	420	140.1	ZA(1)
" "	$K_2Cr_2O_7$	nitrogen	535	135.0	ZA(1)
" fluoride	KF	nitrogen	913	138.4	ZA(1)
" "	KF	nitrogen	1310	104.9	ZA(1)
" molybdate	K_2MoO_4	nitrogen	931	150.5	ZA(1)
" "	K_2MoO_4	nitrogen	1522	112.5	ZA(1)
" nitrate	KNO_3	nitrogen	380	110.4	ZA(1)
" "	KNO_3	air	414	100.7	ZA(1)
" *meta*phosphate	KPO_3	nitrogen	897	155.5	ZA(1)
" " "	KPO_3	nitrogen	1205	133.5	ZA(1)
" " "	KPO_3	nitrogen	1536	100.3	ZA(1)
" sulfate	K_2SO_4	nitrogen	1070	143.7	ZA(1)
" "	K_2SO_4	nitrogen	1306	128.8	ZA(1)
" "	K_2SO_4	nitrogen	1656	106.8	ZA(1)
" tungstate	K_2WO_4	nitrogen	925	161.0	ZA(1)
" "	K_2WO_4	nitrogen	1520	105.6	ZA(1)
Rubidium bromide	RbBr	nitrogen	729	87.7	ZA(1)
" chloride	RbCl	nitrogen	750	95.7	ZA(1)
" "	RbCl	nitrogen	933	79.9	ZA(1)
" "	RbCl	nitrogen	1150	61.4	ZA(1)
" fluoride	RbF	nitrogen	803	127.2	ZA(1)
" iodide	RbI	nitrogen	673	79.4	ZA(1)
" nitrate	$RbNO_3$	nitrogen	327	107.5	ZA(1)
" sulfate	Rb_2SO_4	nitrogen	1086	132.5	ZA(1)
Silver bromide	AgBr	air	M.P.	121.4	AdP(5)
" chloride	AgCl	air	452	125.5	ZA(3)
" "	AgCl	air	494	121.6	ZA(3)
Sodium bromide	NaBr	nitrogen	985	90.0	ZA(1)
" "	NaBr	air	M.P.	102.8	ZA(1)
" tetraborane deriv.	$NaBO_2$	nitrogen	1016	193.7	ZA(1)
" chloride	NaCl	nitrogen	803	113.8	ZA(1)
" "	NaCl	nitrogen	908	106.4	ZA(1)

SURFACE TENSION OF FUSED SALTS (Continued)

Substance Name	Formula	Gas	Temperature °C	Surface tension γ	References
Sodium chloride	$NaCl$	nitrogen	996	99.7	ZA(1)
" "	$NaCl$	nitrogen	1080	94.0	ZA(1)
" "	$NaCl$	nitrogen	1172	88.0	ZA(1)
" fluoride	NaF	nitrogen	1010	199.5	ZA(1)
" "	NaF	nitrogen	1263	173.1	ZA(1)
" "	NaF	nitrogen	1546	143.5	ZA(1)
" iodide	NaI	air	M.P.	93.9	ZA(1)
" "	NaI	nitrogen	861	77.6	ZA(1)
" molybdate	$NaMoO_4$	nitrogen	699	214.0	ZA(1)
" nitrate	$NaNO_3$	nitrogen	322	119.7	ZA(1)
" "	$NaNO_3$	nitrogen	602	103.4	ZA(1)
" "	$NaNO_3$	nitrogen	738	93.7	ZA(1)
" "	$NaNO_3$	nitrogen	513	108.9	ZA(1)
" *meta*phosphate	$NaPO_3$	nitrogen	827	197.5	ZA(1)
" " "	$NaPO_3$	nitrogen	1517	147.5	ZA(1)
" sulfate	$NaSO_4$	nitrogen	900	194.8	ZA(1)
" "	$NaSO_4$	nitrogen	1077	184.7	ZA(1)
" tungstate	$NaWO_4$	nitrogen	710	203.3	ZA(1)
Sulfur	S	air	445	38.97	JS(1)
Tin chloride	$SnCl_2$	nitrogen	307	97.0	ZA(1)
" "	$SnCl_2$	nitrogen	405	89.0	ZA(1)
" "	$SnCl_2$	nitrogen	480	81.6	ZA(1)

SURFACE TENSION OF VARIOUS LIQUIDS

Substance Name	Formula	In contact with	Temperature °C	Surface tension dynes/cm.	References
Acetaldehyde	C_2H_4O	vapor	20	21 2	AC(5)
Acetaldoxime	C_2H_5NO	vapor	35	30 1	JP(1)
Acetamide	C_2H_5NO	vapor	85	39.3	JS(3)
Acetanilide	C_8H_9NO	vapor	120	35.6	JS(3)
Acetic acid	$C_2H_4O_2$	vapor	10	28.8	ZC(1)
" "	$C_2H_4O_2$	vapor	20	27.8	ZC(1)
" "	$C_2H_4O_2$	vapor	50	24.8	AC(1)
" anhydride	$C_4H_6O_3$	vapor	20	32 7	AC(6); GC(1)
Acetone	C_3H_6O	air or vapor	20	26 21	
"	C_3H_6O	air or vapor	20	23.70	
"	C_3H_6O	air or vapor	40	21 16	
Acetonitride	C_2H_3N	vapor	20	29.30	BF(1)
Acetophenone	C_8H_8O	vapor	20	39.8	
Acetyl chloride	C_2H_3ClO	vapor	14 8	26 7	JS(4)
Acetylene	C_2H_2	vapor	−70 5	16 4	JS(2)
Acetylsalicylic acid	$C_9H_8O_4$	vapor	25 9	60 06	GC(2)
Allyl alcohol	C_3H_6O	air or vapor	20	25 8	
" isothiocyanate	$C_4H_5O_4$	air or vapor	20	34 5	AC(7); GC(1)
Ammonia	NH_3	vapor	11 1	23 4	JP(6a)
"	NH_3	vapor	34.1	18 1	JP(6a)
Aniline	C_6H_7N	vapor	20	42 9	
"	C_6H_7N	air	10	44.10	
"	C_6H_7N	air	50	39.4	
Argon	A	vapor	−188	13 2	JS(2)
Azoxybenzene	$C_7H_{10}N_2O$	vapor	51	43 34	JS(5)
Benzaldehyde	C_7H_6O	air	20	40.04	AC(8), (9)
Benzene	C_6H_6	air	10	30 22	
"	C_6H_6	air	20	28 88	
"	C_6H_6	air saturated with vapor	20	28 89	PM(2)

Substance		In contact with	Temperature °C	Surface tension dynes/cm.	References
Name	Formula				
Benzene	C_6H_6	--vapor	30	27 56	
Benzonitrile	C_7H_5N	--air or vapor	20	39 05	
Benzophenone	$C_{13}H_{10}O$	--air or vapor	20	45 1	
Benzylamine	C_7H_9N	--vapor	20	39 5	JS(**3**)
Benzyl alcohol	C_7H_8O	--air or vapor	20	39 0	
Bromine	Br_2	--vapor	20	41 5	
Bromoform	$CHBr_3$	--vapor	20	41 53	JP(**2**); AC(**10**)
p-Bromophenol	C_6H_5BrO	--vapor	74 4	42 36	JS(**6**)
d-*sec*-Butyl alcohol	$C_4H_{10}O$	--vapor	10	23 5	JS(**7**)
n-Butyl alcohol	$C_4H_{10}O$	--air or vapor	0	26 2	
" " "	$C_4H_{10}O$	--air or vapor	20	24 6	
" " "	$C_4H_{10}O$	--air or vapor	50	22 1	
tert-Butyl alcohol	$C_4H_{10}O$	--air or vapor	20	20 7	JS(**8**); AC(**11**)
n-Butylamine	$C_4H_{11}N$	--nitrogen	41	19 7	ZA(**1**)
n-Butyric acid	$C_4H_8O_2$	--air	20	26 8	
Carbon bisulfide	CS_2	--vapor	20	32 33	AC(**7**)
" dioxide	CO_2	--vapor	20	1.16	VK(**1**); (**2**)
" "	CO_2	--vapor	−25	9.13	VK(**1**); (**2**)
" tetrachloride	CCl_4	--vapor	20	26 95	PRS(**1**)
" "	CCl_4	--vapor	100	17 26	PRS(**1**)
" "	CCl_4	--vapor	200	6 53	PRS(**1**)
" monoxide	CO	--vapor	−193	9 8	JS(**2**)
" "	CO	--vapor	−203	12 1	JS(**2**)
Chloroacetic acid	$C_2H_3ClO_2$	--nitrogen	80 2	33 3	ZA(**1**)
Chloral	C_2HCl_3O	--vapor	19 4	25 34	JS(**4**)
Chlorine	Cl_2	--vapor	20	18 4	JP(**3**)
"	Cl_2	--vapor	30	25 4	ZE(**1**)
"	Cl_2	--vapor	−40	27 3	ZE(**1**)
"	Cl_2	--vapor	−50	29 2	ZE(**1**)
"	Cl_2	--vapor	−60	31 2	ZE(**1**)
Chloroform	$CHCl_3$	--air	20	27 14	AC(**8**)
Dichloroacetic acid	$C_2H_2Cl_2O_2$	--nitrogen	25 7	35 4	ZA(**1**)
Diethylamine	$C_4H_{11}N$	--air	56	16 4	GC(**1**)
Diethylaniline	$C_{10}H_{15}N$	--vapor	20	34 2	
Diethyl carbonate	$C_5H_{10}O_3$	--air	20	26 31	AC(**12**); JS(**5**)
" oxalate	$C_6H_{10}O_4$	--vapor	20	32 0	AC(**13**); GC(**1**)
" phthalate	$C_{12}H_{14}O_4$	--vapor	20	37 5	
" sulfate	$C_4H_{10}O_4$	--air	13	34 61	JS(**5**)
Dimethylamine	$(CH_3)_2NH$	--nitrogen	0	18 1	JR(**4**)
"	C_2H_7N	--nitrogen	5	17 7	ZA(**1**)
Dimethylaniline	C8$H_{11}N$	--air or vapor	20	36 6	
1,5-Dimethyl-2-phenyl-3-pyrazolone	$C_{11}H_{12}N_2O$	--vapor	25 9	63 63	GC(**2**)
Dimethyl sulfate	$C_2H_6O_4S$	--air	18	40 12	JS(**5**)
Diphenylamine	$C_{12}H_{11}N$	--air or vapor	80	37 7	
Ethyl acetate	$C_4H_8O_2$	--air	0	26 5	
" "	$C_4H_8O_2$	--air	20	23 9	
" "	$C_4H_8O_2$	--air	50	20 2	
" acetoacetate	$C_6H_{10}O_3$	--air or vapor	20	32 51	
" alcohol	C_2H_6O	--air	0	24 05	
" "	C_2H_6O	--vapor	10	23 61	
" "	C_2H_6O	--vapor	20	22 75	
" "	C_2H_6O	--vapor	30	21 89	
Ethylamine	$C_2H_5NH_2$	--nitrogen	0	21 3	JP(**4**)
"	C_2H_7N	--nitrogen	9 9	20 4	ZA(**1**)
Ethyl benzene	C_8H_{10}	--vapor	20	29 20	
" benzoate	$C_9H_{10}O_2$	--vapor	20	35 5	

SURFACE TENSION OF VARIOUS LIQUIDS (Continued)

Substance: Name	Substance: Formula	In contact with	Temperature °C	Surface tension dynes/cm.	References
Ethyl bromide	C_2H_5Br	--vapor	20	24.15	AC(8)
" cinnamate	$C_{11}H_{12}O_2$	--air	20	38.37	
Ethylene bromide	$C_2H_4Br_2$	--vapor	20	38.75	JP(2)
" chloride	$C_2H_4Cl_2$	--air	20	32.2	AC(7a)
" oxide	$(CH_2)_2O$	--vapor	0	27.6	ZC(3)
" "	$(CH_2)_2O$	--vapor	−20	067	ZC(3)
Ethyl ether	$C_2H_5NO_3$	--vapor	20	17.01	
" "	$C_4H_{10}O$	--vapor	50	13.47	
" formate	$C_3H_6O_2$	--air or vapor	20	23.6	
" iodide	C_2H_5I	--vapor	20	29.4	PRS(1)
" nitrate	$C_2H_5NO_3$	--air or vapor	20	28.7	AC(14); GC(1)
dl-Ethyl lactate	$C_5H_{10}O_3$	--air	20	29.9	
Ethylmercaptan	C_2H_6S	--air or vapor	20	22.5	
Ethyl salicylate	$C_9H_{10}O_3$	--vapor	20.5	38.33	JS(6)
Formamide	CH_3NO	--vapor	20	58.2	AC(14)
Formic acid	CH_2O_2	--air	20	16.2	WN(1)
Furfural	$C_5H_4O_2$	--air or vapor	20	43.5	AC(14); GC(1)
Gelatin solution (1%)		--water	2 85	8.3	ZK(1)
Glycerol	$C_3H_8O_3$	--air	20	63.4	
"	$C_3H_8O_3$	--air	90	58.6	
"	$C_3H_8O_3$	--air	150	51.9	
Glycol	$C_2H_6O_2$	--air or vapor	20	47.7	AC(15); JS(4)
Helium	He	--vapor	−269	12	AS(1)
"	He	--vapor	−270	.239	AS(1)
"	He	--vapor	−271.5	353	AS(1)
n-Hexane	C_6H_{14}	--air	20	18.43	
Hydrazine	N_2H_4	--vapor	25	91.5	AC(19)
Hydrogen	H_2	--vapor	−255.1	2.31	JB(1)
" cyanide	HCN	--vapor	17	18.2	ZE(1)
" peroxide	H_2O_2	--vapor	18.2	76.1	AC(16)
Isobutyl alcohol	$C_4H_{10}O$	--vapor	20	23.0	
" amine	$C_4H_{11}N$	--air	68	17.6	GC(1)
" chloride	C_4H_9Cl	--air	20	21.94	AC(8); GC(1)
Isobutyric acid	$C_4H_8O_2$	--air or vapor	20	25.2	
Isopropyl alcohol	C_3H_8O	--air or vapor	20	21.7	JS(4); AdP(6)
Mercury	Hg	--vapor	20	484	FS(1)
"	Hg	--air	25	473	AC(16)
"	Hg	--in vacuo	90	490	PM(3)
Methyl acetate	$C_3H_6O_2$	--air or vapor	20	24.6	
" alcohol	CH_4O	--air	0	24.49	AC(17)
" "	CH_4O	--air	20	22.61	AC(17)
" "	CH_4O	--vapor	50	20.14	AC(17)
Methylamine	CH_3NH_2	--nitrogen	−12	22.2	JP(4)
"	CH_5N	--vapor	−20	23.0	ZA(1)
"	CH_3NH_2	--nitrogen	−70	29.2	JP(4)
Methylaniline	C_7H_9N	--air or vapor	20	39.6	
Methyl benzoate	$C_8H_8O_2$	--air or vapor	20	37.6	JP(5); GC(1)
" ether	$(CH_3)_2O$	--vapor	−10	16.4	ZC(3)
" "	$(CH_3)_2O$	--vapor	−40	21	ZC(3)
Methylene chloride	CH_2Cl_2	--air	20	50.76	AC(10)
Methyl ethyl ketone	C_4H_8O	--air or vapor	20	24.6	AS(1); AC(9)
Methyl formate	$C_2H_4O_2$	--vapor	20	25.08	AC(17)
" iodide	CH_3I	--air	43.5	25.8	GC(1)
" propionate	$C_4H_8O_2$	--air or vapor	20	24.9	
" salicylate	$C_8H_8O_3$	--nitrogen	94	31.8	ZA(1)
" sulfide	C_2H_6S	--vapor	11.1	26.50	JP(6)

Substance Name	Formula	In contact with	Temperature °C	Surface tension dynes/cm.	References
Neon	Ne	--vapor	−248	5.50	JP(**2**)
Nitrobenzene	$C_6H_5NO_2$	--air or vapor	20	43 9	
Nitroethane	$C_2H_5NO_2$	--air or vapor	20	32.2	JS(**4**)
Nitrogen	N_2	--vapor	−183	6 16	JS(**2**)
"	N_2	--vapor	−193	8 27	JS(**2**)
"	N_2	--vapor	−203	10.53	JS(**2**)
" tetra oxide	N_2O_4	--vapor	19 8	27 5	JS(**4**)
Nitromethane	CH_3NO_2	--vapor	20	36 82	AC(**8**)
Nitrous oxide	N_2O	--vapor	20	1 75	VK(**1**)
n-Octane	C_8H_{18}	--vapor	20	21 80	
n-Octyl alcohol	$C_8H_{18}O$	--air	20	27 53	AC(**12**)
Oleic acid	$C_{18}H_{34}O_2$	--air	20	32 50	PRS(**1**); AC(**12**)
Oxygen	O_2	--vapor	−183	13 2	JS(**2**)
" (65%)	O_2	--air	−190 5	12 2	BF(**1**)
"	O_2	--vapor	−193 0	15.7	JS(**2**)
"	O_2	--vapor	−203	18 3	JS(**2**)
Paraldehyde	$C_6H_{12}O_3$	--air	20	25 9	AC(**15**); AdP(**6**)
Phenetole	$C_8H_{10}O$	--vapor	20	32 74	
Phenol	C_6H_6O	--air or vapor	20	40 9	
"	C_6H_6O	--air or vapor	3	39 88	
Phenythydrazine	$C_6H_8N_2$	--vapor	20	46 1	JS(**3**)
Phosphorus tribromide	PBr_3	--air	24	45 8	JS(**5**)
" trichloride	PCl_3	--vapor	20	29 1	
" triiodide	PI_3	--vapor	75 3	56 5	ZA(**1**)
Propionic acid	$C_3H_6O_2$	--vapor	20	26 7	
n-Propyl alcohol	C_3H_8O	--vapor	20	23 78	PM(**2**)
n-Propylamine	C_3H_9N	--air	20	22 4	GC(**1**); JS(**3**)
Propyl bromide	C_3H_7Br	--vapor	71	19 65	GC(**1**)
n-Propyl chloride	C_3H_7Br	--air	47	18 3	AdC(**6**)
n-Propyl formate	$C_4H_8O_2$	--vapor	20	24 5	
Pyridine	C_5H_5N	--air	20	38 0	
Quinoline	C_9H_7N	--air	20	45 0	
Ricinoleic acid	$C_{18}H_{34}O_3$	--air	16	35 81	PRS(**1**)
Selenium	Se	--air	217	92.4	AdP(**4**)
Styrene	C_8H_8	--air	19	32 14	PRS(**1**)
Tetrabromoethane	$C_2H_2Br_4$	--air	20	49 67	AC(**8**); ZC(**2**)
Tetrachloroethane	$C_2H_2Cl_4$	--air	22 5	36 03	ZC(**2**)
Tetrachloroetheylene	C_2Cl_4	--vapor	20	31 74	AC(**10**)
Toluene	C_7H_8	--vapor	10	27 7	
"	C_7H_8	--vapor	20	28 5	
"	C_7H_8	--vapor	30	27 4	
m-Toluidine	C_7H_9N	--vapor	20	36 9	AC(**10**)
o-Toluidine	C_7H_9N	--air or vapor	20	40 0	
Trichloroacetic acid	$C_2HCl_3O_2$	--nitrogen	80 2	27 8	
2-Trichlorethane	$C_2H_3Cl_3$	--air	114	22 0	GC(**1**)
Triethyl phosphate	$C_6H_{15}O_4P$	--air	15 5	30 61	JS(**5**)
Trimethylamine	C_3H_9N	--nitrogen	−4	17 3	ZA(**1**)
Triphenyl carbinol	$C_{19}H_{16}C$	--vapor	165 8	30 38	JS(**6**)
Vinyl acetate	$CH_2CHOCO{\cdot}CH_3$	--vapor	20	23 95	
" "	$CH_2CHOCO{\cdot}CH_3$	--vapor	25	23 16	
" "	$CH_2CHOCO{\cdot}CH_3$	--vapor	30	22 54	
Water	H_2O	--air	18	74 31	AdP(**7**)
"	H_2O	--air	18	73 9	AdP(**7**)
"	H_2O	--air	25 9	71.6	GC(**2**)
m-Xylene	C_8H_{10}	--vapor	20	28 9	
o-Xylene	C_8H_{10}	--air	20	30 10	
p-Xylene	C_8H_{10}	--vapor	20	28 37	

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VISCOSITY

The **viscosity** of a substance is defined as the tangential force per unit area of either of two horizontal planes at unit distance apart, one of which is fixed, while the other moves with unit velocity, the space being filled with the substance.

In the case of a liquid flowing slowly through a long tube of small diameter, the volume V of liquid which escapes in a time t is given by the equation,

$$V = \frac{\pi p r^4}{8 l \eta} t$$

where p is the difference in pressure between the two ends of the tube; r, its radius; l, its length, and η, the viscosity. (Law of Poiseuille.)

A more complete equation is now generally used:

$$\eta = \frac{\pi d g r^4 t}{8Q(l + \lambda)}\left(h - \frac{mv^2}{g}\right)$$

where η is the viscosity; d, the density in g/cm³; r, the radius, and l, the length, of the tube in cm; Q, the volume in cm³ discharged in t sec.; λ, a correction to the length of the tube; h, the average head in cm; m, the coefficient of the kinetic energy correction, mv^2/g; g, the acceleration due to gravity in cm/sec.²; v, the mean velocity in cm/sec. See Technologic Papers of the Bureau of Standards 100 and 112, 1917 and 1918, for a full discussion

Viscosity is expressed in dyne-seconds per cm² or poises. The centipoise (cp) is 0.01 poise.

Specific viscosity is the ratio of the viscosity of any substance to that of water at 0° C or other specified temperature. Since the viscosity of water at 20° C is 1.0050 centipoises, the viscosity of any substance expressed in centipoises is approximately equal to its specific viscosity referred to water at 20° C.

Kinematic viscosity is the ratio of the viscosity to the density

Fluidity is the reciprocal of viscosity.

VISCOSITY OF WATER BELOW 0° C

White-Twining, 1914

Temperature	Viscosity centipoises	Temperature	Viscosity centipoises
0° C	1.798	−7.23	2.341
−2.10	1.930	−8.48	2.458
−4.70	2.121	−9.30	2.549
−6.20	2.250		

VISCOSITY AND FLUIDITY OF WATER
0–100° C

Bingham and Jackson, Bull. Bur. Stds. **14,** 75 (1918)

Temp. °C	Fluidity 1/poises	Viscosity centi-poises	Specific viscosity (0° C)	Temp. °C	Fluidity 1/poises	Viscosity centi-poises	Specific viscosity (0° C)
0	55.80	1 7921	1.0000	50	182.00	0.5494	0.3066
1	57 76	1.7313	.9661	51	185.05	.5404	.3015
2	59.78	1.6728	.9334	52	188 14	.5315	.2966
3	61.76	1 6191	.9035	53	191 23	.5229	.2918
4	63.80	1.5674	.8746	54	194.34	.5146	.2871
5	65 84	1 5188	.8475	55	197 45	.5064	.2826
6	67 90	1.4728	.8218	56	200.62	.4985	.2782
7	70 01	1 4284	.7971	57	203 78	.4907	2738
8	72 15	1 3860	7734	58	206 95	.4832	.2696
9	74 28	1 3462	.7512	59	210.13	.4759	.2656
10	76.47	1.3077	.7297	60	213 33	.4688	.2616
11	78 66	1 2713	.7094	61	216 54	.4618	.2577
12	80.89	1 2363	.6899	62	219 80	.4550	.2539
13	83 14	1 2028	.6712	63	223 07	.4483	.2502
14	85 40	1.1709	.6534	64	226.34	.4418	.2465
15	87.69	1 1404	.6363	65	229 64	4355	.2430
16	90 00	1 1111	6200	66	232 94	4293	.2396
17	92 35	1 0828	.6042	67	236 25	.4233	.2362
18	94.71	1 0559	5892	68	239.57	.4174	.2329
19	97.10	1 0299	.5747	69	242.91	.4117	.2297
20*	99 50	1 0050	.5608	70	246.26	.4061	.2266
21	101 94	9810	5474	71	249 63	.4006	.2235
22	104 40	9579	.5345	72	253 02	.3952	.2205
23	106 86	9358	.5222	73	256.42	.3900	.2176
24	109 38	.9142	.5101	74	259 82	.3849	.2148
25	111 91	.8937	4987	75	263 25	3799	.2120
26	114 45	.8737	4875	76	266 67	.3750	2093
27	117 03	.8545	.4768	77	270.12	.3702	.2066
28	119.62	.8360	4665	78	273.57	.3655	.2040
29	122.25	.8180	.4564	79	277.04	.3610	.2014
30	124 89	8007	4468	80	280 53	.3565	.1989
31	127 54	7840	4375	81	284 03	.3521	.1965
32	130 22	.7679	4285	82	287 53	.3478	.1941
33	132 93	7523	4198	83	291 03	.3436	.1917
34	135.66	.7371	4113	84	294 54	.3395	.1894
35	138 40	.7225	.4032	85	298 06	.3355	.1872
36	141 15	7085	3953	86	301 63	.3315	1850
37	143 95	6947	3876	87	305 21	3276	.1828
38	146 76	.6814	3802	88	308 78	.3239	.1807
39	149 60	.6685	.3730	89	312.35	3202	.1787
40	152 45	6560	3661	90	315 92	.3165	.1766
41	155 30	6439	.3593	91	319 53	3130	.1747
42	158 20	6321	3527	92	323.13	3095	.1727
43	161.11	.6207	3464	93	326 74	.3060	.1707
44	164.02	.6097	.3402	94	330 38	.3027	.1689
45	167 00	.5988	3341	95	334.01	.2994	.1671
46	169.97	.5883	.3283	96	337 65	2962	.1653
47	172.95	5782	.3226	97	341 30	.2930	.1635
48	175.95	.5683	.3171	98	344 96	2899	.1618
49	178.95	5588	.3118	99	348 63	.2868	1600
50	182.00	5494	.3066	100	352 30	.2838	1584

* The viscosity of water at 20.20° C is 1.0000 centipoise.

VISCOSITY OF WATER
Above 100° C

Pressure is that of the saturated vapor at the temperature indicated

T °C	Viscosity cp	T °C	Viscosity cp	T °C	Viscosity cp
101	0 282	106	.267	120	.232
102	.279	107	.264	130	.212
103	.276	108	.262	140	.196
104	.273	109	.259	150	.184
105	.270	110	.256	160	.174

VISCOSITY OF LIQUIDS

Viscosity of liquids in centipoises (cp) including elements, inorganic and organic compounds and mixtures.

Liquid	Temp. °C	Viscosity cp	Ref.	Liquid	Temp °C	Viscosity cp	Ref
Acetaldehyde	0	2797	16	Allyl alcohol	0	2 145	11
	10	2557	16		15	1 49	99
	20	22	26		20	1 363	11
Acetanilide	120	2 22	2		30	1 07	99
	130	1 90	11		40	.914	11
Acetic acid	15	1 31	79		70	553	11
	18	1 30	22	Allylamine	130	.506	26
	25 2	1 155	63	Allyl chloride	15	347	99
	30	1 04	79		30	.300	99
	41	1 00	22	Ammonia	−69	475	76
	59	70	22		−50	317	85
	70	.60	22		−40	.276	85
	100	43	22		−33 5	255	85
anhydride	0	1 24	22	n-Amyl acetate	11	1 58	35
	15	971	79		45	805	27
	18	90	22	alcohol	15	4 65	99
	30	.783	79		30	2 99	99
	100	49	22	ether	15	1 188	72
Acetone	−92 5	2 148	62	Aniline	−6	13 8	55
	−80 0	1 487	62		0	10 2	55
	−59 6	932	62		5	8 06	55
	−42 5	695	62		10	6 50	55
	−30 0	575	62		15	5 31	55
	−20 9	510	62		20	4 40	55
	−13 0	.470	22		25	3 71	55
	−10 0	450	22		30	3 16	55
	0	.399	62		35	2 71	55
	15	337	72		40	2 37	55
	25	316	60		50	1 85	55
	30	295	72		60	1 51	55
	41	.280	22		70	1 27	55
Acetonitrile	0	.442	16		80	1 09	55
	15	375	79		90	935	55
	25	.345	31		100	825	55
Acetophenone..	11 9	2 28	39	Anisol	0	1 78	86
	23 5	1 59	96		20	1 32	86
	25 0	1 617	48		40	1 12	86
	50 0	1 246	48	Antimony, liq.	645	1 55	105
	80 0	734	19		700	1 26	105
Air, liq	−192.3	.172	40		800	1 08	105
Alcohol See					850	1 05	105
Ethyl, Methyl,				Benzaldehyde	25	1 39	89
etc.				Benzene	0	912	45

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref.
Benzene	10	.758	45
	20	.652	45
	30	.564	45
	40	.503	45
	50	.442	45
	60	.392	45
	70	.358	45
	80	.329	45
Benzonitrile	25	1 24	69
Benzophenone	55	4 79	77
	120	1 38	77
Benzyl alcohol	20	5 8	53
Benzylamine	25	1.59	26
Benzylaniline	33	2 18	14
	130	1.20	26
Benzyl ether	0	10 5	91
	20	5 33	91
	40	3 21	91
Bismuth	285	1 61	38
	304	1 662	57
	365	1 46	38
	451	1 280	57
	600	998	57
Bromine, liq	−4 3	1 31	52
	0	1 241	52
	12.6	1 07	52
	16	1.0	11
	19 5	.995	52
	28.9	.911	52
o-Bromoaniline	40	3 19	102
m-Bromoaniline	20	6 81	102
	40	3 70	102
	80	1 70	102
p-Bromoaniline	80	1 81	102
Bromobenzene	15	1 196	59
	30	.985	59
Bromoform	15	2 152	72
	25	1 89	94
	30	1 741	72
Butyl acetate	0	1 004	90
	20	.732	90
	40	563	90
n-Butyl alcohol	−50 9	36 1	88
	−30 1	14 7	88
	−22 4	11 1	88
	−14 1	8 38	88
	0	5 186	11
	15	3.379	72
	20	2 948	11
	30	2 30	80
	40	1 782	11
	50	1.411	11
	70	.930	11
	100	.540	11
sec-Butyl alcohol	15	4.21	72
n-Butyl bromide	15	.626	54
n-Butyl chloride	15	.469	79
Butyl chloride, tertiary	15	.543	108
n-Butyl formate	0	.940	90
	20	689	90
Butyric acid	0	2.286	11
	15	1 81	99
Butyric acid	20	1 540	11
	40	1.120	11
	50	.975	11
	70	.760	11
	100	.551	11
Cadmium, liq	349	1.44	32
	506	1.18	32
	603	1.10	32
Carbolic acid See *Phenol*.			
Carbon dioxide, liq, pressure that of saturated vapor	0	.099	8
	10	.085	8
	20	.071	8
	30	.053	8
disulfide	−13	.514	22
	−10	.495	22
	0	.436	72
	5	.380	72
	20	.363	72
	40	.330	11
Carbon tetrachloride	0	1 329	59
	15	1 038	59
	20	.969	65
	30	.843	65
	40	.739	65
	50	.651	65
	60	.585	65
	70	.524	65
	80	.468	65
	90	.426	65
	100	.384	65
Cetyl alcohol	50	13 4	82
Chlorine, liq	−76 5	.729	52
	−70 5	.680	52
	−60 2	616	52
	−52 4	.566	52
	−35.4	.494	52
	0	385	52
Chlorobenzene	15	.900	95
	20	.799	65
	40	.631	65
	80	.431	65
	100	367	65
Chloroform	−13	.855	22
	0	.700	36
	8 1	643	49
	15	596	59
	20	58	50
	25	.542	51
	30	.514	59
	39	500	22
o-Chlorophenol	25	4.11	30
	50	2 015	30
m-Chlorophenol	25	11 55	30
p-Chlorophenol	50	4 99	30
Copper, liq	1,085	3.36	105
	1,100	3.33	105
	1,150	3 22	105
	1,200	3.12	105
o-Cresol	40	4.49	86
m-Cresol	10	43 9	86
	20	20 8	86

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref
m-Cresol	40	6 18	86
p-Cresol .	40	7 00	86
Creosote	20	12 0	53
Cycloheptane	13 5	1 64	84
Cyclohexane	17	1 02	95
Cyclohexanol	20	68	83
Cyclohexene	13 5	696	84
	20	66	53
Cyclooctane	13 5	2 35	84
Cyclopentane	13 5	493	84
n-Decane	20	.92	75
Diethylamine	25	346	24
	25	367	26
Diethylaniline.	.5	3 84	42
	20 0	2 18	42
	25 0	1 95	26
Diethylcarbinol	15 0	7 34	99
Diethylketone	15	493	99
Dimethylaniline	10	1 69	42
	20	1 41	42
	25	1 285	26
	30	1 17	74
	40	1 04	42
	50	91	42
Dimethyl-α-naphthylamine	130	868	26
Dimethyl-β-naphthylamine	130	952	26
Diphenyl	70	1 49	75
	100	97	75
Diphenylamine	130	1 04	26
Dodecane	25	1 35	87
Ether (diethyl-)	−100	1 69	1
	−80	.958	1
	−60	637	1
	−40	.461	1
	−20	362	1
	0	2842	1
	17	.240	95
	20	.2332	1
	25	.222	51
	40	.197	1
	60	166	1
	80	.140	1
	100	118	1
Ethyl acetate	0	582	11
	8 96	516	49
	10	.512	11
	15	.473	79
	20	.455	11
	25	441	48
	30	400	79
	50	.345	48
	75	283	48
alcohol	−98 11	44.0	73
	−89 8	28.4	73
	−71.5	13.2	73
	−59 42	8 41	73
	−52 58	6 87	73
	−32 01	3 84	73
	−17.59	2 68	73
	−.30	1 80	73
	0	1 773	1

Liquid	Temp. °C	Viscosity cp	Ref.
Ethyl alcohol	10	1 466	1
	20	1 200	1
	30	1 003	1
	40	834	1
	50	702	1
	60	592	1
	70	504	1
alcohol, anh	−148	8,470	58
	−146	5,990	58
	−130	467	58
aniline	25	2 04	26
Ethylbenzene	17	.691	95
benzoate	20	2 24	43
bromide	−120	5 6	56
	−100	2 89	56
	−80	1 81	56
	0	487	11
	10	441	11
	15	418	59
	20	402	11
	30	348	59
n-Ethyl butyrate	15	711	99
Ethyl carbonate	15	868	79
Ethylene bromide	0	2 438	11
	17	1 95	95
	20	1 721	11
	40	1 286	11
	67 3	922	17
	70	903	11
	82 2	750	17
	99 0	648	17
chloride	0	1 077	22
	15	887	72
	19 4	800	22
	40	652	11
	50	565	22
	70	479	11
glycol	20	19 9	75
	40	9 13	75
	60	4 95	75
	80	3 02	75
	100	1 99	75
oxide	−49 8	577	46
	−38 2	488	46
	−21 0	394	46
	0	320	46
Ethyl formate.	20	402	
iodide	0	727	11
	15	617	72
	20	592	11
	40	495	11
	70	391	11
malate	24 7	3 016	27
oxalate	15	2 31	79
propionate	15	564	79
Eugenol	0	29 9	91
	20	9 22	91
	40	4 22	91
Fluorobenzene	20	598	65
	40	.478	65
	60	389	65
	80	.329	65
	100	275	65

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref.
Formamide	0	7.55	39
	25	3.30	33
Formic acid	7.59	2 3868	5
	10	2.262	5
	20	1.804	5
	30	1.465	5
	40	1.219	11
	70	.780	11
	100	.549	11
Furfurol.	0	2 48	16
	25	1 49	31
Glucose	22	9.1 $\times 10^{15}$	107
	30	6 6 $\times 10^{13}$	107
	40	2 8 $\times 10^{11}$	107
	60	9 3 $\times 10^{7}$	107
	80	6 6 $\times 10^{5}$	107
	100	2 5 $\times 10^{4}$	107
Glycerin	−42	6.71 $\times 10^{6}$	58
	−36	2 05 $\times 10^{6}$	58
	−25	2 62 $\times 10^{5}$	58
	−20	1 34 $\times 10^{5}$	58
	−15 4	6 65 $\times 10^{4}$	58
	−10 8	3 55 $\times 10^{4}$	58
	−4 2	1 49 $\times 10^{4}$	58
	0	12,110	68
	6	6,260	68
	15	2,330	68
	20	1,490	68
	25	954	68
	30	629	68
Glycerin trinitrate	10	69 2	78
	20	36 0	78
	30	21 0	78
	40	13 6	78
	60	6 8	78
Heptane. . .	0	.524	11
	17	.461	95
	20	.409	71
	25	386	87
	40	.341	11
	70	.262	11
n-Heptyl alcohol	15	8 53	81
Hexadecane	20	3 34	28
Hexane	0	401	11
	17	374	95
	20	.326	11
	25	294	87
	40	271	11
	50	.248	11
Hydrazin .	1	1 29	101
	10	1 12	101
	20	97	101
Hydrogen, liq	...	011	40
Iodine, liq..	116	2 27	52
Iodobenzene .	15	1.74	99
Iron, 2 5% carbon, liq.. .	1,400	2.25	64
Isoamyl acetate	8 97	1 030	49
	19.91	.872	49
alcohol.	10	6 20	19
amine .	25	724	26
Isobutyl alcohol	15	4 703	72
amine .	25	.553	26
Isobutyric acid.	15	1.44	108
	30	1 13	108
Isoeugenol...	25	26.72	21
Isoheptane....	0	.481	11
	20	.384	11
	40	.315	11
Isohexane.....	0	.376	11
	20	.306	11
	40	.254	11
Isopentane...	0	.273	11
	20	.223	11
Isopropyl alcohol	15	2 86	108
	30	1.77	108
Isoquinoline	25	3.57	26
Isosafrol .	25	3.981	21
Lead, liq......	350	2 58	105
	400	2.33	105
	441	2.116	61
	500	1 84	105
	551	1.70	61
	600	1.38	105
	703	1.349	61
	844	1.185	61
Menthol, liq	55 6	6 29	17
	74 6	2.47	17
	99 0	1 04	17
Mercury	−20	1 855	66
	−10	1 764	66
	0	1 685	66
	10	1 615	66
	19 02	1 56	98
	20	1.554	66
	20 2	1.55	98
	30	1 499	66
	40	1 450	66
	40 8	1 45	98
	41 86	1 44	98
	50	1 407	66
	60	1 367	66
	70	1 331	66
	80	1 298	66
	90	1 268	66
	100	1.240	66
	150	1 130	66
	200	1.052	66
	250	.995	66
	300	.950	66
	340	.921	66
Methyl acetate.	0	.484	11
	20	.381	65
	40	320	11
Methyl alcohol (Methanol)	−98 30	13.9	100
	−84 23	6.8	100
	−72 55	4.36	100
	−44.53	1.98	100
	−22.29	1 22	100
	0	.82	100
	15	.623	79
	20	.597	18
	25	.547	1
	30	.510	79
	40	.456	11
	50	.403	11

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref.
Methyl amine	0	.236	23
aniline	25	2 02	26
	30	1 55	74
chloride	20	.1834	10
Methylene bromide	15	.109	99
	30	.092	99
chloride	15	.449	99
	30	.393	99
Methyl iodide	0	.606	11
	15	.518	108
	20	500	11
	30	.460	108
	40	.424	11
Naphthalene	80	.967	77
	100	.776	77
Nitric acid	0	2 275	
	10	1.770	
Nitrobenzene	2 95	2 91	103
	5 69	2 71	93
	5 94	2 71	103
	9.92	2 48	103
	14.94	2 24	103
	20.00	2 03	103
Nitromethane	0	853	97
	25	620	97
o-Nitrotoluene	0	3 83	102
	20	2 37	102
	40	1 63	102
	60	1 21	102
m-Nitrotoluene	20	2 33	102
	40	1 60	102
	60	1 18	102
p-Nitrotoluene	60	1 20	102
n-Nonane	20	711	75
n-Octane	0	706	11
	16	574	95
	20	542	11
	40	433	11
Octodecane	40	2 86	28
n-Octylalcohol	15	10 6	81
Oil, castor	10	2,420	41
	20	986	41
	30	451	41
	40	231	41
	100	16 9	41
cottonseed	20	70 4	53
cylinder, filtered	37.8	240 6	20
	100	18 7	20
cylinder, dark	37 8	422 4	20
	100	24 0	20
linseed	30	33.1	29
	50	17.6	29
	90	7 1	29
machine, light	15 6	113 8	20
	37 8	34 2	20
	100	4 9	20
machine, heavy	15 6	660 6	20
	37 8	127 4	20
olive	10	138 0	34
	20	84 0	34
	40	36 3	34
	70	12 4	34
rape	0	2,530	3

Liquid	Temp. °C	Viscosity cp	Ref.
Oil, rape	10	385	3
	20	163	3
	30	96	3
soya bean	20	69 3	53
	30	40 6	29
	50	20 6	29
	90	7 8	29
sperm	15.6	42 0	20
	37.8	18 5	20
	100.0	4 6	20
Oleic acid	30	25 6	80
Pentadecane	22	2 81	9
Pentane	0	.289	11
	20	240	11
o-Phenetidine	0	16 5	102
	20	6 08	102
	30	4 22	102
m-Phenetidine	30	12 9	102
p-Phenetidine	20	12 9	102
	30	8 3	102
Phenol	18.3	12 7	13
	50	3 49	92
	60	2 61	92
	70	2 03	92
	90	1 26	13
Phenylcyanide	28	1 96	42
	20 0	1 33	42
Phosphorus, liq.	21.5	2 34	104
	31 2	2 01	104
	43 2	1 73	104
	50 5	1 60	104
	60 2	1 45	104
	69 7	1 32	104
	79 9	1 21	104
Potassium bromide, liq	745	1 48	25
	775	1 34	25
	805	1 19	25
nitrate, liq	334	2 1	25
	358	1 7	25
	333	2 97	25
	418	2 00	25
Propionic acid	10	1.289	11
	15	1 18	79
	20	1 102	11
	40	.845	11
Propyl acetate	10	66	7
	20	59	7
	40	44	7
n-Propyl alcohol	0	3 883	11
	15	2 52	108
	20	2 256	11
	30	1 72	108
	40	1 405	11
	50	1.130	11
	70	.760	11
Propyl aldehyde	10	.47	11
	20	41	11
	40	.33	11
bromide	0	.651	11
	20	.524	11
	40	.433	11
chloride	0	.436	11
	20	.352	11

VISCOSITY OF LIQUIDS (Continued)

Liquid	Temp. °C	Viscosity cp	Ref.	Liquid	Temp. °C	Viscosity cp	Ref.
Propyl chloride	40	.291	11	Tetradecane	20	2.18	28
n-Propyl ether	15	.448	79	Tin, liq	240	2.12	105
Pyridine	20	.974	47		280	1.678	4
Salicylic acid...	10	3.20	6		300	1.73	105
	20	2.71	6		301	1.680	57
	40	1.81	6		400	1.43	105
Salol	45	.746	77		450	1.270	57
Sodium bromide	762	1.42	25		500	1.20	105
	780	1.28	25		600	1.08	105
chloride, liq.	841	1.30	25		604	1.045	57
	896	1.01	25		750	.905	57
	924	.97	25	Toluene	0	.772	11
nitrate, liq...	308	2.919	25		17	.61	95
	348	2.439	25		20	.590	11
	398	1.977	25		30	.526	74
	418	1.828	25		40	.471	11
Stearic acid	70	11.6	75		70	.354	11
Sucrose (cane	109	2.8×10^6	12	*o*-Toluidine	20	4.39	42
sugar)	124.6	1.9×10^5	12	*m*-Toluidine	20	3.81	91
Sulfur (gas free)	123.0	10.94	44	*p*-Toluidine	50	1.80	30
	135.5	8.66	44	Triacetin	17	28.0	95
	149.5	7.09	44	Tributyrin	20	11.6	53
	156.3	7.19	44	Trichlorethane	20	1.2	70
	158.2	7.59	44	Tridecane	23.3	1.55	9
	159.2	9.48	44	Triethylcarbinol	20	6.75	90
	159.5	14.45	44	Tripalmitin	70	16.8	67
	160.0	22.83	44	Tristearin ...	75	18.5	67
	160.3	77.32	44	Turpentine...	0	2.248	11
	165.0	500.0	44		10	1.783	11
	171.0	4,500.0	44		20	1.487	11
	184.0	16,000.00	44		30	1.272	11
	190.5	19,700.0	44		40	1.071	11
	197.5	21,300.0	44		70	.728	11
	200.0	21,500.0	44	Turpentine,			
	210.0	20,500.0	44	Venice	17.3	1.3×10^5	15
	217.0	19,100.0	44	*n*-Undecane	20	1.17	75
	220.0	18,600.0	44	*o*-Xylene (xylol)	0	1.105	11
Sulfur dioxide,	−33.5	.5508	23		16	.876	95
liq.	−10.5	.4285	23		20	.810	11
	0.1	.3936	23		40	.627	11
Sulfuric acid	0	48.4	1	*m*-Xylene (xylol)	0	.806	11
	15	32.8	106		15	.650	79
	20	25.4	106		20	.620	11
	30	15.7	106		40	.497	11
	40	11.5	106	*p*-Xylene (xylol)	16	.696	95
	50	8.82	106		20	.648	11
	60	7.22	106		40	.513	11
	70	6.09	106	Zinc, liq.	280	1.68	38
	80	5.19	106		357	1.42	38
Tetrachloro-					389	1.31	38
ethane	15	1.844	59				

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VISCOSITY OF LIQUIDS (Continued)

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VISCOSITY OF GASES

Gas or vapor	Temp. °C	Viscosity micropoises	Ref.	Gas or vapor	Temp °C	Viscosity micropoises	Ref
Acetic acid, vap	119.1	107.0	3	Air	18	182.7	32
Acetone, vap	100	93.1	8		40	195.8	32
	119.0	99.1	34		54	195.8	32
	190.4	118.6	34		74	210.2	32
	247.7	133.4	34		229	263.8	32
	306.4	148.1	34		334	312.3	32
Acetylene	0	93.5	12		357	317.5	32
Air	−194.2	55.1	30		409	341.3	32
	−183.1	62.7	30		466	350.1	32
	−104.0	113.0	30		481	358.3	32
	−69.4	133.3	30		537	368.6	32
	−31.6	153.9	30		565	375.0	32
	0	170.8	30		620	391.6	32

Gas or vapor	Temp. °C	Viscosity micropoises	Ref.	Gas or vapor	Temp. °C	Viscosity micropoises	Ref.
Air	638	401.4	32	Carbon dioxide	1.3	136.1	30
	750	426.3	32		15	145.7	7
	810	441.9	32		19	149.9	32
	923	464.3	32		20	148.0	10
	1034	490.6	32		30	153	10
	1134	520.6	32		32	155	10
Alcohol. See *Ethyl*,					35	156	10
Methyl, etc.					40	157	10
Ammonia	−78.5	67.2	12, 16		99.1	186.1	7
	0	91.8			104	188.9	32
	20	98.2	27		182.4	222.1	7
	50	109.2	27		235	241.5	32
	100	127.9	27		302.0	268.2	7
	132.9	139.9	27		490	330.0	32
	150	146.3	27		685	380.0	32
	200	164.6	27		850	435.8	32
	250	181.4	27		1052	478.6	32
	300	198.7	27	disulfide, vap	0	91.1	18
Argon	0	209.6	1		14.2	96.4	18
	20	221.7	21		114.3	130.3	34
	100	269.5	21		190.2	156.1	34
	200	322.3	21		309.8	196.6	34
	302	368.5	23	monoxide	−191.5	56.1	12, 17
	401	411.5	23		−78.5	127	
	493	448.4	23		0	166	
	584	481.5	23		15	172	
	714	525.7	23		21.7	175.3	22
	827	563.2	23		126.7	218.3	22
Arsenic hydride (Ar-					227.0	254.8	22
sine)	0	145.8	16		276.9	271.4	22
	15	114.0	16	tetrachloride, vap	76.7	195.0	4
	100	198.1	16		127.9	133.4	34
Benzene, vap	14.2	73.8	8, 18		200.2	156.2	34
	131.2	103.1	34		314.9	190.2	34
	194.6	119.8	34	Chlorine	12.7	129.7	9
	252.5	134.3	34		20	132.7	38
	312.8	148.4	34		50	146.9	38
Bromine, vap	12.8	151	9		100	167.9	38
	65.7	170	9		150	187.5	38
	99.7	188	9		200	208.5	38
	139.7	208	9		250	227.6	38
	179.7	227	9	Chloroform, vap	0	93.6	1
	220.3	248	9		14.2	98.9	1
Bromoform, vap	151.2	253.0	4		100	129	1
Butyl alcohol, *n*, vap	116.9	143	4		121.3	135.7	34
tert, vap	82.9	160	4		189.1	157.9	34
chloride, *n*, vap	78	149.5	4		250.0	177.6	34
iodide, vap	130	202	4		307.5	194.7	34
β-Butylene	18.8	74.4	37	Cyanogen	0	92.8	16
	100.4	94.5	37		17	98.7	16
	200	119.2	37		100	127.1	16
Butyric acid, vap	161.7	130.0	3	Ethane	−78.5	63.4	12
Carbon dioxide	−97.8	89.6	30		0	84.8	12
	−78.2	97.2	30		17.2	90.1	25
	−60.0	106.1	30		50.8	100.1	25
	−40.2	115.5	30		100.4	114.3	25
	−21	129.4	7		200.3	140.9	25
	−19.4	126.0	30	Ether (diethyl), vap	0	67.8	1
	0	139.0	7		14.2	71.6	1
	0	142	14		100	95.5	1

Gas or vapor	Temp. °C	Viscosity micropoises	Ref.
Ether (diethyl), vap.	121.8	98.3	34
	159.4	107.9	34
	189.9	115.2	34
	251.0	130.0	34
	277.8	135.8	34
Ethyl acetate, vap	0	68.4	1
	100	94.3	1
	128.1	101.8	34
	158.6	109.8	34
	192.9	119.5	34
	212.5	126	1
alcohol, vap	100	108	8
	130.2	117.3	34
	170.7	129.3	34
	191.8	135.5	34
	212.5	140	8
	251.7	151.9	34
	308.7	167.0	34
bromide, vap	38.4	186.5	4
butyrate, vap	119.8	160.0	3
chloride, vap	0	93.7	12
Ethylene	−75.7	69.9	11
	−44.1	76.9	11
	−38.6	78.5	11
	0	90.7	11
	13.8	95.4	11
	20	100.8	27
	50	110.3	27
	100	125.7	27
	150	140.3	27
	200	154.1	27
	250	166.6	27
bromide, vap	131.6	221.0	4
chloride, vap	83.5	168.0	4
Ethyl formate, vap	99.8	92	15
iodide, vap	72.3	216.0	4
Helium	−257.4	27.0	19
	−252.6	35.0	19
	−191.6	87.1	19
	0	186.0	19
	20	194.1	21
	100	228.1	21
	200	267.2	21
	250	285.3	21
	282	299.2	23
	407	343.6	23
	486	370.6	23
	606	408.7	23
	676	430.3	23
	817	471.3	23
Hydrogen	−257.7	5.7	19
	−252.5	8.5	19
	−198.4	33.6	30
	−183.4	38.8	30
	−113.5	57.2	30
	−97.5	61.5	30
	−31.6	76.7	30
	0	83.5	30
	20.7	87.6	30
	28.1	89.2	24
Hydrogen	129.4	108.6	24
	229.1	126.0	24
	299	138.1	23
	412	155.4	23
	490	167.2	23
	601	182.9	23
	713	198.2	23
	825	213.7	23
bromide	18.7	181.9	15
	100.2	234.4	15
chloride	12.5	138.5	15
	16.5	140.7	20
	18	142.6	20
	100.3	182.2	15
iodide	20	165.5	38
	50	201.8	38
	100	231.6	38
	150	262.7	38
	200	292.4	38
	250	318.9	38
phosphide	0	106.1	16
	15	112.0	16
	100	143.8	16
sulfide	0	116.6	16
	17	124.1	16
	100	158.7	16
Iodine, vap	124.0	184	9
	170.0	204	9
	205.4	220	9
	247.1	240	9
Isobutyl acetate, vap	16.1	76.4	6
	116.4	155.0	6
alcohol, vap	108.4	144.5	4
bromide, vap	92.3	179.5	4
butyrate, vap	156.9	167.0	3
chloride, vap	68.5	150.0	4
iodide, vap	120	204.7	4
Isopentane, vap	25	69.5	31
	100	86.0	31
Isopropyl alcohol, vap	99.8	109	13
	120.3	103.1	34
	198.4	124.8	34
	293.1	148.8	34
bromide, vap	60	176.0	4
chloride, vap	37.0	148.5	4
iodide, vap	89.3	201.5	4
Krypton	0	232.7	9
	15	246	9
Mercury, vap	273	494	5
	313	551	5
	369	641	24
	380	654	24
Methane	−181.6	34.8	12, 16
	−78.5	76.0	
	0	102.6	
	20	108.7	25
	100.0	133.1	25
	200.5	160.5	25
	284	181.3	23

VISCOSITY OF GASES (Continued)

Gas or vapor	Temp. °C	Viscosity micropoises	Ref.
Methane	380	202.6	23
	499	226.4	23
Methyl acetate, vap	99.8	98	8, 13
	100	100	
	143.3	113.9	34
	218.5	134.8	34
alcohol, vap	66.8	135.0	4
	111.3	125.9	34
	217.5	162.0	34
	311.5	192.1	34
chloride	−15.3	92	7, 12
	0	96.9	
	15.0	104	
	99.1	137	
	182.4	168	
	302.0	211	
iodide, vap	44	232	4
Neon	0	297.3	9
	20	311.1	21
	100	364.6	21
	200	424.8	21
	250	453.2	21
	285	470.8	23
	429	545.4	23
	502	580.2	23
	594	623.0	23
	686	662.6	23
	827	721.0	23
Nitric oxide (NO)	0	178	12
	20	187.6	36
	100	227.2	36
	200	268.2	36
Nitrogen	−21.5	156.3	2
	10.9	170.7	2
	27.4	178.1	22
	127.2	219.1	22
	226.7	255.9	22
	299	279.7	23
	490	337.4	23
	825	419.2	23
Nitrosyl chloride	15	113.9	36
	100	150.4	36
	200	192.0	36
Nitrous oxide (N_2O)	0	135	12
	26.9	148.8	24
	126.9	194.3	24
n-Nonane, vap	100.3	63.3	28
	202.1	78.1	28
n-Octane, vap.	100.4	67.5	28
	202.2	84.8	28
Oxygen	0	189	14
	19.1	201.8	22
	127.7	256.8	22
Oxygen	227.0	301.7	22
	283	323.3	23
	402	369.3	23
	496	401.3	23
	608	437.0	23
	690	461.2	23
	829	501.2	23
n-Pentane, vap	25	67.6	31
	100	84.1	31
Propane	17.9	79.5	25
	100.4	100.9	25
	199.3	125.1	25
n-Propyl alcohol, vap.	99.9	93	13
	121.7	102.5	34
	209.7	126.7	34
	273.0	143.4	34
bromide, vap	99.8	119	13
Propylene	16.7	83.4	37
	49.9	93.5	37
	100.1	107.6	37
	199.4	133.8	37
Propyl iodide, vap	102	210.0	4
Sulfur dioxide	−75.0	85.8	29
	−20.0	107.8	29
	0	115.8	29
	0	117	12, 17
	18	124.2	
	20.5	125.4	29
	100.4	161.2	26
	199.4	203.8	26
	293	244.7	23
	490	311.5	23
Trimethylbutane (2,2,3-), vap	70.3	73.4	33
	132.2	82.7	33
	262.1	104.8	33
Trimethylethylene, vap	25	70.1	31
	100	86.9	31
Water, vap	100	125.5	35
	150	144.5	35
	200	163.5	35
	250	182.7	35
	300	202.4	35
	350	221.8	35
	400	241.2	35
Xenon	0	210.1	9
	16.5	223.5	27
	20	226.0	27
	127	300.9	27
	177	335.1	27
	227	365.2	27
	277	395.4	27

VISCOSITY OF GASES (Continued)

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VISCOSITY OF SOLIDS

Substance	Temp. °C	Viscosity poises	Observer
Glass, soda. . .	575	11×10^{12}	Trouton and Andrews, 1904
Ice, glacier. . .	.....	12×10^{13}	Deelev, 1908
Menthol. . .	14.9	2×10^{12}	Heydweiller, 1897
Pitch.	0	51×10^{10}	Trouton and Andrews, 1904
	15	1.3×10^{10}	Trouton and Andrews, 1904
Wax, shoe makers'	8	4.7×10^{6}	Trouton and Andrews, 1904

VISCOSITY OF ALCOHOL-WATER MIXTURES

Bingham and Jackson, Bull. Bur. Stds. **14,** 59 (1918–1919)

Giving the viscosity in centipoises of mixtures of ethyl alcohol and water. For densities see table Ethyl Alcohol—Density of aqueous solutions at 20° C.

% by wt.	10	20	30	40	50	60	70	80	90	100
% by vol.	12 36	24 09	35 23	45.83	55 93	65.56	74 80	83 59	92 01	100
Temp. °C										
0	3 311	5.319	6 94	7 14	6 58	5.75	4 762	3 690	2 732	1 773
5	2 577	4 065	5 29	5.59	5 26	4 63	3 906	3 125	2 309	1.623
10	2 179	3 165	4 05	4.39	4.18	3 77	3.268	2 710	2 101	1.466
15	1 792	2 618	3 26	3 53	3 44	3 14	2 770	2 309	1 802	1 332
20	1 538	2 183	2 71	2 91	2 87	2 67	2 370	2 008	1 610	1 200
25	1 323	1 815	2.18	2 35	2.40	2 24	2 037	1 748	1 424	1 096
30	1 160	1 553	1 87	2 02	2 02	1 93	1 767	1 531	1 279	1 003
35	1 006	1 332	1.58	1.72	1 72	1 66	1.529	1 355	1 147	914
40	907	1 160	1 368	1 482	1.499	1 447	1 344	1 203	1 035	834
45	812	1 015	1.189	1 289	1 294	1 271	1.189	1 081	939	.764
50	734	.907	1 050	1 132	1 155	1.127	1.062	968	848	.702
55	663	814	.929	998	1 020	997	.943	867	764	.644
60	609	736	834	893	913	.902	856	789	704	.592
65	554	666	752	802	818	806	766	711	641	551
70	514	608	683	727	740	729	695	650	589	.504
75	476	559	624	663	672	663	636	600	.546	.471
80	430	505	567	601	612	604				

VISCOSITY OF AQUEOUS SUCROSE SOLUTIONS

Bingham and Jackson, Bull. Bur Stds. **14,** 59 (1918–19)

Giving the viscosity in centipoises for 20, 40 and 60% by weight sucrose solutions for each 5° C from 0 to 100° C. For densities see table Sucrose—Specific gravity of aqueous sugar solutions.

Temp. °C	Viscosity, cp			Temp. °C	Viscosity, cp		
	20%	40%	60%		20%	40%	60%
0	3 804	14 77	238	55	0 884	2 219	11 67
5	3 154	11 56	156	60	808	1 982	9 83
10	2 652	9 794	109 8	65	742	1 778	8.34
15	2 267	7 468	74 6	70	685	1 608	7.15
20	1 960	6 200	56.5	75	.635	1 462	6.20
25	1 704	5 187	43.86	80	590	1.334	5.40
30	1 504	4 382	33 78	85	.550	1 221	4.73
35	1 331	3 762	26 52	90	. .	1 123	4.15
40	1 193	3 249	21 28	95	.	1 037	3 72
45	1 070	2 847	17 18	100	. .	960	3 34
50	970	2 497	14 01				

VISCOSITY OF AQUEOUS GLYCEROL SOLUTIONS FOR CALIBRATION

From the data of M. L. Sheely, Indust. and Eng. Chem., **24**, 1060, (1932)

Sp. gr. 25°/25°C	% Glycerol	Viscosity 20°	Viscosity 25°	Viscosity 30°	Sp. gr. 25°/25°C	% Glycerol	Viscosity 20°	Viscosity 25°	Viscosity 30°
1 00000	0	1.005	0.893	0.800	1.12720	50	6.050	5.041	4.247
1.00235	1	1.029	0.912	0.817	1.12995	51	6.396	5.319	4.467
1.00475	2	1.055	0.935	0.836	1.13265	52	6.764	5.597	4.709
1.00710	3	1.083	0.959	0.856	1.13540	53	7.158	5.910	4.957
1 00950	4	1.112	0.984	0.877	1.13815	54	7.562	6.230	5.210
1.01185	5	1.143	1.010	0.900	1.14090	55	7.997	6.582	5.494
1.01425	6	1.175	1.037	0.924	1.14365	56	8.482	6.963	5.816
1.01660	7	1.207	1.064	0.948	1.14640	57	9.018	7.394	6.148
1.01900	8	1.239	1.092	0.972	1.14915	58	9.586	7.830	6.495
1.02135	9	1.274	1.121	0.997	1.15185	59	10.25	8.312	6.870
1.02370	10	1.311	1.153	1.024	1.15460	60	10.96	8.823	7.312
1.02620	11	1.350	1.186	1.052	1.15735	61	11.71	9.428	7.740
1 02865	12	1.390	1.221	1.082	1.16010	62	12.52	10.11	8.260
1.03110	13	1.431	1.256	1.112	1.16285	63	13.43	10.83	8.812
1.03360	14	1.473	1.292	1.143	1.16560	64	14.42	11.57	9.386
1.03605	15	1.517	1.331	1.174	1.16835	65	15.54	12.36	10.02
1.03850	16	1.565	1.370	1.207	1.17110	66	16.73	13.22	10.68
1.04100	17	1.614	1.411	1.244	1.17385	67	17.96	14.18	11.45
1.04345	18	1.664	1.453	1.281	1.17660	68	19.40	15.33	12.33
1.04590	19	1.715	1.495	1.320	1.17935	69	21 07	16.62	13.27
1.04840	20	1.769	1.542	1.360	1.18210	70	22.94	17.96	14.32
1.05095	21	1.829	1.592	1.403	1.18480	71	25.17	19.53	15.56
1.05350	22	1.892	1.644	1.447	1.18755	72	27 56	21.29	16.88
1.05605	23	1.957	1.699	1.494	1.19025	73	30.21	23.28	18.34
1.05860	24	2.025	1.754	1.541	1.19295	74	33.04	25.46	19.93
1 06115	25	2.095	1.810	1.590	1.19565	75	36.46	27.73	21.68
1.06370	26	2.167	1.870	1.641	1.19840	76	40.19	30.56	23.60
1.06625	27	2.242	1.934	1.695	1.20110	77	44.53	33.58	25.90
1.06880	28	2.324	2.008	1.752	1.20380	78	49.57	37 18	28.68
1.07135	29	2.410	2.082	1.812	1.20655	79	55.47	41.16	31.62
1.07395	30	2.501	2.157	1.876	1.20925	80	62.0	45.86	34.92
1.07660	31	2.597	2.235	1.942	1.21190	81	69.3	51.02	38.56
1.07925	32	2.700	2.318	2.012	1.21455	82	77.9	56.90	42.92
1.08190	33	2.809	2.407	2.088	1.21720	83	87.9	64.2	47.90
1.08455	34	2.921	2.502	2.167	1.21990	84	99.6	72.2	53.63
1.08715	35	3.040	2.600	2.249	1.22255	85	112.9	81.5	60.05
1.08980	36	3.169	2.706	2.335	1.22520	86	129.6	92 6	68.1
1.09245	37	3.300	2.817	2.427	1.22790	87	150.4	106 1	77 5
1.09510	38	3.440	2.932	2.523	1.23055	88	174.5	122 6	88 8
1.09775	39	3.593	3.052	2.624	1.23320	89	201.4	141 8	101 1
1.10040	40	3.750	3.181	2.731	1.23585	90	234.6	163 6	115 3
1.10310	41	3.917	3.319	2.845	1.23850	91	278.4	189.3	134 4
1.10575	42	4.106	3.466	2.966	1.24115	92	328.4	221.8	156 5
1.10845	43	4.307	3.624	3.094	1.24380	93	387.7	262.9	182 8
1.11115	44	4.509	3.787	3.231	1.24645	94	457 7	308.7	212.0
1.11380	45	4.715	3.967	3.380	1.24910	95	545	366.0	248.8
1.11650	46	4.952	4 165	3.540	1.25165	96	661	435.0	296.7
1.11915	47	5.206	4.367	3.706	1.25425	97	805	522.9	354.0
1.12185	48	5.465	4.571	3.873	1.25685	98	974	629	424.0
1.12450	49	5.730	4.787	4.051	1.25945	99	1197	775	511.0
1.12720	50	6.050	5 041	4.247	1.26201	100	1499	945	624

DIFFUSION

Gases into Air

Gas or vapor	Temp. °C	Coefficient of diffusion, sq. cm/sec	Observer
Alcohol, vapor	40.4	0.137	Winkelmann
Carbon dioxide	0.0	0.139	Mean of various
Carbon disulfide	19.9	0.102	Winkelmann
Ether, vapor	19.9	0.089	Winkelmann
Hydrogen	0.0	0.634	Obermayer
Oxygen	0.0	0.178	Obermayer
Water, vapor	8.0	0.239	Guglielmo

Aqueous Solutions into Pure Water

Concentration in gram-molecules per liter.

Substance	Concentration	Temp. °C	Diffusion sq. cm/day	Observer
Acetic acid	0.2	13.5	0.77	Scheffer
	1.0	12	0.74	Arrhenius
	2.0	12	0.69	Arrhenius
	3.0	12	0.68	
	4.0	12	0.66	Arrhenius
Ammonia	1.0	15.23	1.54	Abegg
Barium chloride	0.2	8	0.66	Scheffer
Bromine	0.1	12	0.8	Euler
Cadmium sulfate	2.0	19.04	0.246	Seitz
Calcium chloride	2.0	10	0.68	Schuhmeister
Chlorine	0.1	12	1.22	Euler
Copper sulfate	0.1	17	0.39	Thovert
Formic acid	1.0	12	0.97	Abegg
Glycerine	0.1	10.14	0.357	Heimbrodt
	0.2	10.1	3.55	Heimbrodt
	1.0	10.14	0.339	Heimbrodt
Hydrochloric acid	0.1	19.2	2.21	Thovert
	1.0	12	2.09	Arrhenius
	2.0	12	2.21	Arrhenius
Iodine	0.1	12	(0.5)	Euler
Magnesium sulfate	1.0	7	0.30	Scheffer
Nitric acid	0.1	19.5	2.07	Thovert
Potassium bromide	1.0	10	1.13	Schuhmeister
carbonate	3.0	10	0.60	Schuhmeister
chloride	0.1	17.5	1.38	Thovert
chloride	4.0	10	1.27	Schuhmeister
hydrate	0.1	13.5	1.72	Thovert
	1.0	12	1.72	Arrhenius
	3.0	12	1.89	Arrhenius
Silver nitrate	0.1	12	0.985	Thovert
Sodium acetate	0.2	12	0.67	Kawalki
chloride	0.1	15	0.94	Thovert
	0.2	15	0.94	Thovert
	1.0	15	0.94	Thovert
	1.0	14.3	0.964	Heimbrodt
hydrate	1.0	12	1.11	Thovert
iodide	1.0	10	0.80	Schuhmeister
	2.0	10	0.90	Schuhmeister
Sugar	1.0	12	0.254	Arrhenius
Sulfuric acid	1.0	12	1.12	Arrhenius
	2.0	12	1.16	Arrhenius
Urea	0.1	14.8	0.97	Heimbrodt
	0.2	14.8	0.969	Heimbrodt
Zinc acetate	2.0	18.05	0.210	Seitz
	2.0	0.04	0.120	Seitz
sulfate	1.0	14.8	0.236	Seitz

OSMOTIC PRESSURE OF AQUEOUS SOLUTIONS

For a Membrane of Ferrocyanide of Copper

Dissolved Substance.	Gms. substance in 1 cm ^{3} sol.	Temp. °C.	Pressure, cm. Hg.	Observer.
Glycerine....	.00199	0	36.7	
Gum arabic........	0.0099	15.5	7.0	Pfeffer
Gum arabic.	0.164	15 6	119.3	Pfeffer
Phenol (carbolic acid)	.00127	0	23 3	Naccari

	Gm.-mol. substance per gm. sol.		Pressure in atm.	
Glucose............	.0001	10.2	2.39	Morse,1911
	.0005	10.2	11.55	Morse,1911
	.0010	10.0	23.80	Morse,1911
Saccharose (cane sugar)...........	.0001	10.0	2.50	Morse,1911
	.0005	10.0	12.30	Morse,1911
	.0010	10.0	25.69	Morse,1911

	Gm.-mol. substance in 1 ccm.^{3} sol.			
Potassium carbonate	.00005	15	1.17	Adie, 1891
ferrocyanide......	.00005	15	3.44	Adie, 1891
nitrate.......... .	.00005	15	1.56	Adie, 1891
Sodium citrate (acid)	.00005	15	4.32	Adie, 1891

HEAT AND HYGROMETRY

SOUND

ELECTRICITY AND MAGNETISM

LIGHT

COEFFICIENT OF THERMAL EXPANSION

Linear

The coefficient given is the increase in length per unit length (measured at 0° C.) per degree Centigrade.

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Aluminum	−191 to +16	18 35	Henning, 1907
	20	25 5	Voigt, 1893
	40	23.13	Fizeau, 1869
	600	31 50	Chatelier
99 95%	20–100	23 8	Hidnert, 1925
	20–300	25.7	"
	20–600	28 7	"
commercial	20–100	24.0	"
	20–300	26 7	"
	20–600	28.7	"
Aluminum-bronze	20	17.0	National Physical Laboratory
Aluminum-beryllium alloy			
10% Be	20–100	21.4	Hidnert & Sweeney, 1927
	20–300	23 3	" "
	20–500	25 4	" "
32 7% Be	20–100	17.9	" "
	20–300	20.6	" "
	20–500	22.3	" "
Aluminum-copper alloy			
10% Cu	20–100	22 4	Hidnert, 1925
	20–300	28 3	Hidnert, 1925
	20–500	27.7	Hidnert, 1925
Aluminum-silicon alloy 10% Si	20–100	21 1	Hidnert, 1925
	20–300	22 9	Hidnert, 1925
Aluminum-zinc alloy 12% Zn	20–100	24 9	Hidnert, 1925
	20–300	28.1	Hidnert, 1925
97% Zn	20–100	27 5	Hidnert, 1925
	20–200	29 6	Hidnert, 1925
Antimony	−180 to +13	10.23	Gruneisen, 1910
	20	12.	Fizeau, 1869
	15–101	10 88	Gruneisen, 1910
parallel to axis	10–90	17.30	Fizeau, 1869
perpendicular to axis	10–90	8 28	"
Arsenic	10–90	3.86	"
*Bakelite-dilecto	20–60	22.	Souder & Hidnert, 1919
micarta 32X	25–50	33.	" "
Beryllium 98.9%	20–100	12.3	Hidnert, 1925
	20–300	14 0	"
	20–700	16 8	"
Bismuth	−180 to +15	12.98	
	19–101	13.45	
parallel to axis	10–90	15 37	
perpendicular to axis	10–90	10 84	
Brass			
cast	0–100	18 75	Smeaton
wire	0–100	19 30	"
66Cu, 34Zn	20	18 9	National Physical Laboratory

* See Scientific Paper of Bureau of Standards No. 352.

COEFFICIENT OF THERMAL EXPANSION (Continued)

LINEAR

Substance	Temp. °C.	Coefficient	Observer
Primer gilding 97Cu, 2.97Zn...	25–100	16.9	
.01Pb, .02Fe, cold rolled	25–300	17.7	
cast	25–100	17.2	
commercial bronze 90.26Cu	25–100	17.5	
9.7Zn, .01Pb, .03Fe	25–300	18.1	
cold rolled			
cast	25–100	17.4	
Low brass 80.02Cu	25–100	18.0	
19.89Zn, .05Pb, .03Fe	25–300	19.1	
cold rolled			
cast	25–100	17.9	
Spring brass, 72.02Cu	25–100	18.5	
27.95Zn, .01Pb, .02Fe	25–300	19.8	Hidnert, 1921
cold rolled			Scientific Paper No. 410
cast	25–100	18.3	Bureau of Standards
Commercial brass, 64.81Cu	25–100	19.0	
34.92Zn, .24Pb, .03Fe	25–300	20.2	
cold rolled			
cast	25–100	18.9	
Leaded bronze 88.3Cu	25–100	17.5	
10 Zn, 1.68Pb, .02Fe	25–300	18.3	
cold rolled			
cast	25–100	17.6	
Free turning rod 62.33Cu	25–100	19.1	
35.04Zn, 2.57Pb, .06Fe	25–300	20.4	
cold rolled			
cast	25–100	19.0	
Brick	....	9.5	National Physical Laboratory
Bronze			
3Cu, 1Sn	16.6–100	18.44	Daniell
	16.6–350	21.16	"
	16.6–957	17.37	"
93.5Cu, 6.5Sn	16–100	17.5	Bein, 1912
90Cu, 10Sn	0–900	22.0	Le Chatelier, 1889
80Cu, 20Sn	0–800	27.0	" "
70Cu, 30Sn	0–700	29.5	" "
phosphor			
97.6Cu, 2Sn, 0.2P	0–85	16.8	Mean
Cadmium	−183 to +14	44.6	Gruneisen, 1901
	20	28.8	Matthiessen, 1866
	0–100	31.59	"
	10–90	29.39	Fizeau
	315	31.6	Vicentini & Omodie
Calcite, parallel to axis	0–85	25.14	Benoit, 1888
perpendicular to axis	0–85	−5.58	"
Caoutchouc	...	65.7–68.6	Various
	17–25	77.0	Kohlrausch
Carbon			
diamond	40	1.18	Fizeau, 1869
gas carbon	40	5.40	"
graphite	40	7.86	"
Celluloid	20–70	109.	Souder & Hidnert, 1919
Cement and concrete		10–14	Fizeau
Chromium	20–100	6.8	Hidnert, 1931
Cobalt	40	12.36	Fizeau
*Condesite (No. 100)	16–79	44.0	Souder & Hidnert, 1919
(No. 128)	18–56	20.0	" "
Constantan	4–29	15.23	
60Cu, 40Ni	20	17.0	National Physical Laboratory

* See Scientific Paper Bureau of Standards No. 352.

LINEAR

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Constantan	−191 to +16	12 02	Henning, 1907
	0–38	14 48	Guillaume, 1896
	0–500	14 81	Holborn & Day, 1900
Copper	−191 to +16	14 09	Henning, 1907
electrolytic	25–100	16 8	Hidnert, 1921
	25–300	17.8	"
	0–625	16.07	Dittenberger, 1902
Diamond, *see Carbon*			
Duralumin, cast	20–100	23 6	Hidnert, 1925
	20–300	26 0	"
	20–500	27.3	"
cold rolled	20–100	23 7	"
	20–300	26 4	"
	20–500	27.3	"
Ebonite	25–35	84.2	Kohlrausch
Emerald, parallel to axis	0–85	−1.35	Benoit
perpendicular to axis	0–85	1 00	
Fluor spar, CaF_2	0–100	19 5	Pfaff
Formica	20–60	30 0	Souder & Hidnert, 1919
Galena		19 9	
German silver. 60Cu, 15Ni, 25Zn	0–100	18 36	Pfaff
Glass			
tube	0–100	8 33	Fizeau
soft		8 5	Schott
hard		9 7	"
plate	0–100	8.91	Lavoisier & Laplace
crown	0–100	8 97	" "
flint	50–60	7 88	Pulfrich
Jena thermometer			
16^{III} normal	0–100	8 1	Schott
59^{III}	0–100	5 8	"
59^{III}	−191 to +16	4 24	Henning, 1907
Gold	−183 to +16	13.2	Gruneisen, 1910
	16–100	14 3	"
Gold-copper 2Au, 1Cu	0–100	15 52	Matthiessen
Gold-platinum 2Au, 1Pt.	0 100	15 23	"
Granite		8 3	
Gun Metal		18 3	National Physical Laboratory
Gutta percha		198 3	Russner, 1882
Hard Rubber	20–60	80	Souder & Hidnert, 1919
Ice	−20 to −1	51 0	
	−10 to 0	50 7	Vincent, 1902
Indium	40	41 7	Fizeau, 1869
Invar, *see Nickel steel*			
Iodine	−188 to 16	83 7	Dewar 1902
Iridium	−183 to +19	5 71	Gruneisen, 1910
Iron	−190 to +17	9 07	Henning, 1907
soft	40	12 10	Fizeau, 1869
cast	40	10 61	"
cast	−190 to +16	8.50	Henning, 1907
wrought	−18 to +100	11 40	Andrews
steel	40	13 22	Fizeau, 1869
steel, annealed	40	10 95	"
steel, 1 2% C.	0–100	10.5	Le Chatelier, 1899
"	100–200	11 5	"
"	200–300	13.	"

COEFFICIENT OF THERMAL EXPANSION (Continued)

Linear

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Iron, steel	300–400	15.	Le Chatelier, 1899
“	400–500	14.	“
“	500–600	16.	“
“	600–700	16.	“
“	above 900	29.	“
Lead	−183 to +14	27.08	Gruneisen, 1910
	18–100	29.40	“
Lead-tin	0–100	25.08	Smeaton
2Pb, 1Sn			
Magnesium	−183 to +15	21.40	Gruneisen, 1910
	18–100	26.08	“
	20–100	26.0	Hidnert & Sweeney, 1928
	20–200	27.9	“ “
	20–500	29.8	“ “
cast	20–100	26.96	C. D. H., 1917
wrought	20–100	26.73	“
Magnalium	0–13	22	Guillaume, 1902
96Al, 4Mg,			
86Al, 14Mg	12–39	23.8	Stadhagen, 1901
Marble	15–100	11.7	Frohlich
* Rutland blue (Vt)			
heated in air	25–100	15	Souder & Hidnert, 1919
	100–200	23	“ “
	200–300	28.	“ “
cooled	300–200	15.	“ “
	200–100	9.	“ “
	100–25	4.	“ “
* Silver gray (Ga.)			
cooled	25–0	13.	“ “
	0 to −60	10	“ “
heated in air	20–65	1.0	“ “
cooled	65–20	.5	“ “
Masonry		4 -7.	
Mercury	−183 to −39	30	Dewar, 1902
	−78 to −38	41	Grunmach, 1901
Molybdenum	25–100	4.9	Hidnert & Gero, 1924
	25–500	5.5	“ “
Monel metal	25–100	13.7–14.5	Souder & Hidnert
	25–300	14.9–15.2	“ “
	25–600	15.9–16.7	“ “
Nickel	−191 to +16	10.12	Henning, 1907
	40	12.79	Fizeau
	16–250	13.97	Holborn & Day, 1901
	375–1000	13.46	Holborn & Day, 1901
commercial	25–100	12.9	Souder & Hidnert, 1921
		13.5	
Nickel steel			
10% Ni	20	13.0	Nat. Phys. Lab.
20	20	19.5	“ “ “
30	20	12	“ “ “
36 (Invar)	20	.9	“ “ “
40	20	6.0	“ “ “
50	20	9.7	“ “ “
80	20	12.5	“ “ “
Osmium	40	6.57	Fizeau
Palladium	40	11.76	“
	0–100	11.04	Matthiessen
Paraffine	0–16	106.6	Rodwell
	16–38	130.3	“
	38–49	477.1	“
Phosphorus	0–44	124	Laduc, 1891

* For full details and data on other samples see Scientific Paper 352 Bureau of Standards.

COEFFICIENT OF THERMAL EXPANSION (Continued)

Linear

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Phosphor bronze, *see Bronze*			
Platinum	40	8.99	Fizeau
Platinum iridium	40	8.84	"
10 Pt. 1Ir			
Platinum silver	0–100	15.23	Matthiessen
33Pt, 67Ag			
Porcelain	20–790	4.13	Braun
Berlin	0–100	3.1	Holborn & Gruneisen
Bayeux	0	2.5	Tutton, 1902
	1000–1400	5.53	Deville & Troost
Clay .50, flint .15			
beryl .35	20–200	1.6	Souder & Hidnert, 1919
	400–540	3.6	" "
clay .80, feldspar	20–200	2.9	" "
.85, whiting .015	200–400	4.0	" "
clay .70, feldspar	20–200	3.3	" "
.19, flint .095, whiting 1.5	200–400	4.0	" "
clay .50, feldspar	20–200	4.7	" "
.16, flint 34	200–400	4.6	" "
Quartz (crystal)	−190 to +16	5.21	Scheel
parallel to axis	0–80	7.97	Benoit, 1888
perpendicular to axis	0–80	13.37	"
fused	−191 to +16	.256	Henning, 1907
	0–30	.42	Chappuis, 1903
	0–100	.50	Scheel, 1907
	0–800	.546	Randall, 1910
	0–1200	.585	"
Rhodium	40	8.5	Fizeau
Rock salt	40	40.40	"
Rubidium	2–17	86.2	Elsa Deuss, 1911
Ruthenium	40	9.63	Fizeau
Sandstone	20	7.–12.	......
Selenium	−180 to 0	37.2	Dorsey, 1908
	40	36.80	Fizeau
Silicon	40	7.63	"
Silver	−191 to +16	17.04	Henning, 1907
	20	18.8	Voigt, 1893
Slate	20	6.–10.	......
Solder, *see Lead-tin*			
Speculum metal	20	19.3	Smeaton
68Cu, 32Sn			
Sodium	−188 to +17	62.2	Dewar, 1902
Stainless steel			
hardened	20–100	9.6	Souder & Hidnert, 1921
	20–200	9.8	" "
	20–600	11.2	" "
annealed	20–100	10.3	" "
	20–200	10.7	" "
	20–600	12.1	" "
Stellite, soft	20–100	14.1	Souder & Hidnert, 1921
80Co, 20Cr	20–300	15.2	" "
	20–600	16.1	" "
hard, 55Co, 40Cr	20–100	13.4	" "
3W, 2C	20–300	15.0	" "
	20–600	16.5	" "
"No. 2" 55Co, 35Cr	20–100	11.0	" "
10W	20–300	12.4	" "
	20–600	13.6	" "
Sulphur, crystal	40	64.13	Fizeau, 1869
Tellurium	40	16.75	Fizeau, 1869

COEFFICIENT OF THERMAL EXPANSION (Continued)

Linear

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-6}$	
Thallium	40	30 21	Fizeau, 1869
Thorium	0-100	12 3	Rentschler, Marden, 1925
Tin	−183 to +16	22 57	Gruneisen, 1910
	18-100	26 92	"
Topaz, axis a	0-100	8 32	Pfaff
" b	0-100	8.36	"
" c	0-100	4.72	"
Tourmaline			
parallel to axis	0-100	9 37	"
perpendicular to axis	0-100	7.73	"
Tungsten 99.978%	−100-0	4 2	Hidnert & Sweeney, 1925
	0-100	4.3	" "
	0-300	4 5	" "
	0-500	4 6	" "
filament	1000-2000	6 1	Worthen, 1916
Type metal	17-254	19 52	Daniell
Vulcanite	0-18	63 60	Mayer
Wood			
parallel to fiber			
ash	0-100	9 51	Glatzel
beech	2-34	2 57	Villari
chestnut	2-34	6 49	"
elm	2-34	5 65	"
mahogany	2-34	3 61	"
maple	2-34	6 38	"
oak	2-34	4 92	"
pine	2-34	5 41	"
walnut	2-34	6 58	"
across fiber			
beech	2-34	61 4	"
chestnut	2-34	32 5	"
elm	2-34	44 3	"
mahogany	2-34	40 4	"
maple	2-34	48 4	"
oak	2-34	54 4	"
pine	2-34	34 1	"
walnut	2-34	48 4	"
Zinc	− 180 to 0	26 4	Dorsey, 1908
	10-100	26 28	Thiesen, 1895
Alundum, Al_2O_3	25-900	8 7	Boeck, 1912
Bauxite brick	25-100	4 4	Wilkes
Caoutchouc	16 7-25 3	77 0	Kohlrausch
Carborundum, SiC	25-100	6 58	Boeck, 1912
	100-900° C.	4 74	
Corundum	..	6 76	Pfaff
Fire clay brick	25-100	8 1±3	
Flint, SiO_2	15-1000	17 4	Houldsworth & Cobb, 1924
Limestone, Oolitic, (Ind)	25-100	9	Souder & Hidnert, 1919
Magnesium oxide	25-100	9 7- 11 4	
Rubber, "Red Antimony" tubing	10-100	111	Napier & Prettyman, 1932

THERMAL EXPANSION OF GLASSES

The following table gives the mean coefficient of linear expansion for various types of glass as determined by Peters and Cragoe of the Bureau of Standards. 1920.

Glass sample	Temp. interval	Coefficient	Temp. interval	Coefficient
		$\times 10^{-4}$		$\times 10^{-4}$
1 Barium flint	22–494	0.088	519–550	0.331
4 Plate, American	20–508	.108	540–560	.401
6 German	21–496	.099	564–589	.477
7 French	21–513	.094	597–613	.424
8 Light crown	24–422	.104	494–507	.548
10 Borosilicate crown	22–498	090	539–562	.393
11 Barium crown	23–499	.090	589–610	.649
12 Medium flint	23–402	.097	452–478	.396
13 Light flint	22–451	.088	494–512	.347
16 Commercial glass	23–445	.107	510–534	.309
20 McBeth-Evans flask	22–449	.069	567–586	.454
21 Pyrex	21–471	036	552–571	.151
22 Schott-Genossen flask	19–414	.056	540–562	.404
23 Soda tubing	21–372	.120	506–525	.234
24 Lead tubing	21–338	.091	464–483	.236
26 Fluorite tubing	22–364	.098	510–551	284
29 Fusing in glass, German	23–383	090	456–481	.283
30 Fusing in glass, Corning	22–376	083	460–485	258
Chemical glassware*				
Glasbake	20–300	.037		
Kimble	20–300	.049		
Pyrex	20–300	.033		
Vycor	20–300	.008		

More complete data, including the composition of the samples named above, will be found in Scientific Paper No. 393, Bureau of Standards.

* Wichers, Finn, Clabaugh, Jour. Res. N.B.S. 26, 539, 1941.

EQUATION FOR THE LINEAR EXPANSION OF SOLIDS

If l_0 is the length at 0° C the length at t° C is $l_t = l_0\ (1 + \alpha t + \beta t^2)$.
The table gives the values of these coefficients.

Substance	Temp limits °C	α	β	Observer
Aluminum	10–90	$.2221 \times 10^{-4}$	114×10^{-7}	Fizeau
Brass	10–90	1781	.098	Fizeau
Copper	10–90	1596	102	Fizeau
Gold	10–90	1410	042	Fizeau
Iron, pure	0–38	1145	.071	Guillaume
Lead	10–90	2829	.120	Fizeau
Nickel	0–38	1255	057	Guillaume
Platinum	0–1000	0868	.013	Holborn and Valentine
Silver	10–90	1862	.074	Fizeau
Tin	10–90	.2094	.175	Fizeau
Zinc	10–90	2969	− 0635	Fizeau

CUBICAL EXPANSION OF SOLIDS

The coefficient of cubical expansion for a solid is approximately three times the linear coefficient.

The experimental values for various solids are given in the following table. The coefficient is the increase in volume per unit volume per degree Centigrade.

Substance	Temp °C	Coefficient	Observer
Antimony	0–100	0.3167×10^{-4}	Matthiessen
Asphalt	...	5–7	...
Beryl	0–100	0.3167	Pfaff
Bismuth	...	0.4000	Kopp
Diamond	40	0.0354	Fizeau
Emerald	40	0.0168	Fizeau
Fiber, vulcanized	...	0.27	...
Fluor spar	14–47	0.6235	Kopp
Galena	0–100	0.558	Pfaff
Glass, white tube	0–100	0.2648	Regnault
green tube	0–100	0.2299	Regnault
Jena	0–100	0.2533	Reichsanstalt
Ice	−20 to −1	1.1250	Brunner
Iceland spar	50–60	0.1447	Pulfrich
Iron	0–100	0.3550	Dulong and Petit
Marble	...	0.3–0.6	...
Paraffin	20	5.88	Russner
Platinum	0–100	0.265	...
Porcelain	0–100	0.1080	Deville and Troost
Quartz	50–60	0.3530	Pulfrich
Rock salt	50–60	1.2120	Pulfrich
Silver	0–100	0.5831	Matthiessen
Slate	...	0.15–0.3	...
Sulfur	13.2–50.3	2.23	Kopp
Tar	...	6–8	...
Tin	0–100	0.6889	Matthiessen
Zinc	0–100	0.8928	Matthiessen

CUBICAL EXPANSION OF LIQUIDS

(From Smithsonian Tables)

The table gives the values of the coefficients α, β and γ in the equation $V_t = V_o(1 + \alpha t + \beta t^2 + \gamma t^3)$ and also the true coefficient at 20°C.

Liquid	Temp. Range °C	$\alpha \times 10^3$	$\beta \times 10^6$	$\gamma \times 10^8$	True coeff. at 20°C $\times 10^3$
Acetic acid	16–107	1 0630	0 12636	1 0876	1 071
Acetone	0–54	1 3240	3 8090	−0 87983	1 487
Alcohol:					
Amyl	−15–80	0 9001	0 6573	1 18458	0 902
Ethyl, 30% by vol	18–39	0 2928	10 790	−11 87	.
" 50% "	0–39	0 7450	1 85	0 730	.
" 99 3% "	27–46	1 012	2 20		1 12
" 500 atmos. press	0–40	0 866			.
" 3000 " "	0–40	0 524			.
Methyl	0–61	1 1342	1 3635	0 8741	1 199
Benzene	11–81	1 17626	1 27776	0 80648	1 237
Bromine	0–59	1 06218	1 87714	−0 30854	1 132
Calcium chloride:					
5 8% solution	18–25	0 07878	4 2742		0 250
40 9% "	17–24	0 42383	0 8571		0 458
Carbon disulphide	−34–60	1 13980	1 37065	1 91225	1 218
500 atmos. pressure	0–50	0 940			
3000 " "	0–50	0 581			
Carbon tetrachloride	0–76	1 18384	0 89881	1 35135	1 236
Chloroform	0–63	1 10715	4 66473	−1 74328	1 273
Ether	−15–38	1 51324	2 35918	4 00512	1 656
Glycerine		0 4853	0 4895		0 505
Hydrochloric acid:					
33 2% solution	0–33	0 4460	0 215		0 455
Mercury	0–100	0 18182	0 0078		0 18186
Olive oil		0 6821	1 1405	−0 539	0 721
Pentane	0–33	1 4646	3 09319	1 6084	1 608
Potassium chloride:					
24 3% solution	16–25	0 2695	2 080		0 353
Phenol	36–157	0 8340	0 10732	0 4446	1 090
Petroleum:					
Density 0.8467	24 120	0 8994	1 396		0 955
Sodium chloride:					
20 6% solution	0 29	0 3640	1 237		0 414
Sodium sulphate:					
24% solution	11 40	0 3599	1 258		0 410
Sulphuric acid:					
10 9% solution	0–30	0 2835	2 580		0 387
100 0%	0–30	0 5758	−0 432		0 558
Turpentine	−9–106	0 9003	1 9595	−0 44998	0 973
Water	0–33	−0 06427	8 5053	−6 7900	0 207

COEFFICIENTS OF EXPANSION OF GASES AT CONSTANT PRESSURE

Change in volume per unit volume per degree Centigrade.

(From Smithsonian Tables.)

Gas.	Temp. ° C.	Pressure in cm. of mercury.	Coefficient.	Observer.
Acetylene	0	76.	.003772	Leduc, 1912
Acetylene	0–100	76.	3739	Leduc, 1912
Air	0–100	76.	3670	Regnault, 1842
Air	0–100	100.1	36728	Chappuis, 1903
Ammonia	0	76.	3860	Leduc, 1912
Ammonia	0–100	76.	3800	Leduc, 1912
Carbon dioxide	0	76.	3751	Leduc, 1912
Carbon dioxide	0–100	76.	3723	Leduc, 1912
Carbon dioxide	0–20	51.8	37128	Chappuis, 1903
Carbon dioxide	0–40	51.8	37100	Chappuis, 1903
Carbon dioxide	0–100	51.8	37073	Chappuis, 1903
Carbon dioxide	0–20	99.8	37602	Chappuis, 1903
Carbon dioxide	0–100	99.8	37410	Chappuis, 1903
Carbon dioxide	0–20	137.7	37972	Chappuis, 1903
Carbon dioxide	0–100	137.7	37703	Chappuis, 1903
Carbon dioxide	0–7.5	2621.	1097	Baly-Ramsay, 1894
Carbon dioxide	64–100	2621.	6574	Baly-Ramsay, 1894
Carbon monoxide	0–100	76.	3669	Regnault, 1842
Chlorine	0	76.	3900	Leduc, 1912
Chlorine	0–100	76.	3830	Leduc, 1912
Cyanogen	0	76.	396	Leduc, 1912
Cyanogen	0–100	76.	387	Leduc, 1912
Hydrochloric acid	0	76.	3770	Leduc, 1912
Hydrochloric acid	0–100	76.	3734	Leduc, 1912
Hydrogen	0–100	100.0	36600	Chappuis, 1903
Hydrogen	0–100	200. atm	332	Amagat, 1890
Hydrogen	0–100	400. atm	295	Amagat, 1890
Hydrogen	0–100	600. atm	261	Amagat, 1890
Hydrogen	0–100	800. atm	242	Amagat, 1890
Nitrogen	0	76.	3673	Leduc, 1912
Nitrogen	0–100	76.	3671	Leduc, 1912
Nitrous oxide	0–100	76.	3719	Regnault, 1842
Oxygen	0–100	100. atm	486	Amagat
Oxygen	0–100	200. atm	534	Amagat
Oxygen	0–100	400. atm	459	Amagat
Oxygen	0–100	600. atm	357	Amagat
Oxygen	0–100	800. atm	288	Amagat
Oxygen	0–100	1000. atm	241	Amagat
Sulphur dioxide	0–100	76.	3903	Regnault, 1842
Sulphur dioxide	....	98.	3980	Regnault, 1842
Water vapor	0–119	76.	4187	Hirn, 1862
Water vapor	0–141	76.	4189	Hirn, 1862
Water vapor	0–162	76.	4071	Hirn, 1862
Water vapor	0–200	76.	3938	Hirn, 1862
Water vapor	0–247	76.	3799	Hirn, 1862

COEFFICIENT OF EXPANSION OF GASES AT CONSTANT VOLUME

Change in pressure per unit pressure per degree Centigrade.

(From Smithsonian Tables.)

Gas.	Temp. ° C.	Pressure cm. of Hg.	Coefficient.	Observer.
Acetylene	0	76	.003741	Leduc, 1912
Acetylene	0–100	76.	3726	Leduc, 1912
Air	..	.6	37666	Meleander, 1890–92
Air		1.3	37127	Meleander, 1890–92
Air		10.0	36630	Meleander, 1890–92
Air		25.4	36580	Meleander, 1890–92
Air		75.2	36660	Meleander, 1890–92
Air	0–100	100.1	36744	Chappuis, 1903
Air		76.0	36650	Regnault, 1842
Air	..	200.0	36903	Regnault, 1842
Air	..	2000	38866	Regnault, 1842
Air		10000.	4100	Regnault, 1842
Ammonia	0	76	3800	Leduc, 1912
Ammonia	0–100	76	3770	Leduc, 1912
Argon		51.7	3668	Keunen-Randall, 1896
Carbon dioxide	0–20	51.8	36985	Chappius, 1903
Carbon dioxide	0–40	51.8	36972	Chappuis, 1903
Carbon dioxide	0–100	51.8	36981	Chappuis, 1903
Carbon dioxide	0–20	99.8	37335	Chappuis, 1903
Carbon dioxide	0–100	99.8	37262	Chappuis, 1903
Carbon dioxide	0–100	100.0	37248	Chappuis, 1892
Carbon dioxide	0	76	3724	Leduc, 1912
Carbon dioxide	0–100	76	3714	Leduc, 1912
Carbon monoxide	....	76	36667	Regnault, 1842
Cyanogen	0	76	3870	Leduc, 1912
Cyanogen	0–100	76	3830	Leduc, 1912
Ethane	0	76	3780	Leduc, 1912
Ethane	0–100	76	3750	Leduc, 1912
Helium		56.7	3665	Keunen-Randall, 1896
Hydrochloric acid		76	3740	Leduc, 1912
Hydrochloric acid	0–100	76	3721	Leduc, 1912
Hydrogen	0	76	3663	Leduc, 1912
Hydrogen	0–100	76.	3664	Leduc, 1912
Hydrogen	16–132	.0077	3328	Baly-Ramsay, 1894
Hydrogen	15–132	.025	3623	Baly-Ramsay, 1894
Hydrogen	12–105	.47	3656	Baly-Ramsay, 1894
Hydrogen	0–100	100.0	36626	Chappuis, 1903
Methane	0	76	3680	Leduc, 1912
Methane	0–100	76	3678	Leduc, 1912
Nitrogen	0	76	3672	Leduc, 1912
Nitrogen	0–100	76.	3672	Leduc, 1912
Nitrogen	13–132	.06	3021	Baly-Ramsay, 1894
Nitrogen	9–133	.53	3290	Baly-Ramsay, 1894
Nitrogen	0–20	100.2	36754	Chappuis, 1903
Nitrogen	0–100	100.2	36744	Chappuis, 1903
Oxygen	0	76	3673	Leduc, 1912
Oxygen	0–100	76.	3672	Leduc, 1912
Oxygen	11–132	.007	4161	Baly-Ramsay, 1894
Oxygen	9–132	.25	3984	Baly-Ramsay, 1894
Oxygen	11–132	.51	3831	Baly-Ramsay, 1894
Oxygen	..	1.9	36683	Meleander, 1891
Oxygen	.	18.5	36690	Meleander, 1891
Nitrous oxide	..	76	3676	Regnault, 1842
Sulphur dioxide, SO_2	..	76	3845	Regnault, 1842

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS

Factors and their logarithms for reducing a gas volume to normal conditions, 0° C., 760 mm pressure.

The volume of *dry* gas measured at any temperature 10–35° C. inclusive and pressure 690–784 mm of Hg may be reduced to the volume at 0° C. (273.18° K.) and 760 mm of Hg pressure by multiplying by the factor found in the table.

In case the volume of gas is measured in the presence of water vapor the pressure of the aqueous vapor must be subtracted from the value of the total or barometric pressure before entering the table. In the case of atmospheric air the vapor pressure may be found by determining the dew point or temperature of saturation. The pressure of water vapor may then be read from the small table below. If gas volumes are measured over water, the vapor pressure will be that of saturated aqueous vapor at the temperature used. A table giving the pressure of saturated aqueous vapor over water is given below.

Pressure of Saturated Water Vapor

°C.	mm	°C	mm	°C.	mm
9	8 6	18	15 5	27	26 7
10	9 2	19	16 5	28	28 3
11	9 8	20	17 5	29	30 0
12	10 5	21	18 7	30	31 8
13	11 2	22	19 8	31	33 7
14	12 0	23	21 1	32	35 7
15	12 8	24	22 4	33	37 7
16	13 6	25	23 8	34	39 9
17	14 5	26	25 2	35	42 2

Factors and Logarithms

T°C.	690		692		694		696		697		698	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	8758	9424	8783	9437	8809	9449	8834	.9462	8847	9468	8860	9474
11	8727	9409	.8752	.9421	8778	9434	8803	.9446	8816	.9453	8828	9459
12	8696	9393	8722	.9406	8747	9419	8772	.9431	8785	9437	8797	9443
13	8666	.9378	8691	9391	8716	.9403	8741	9416	8754	9422	8767	.9428
14	8636	.9363	8661	9376	8686	9388	8711	.9401	8723	9407	8736	.9413
15	.8606	.9348	8631	9361	8656	9373	8681	.9386	8693	9392	8706	.9398
16	8576	9333	8601	.9345	8626	9358	8651	9370	8663	9377	8675	9383
17	8546	.9318	8571	9330	8596	9343	8621	.9355	8633	.9362	8646	.9368
18	.8517	.9303	.8542	.9315	8566	.9328	8591	.9341	8603	9347	8616	9353
19	.8488	9288	8512	.9301	8537	.9313	8562	.9326	8574	.9332	8586	.9338
20	.8459	.9273	.8483	.9286	8508	9298	8532	.9311	8545	9317	8557	.9323
21	8430	.9258	.8455	.9271	8479	9283	8503	.9296	8516	9302	8528	9308
22	8402	9244	8426	.9256	8450	9269	8475	.9281	8487	9287	8499	9294
23	8373	.9229	8397	9241	8422	9254	8446	9266	8458	9273	8470	9279
24	8345	.9214	8369	.9227	8393	9239	8417	.9252	8430	.9258	8442	9264
25	8317	.9200	8341	.9212	8365	.9225	8389	9237	8401	.9243	8413	.9250
26	8289	.9185	8313	.9198	8337	.9210	8361	.9223	8373	.9229	8385	9235
27	8261	.9171	.8285	.9183	8309	.9196	8333	.9208	8345	.9214	8357	9221
28	8234	9156	8258	.9169	8282	.9181	8306	.9194	8318	.9200	8329	.9206
29	.8207	9142	.8230	.9154	.8254	.9167	.8278	.9179	8290	.9186	8302	.9192
30	8180	.9127	8203	.9140	8227	.9152	8251	.9165	8263	9171	8274	9177
31	.8153	.9113	8176	.9126	8200	9138	8224	.9151	8235	9157	.8247	9163
32	.8126	9099	.8149	.9111	8173	9124	8197	.9136	8208	.9143	8220	.9149
33	.8099	.9085	.8123	.9097	8146	9110	8170	9122	8182	.9128	8193	9135
34	8073	.9070	8096	9083	8120	9095	8143	9108	8155	.9114	8167	.9120
35	.8047	.9056	8070	.9069	.8093	9081	8117	9094	8128	9100	.8140	9106

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	699 Value	699 Log	700 Value	700 Log	701 Value	701 Log	702 Value	702 Log	703 Value	703 Log	704 Value	704 Log
10	.8872	.9480	.8885	.9487	.8898	.9493	.8910	.9499	8923	.9505	.8936	.9511
11	8841	.9465	.8854	9471	.8866	.9477	.8879	.9484	.8892	.9490	8904	.9496
12	.8810	.9450	.8823	.9456	.8835	.9462	.8848	.9468	8860	.9474	8873	9481
13	.8779	.9434	.8792	.9441	.8804	.9447	.8817	.9453	8829	.9459	8842	9465
14	8748	.9419	.8761	.9426	.8774	.9432	.8786	.9438	8799	.9444	8811	.9450
15	8718	.9404	.8731	.9410	.8743	.9417	8756	.9423	.8768	.9429	.8780	.9435
16	.8688	.9389	.8700	.9395	.8713	.9402	8725	.9408	.8738	.9414	.8750	.9420
17	8658	.9374	8670	.9380	.8683	.9387	.8695	.9393	.8707	.9399	.8720	.9405
18	8628	.9359	8641	.9365	.8653	.9372	8665	.9378	8678	.9384	.8690	.9390
19	8599	.9344	.8611	.9350	.8623	.9357	.8636	.9363	8648	.9369	.8660	.9375
20	.8569	.9329	.8582	.9336	.8594	.9342	.8606	.9348	.8618	.9354	8631	.9360
21	8540	.9315	.8552	.9321	.8565	.9327	.8577	.9333	.8589	.9339	.8601	.9346
22	8511	.9300	8523	.9306	.8535	.9312	8548	.9318	8560	.9325	.8572	.9331
23	.8482	.9285	8494	.9291	.8507	.9298	.8519	.9304	.8531	.9310	8543	.9316
24	.8454	.9271	.8466	.9277	8478	.9283	8490	.9289	.8502	.9295	8514	.9301
25	8425	.9256	.8437	.9262	8449	9268	8462	.9275	8474	.9281	.8486	.9287
26	8397	.9241	.8409	.9248	.8421	.9254	.8433	.9260	8445	.9266	8457	.9272
27	8369	.9227	8381	.9233	.8393	9239	.8405	.9245	8417	.9252	.8429	.9258
28	.8341	.9212	.8353	.9219	8365	.9225	.8377	.9231	8389	.9237	.8401	.9243
29	.8314	.9198	8326	.9204	.8338	.9210	8349	.9217	.8361	.9223	.8373	.9229
30	8286	.9184	8298	.9190	8310	.9196	8322	.9202	8334	.9208	8346	.9215
31	8259	9169	.8271	.9175	8283	9182	8294	.9188	8306	.9194	.8318	9200
32	8232	.9155	8244	.9161	8255	.9167	8267	9174	8279	.9180	8291	9186
33	.8205	.9141	8217	.9147	8228	9153	8240	.9159	8252	9165	8264	.9172
34	8178	9127	8190	.9133	.8202	.9139	8213	.9145	8225	9151	8237	.9158
35	8152	9112	8163	.9119	8175	9125	8187	.9131	8198	9137	.8210	9143

T°C.	705 Value	705 Log	706 Value	706 Log	707 Value	707 Log	708 Value	708 Log	709 Value	709 Log	710 Value	710 Log
10	8948	9517	8961	9524	8974	9530	8986	.9536	8999	.9542	9012	.9548
11	8917	.9502	.8929	.9508	8942	9514	8955	.9521	8967	9527	8980	9533
12	8886	9487	8898	.9493	8911	9499	8923	.9505	.8936	.9511	8949	.9518
13	.8854	9472	8867	9478	8880	9484	8892	.9490	8905	.9496	8917	.9502
14	8824	.9456	8836	9463	8849	9469	8861	.9475	8874	.9481	.8886	.9487
15	8793	.9441	8805	9447	8818	9454	8830	.9460	8843	.9466	.8855	.9472
16	8762	.9426	8775	.9432	8787	9439	.8800	.9445	8812	.9451	.8825	.9457
17	8732	.9411	8745	.9417	8757	9424	8769	9430	8782	.9436	8794	.9442
18	8702	.9396	8715	.9402	8727	.9409	8739	9415	.8752	9421	.8764	.9427
19	8672	9381	8685	.9388	8697	.9394	8709	9400	.8722	9406	.8734	.9412
20	8643	9367	.8655	.9373	8667	.9379	8680	.9385	.8692	.9391	.8704	.9397
21	8613	.9352	8626	.9358	.8638	.9364	8650	9370	.8662	.9376	8674	.9382
22	8584	9337	8596	.9343	8609	.9349	8621	.9355	.8633	.9362	8645	.9368
23	8555	.9322	8567	.9328	8579	.9335	8592	.9341	8604	.9347	.8616	.9353
24	8526	.9308	8538	.9314	8551	9320	8563	.9326	8575	9332	8587	.9338
25	8498	9293	8510	.9299	8522	.9305	8534	.9311	8546	9318	.8558	.9324
26	8469	.9278	8481	.9285	8493	.9291	8505	.9297	8517	.9303	8529	.9309
27	8441	.9264	8453	.9270	8465	.9276	8477	.9282	8489	.9289	8501	.9295
28	8413	.9249	8425	.9256	8437	.9262	8449	.9268	8461	9274	8473	.9280
29	8385	.9235	8397	.9241	.8409	.9247	8421	.9254	8433	.9260	.8445	.9266
30	8357	.9221	8369	.9227	8381	.9233	8393	9239	8405	.9245	.8417	9251
31	8330	.9206	8342	.9213	8354	.9219	8365	9225	8377	.9231	8389	9237
32	8303	.9192	8314	.9198	8326	.9204	8338	.9211	8350	.9217	8361	.9223
33	.8275	.9178	8287	.9184	.8299	.9190	8311	.9196	8322	.9202	8334	.9209
34	8248	.9164	.8260	.9170	8272	.9176	.8284	.9182	8295	.9188	.8307	.9194
35	8222	.9150	8233	.9156	8245	9162	8257	.9168	.8268	9174	8280	.9180

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	711 Value	Log	712 Value	Log	713 Value	Log	714 Value	Log	715 Value	Log	716 Value	Log
10	.9025	.9554	9037	9560	.9050	.9566	9063	.9573	.9075	.9579	.9088	.9585
11	.8993	.9539	.9005	.9545	.9018	.9551	9031	.9557	.9043	.9563	.9056	.9569
12	8961	.9524	8974	.9530	8986	.9536	8999	.9542	.9012	.9548	.9024	.9554
13	8930	9508	8942	.9515	.8955	.9521	8967	.9527	.8980	.9533	8993	.9539
14	8899	.9493	8911	.9499	8924	9505	.8936	.9512	.8949	.9518	8961	.9524
15	8868	.9478	8880	.9484	.8893	.9490	.8905	.9496	8918	.9503	8930	.9509
16	8837	.9463	8849	.9469	8862	.9475	.8874	.9481	8887	9487	8899	.9494
17	8807	.9448	8819	.9454	8831	9460	.8844	9466	8856	.9472	8869	9479
18	8776	.9433	8789	.9439	.8801	.9445	.8813	9451	8826	.9457	8838	.9464
19	8746	.9418	.8759	.9424	.8771	.9430	8783	9436	8795	.9443	8808	.9449
20	8716	.9403	.8729	.9409	.8741	.9416	.8753	9422	.8765	.9428	.8778	.9434
21	.8687	.9389	8699	.9395	8711	.9401	8723	.9407	.8736	.9413	.8748	9419
22	8657	.9374	8669	.9380	8682	.9386	8694	9392	8706	.9398	.8718	9404
23	8628	9359	8640	.9365	8652	9371	8664	9377	8677	.9383	8689	9390
24	.8599	.9344	8611	.9351	.8623	.9357	8635	.9363	8647	.9369	8659	9375
25	8570	.9330	8582	.9336	8594	.9342	8606	.9348	8618	.9354	8630	9360
26	.8541	.9315	8553	.9321	8565	.9327	8577	.9334	8589	.9340	8601	.9346
27	8513	9301	8525	.9307	8537	.9313	8549	.9319	8561	.9325	8573	9331
28	8485	.9286	8497	.9292	8508	.9299	8520	.9305	8532	.9311	8544	.9317
29	8456	.9272	8468	.9278	8480	.9284	8492	.9290	8504	.9296	8516	9302
30	8429	.9258	8440	9264	.8452	.9270	8464	9276	8476	9282	.8488	.9288
31	8401	.9243	8413	.9249	8424	9255	8436	.9261	.8448	9268	8460	.9274
32	8373	.9229	8385	.9235	8397	.9241	8409	.9247	.8420	.9253	8432	9259
33	8346	.9215	8358	.9221	8369	9227	8381	9233	8393	.9239	.8405	.9245
34	8319	.9201	8330	.9207	8342	.9213	8354	9219	8365	.9225	8377	.9231
35	8292	9186	8303	.9193	8315	9199	8327	9205	8338	9211	8350	9217

T°C.	717 Value	Log	718 Value	Log	719 Value	Log	720 Value	Log	721 Value	Log	722 Value	Log
10	9101	9591	9113	9597	9126	9603	9139	9609	9151	9615	9164	.9621
11	9069	9575	9081	.9581	9094	9588	9107	9594	9119	.9600	9132	.9606
12	9037	.9560	9049	.9566	9062	9572	9075	9578	9087	9584	9100	9590
13	9005	.9545	9018	.9551	9030	.9557	9043	9563	9055	.9569	9068	.9575
14	8974	.9530	8986	.9536	8999	9542	9011	9548	9024	9554	9036	9560
15	8943	9515	8955	9521	8968	9527	8980	9533	8992	.9539	9005	.9545
16	8912	9500	8924	9506	8936	9512	8949	9518	8961	9524	8974	9530
17	8881	.9485	8893	9491	8906	9497	8918	9503	8930	9509	8943	9515
18	8850	9470	8863	.9476	8875	9482	8887	9488	8900	9494	8912	9500
19	8820	9455	8832	9461	8845	9467	8857	.9473	8869	9479	8882	9485
20	8790	.9440	8802	9446	8814	9452	8827	9458	8839	.9464	8851	9470
21	8760	.9425	8772	9431	8784	9437	8797	9443	8809	.9449	8821	9455
22	8730	.9410	8742	.9416	8755	9422	8767	9428	8779	9434	8791	9440
23	8701	.9396	8713	.9402	8725	9408	8737	.9414	8749	.9420	8761	.9426
24	8671	.9381	8684	.9387	8696	.9393	8708	.9399	8720	.9405	8732	9411
25	8642	.9366	8654	9372	8666	9378	8679	9384	8691	9390	8703	9397
26	8613	.9352	8625	.9358	8637	9364	8649	9370	8661	.9376	8674	9382
27	8585	.9337	8597	.9343	8609	.9349	8621	.9355	8633	9361	8645	.9367
28	8556	.9323	.8568	.9329	8580	.9335	.8592	9341	8604	9347	8616	9353
29	8528	.9308	8540	.9314	8552	.9320	8564	.9327	8575	.9333	8587	9339
30	8500	.9294	8512	.9300	8523	9306	8535	9312	8547	9318	8559	9324
31	8472	9280	8484	.9286	8495	9292	8507	.9298	8519	.9304	8531	.9310
32	8444	.9265	.8456	.9271	8467	.9278	8479	.9284	8491	.9290	8503	.9296
33	8416	.9251	8428	.9257	8440	.9263	8452	.9269	8463	.9275	8475	9281
34	8389	.9237	.8401	.9243	.8412	.9249	.8424	9255	8436	.9261	8447	9267
35	8362	.9223	8373	9229	.8385	.9235	8397	9241	8408	9247	8420	9253

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	723 Value	723 Log	724 Value	724 Log	725 Value	725 Log	726 Value	726 Log	727 Value	727 Log	728 Value	728 Log
10	9177	.9627	9190	.9633	9202	.9639	9215	.9645	9228	.9651	9240	9657
11	.9144	9612	9157	.9618	9170	.9624	9182	.9630	9195	.9636	.9208	.9642
12	.9112	.9596	9125	.9602	.9138	.9608	9150	.9614	9163	.9620	.9175	.9626
13	.9081	.9581	9093	.9587	9106	9593	.9118	.9599	9131	.9605	.9143	.9611
14	9049	.9566	9061	.9572	9074	.9578	.9086	.9584	9099	.9590	9111	.9596
15	.9017	.9551	9030	9557	9042	.9563	9055	.9569	9067	.9575	.9080	.9581
16	.8986	.9536	8999	9542	9011	9548	9023	.9554	.9036	.9560	9048	.9566
17	8955	9521	8968	.9527	.8980	.9533	.8992	.9539	.9005	.9545	.9017	.9551
18	.8924	9506	8937	.9512	8949	.9518	8961	.9524	.8974	.9530	.8986	.9536
19	8894	.9491	8906	.9497	8918	.9503	8931	.9509	.8943	.9515	.8955	.9521
20	8863	9476	8876	.9482	.8888	.9488	8900	.9494	8913	9500	.8925	.9506
21	8833	9461	8846	.9467	8858	.9473	.8870	.9479	8882	.9485	8894	.9491
22	8803	.9446	8816	.9452	8828	.9458	8840	.9464	8852	9470	8864	.9476
23	8774	9432	8786	9438	8798	.9444	8810	.9450	8822	.9456	8834	.9462
24	8744	.9417	8756	9423	8768	9429	8780	.9435	8792	.9441	8805	.9447
25	8715	9403	8727	.9409	8739	.9415	8751	.9420	8763	9426	8775	.9432
26	8686	.9388	8698	9394	8710	.9400	.8722	.9406	8734	.9412	8746	.9418
27	8657	.9373	8669	9379	8680	.9385	8692	.9391	8704	9397	8716	.9403
28	8628	.9359	8640	.9365	8652	9371	.8664	.9377	8676	9383	8687	.9389
29	8599	.9345	.8611	9351	8623	.9357	.8635	.9363	8647	.9369	8659	9375
30	8571	.9330	8583	9336	8595	9342	.8606	.9348	8618	9354	8630	9360
31	8543	9316	8554	9322	8566	.9328	8578	.9334	8590	.9340	8602	.9346
32	8515	.9302	8526	9308	8538	9314	8550	.9320	.8562	.9326	8573	.9332
33	.8487	9287	8498	9293	8510	.9299	8522	9305	8534	.9311	8545	9317
34	8459	9273	8471	9279	8482	.9285	8494	.9291	8506	9297	8518	.9303
35	8432	9259	8443	9265	8455	9271	8467	.9277	8478	9283	8490	9289

T°C.	729 Value	729 Log	730 Value	730 Log	731 Value	731 Log	732 Value	732 Log	733 Value	733 Log	734 Value	734 Log
10	9253	9663	9266	9669	9278	9675	9291	9681	9304	.9687	9316	9693
11	9220	.9647	9233	.9653	9246	9659	9258	9665	9271	.9671	9284	9677
12	9188	.9632	9201	.9638	9213	9644	9226	9650	9238	.9656	9251	.9662
13	9156	9617	.9168	.9623	9181	9629	9194	9635	9206	.9641	9219	9647
14	9124	.9602	9136	.9608	9149	9614	9162	.9620	9174	.9626	9187	9632
15	9092	.9587	9105	9593	9117	9599	9130	9605	9142	.9610	9155	9616
16	.9061	9572	9073	9578	9086	9584	9098	.9589	9110	.9595	9123	.9601
17	.9030	9557	.9042	9563	9054	.9569	9067	.9574	9079	9580	9091	.9586
18	8998	9542	9011	9548	9023	9554	9036	9560	9048	9565	9060	.9571
19	8968	9527	8980	9533	8992	.9539	9005	9545	9017	9551	9029	.9556
20	8937	9512	8949	9518	8962	9524	8974	9530	8986	9536	8998	9542
21	8907	9497	8919	9503	8931	9509	8943	9515	8955	.9521	8968	9527
22	8876	9482	8889	9488	8901	9494	8913	9500	8925	.9506	8937	.9512
23	8846	9468	8859	9474	8871	.9480	8883	9486	8895	.9491	8907	.9497
24	8817	9453	8829	9459	8841	9465	8853	9471	8865	.9477	8877	.9483
25	8787	9438	8799	9444	8811	9450	8823	.9456	8835	.9462	8847	.9468
26	8758	9424	8770	9430	8782	9436	8794	9442	8806	9448	8818	9454
27	8728	9409	8740	9415	8752	.9421	8764	9427	8776	9433	8788	9439
28	8699	.9395	8711	9401	8723	.9407	8735	9413	8747	.9419	8759	.9425
29	8671	.9380	8682	.9386	8694	.9392	8706	9398	8718	9404	.8730	.9410
30	8642	9366	8654	9372	8666	.9378	8677	9384	8689	9390	8701	.9396
31	8613	9352	8625	.9358	8637	9364	8649	9370	8661	9376	8673	.9381
32	8585	9338	8597	9343	8609	9349	8621	9355	8632	9361	8644	.9367
33	8557	9323	8569	9329	8581	.9335	8592	.9341	8604	9347	8616	.9353
34	8529	9309	8541	9315	8553	.9321	8564	.9327	8576	9333	8588	.9339
35	8502	9295	8513	9301	8525	.9307	.8537	9313	8548	9319	8560	.9325

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	735		736		737		738		739		740	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	9329	.9698	9342	9704	9355	.9710	9367	.9716	9380	9722	9393	9728
11	9296	9683	9309	9689	9322	.9695	9334	.9701	9347	9707	9360	9713
12	9264	.9668	9276	9674	9289	.9680	9301	.9686	9314	9691	9327	9697
13	9231	9653	9244	9659	9256	9664	9269	.9670	9281	9676	9294	.9682
14	9199	9637	9212	.9643	9224	.9649	9237	9655	9249	9661	9262	9667
15	9167	9622	9180	.9628	9192	9634	9205	9640	9217	9646	9229	9652
16	9135	9607	9148	9613	9160	.9619	9173	9625	9185	9631	9198	9637
17	9104	9592	9116	.9598	9129	9604	9141	9610	9153	9616	9166	9622
18	9073	9577	9085	9583	9097	9589	9110	9595	9122	9601	9134	9607
19	9041	9562	9054	9568	9066	9574	9078	9580	9091	9586	9103	9592
20	9011	.9548	.9023	9553	9035	.9559	9047	9565	9060	9571	9072	.9577
21	8980	9533	8992	9539	9004	9545	9017	9550	9029	.9556	9041	9562
22	8949	.9518	8962	.9524	8974	9530	8986	9536	8998	.9542	9010	9547
23	8919	.9503	8931	.9509	8943	9515	8956	9521	8968	9527	8980	9533
24	8889	.9489	8901	9495	8913	9500	8925	9506	8938	9512	8950	9518
25	8859	9474	8871	9480	8883	9486	8895	9492	8908	9498	8920	9503
26	8830	9459	8842	9465	8854	9471	8866	9477	8878	9483	8890	9489
27	8800	.9445	8812	9451	8824	9457	8836	9463	8848	9469	8860	.9474
28	8771	.9430	8783	9436	8795	9442	8807	9448	8819	9454	8831	9460
29	8742	.9416	8754	9422	8766	.9428	8778	9434	8789	9440	8801	9446
30	8713	9402	8725	9408	8737	9414	8749	9419	8760	.9425	8772	9431
31	8684	9387	8696	9393	8708	9399	8720	9405	8732	9411	8743	9417
32	8656	9373	8668	9379	8679	9385	8691	9391	8703	9397	8715	9403
33	8628	9359	8639	9365	8651	.9371	8663	9377	8675	.9382	8686	9388
34	8599	9345	8611	.9351	8623	9357	8635	9362	8646	9368	8658	9374
35	8572	9331	8583	9336	8595	9342	8607	9348	8618	9354	8630	9360

T°C	741		742		743		744		745		746	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	9405	9734	9418	9740	9431	9745	9443	9751	9456	9757	9469	9763
11	9372	9718	9385	9724	9397	9730	9410	9736	9423	9742	9435	.9748
12	9339	9703	9352	9709	9364	9715	9377	9721	9390	9727	9402	9732
13	9307	9688	9319	9694	9332	9700	9344	.9705	9357	9711	9369	9717
14	9274	9673	9287	9679	9299	9684	9312	9690	9324	9696	9337	9702
15	9242	.9658	9254	.9663	9267	9669	9279	9675	9292	9681	9304	9687
16	9210	9643	9222	9648	9235	9654	9247	9660	9260	9666	9272	9672
17	9178	.9628	9191	9633	9203	9639	9215	9645	9228	.9651	9240	9657
18	9147	9613	9159	9618	9171	9624	9184	9630	9196	9636	9208	9642
19	9115	9598	9128	9604	9140	9609	9152	.9615	9164	9621	9177	9627
20	9084	.9583	9096	9589	9109	9595	9121	9600	9133	9606	9145	9612
21	9053	9568	9065	9574	9078	.9580	9090	.9586	9102	9591	9114	.9597
22	9023	9553	9035	9559	9047	9565	9059	9571	9071	9577	9083	9582
23	8992	9539	9004	9544	9016	9550	9028	9556	9041	9562	9053	9568
24	8962	9524	8974	9530	8986	9536	8998	9541	9010	9547	9022	9553
25	8932	9509	8944	.9515	8956	9521	8968	9527	8980	9533	8992	.9539
26	8902	9495	8914	9501	8926	9506	8938	9512	8950	9518	8962	.9524
27	8872	9480	8884	9486	8896	.9492	8908	9498	8920	9504	8932	.9509
28	8843	9466	8855	9472	8866	9477	8878	.9483	8890	9489	8902	.9495
29	8813	9451	8825	9457	8837	.9463	8849	9469	8861	9475	8873	.9481
30	8784	9437	8796	9443	8808	.9449	8820	9455	8832	9460	8843	9466
31	8755	9423	8767	9429	8779	9434	8791	9440	8803	9446	8814	.9452
32	8727	9408	8738	9414	8750	9420	8762	9426	8774	9432	8785	9438
33	8698	9394	8710	9400	8721	.9406	8733	.9412	8745	9418	8757	9423
34	8670	9380	8681	9386	8693	9392	8705	9398	8716	9403	8728	9409
35	8642	9366	8653	9372	8665	9378	8676	9383	8688	9389	8700	9395

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	747 Value	747 Log	748 Value	748 Log	749 Value	749 Log	750 Value	750 Log	751 Value	751 Log	752 Value	752 Log
10	9481	9769	9494	9775	9507	9780	9520	.9786	9532	.9792	9545	.9798
11	9448	.9753	9461	9759	9473	.9765	.9486	.9771	9499	.9777	9511	.9782
12	9415	9738	9427	9744	9440	.9750	9453	.9756	9465	9761	9478	.9767
13	9382	9723	9395	.9729	9407	.9735	9420	.9740	.9432	.9746	9445	9752
14	9349	9708	9362	9714	9374	.9719	9387	.9725	.9399	.9731	9412	9737
15	9317	9693	9329	9698	9342	.9704	9354	.9710	9367	.9716	9379	.9722
16	9285	.9678	9297	9683	9309	9689	9322	.9695	9334	.9701	9347	.9707
17	9252	.9663	9265	9668	9277	9674	9290	.9680	9302	.9686	9314	.9692
18	9221	9648	9233	9653	9245	9659	9258	.9665	9270	.9671	9282	.9677
19	9189	9633	9201	9639	9214	9644	9226	.9650	9238	9656	9251	.9662
20	9158	9618	9170	9624	9182	.9629	9194	.9635	9207	.9641	9219	9647
21	9127	.9603	9139	9609	9151	.9615	9163	.9620	9175	.9626	9188	.9632
22	9096	.9588	9108	9594	9120	.9600	9132	.9606	9144	.9611	9156	.9617
23	9065	.9574	9077	9579	9089	.9585	9101	9591	9113	.9597	9126	.9603
24	9034	9559	9046	9565	9058	.9571	9071	9576	9083	9582	9095	9588
25	9004	.9544	9016	.9550	9028	.9556	9040	9562	9052	.9568	9064	.9573
26	8974	9530	8986	.9536	8998	.9541	9010	9547	9022	.9553	9034	.9559
27	8944	.9515	8956	.9521	8968	9527	8980	9533	8992	.9538	9004	.9544
28	8914	9501	8926	9507	8938	9512	8950	9518	8962	.9524	8974	9530
29	8885	9486	8897	9492	8908	9498	8920	9504	8932	.9510	8944	.9515
30	8855	9472	8867	9478	8879	9484	8891	.9489	8903	9495	8915	9501
31	8826	.9458	8838	9464	8850	.9469	.8862	.9475	8873	.9481	8885	.9487
32	8797	.9443	8809	9449	8821	9455	8833	.9461	8844	.9467	8856	.9472
33	8768	9429	8780	9435	8792	9441	8804	.9447	8815	.9452	8827	9458
34	8740	.9415	8752	9421	8763	9427	8775	.9432	8787	.9438	8798	.9444
35	8711	9401	8723	9407	8735	9413	8746	9418	8758	9424	8770	.9430

T°C.	753 Value	753 Log	754 Value	754 Log	755 Value	755 Log	756 Value	756 Log	757 Value	757 Log	758 Value	758 Log
10	9558	9803	9570	9809	9583	9815	9596	9821	9608	.9827	9621	9832
11	9524	9788	9537	9794	9549	9800	9562	.9805	9575	.9811	9587	9817
12	9491	9773	9503	9779	9516	.9784	9528	9790	9541	.9796	9554	9802
13	9457	9758	9470	9763	9482	9769	9495	.9775	9508	.9781	9520	.9786
14	9424	9743	9437	9748	9449	9754	9462	.9760	9474	9766	9487	9771
15	9392	9727	9404	9733	9417	9739	9429	9745	9441	9750	9454	9756
16	9359	9712	9372	9718	9384	9724	9396	9730	9409	9735	9421	9741
17	9327	.9697	9339	9703	9352	9709	9364	9715	9376	.9720	9389	.9726
18	9295	9682	9307	9688	9319	9694	9332	9700	9344	9705	9356	.9711
19	9263	.9667	9275	9673	9287	.9679	9300	9685	9312	9690	9324	9696
20	9231	9653	9244	9658	9256	.9664	9268	9670	9280	9676	9293	9681
21	9200	9638	9212	9644	9224	.9649	9236	9655	9249	.9661	9261	9667
22	9167	9623	9181	9629	9193	.9635	9205	9640	9217	.9646	9230	9652
23	9138	9608	9150	.9614	9162	9620	9174	.9626	9186	9631	9198	.9637
24	9107	9594	9119	9599	9131	9605	9143	.9611	9155	.9617	9167	.9622
25	9076	9579	9088	9585	9100	.9591	9112	9596	9124	9602	9137	9608
26	9046	.9565	9058	9570	9070	.9576	9082	9582	9094	.9588	9106	.9593
27	9016	.9550	9028	9556	9040	.9562	9052	9567	9064	.9573	9076	9579
28	8986	9536	8998	.9541	9010	9547	9022	9553	9034	.9559	9045	.9564
29	8956	9521	8968	9527	8980	.9533	8992	9538	9004	.9544	9015	9550
30	8926	.9507	8938	.9513	8950	9518	8962	9524	8974	.9530	8986	.9536
31	8897	9492	8909	.9498	8921	9504	8933	9510	8944	.9515	8956	9521
32	8868	9478	8880	9484	8891	.9490	8903	9495	8915	.9501	8927	.9507
33	8839	9464	8851	9470	8862	9475	8874	9481	8886	.9487	.8898	9493
34	8810	9450	8822	9456	8833	9461	8845	9467	8857	9473	.8869	9479
35	.8781	9436	8793	9441	8805	9447	8816	9453	8828	9459	8840	9464

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C.	759		760		761		762		763		764	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	9634	9838	9646	.9844	.9659	.9849	9672	.9855	.9685	.9861	9697	9866
11	9600	9823	9612	9828	9625	9834	9638	.9840	9650	.9845	9663	9851
12	9566	.9807	9579	9813	9591	.9819	9604	.9824	9617	.9830	9629	9836
13	9533	9792	9545	9798	9558	.9804	9570	.9809	9583	.9815	9595	9821
14	9499	9777	9512	9783	9524	.9788	.9537	.9794	9549	.9800	9562	9805
15	9466	9762	9479	9768	9491	.9773	9504	.9779	9516	.9785	.9529	9790
16	9434	.9747	9446	.9753	9459	.9758	9471	.9764	9483	.9770	9496	9775
17	9401	.9732	9413	9738	9426	.9743	9438	.9749	9451	.9755	9463	9760
18	9369	9717	9381	.9723	9393	.9728	9406	9734	9418	9740	9431	9745
19	9337	9702	9349	.9708	9361	.9713	9374	.9719	9386	.9725	9398	9730
20	9305	9687	9317	.9693	9329	.9698	.9342	9704	9354	.9710	9366	9716
21	9273	9672	9285	9678	9298	9684	.9310	.9689	9322	.9695	9334	9701
22	9242	9658	9254	.9663	9266	.9669	.9278	.9675	9290	.9680	9303	9686
23	9210	9643	9223	.9649	9235	9654	9247	.9660	9259	.9666	9271	.9671
24	9179	9628	9192	.9634	9204	.9640	.9216	.9645	9228	9651	9240	9657
25	9149	9614	9161	9619	9173	.9625	.9185	.9631	9197	.9636	9209	9642
26	9118	9599	9130	.9605	9142	.9610	9154	.9616	9166	.9622	9178	9628
27	9088	9584	9100	.9590	9112	.9596	.9123	.9602	9135	.9607	9147	9613
28	9057	9570	9069	9576	9081	.9581	9093	9587	9105	9593	9117	9599
29	9027	9556	9039	.9561	.9051	.9567	9063	9573	9075	9578	9087	9584
30	8998	.9541	.9009	.9547	9021	.9553	.9033	9558	9045	9564	9057	9570
31	8968	9527	8980	.9533	8992	9538	9003	9544	9015	9550	9027	9555
32	8939	9513	8950	.9518	8962	.9524	8974	9530	8986	9535	8997	.9541
33	8909	9498	8921	.9504	8933	.9510	8945	9516	8956	9521	8968	9527
34	8880	9484	8892	.9490	8904	.9496	8915	9501	8927	9507	8939	9513
35	8851	.9470	8863	9476	8875	.9482	8886	9487	8898	9493	8910	9499

T°C.	765		766		767		768		769		770	
	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log	Value	Log
10	9710	.9872	9723	9878	9735	9883	9748	9889	9761	9895	9773	9900
11	9676	.9857	9688	9863	9701	9868	9714	9874	9726	9879	9739	9885
12	9642	9842	9654	9847	9667	9853	9680	9859	9692	.9864	9705	9870
13	9608	.9826	9621	9832	9633	9838	9646	9843	9658	9849	9671	9855
14	9575	.9811	9587	9817	9600	.9823	9612	9828	9625	9834	9637	9839
15	9541	.9796	9554	9802	.9566	.9807	9579	9813	9591	.9819	9604	9824
16	9508	.9781	9521	9787	9533	9792	9546	.9798	9558	9804	9570	9809
17	9475	9766	9488	9772	9500	9777	9513	9783	9525	.9789	9537	9794
18	9443	9751	9455	9757	9468	9762	9480	9768	9492	9774	9505	9779
19	9410	9736	9423	9742	9435	9747	9447	.9753	9460	9759	9472	9764
20	9378	9721	9391	.9727	9403	9733	9415	9738	9427	9744	9440	9750
21	9346	.9706	9359	.9712	9371	9718	9383	.9723	9395	9729	9408	9735
22	9315	.9692	9327	9697	9339	.9703	9351	.9709	9363	9714	9376	9720
23	9283	.9677	9295	.9683	9308	.9688	9320	9694	9332	9700	9344	9705
24	9252	.9662	9264	.9668	9276	.9674	9288	.9679	9300	9685	9312	9691
25	9221	.9648	9233	9653	9245	.9659	9257	9665	9269	.9670	9281	9676
26	9190	.9633	9202	9639	9214	9645	9226	.9650	9238	9656	9250	9661
27	.9159	.9619	9171	9624	9183	.9630	9195	9636	9207	9641	9219	9647
28	9129	9604	9141	9610	9153	.9616	9165	9621	9177	9627	9189	9633
29	9099	9590	9111	9595	9123	.9601	9134	9607	9146	9612	9158	9618
30	9069	.9575	9081	9581	9092	9587	9104	9592	9116	9598	9128	9604
31	9039	9561	9051	9567	9062	.9572	9074	9578	9086	9584	9098	9589
32	.9009	9547	9021	.9553	9033	.9558	9045	9564	9056	9570	9068	9575
33	8980	9533	8991	9538	.9003	9544	9015	.9550	9027	.9555	9038	.9561
34	8950	9518	8962	.9524	8974	.9530	8986	9535	8997	9541	9009	9547
35	.8921	.9504	8933	9510	8945	.9516	8956	9521	8968	9527	8980	.9533

REDUCTION OF GAS VOLUME TO NORMAL CONDITIONS (Continued)

T°C	771 Value	771 Log	772 Value	772 Log	773 Value	773 Log	774 Value	774 Log	775 Value	775 Log	776 Value	776 Log
10	.9786	.9906	9799	.9912	.9811	.9917	9824	.9923	.9837	.9929	.9850	.9934
11	9752	9891	9764	.9896	.9777	.9902	9790	.9908	.9802	.9913	9815	.9919
12	.9717	9875	9730	.9881	9743	.9887	9755	.9892	.9768	.9898	.9780	.9904
13	9683	.9860	9696	.9866	9708	.9872	9721	.9877	.9734	.9883	.9746	.9888
14	9650	.9845	9662	.9851	9675	.9856	9687	.9862	.9700	.9868	.9712	.9873
15	9616	.9830	9629	.9836	.9641	.9841	9654	.9847	.9666	.9852	9678	.9858
16	9583	.9815	9595	.9821	.9608	9826	9620	.9832	9633	.9837	9645	.9843
17	9550	9800	9562	9806	9575	.9811	9587	.9817	9599	.9822	.9612	.9828
18	9517	.9785	9529	.9791	.9542	.9796	.9554	.9802	.9566	.9807	.9579	.9813
19	9484	9770	9497	9776	9509	.9781	.9521	.9787	9534	.9793	.9546	.9798
20	9452	.9755	9464	9761	9476	9766	9489	9772	.9501	.9778	.9513	.9783
21	9420	9740	9432	9746	9444	9752	.9456	.9757	.9469	.9763	9481	.9768
22	9388	9726	9400	9731	9412	9737	9424	.9742	9437	9748	9449	9754
23	9356	9711	9368	9717	9380	.9722	9392	9728	9405	.9733	9417	.9739
24	9325	9696	9337	9702	.9349	.9708	9361	9713	9373	9719	9385	.9724
25	9293	9682	9305	.9687	9317	.9693	9329	9699	.9341	9704	9354	.9710
26	9262	9667	9274	9673	9286	9678	.9298	9684	9310	9690	9322	.9695
27	9231	9653	9243	.9658	9255	9664	9267	.9669	9279	.9675	9291	.9681
28	9201	9638	9213	9644	.9224	9649	9236	9655	9248	.9661	9260	.9666
29	9170	9624	.9182	9629	9194	.9635	9206	.9641	.9218	.9646	.9230	.9652
30	9140	9609	9152	9615	9164	.9621	9175	.9626	9187	.9632	9199	.9637
31	9110	9595	9122	.9601	.9133	.9606	9145	9612	9157	.9618	9169	.9623
32	9080	9581	9092	.9586	9103	.9592	.9115	.9598	9127	.9603	.9139	.9609
33	9050	.9567	9062	9572	9074	9578	9085	9583	.9097	.9589	.9109	9595
34	9021	9552	9032	9558	9044	9564	9056	9569	9067	.9575	9079	9580
35	8991	9538	9003	9544	9015	9550	9026	.9555	9038	.9561	.9050	.9566

T°C	777 Value	777 Log	778 Value	778 Log	779 Value	779 Log	780 Value	780 Log	782 Value	782 Log	784 Value	784 Log
10	9862	9940	9875	9945	9888	9951	.9900	.9956	9926	.9968	9951	.9979
11	9827	9924	9840	9930	9853	9936	.9865	.9941	9891	9952	9916	.9963
12	9793	9909	9806	.9915	9818	.9920	9831	.9926	9856	.9937	9881	9948
13	9759	.9894	9771	.9900	9784	.9905	9796	.9911	9822	9922	9847	.9933
14	9725	9879	9737	9884	9750	.9890	9762	9896	9787	.9907	9812	9918
15	9691	9864	9703	9869	9716	9875	9728	9880	9753	.9892	9778	.9903
16	9657	9849	9670	9854	9682	9860	9695	9865	9720	9876	9744	.9888
17	9624	9834	9636	.9839	9649	9845	9661	.9850	9686	.9861	9711	.9873
18	9591	9819	9603	.9824	9616	.9830	.9628	.9835	9653	.9846	9677	.9858
19	9558	9804	9570	.9809	9583	.9815	.9595	.9820	9620	.9832	.9644	9843
20	9525	9789	9538	.9794	9550	.9800	9562	.9806	.9587	.9817	9611	.9828
21	9493	.9774	9505	.9780	9517	.9785	9530	.9791	.9554	.9802	9579	.9813
22	9461	.9759	9473	.9765	.9485	.9770	.9497	.9776	.9522	.9787	9546	.9798
23	9429	.9745	9441	.9750	.9453	.9756	9465	.9761	9490	.9772	9514	.9784
24	9397	9730	9409	.9736	9421	.9741	.9433	.9747	9458	.9758	.9482	.9769
25	9366	.9715	9378	.9721	9390	.9727	9402	.9732	9426	.9743	9450	.9754
26	9334	.9701	9346	.9706	.9358	.9712	9370	.9718	9394	.9729	9418	.9740
27	9303	.9686	9315	.9692	9327	.9697	9339	.9703	9363	.9714	9387	.9725
28	9272	.9672	9284	.9677	9296	.9683	9308	.9689	.9332	.9700	9356	.9711
29	9241	.9657	9253	.9663	9265	.9669	9277	.9674	.9301	.9685	9325	.9696
30	9211	.9643	9223	.9649	9235	.9654	.9247	.9660	9270	.9671	9294	.9682
31	9181	9629	.9192	.9634	9204	.9640	.9216	.9645	9240	.9657	9263	.9668
32	9151	9614	.9162	.9620	9174	.9626	9186	.9631	.9209	.9642	9233	.9653
33	9121	.9600	.9132	.9606	9144	.9611	9156	.9617	9179	.9628	.9203	.9639
34	9091	.9586	.9103	.9592	9114	.9597	9126	.9603	9149	.9614	.9173	.9625
35	9061	.9572	.9073	9578	9085	.9583	.9096	.9589	9120	.9600	.9143	9611

REDUCTION OF GAS VOLUME

VALUES OF (1 + at) FOR TEMPERATURES FROM 0 TO 120° C.

T	0	1	2	3	4	5	6	7	8	9
00	1 0000	1 0037	1 0073	1 0110	1 0147	1 0183	1 0220	1 0257	1 0294	1 0330
10	1 0367	1 0404	1 0440	1 0477	1 0514	1 0550	1 0587	1 0624	1 0661	1 0697
20	1 0734	1 0771	1.0807	1 0844	1 0881	1 0917	1 0954	1 0991	1 1028	1 1064
30	1 1101	1 1138	1.1174	1.1211	1 1248	1 1284	1 1321	1.1358	1 1395	1.1431
40	1 1468	1.1505	1.1541	1 1578	1 1615	1 1651	1 1688	1 1725	1 1762	1 1798
50	1 1835	1.1872	1 1908	1 1945	1 1982	1 2018	1 2055	1 2092	1 2129	1.2165
60	1 2202	1 2239	1 2275	1.2312	1 2349	1 2385	1 2422	1 2459	1 2496	1.2532
70	1.2569	1 2606	1 2642	1.2679	1 2716	1 2752	1.2789	1 2826	1 2863	1.2899
80	1.2936	1.2973	1 3009	1 3046	1 3083	1 3119	1.3156	1 3193	1 3230	1 3266
90	1 3303	1 3340	1.3376	1 3413	1 3450	1 3486	1.3523	1 3560	1 3597	1 3633
100	1 3670	1 3707	1.3743	1 3780	1 3817	1 3853	1 3890	1 3927	1 3964	1 4000
110	1 4037	1 4074	1 4110	1 4147	1 4184	1 4220	1 4257	1 4294	1 4331	1 4367
120	1 4404									

VALUES OF H/760 FOR PRESSURES FROM 700 TO 780 MM OF MERCURY

H	0	1	2	3	4	5	6	7	8	9
700	0 9211	0 9224	0 9237	0 9250	0 9263	0 9276	0 9289	0 9303	0 9316	0 9329
710	0 9342	0 9355	0 9368	0 9382	0 9395	0 9408	0 9421	0 9434	0 9447	0 9461
720	0 9474	0 9487	0 9500	0 9513	0 9526	0 9539	0 9553	0 9566	0.9579	0 9592
730	0 9605	0 9618	0 9632	0 9645	0 9658	0 9671	0 9684	0 9697	0 9711	0.9724
740	0 9737	0 9750	0 9763	0 9776	0 9789	0 9803	0 9816	0 9829	0 9842	0 9855
750	0 9868	0 9882	0 9895	0 9908	0 9921	0 9934	0 9947	0 9961	0 9974	0 9987
760	1.0000	1 0013	1 0026	1 0039	1 0053	1 0066	1 0079	1 0092	1 0105	1.0118
770	1 0132	1 0145	1 0158	1 0171	1 0184	1 0197	1 0211	1 0224	1 0237	1 0250
780	1 0263									

MECHANICAL EQUIVALENT OF HEAT

Observer.	Ergs per calorie (15°)	Observer.	Ergs per calorie (15°).
Joule, 1878........	4.177×10^7	Callendar and Barnes, 1900	4.186×10^7
Rowland, 1879.......	4.188	Dieterici, 1905	4 1879
Griffiths, 1893.......	4.196	Blousfield, 1912.... .	4 1791
Schuster and Gannon, 1898	4.196	Jaeger and Steinwehr, 1921	4.184

ACCEPTED VALUES

1 gram calorie (20°C) = 4.181 joules
1 gram calorie (15°C) = 4.185 joules
1 gram calorie (mean) = 4.186 joules
1 British thermal unit (39°F) = 1060.4 joules
1 British thermal unit (60°F) = 1054.6 joules
1 British thermal unit (mean) = 1054.8 joules

SPECIFIC HEAT OF WATER

Ice

Temp. °C	Specific heat	Observer	Temp °C.	Specific heat	Observer
−252 to −188	.146	Dieterici, 1903	−31.8	.4454	Dickinson-Osborne, 1915
−250	.0361		−23.7	.4599	Dickinson-Osborne, 1915
−200	.162	Mean	−24 5	.4605	Dickinson-Osborne, 1915
−188 to −78	.285	Dieterici, 1903	−20.8	.4668	Dickinson-Osborne, 1915
−180	199	Nernst, 1910	−14 8	.4782	Dickinson-Osborne, 1915
−160	230	Nernst, 1910	−14 6	.4779	Dickinson-Osborne, 1915
−150	246		−11 0	.4861	Dickinson-Osborne, 1915
−140	262	Nernst, 1910	− 8 1	.4896	Dickinson-Osborne, 1915
−100	329	Mean	− 4.3	.4989	Dickinson-Osborne, 1915
− 78 to −18	.463	Dieterici, 1903	− 4 5	.4984	Dickinson-Osborne, 1915
− 60	.392		− 4 9	.4932	Dickinson-Osborne, 1915
− 38 3	.4346	Dickinson-Osborne, 1915	− 2 6	.5003	Dickinson-Osborne, 1915
− 34.3	.4411	Dickinson-Osborne, 1915	− 2 2	.5018	Dickinson-Osborne, 1915
− 30 6	.4488	Dickinson-Osborne, 1915			
		Water Below 0 C			
− 6	1.0119	Martinetti, 1890	− 3	1 0102	Martinetti, 1890
− 5	1 0155	Barnes, 1902	− 2	1 0097	Martinetti, 1890
− 5	1 0113	Martinetti, 1890	− 1	1 0092	Martinetti, 1890
− 4	1.0105	Martinetti, 1890			

Heat Capacity of Air-free Water 0°-100°C at 1 Atmosphere Pressure

The heat capacity of air-free water is given in international steam table calories per gram and in absolute joules per gram. (1 absolute joule—0.238846 I.T. Cal.).

The enthalpy or heat content is given for air-free water in I.T. Cal. per gram and in absolute joules per gram.

From Osborne, Stimson and Ginnings, B of S. Jour. Res **23**. 238, 1939.

Temp. °C	Thermal Capacity		Enthalpy	
	Cal./g/°C	Joules/g/°C	Cal /g	Joules/g
0	1.00738	4.2177	0.0245	0.1026
1	1.00652	4.2141	1.0314	4.3184
2	1.00571	4.2107	2.0376	8.5308
3	1.00499	4.2077	3.0429	12.7400
4	1.00430	4.2048	4.0475	16.9462
5	1.00368	4.2022	5.0515	21.1498
6	1.00313	4.1999	6.0549	25.3508
7	1.00260	4.1977	7.0578	29.5496
8	1.00213	4.1957	8.0602	33.7463
9	1.00170	4.1939	9.0621	37.9410
10	1.00129	4.1922	10.0636	42.1341
11	1.00093	4.1907	11.0647	46.3255
12	1.00060	4.1893	12.0654	50.5155
13	1.00029	4.1880	13.0659	54.7041
14	1.00002	4.1869	14.0660	58.8916

SPECIFIC HEAT OF WATER (Continued)

Heat Capacity of Air-free Water 0°–100°C at 1 Atmosphere Pressure

(Continued)

Temp. °C	Thermal Capacity		Enthalpy	
	Cal./g/°C	Joules/g/°C	Cal./g	Joules/g
15	.99976	4.1858	15.0659	63.0779
16	.99955	4.1849	16.0655	67.2632
17	.99933	4.1840	17.0650	71.4476
18	.99914	4.1832	18.0642	75.6312
19	.99897	4.1825	19.0633	79.8141
20	.99883	4.1819	20.0622	83.9963
21	.99869	4.1813	21.0609	88.1778
22	.99857	4.1808	22.0596	92.3589
23	.99847	4.1804	23.0581	96.5395
24	.99838	4.1800	24.0565	100.7196
25	.99828	4.1796	25.0548	104.8994
26	.99821	4.1793	26.0530	109.0788
27	.99814	4.1790	27.0512	113 2580
28	.99809	4.1788	28.0493	117.4369
29	.99804	4.1786	29.0474	121.6157
30	.99802	4.1785	30.0455	125.7943
31	.99799	4.1784	31.0435	129.9727
32	.99797	4.1783	32.0414	134.1510
33	.99797	4.1783	33.0394	138.3293
34	.99795	4.1782	34.0374	142.5076
35	.99795	4.1782	35.0353	146.6858
36	.99797	4.1783	36.0333	150.8641
37	.99797	4.1783	37.0312	155.0423
38	.99799	4.1784	38.0292	159.2207
39	.99802	4.1785	39.0272	163.3991
40	.99804	4.1786	40.0253	167.5777
41	.99807	4.1787	41.0233	171.7563
42	.99811	4.1789	42.0214	175.9351
43	.99816	4.1791	43.0195	180.1141
44	.99819	4.1792	44.0177	184.2933
45	.99826	4.1795	45.0159	188.4726
46	.99830	4.1797	46.0142	192.6522
47	.99835	4.1799	47.0125	196.8320
48	.99842	4.1802	48.0109	201.0120
49	.99847	4.1804	49.0094	205.1923
50	.99854	4.1807	50.0079	209.3729
51	.99862	4.1810	51.0065	213.5538
52	.99871	4.1814	52.0051	217.7350
53	.99878	4.1817	53.0039	221.9166
54	.99885	4.1820	54.0027	226.0984

SPECIFIC HEAT OF WATER (Continued)

Heat Capacity of Air-free Water 0°–100°C at 1 Atmosphere Pressure (Continued)

Temp. °C	Thermal Capacity		Enthalpy	
	Cal/g/°C	Joules/g/°C	Cal/g	Joules/g
55	.99895	4.1824	55.0016	230.2806
56	.99905	4.1828	56.0006	234.4632
57	.99914	4.1832	56.9997	238.6462
58	.99924	4.1836	57.9989	242.8296
59	.99933	4.1840	58.9982	247.0134
60	.99943	4.1844	59.9975	251.1976
61	.99955	4.1849	60.9970	255.3822
62	.99964	4.1853	61.9966	259.5673
63	.99976	4.1858	62.9963	263.7529
64	.99988	4.1863	63.9962	267.9390
65	1.00000	4.1868	64.9961	272.1256
66	1 00014	4.1874	65.9962	276.3127
67	1 00026	4.1879	66 9964	280.5003
68	1 00041	4.1885	67.9967	284.6885
69	1 00053	4.1890	68 9972	288.8772
70	1 00067	4.1896	69 9977	293.0665
71	1 00081	4.1902	70.9985	297.2564
72	1 00096	4.1908	71.9994	301.4469
73	1 00112	4.1915	73.0004	305.6381
74	1.00127	4.1921	74 0016	309.8299
75	1 00143	4.1928	75.0030	314 0224
76	1.00160	4.1935	76.0045	318.2155
77	1.00177	4.1942	77 0062	322.4094
78	1 00194	4.1949	78 0080	326.6039
79	1.00213	4.1957	79.0101	330.7992
80	1 00229	4 1964	80.0123	334.9952
81	1 00248	4 1972	81.0147	339.1920
82	1 00268	4.1980	82 0172	343.3897
83	1.00287	4 1988	83.0200	347.5881
84	1.00308	4.1997	84 0230	351.7873
85	1 00327	4 2005	85.0262	355.9874
86	1 00349	4.2014	86.0295	360.1883
87	1 00370	4.2023	87.0331	364.3902
88	1.00392	4.2032	88.0369	368.5929
89	1.00416	4.2042	89.0410	372.7966
90	1.00437	4.2051	90 0452	377.0012
91	1.00461	4.2061	91.0497	381.2068
92	1.00485	4 2071	92.0545	385.4135
93	1.00509	4.2081	93.0594	389.6211
94	1.00535	4.2092	94.0647	393.8297

SPECIFIC HEAT OF WATER (Continued)

Heat Capacity of Air-free Water 0°-100°C at 1 Atmosphere Pressure (Continued)

Temp. °C	Thermal Capacity		Enthalpy	
	Cal/g/°C	Joules/g/°C	Cal/g	Joules/g
95	1.00561	4.2103	95.0701	398.0395
96	1.00588	4 2114	96.0759	402.2503
97	1.00614	4.2125	97.0819	406.4622
98	1.00640	4 2136	98 0882	410.6753
99	1.00669	4.2148	99.0947	414.8895
100	1.00697	4.2160	100.1015	419.1049

Enthalpy of Air-saturated Water 1 Atmosphere Pressure 0–100°C

Temp. °C	Enthalpy		Temp.	Enthalpy	
	Cal/g	Joules/g	°C	Cal/g	Joules/g
0	0	0	75	74.9907	313.9712
5	5.0276	21.0496	80	80.0019	334.9519
10	10.0402	42.0363	85	85.0180	355.9532
15	15.0431	62 9826	90	90 0395	376.9773
20	20 0400	83.9034	95	95 0671	398.0270
25	25.0332	104 8089	100	100.1016	419.1053
30	30.0244	125.7063			
35	35.0149	146.6003			
40	40.0055	167.4949			
45	44.9968	188.3928			
50	49.9896	209.2964			
55	54.9842	230 2077			
60	59.9811	251 1289			
65	64.9808	272 0619			
70	69.9839	293 0087			

SPECIFIC HEAT OF WATER (Continued)

Specific Heat of Water Above 100°C

Mean specific heat of water in 15°C calories between 0°C and the temperature stated.

Heat content (Enthalpy) in joules per gram between 0°C and the temperature stated.

From data by Osborne, Stimson and Fiock, B of S Jour. Res. 5, 411, 1930.

Temp. °C	Specific heat mean 0–t°C	Heat content 0–t joules/g	Temp. °C	Specific heat mean 0–t°C	Heat content 0–t joules/g
100	1.0008	418.75	190	1.0153	807.15
110	1.0015	460.97	200	1.0181	852.02
120	1.0025	503.36	210	1.0212	897.35
130	1.0037	545.93	220	1.0247	943.24
140	1.0050	588.71	230	1.0285	989.75
150	1.0067	631.75	240	1.0326	1036.97
160	1.0083	675.06	250	1.0376	1084.97
170	1.0103	718.66	260	1.0423	1133.87
180	1.0127	762.72	270	1.0483	1184.32

Specific Heat of Super-heated Steam

Specific heat of steam under constant pressure given in atmospheres and at temperatures above saturation.

Temp. °C	Pressure in atmospheres						
	1	2	4	6	8	10	12
110	0.481						
120	0.477	0.498					
130	0.475	0.494					
140	0.473	0.489					
150	0.472	0.486	0.519				
160	0.471	0.483	0.512	0.549			
170	0.470	0.481	0.507	0.538			
180	0.469	0.479	0.502	0.528	0.561	0.602	
190	0.469	0.478	0.498	0.522	0.549	0.583	0.625
200	0.469	0.478	0.495	0.515	0.539	0.567	0.601
210	0.470	0.477	0.493	0.510	0.531	0.555	0.584
220	0.470	0.477	0.491	0.506	0.524	0.545	0.569
230	0.471	0.477	0.489	0.504	0.519	0.537	0.557
240	0.472	0.477	0.488	0.501	0.515	0.530	0.548
250	0.473	0.477	0.488	0.499	0.512	0.525	0.540
260	0.474	0.478	0.487	0.498	0.509	0.521	0.534
270	0.474	0.478	0.487	0.497	0.507	0.518	0.529
280	0.475	0.479	0.487	0.496	0.505	0.515	0.525
290	0.476	0.480	0.487	0.495	0.504	0.513	0.523
300	0.477	0.481	0.488	0.495	0.503	0.511	0.519

Specific Heat of Super-heated Steam (Continued)

Temp. °C	Pressure in atmospheres 1	2	4	6	8	10	12
310	0 478	0 482	0.488	0 495	0 502	0 510	0 518
320	0 480	0 483	0 489	0 496	0 502	0 509	0 516
330	0 482	0.484	0 490	0 496	0 502	0 508	0 515
340	0 483	0.485	0.491	0.496	0 502	0 507	0 513
350	0.484	0.486	0.492	0.497	0.502	0 507	0.512
360	0 485	0.487	0 492	0 497	0.502	0 507	0 511
370	0 486	0 488	0 493	0 498	0 503	0 507	0 511
380	0 488	0 490	0 494	0 498	0 503	0.507	0 511
390	0 489	0.491	0 495	0 499	0 503		
400	0.490	0.492	0 496	0.500	0 504		
410	0 492	0 494	0 497	0 501	0 505		
420	0 494	0 496	0 498	0 502	0 506		
430	0 495	0.497	0 500	0 504	0 507		
440	0 497	0.499	0 501	0 505	0 508		
450	0 498	0.500	0 503	0.506	0 509		
460	0 500	0.501	0 505	0 507	0 510		
470	0 502	0 503	0 506	0 508	0 512		
480	0 504	0 505	0 507	0 509	0 513		
490	0 505	0 506	0 509	0 511	0 514		
500	0 506	0.508	0 510	0 512	0 515		

SPECIFIC HEAT AND ATOMIC HEAT OF MERCURY

The specific heat is given in relation to water at 15°C. The atomic heat is the thermal capacity of one gram atom.

Values between −75.6° and −36.7°C. are from Carpenter and Stoodley, Phil. Mag. **10**, 249. 1930; from 0 80°C., Barnes-Cooke, from 90 140°C., mean of Winklemann, Naccari and Milthaler, above 140°C., mean of Naccari and Milthaler.

Temp. °C	Specific heat	Atomic heat	Temp. °C	Specific heat	Atomic heat
	Solid			Liquid	
−75.6	0319	6 3995	30	.03316	6 6522
−72 9	0324	6 4998	35	.03312	6 6442
−65 4	.0324	6.4998	40	.03308	6.6362
−59 5	.0324	6 4998	50	.03300	6.6201
−44 9	.0336	6 7405	60	.03294	6.6081
−42 2	.0336	6 7405	70	.03289	6.5981
−40 0	.0337	6 7606	80	.03284	6.5880
			90	.03277	6.5740
	Liquid		100	.03269	6.5579
−36 7	.0339	6 8007	110	.03262	6.5439
			120	.03255	6.5299
	Liquid		130	.03248	6.5158
0	.03346	6 7124	140	.03241	6.5018
5	.03340	6.7004	150	.03240	6.4998
10	.03335	6.6903	170	.03220	6.4596
15	.03330	6.6803	190	.03200	6.4195
20	.03325	6 6703	210	.03190	6.3995
25	.03320	6.6603			

SPECIFIC HEAT OF ELEMENTS

Element	Temp. °C	Sp. ht., cal./g
Aluminum	−250	0.0039
	−240.6	0.0092
	−233	0.0165
	−200	0.076
	−150	0.1367
	−100	0.1676
	−50	0.1914
	0	0.2079
	20	0.214
	100	0.225
	300	0.248
	600	0.277
liquid	660	0.25
Antimony	−207.1	0.0322
	−150	0.0412
	−100	0.0448
	−50	0.0476
	0	0.0494
	20–100	0.0504
	100	0.0513
	200	0.0520
	300	0.0537
	500	0.054
Argon, solid	−223	0.155
liquid	−100	0.134
Arsenic	−216	0.032
	−117.6	0.0666
	18	0.078
gray, crystal	0–100	0.0822
blk., amor	0–100	0.0861
Barium	−185 to +20	0.068
Beryllium	−202	0.017
	0–46	0.397
	0–100	0.425
	0–300	0.505
Bismuth	−150	0.0264
	−100	0.0273
	−50	0.0282
	0	0.0291
	20	0.0294
	100	0.0304
liquid	297	0.0292
	400	0.035
Boron	−191 to −78	0.071
	−76 to 0	0.168
	0–100	0.307
	100	0.287
	500	0.472
	900	0.510
Bromine, solid	−253.1	0.0205
	−173.1	0.0659
	−73.1	0.080
	−13.1	0.088
Bromine, liquid	13–45	0.107
Cadmium	−263	0.0019
	−203.1	0.0415
	−103.1	0.0518
	27.9	0.0552
	107.9	0.0569
	277	0.060
liquid	321	0.077
Calcium	−185 to +20	0.157
	0–20	0.145
	24	0.168
Calcium (continued)........	100	0.1625
	300	0.1832
	600	0.188
Carbon, charcoal.	0–24	0.165
diamond	−233	0.0005
	−185	0.0025
	−188 to −78	0.019
	−78 to +18	0.079
	0	0.1044
	20	0.12
	140	0.222
	223	0.264
	247	0.303
	606	0.441
	823	0.428
gas carbon.	24–68	0.204
graphite	−243	0.005
	−203	0.0175
	−191 to −79	0.057
	−66	0.053
	20	0.17
	85	0.177
	138	0.254
	642	0.445
	896	0.454
Cerium	−253 to −196	0.033
	0–100	0.0423
	20–100	0.0511
Cesium, solid	20	0.052
	0–26	0.0482
liquid	50	0.058
Chlorine	−113	0.19
liquid	0–24	0.226
Chromium	−150	0.0599
	−100	0.0797
	−50	0.0941
	0	0.1044
	20	0.11
	18–100	0.111
	100	0.112
	400	0.133
	500	0.150
	600	0.187
Cobalt	−150	0.0672
	−100	0.0809
	−50	0.0914
	0	0.1028
	20	0.1001
	100	0.1067
	200	0.1134
	300	0.121
	*508	0.145 0.125
	800	0.160
	1000	0.184
	*1112	0.270 0.170
Copper	−253	0.0031
	−189	0.0506
	−150	0.0674
	−100	0.0783
	−50	0.0862
	0	0.0910

* Temperatures of transformation.

SPECIFIC HEAT OF ELEMENTS (Continued)

Element	Temp °C	Sp. ht., cal /g
Copper (continued)	20	0 0921
	15–100	0 09305
	100	0 0939
	200	0 0963
	900	0 1259
	18–100	0 0928
liquid	1084	0 101
Gallium	−258 1	0 0049
	−213 1	0 044
	−73 1	0 084
	12–23	0 079
liquid	13–110	0 080
	119	0 079
Germanium	0–100	0 074
Gold	−258 1	0 0018
	−209 5	0 0211
	−150	0 0266
	−100	0 0281
	−50	0 0293
	0	0 0302
	18	0 0312
	0–100	0 0316
	100	0 0314
liquid	1100	0 0327
Hydrogen, solid	−260 6	0 57
liquid	−252	0 231
Indium	−186 to −79	0 0263
	−79 to +18	0 0303
	0–100	0 057
Iodine	−263 2	0 0037
	−255 9	0 0118
	−221 1	0 0353
	−90 to +17	0 0485
	20	0 0523
liquid	107–180	0 108
Iridium	−186 to +18	0 0282
	18–100	0 0323
	0–900	0 0371
Iron, cast	20–100	0 1189
wrought	15–100	0 1152
hard drawn	20–100	0 1146
pure	−256 2	0 00067
	−214 0	0 0194
	−172 6	0 0512
	−67 5	0 0939
	0	0 1043
	20	0 107
α, β, γ	100	0 115
	500	0 163
	760	0 320
	1000	0 162
γ	100	0 127
	700	0 157
	1000	0 162
Lanthanum	0–100	0 0448
Lead	−270	0 00001
	−267	0 00086
	−259	0 0073
	−150	0 0279
	−100	0 0283
	−50	0 0289
	0	0 0297
	20	0 0306
	100	0 0320
Lead (continued)	300	0 0356
liquid	360	0 0375
	500	0 0370
Lithium	−183	0 3
	−100	0 600
	0	0 079
	50	0 96
	100	1 0407
	190	1 374
Magnesium	−150	0 1767
	−100	0 2025
	−50	0 2228
	0	0 2316
	20	0 246
	100	0 257
	300	0 279
	600	0 311
liquid	650–775	0 284
Manganese	−188 to −79	0 0820
	−100	0 0979
	0	0 1072
	20–100	0 1211
	60	0 1211
	325	0 1783
Mercury, solid	−263 3	0 00552
	−259 8	0 00783
	−245 6	0 0172
	−220 2	0 0255
	−163 7	0 0298
	−81 4	0 0324
	−43 1	0 0337
liquid	−33 1	0 0338
	0	0 03346
	20	0 03325
	40	0 03308
	60	0 03294
	100	0 03269
	200	0 0323
	250	0 0321
Molybdenum	−257	0 0004
	−239 1	0 0034
	−181 5	0 0300
	−152 7	0 0399
	−34 5	0 0561
	0	0 0589
	20–100	0 065
	250	0 0632
	475	0 0750
Neodymium	0–100	0 045
Nickel	−258	0 0008
	−247 9	0 0024
	−201 2	0 0363
	−150	0 0660
	−100	0 0817
	−50	0 0940
	0	0.1032
	20	0 105
	100	0 1146
	500	0 1270
	800	0 1413
liquid	1452	0 13
Nitrogen, solid	−212	0 39
liquid	−200	0 474

SPECIFIC HEAT OF ELEMENTS (Continued)

Element	Temp. °C	Sp. ht., cal./g	Element	Temp. °C	Sp. ht., cal./g
Osmium	19–98	0 0311	Silver (con-		
Oxygen, solid	−221 8	0 336	tinued)	500	0 0581
liquid	−200	0 394		800	0 076
Palladium	−180 to +18	0 0528	liquid	900	0 0685
	0	0 0538	Sodium	−256.1	0 026
	100	0 0564		−238.5	0 108
	500	0 0653		−155 5	0 245
	900	0 0717		−40	0 279
	1500	0 0766		20	0.295
Phosphorus, yel-			liquid	100	0.32
low	−136	0 124	Sulfur	−188 to +18	0.137
	−40	0 165	rhombic	15–96	0.176
	9	0 189	monocl	0–52	0.181
red	−136	0 107	liquid	115–160	0 220
	−40	0 182	Tantalum	−201 7	0 0205
	9	0 190		20	0.036
Platinum	−255 6	0 00123		380	0 035
	−237 7	0 0073		900	0.036
	−191 7	0 0211		1100	0.043
	−152 1	0 0261		1400	0 044
	−64 8	0 0307	Tellurium	−188 to +18	0 047
	0	0 03162	cryst	15–100	0 0483
	20	0 0324		15–200	0 0487
	500	0 0349	Thallium	−185 to +20	0.038
	750	0 0365		28	0 0311
	1000	0 0381		20–100	0.0326
	1300	0 0400	Thorium	−253 to −196	0 0197
Potassium	−258 4	0 032		0–100	0 0276
	−255 8	0 045	Tin	−186 to −79	0.0486
	−201 3	0 140		−186 7	0 0422
	−53 1	0 172		−150	0 0450
	14	0 18		−100	0 0483
	22-56	0 192		−50	0 0512
liquid	63	0 18		0	0 0536
	78–100	0 217		18	0.0542
	90	0 200		100	0 0577
	181	0 196	liquid	1100	0 0758
Praseodymium	0–100	0 046	gray	20	0 515
Rhenium	0–20	0 035	Titanium	−185 to +20	0 082
Rhodium	10–97	0 058		0–100	0.1125
Rubidium, solid	0	0 0802	Tungsten	−247 1	0 0012
liquid	50	0 0908		−218 4	0 0098
Ruthenium	0–100	0 0611		−173 1	0 0205
Selenium	−188 to +18	0 068		−73 1	0 0288
	3	0 072		20–100	0 034
	20 5	0 077		100	0 0320
	29 5	0 085		500	0 0344
	32	0 127		1000	0 0367
	38	0 131		1500	0 0390
Silicon	−212	0 029	Uranium	0–98	0 0280
	−143 3	0 087	Vanadium	0–100	0 1153
	−86 2	0 126	Zinc	−252 4	0 0071
	13 9	0 168		−201 3	0 0573
	18 2–99 1	0 181		−150	0 0740
	18 0–900 6	0.210		−100	0 0814
Silver	−238	0 0146		−50	0 0871
	−150	0 0461		0	0 0913
	−100	0 0505		0–100	0 095
	−50	0 0537		20	0 0925
	0	0 0557		100	0.0957
	20	0 0558		300	0.1043
				400	0.1089
	100	0 0564	Zirconium	0–100	0.068

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS

Specific heat is given in calories (15°) per gram per degree Centigrade. To change to joules per gram per degree Centigrade multiply by 4.185.

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Aluminum chloride	$AlCl_3$ (α)	93	.468
chloride	$AlCl_3$ (β)	0	.196
chloride	$AlCl_36H_2O$	35	.313
fluoride	AlF_3	35	.229
fluoride	$2AlF_3{\cdot}7H_2O$	35	.342
hydroxide	$Al(OH)_3$	0	.177
		50	.202
oxide	Al_2O_3	0	.174
		50	.198
sulfate	$Al_2(SO_4)_3$	50	.184
sulfate	$Al_2(SO_4)_3{\cdot}18H_2O$	34	.354
Ammonia	NH_3	−103 to −188	.502
Ammonium bromide	NH_4Br	20	210
chloride	NH_4Cl	−200	121
		−100	.263
		0	.357
		50	389
iodide	NH_4I	0	.111
		50	.118
nitrate	NH_4NO_3	−100	.306
		0	.397
		100	.428
sulfate	$(NH_4)_2SO_4$	−100	.283
		0	.337
		50	.345
Antimony trisulfide	Sb_2S_3	0	.0829
Arsenous oxide	As_2O_3	0	.117
Barium carbonate	$BaCO_3$	0	0999
		100	.110
chlorate	$Ba(ClO_3)_2{\cdot}H_2O$	32	.158
chloride	$BaCl_2{\cdot}2H_2O$	0	.140
nitrate	$Ba(NO_3)_2$	47	.148
sulfate	$BaSO_4$	0	.111
thiosulfate	BaS_2O_3	58	.162
Beryllium oxide	BeO	50	.260
sulfate	$BeSO_4$	50	.198
Bismuth sulfide	Bi_2S_3	50	.0600
trioxide	Bi_2O_3	50	.0569
Cadmium nitrate	$Cd(NO_3)_2{\cdot}4H_2O$	40	.260
sulfate	$3CdSO_4{\cdot}8H_2O$	0	.195
		20	.200
sulfide	CdS	0	.0882
		50	.0922
Calcium carbonate	$CaCO_3$	0	203
		100	.214
chloride	$CaCl_2$	61	.164
chloride	$CaCl_2{\cdot}6H_2O$	0	.320
fluoride	CaF_2	0	.204
		40	212
formate	$Ca(HCO_2)_2$	0	.238
hydroxide	$Ca(OH)_2$	0	260
		50	.288
molybdate	$CaMoO_4$	15	.165
oxide	CaO	0	.177
		100	.197

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Calcium			
sulfate	$CaSO_4 \cdot 2H_2O$	36	.265
tungstate	$CaWO_4$	15	.104
Carbon dioxide, solid	CO_2	−225	.124
monoxide, solid	CO	−220	.417
		−206	.457
Ceric oxide	CeO_2	0	.0870
		50	.0946
sulfate	$Ce(SO_4)_2$	50	.117
sulfate	$CeSO_4 \cdot 5H_2O$	50	.201
Chromic oxide	Cr_2O_3	0	.168
		50	.189
sulfate	$Cr_2(SO_4)_3$	50	.172
sulfate	$Cr_2(SO_4)_3 \cdot 5H_2O$	50	.200
Cobaltous nitrate	$Co(NO_3)_2 \cdot 6H_2O$	32	.373
sulfate	$CoSO_4 \cdot 7H_2O$	48	.342
Columbium pentoxide	Cb_2O_5	50	.101
Copper ammonium sulfate	$CuSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	0	.256
Copper sulfate	$CuSO_4 \cdot H_2O$	0	.172
		50	.191
sulfate	$CuSO_4 \cdot 3H_2O$	9	.228
sulfate	$CuSO_4 5H_2O$	0	.253
		50	.287
Cupric carbonate	$2CuO \cdot CO_2 \cdot H_2O$	57	.177
chloride	$CuCl_2$	58	.139
oxide	CuO	0	125
		100	.144
sulfide	CuS	0	129
		100	.151
Cuprous iodide	CuI	0	.0658
		50	.0671
oxide	Cu_2O	0	.110
		100	.116
selenide	Cu_2Se	60	.104
sulfide	Cu_2S	0	.148
		50	.166
Erbium oxide	Er_2O_3	50	.0650
Ferric oxide	Fe_2O_3	0	.148
		100	.182
Ferrosoferric oxide (magnetite)	Fe_3O_4	0	.151
		100	.179
Ferrous carbonate	$FeCO_3$	54	.194
sulfate	$FeSO_4$	45	.167
sulfate	$FeSO_4 \cdot 4H_2O$	9	.284
sulfate	$FeSO_4 \cdot 7H_2O$	0	.325
		10	.337
sulfide	FeS	0	.135
Gallium sesqui-oxide	Ga_2O_3	50	.105
Gold iodide	AuI	0	.0404
		50	.0432
Hydrogen peroxide	H_2O_2	−25	.471
Indium sesquioxide	In_2O_3	50	.0808
Iron diarsenide	$FeAs_2$	50	.0860
disulfide	FeS_2	0	.118
		50	.128
Lanthanum sesquioxide	La_2O_3	50	.0750

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS
(Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Lead ammonium chloride	$2PbCl_2 \cdot NH_4Cl$	10	.0865
Lead borate	PbB_2O_4	57	.0903
Lead bromide	$PbBr_2$	0	.0502
		50	.0530
carbonate	$PbCO_3$	32	.0800
chloride	$PbCl_2$	0	.0649
		100	.0681
chromate	$PbCrO_4$	35	.0908
dioxide	PbO_2	0	.0619
		50	.0650
iodide	PbI_2	0	.0417
		100	.0437
molybdate	$PbMoO_4$	15	.100
monoxide	PbO	0	.0483
		50	.0509
nitrate	$Pb(NO_3)_2$	45	.115
pyrophosphate	$Pb_2P_2O_7$	55	.0820
silicate	$PbSiO_3$	60	.0779
sulfate	$PbSO_4$	45	.0839
sulfide	PbS	0	.0502
		100	.0511
thiosulfate	PbS_2O_3	58	.0918
tungstate	$PbWO_4$	15	.0769
Lithium chloride	$LiCl$	55	.282
fluoride	LiF	10	.373
hydride	LiH	0	.980
		50	1 07
hydroxide	$LiOH$	0	.327
		50	.356
nitrate	$LiNO_3$	210	.387
thiosulfate	$Li_2S_2O_3$	58	.0920
Magnesium carbonate	$MgCO_3$	25	.200
chloride	$MgCl_2 \cdot 6H_2O$	44	378
chloride	$MgCl_2$	48	.194
nitrate	$Mg(NO_3)_2 \cdot 6H_2O$	55	.887
oxide	MgO	0	.209
		50	232
sulfate	$MgSO_4 \cdot 7H_2O$	12	361
sulfate	$MgSO_4 \cdot 6H_2O$	9	349
sulfate	$MgSO_4H_2O$	9	239
sulfate	$MgSO_4$	61	.222
Manganese dioxide	MnO_2	0	.152
		50	.163
nitrate	$Mn(NO_3)_2 \cdot 6H_2O$	47	.373
Manganic oxide	Mn_2O_3	58	162
oxide	$Mn_2O_3 \cdot 3H_2O$	38	177
Manganous oxide	MnO	58	.158
sulfate	$MnSO_4 \cdot 5H_2O$	32	.323
sulfate	$MnSO_4$	61	182
Mercuric chloride	$HgCl_2$	0	0640
		100	.0669
cyanide	$Hg(CN)_2$	29	.100
iodide	HgI_2 (red)	0	.0404
		50	.0413
oxide	HgO	0	.0485
		50	.0521
sulfide	HgS	0	.0506
		50	.0520

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Mercurous chloride	$HgCl$	0	.0499
		50	.0512
sulfate	Hg_2SO_4	0	.0616
		50	.0680
Molybdenum trioxide	MoO_3	54	.134
Nickel nitrate	$Ni(NO_3)_2 \cdot 6H_2O$	80	.473
sulfate	$NiSO_4 \cdot 6H_2O$	35	.313
sulfate	$NiSO_4$	58	.225
sulfide	NiS	0	.116
		100	.128
Nitrogen pentoxide	N_2O_5	−80 to −5	.239
Potassium acetate	$KC_2H_3O_2$	20	.272
	$KHSO_4$	35	.244
aluminum sulfate, (alum)	$K_2SO_4Al_2(SO_4)_3 \cdot 24H_2O$	0	.324
		50	.360
Potassium arsenate, acid	KH_2AsO_4	31	.174
Potassium bromide	KBr	0	.104
		100	.108
	K_2CO_3	47	.210
chlorate	$KClO_3$	0	.191
		50	.205
chloride	KCl	0	.162
		100	.168
chloroplatinate	K_2PtCl_6	30	.112
chromate	K_2CrO_4	46	.186
dichromate	$K_2Cr_2O_7$	0	.178
ferricyanide	$K_3Fe(CN)_6$	26	.232
ferrocyanide	$K_4Fe(CN)_6$	0	.210
		50	.225
ferrocyanide	$K_4Fe(CN)_6 \cdot 3H_2O$	0	.267
		50	.285
fluoride	KF	0	.199
		50	.204
metaborate	$K_2B_2O_4$	57	.225
nitrate	KNO_3	0	.214
		100	.240
perchlorate	$KClO_4$	30	.189
phosphate, dihydrogen	KH_2PO_4	33	.208
pyrophosphate	$K_4P_2O_7$	58	.191
thiosulfate	$K_2S_2O_3$	60	.196
Silicon carbide	SiC	0	.143
		100	.194
Silver bromide	$AgBr$	0	.0695
		100	.0734
chloride	$AgCl$	0	.0848
		50	.0906
cyanate	$AgCNO$	40	.124
iodide	AgI	0	.0548
		100	.0593
nitrate	$AgNO_3$	50	.146
selenide	Ag_2Se	37 to 187	.0693
sulfide	Ag_2S	0	.0719
		50	.0748
Sodium acetate	$NaC_2H_3O_2$	38	.339
acetate	$NaC_2H_3O_2 \cdot 3H_2O$	0	.344
		40	.602

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Sodium bromide	$NaBr$	0	.118
		100	.124
carbonate	Na_2CO_3	45	.256
chloride	$NaCl$	0	.204
		100	.217
fluoride	NaF	0	.258
		100	.279
formate	$NaHCO_2$	46	.306
iodide	NaI	0	.0829
		50	.0848
metaborate	$Na_2B_2O_4$	57	.253
nitrate	$NaNO_3$	0	.247
		50	.270
phosphate, di-	$Na_2HPO_4 \cdot 12H_2O$	0	.404
		50	.464
phosphate, di-	$Na_2HPO_4 \cdot 7H_2O$	0	.351
		50	.406
pyrophosphate	$Na_4P_2O_7$	50	.227
sulfate	Na_2SO_4	0	.202
		100	.220
tetraborate	$Na_2B_4O_7$	45	.234
tetraborate (borax)	$Na_2B_4O_7 \cdot 10H_2O$	35	.385
thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$	21	.346
thiosulfate	$Na_2S_2O_3$	9	.220
Stannic oxide	SnO_2	45	.0898
sulfide	SnS_2	54	.119
Stannous chloride	$SnCl_2$	60	.102
sulfide	SnS	56	.0839
Strontium molybdate	$SrMoO_4$	15	.148
nitrate	$Sr(NO_3)_2$	32	.182
sulfate	$SrSO_4$	48	.143
Sulfuric acid	H_2SO_4	−30	.239
		0	.270
Sulfur dioxide	SO_2	−185 to −103	.229
Thallium monochloride	$TlCl$	0	.0520
		100	.0542
Thorium chloride	$ThCl$	30	.406
dioxide	ThO_2	0	.0571
		50	.0589
sulfate	$Th(SO_4)_2$	50	.0980
Tin see under Stannous and Stannic			
Titanium dioxide	TiO_2	0	.168
Tungsten trioxide	WO_3	0	.0743
		50	0832
Uranium oxide (ous-ic)	U_3O_8	0	.0671
		50	.0750
Water, solid	H_2O	−250	.0361
		−200	.156
		−150	.246
		−100	.332
		−40	.435
		0	.492
Yttrium oxide	Y_2O_3	57	.112
Zinc chloride	$ZnCl_2$	60	.136

SPECIFIC HEAT OF SOLID INORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Zinc nitrate	$Zn(NO_3)_2 \cdot 6H_2O$	30	.318
oxide	ZnO	0	.114
		100	.129
sulfate	$ZnSO_4 \cdot 7H_2O$	0	.322
sulfate	$ZnSO_4 \cdot 6H_2O$	9	.299
sulfate	$ZnSO_4 \cdot H_2O$	9	.194
sulfate	$ZnSO_4$	50	.174
sulfide	ZnS	0	.116
		100	.118
Zirconium dioxide	ZrO_2	0	.103

SPECIFIC HEAT OF LIQUID INORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Specific Heat Cal. (15°)/g
Ammonia	NH_3	−60	1.047
		0	1 098
		20	1 125
		100	1.48
Calcium chloride	$CaCl_2 \cdot 6H_2O$	33–99	.552
Hydrogen peroxide	H_2O_2	0	.578
Lead bromide	$PbBr_2$	550	.0779
chloride	$PbCl_2$	540	.121
Lithium nitrate	$LiNO_3$	280	.390
Potassium dichromate	$K_2Cr_2O_7$	397	.0335
nitrate	KNO_3	380	.0332
Silver bromide	$AgBr$	500	.0760
chloride	$AgCl$	490	.129
nitrate	$AgNO_3$	250	.187
Sodium acetate	$NaC_2H_3O_2$	61.8	.846
chlorate	$NaClO_3$	280	.325
nitrate	$NaNO_3$	350	.430
thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$	13–98	.570
Stannic chloride	$SnCl_4$	14–98	.148
Sulfur dioxide	SO_2	−20	.313
		0	.318
		20	.327
		100	.418
Sulfuric acid	H_2SO_4	10	.339
acid pyro-	$H_2S_2O_7$	35	.334
Water	H_2O See special table		

SPECIFIC HEAT OF SOLID ORGANIC COMPOUNDS

Specific heat is given in calories (15°) per gram per degree Centigrade. To change to joules per gram per degree Centigrade multiply by 4.185.

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Acetic acid	CH_3CO_2H	0	.487
Acetone	$(CH_3)_2CO$	−210	.540
o-Aminobenzoic acid	$H_2NC_6H_4CO_2H$	85	.254
m-Aminobenzoic acid		120	.253
p-Aminobenzoic acid		128	.287
Aniline	$C_6H_5NH_2$	?	.741
Anthracene	$C_{14}H_{10}$	50	.308
		100	.350
Anthraquinone	$(C_6H_4)_2(CO)_2$	0	.258
Azobenzene	$(C_6H_5N)_2$	28	330
Benzene	C_6H_6	−250	.0399
		−200	124
		−100	.227
		−50	.299
Benzoic acid	$C_6H_5CO_2H$	20	.287
Benzophenone	$(C_6H_5)_2CO$	−150	.115
		−50	.220
		0	.275
		20	.303
Betol	$HOC_6H_4CO_2C_{10}H_7$	−150	.129
		−100	.167
o-Bromochlorobenzene	C_6H_4BrCl	−34	.192
m-Bromochlorobenzene		−52	.150
p-Bromochlorobenzene		−40	.150
		0	.170
o-Bromoiodobenzene	C_6H_4BrI	−50	.143
m-Bromoiodobenzene		−75 to −15	.143
p-Bromoiodobenzene		−40	.116
β-Bromonaphthalene	$C_{10}H_7Br$	41	.260
Bromophenol	HOC_6H_4Br	32	.263
Camphene	$C_{10}H_{16}$	35	.380
Capric acid	$CH_3(CH_2)_8CO_2H$	8	695
Caprylic acid	$CH_3(CH_2)_6CO_2H$	−2	628
Carbon tetrachloride	CCl_4	−200	0812
		−80	.182
		−40	.201
Catechol	$C_6H_4(OH)_2$	163	.278
Chloral alcoholate	$CCl_3CHO{\cdot}C_2H_5OH$	78	.509
hydrate	$CCl_3CHO{\cdot}H_2O$	32	.213
Chloroacetic acid	CH_2ClCO_2H	60	.363
p-Chlorobenzoic acid	$ClC_6H_4CO_2H$	80	228
m-Chlorobenzoic acid		94	232
p-Chlorobenzoic acid		180	242
Crotonic acid	$CH_3CHCHCO_2H$	38	520
Cyamelide	$C_3H_3O_3N_3$	40	.263
Cyanuric acid	$(HNCO)_3$	40	.318
Dextrose	$C_6H_{12}O_6$	−250	.0155
		0	.277
		20	.275
Dextrin	$(C_6H_{10}O_5)x$	0 to 90	.292
o-Dibromobenzene	$C_6H_4Br_2$	−36	.249
m-Dibromobenzene		−25	.134
p-Dibromobenzene		−50	.139
Dichloroacetic acid	$CHCl_2CO_2H$	solid	.406
o-Dichlorobenzene	$C_6H_4Cl_2$	−48.5	.185

SPECIFIC HEAT OF SOLID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
m-Dichlorobenzene	....	−52	.186
p-Dichlorobenzene	....	−50	.219
Dicyandiamide	$C_2H_4N_4$	0 to 204	.456
Dulcitol	$C_6H_8(OH)_6$	20	.282
m-Diiodobenzene	$C_6H_4I_2$	−52	.100
p-Diiodobenzene	....	−50	.101
Dibenzyl	$(C_6H_5CH_2)_2$	28	.363
Dimethyl oxalate	$(CO_2CH_3)_2$	10	.212
Dimethylpyrone	$(CH_3)_2C_5H_2O_2$	50	.368
o-Dinitrobenzene	$C_6H_4(NO_2)_2$	−160	.252
m-Dinitrobenzene	....	−160	.248
p-Dinitrobenzene	....	119	.259
Diphenyl	$(C_6H_5)_2$	40	.385
Diphenylamine	$(C_6H_5)_2NH$	26	.337
Ethyl alcohol (crystalline)	C_2H_5OH	−190	.232
(vitreous)	....	−190	260
Erythritol	$(CHOHCH_2OH)_2$	60	.351
Formic acid	HCO_2H	−22	.387
		0	.430
Glutaric acid	$(CH_2)_3(CO_2H)_2$	20	.299
Glyceral	$C_3H_5(OH)_3$	−250	.0471
		−200	.115
		−100	.217
		0	.330
Glycol	$(CH_2OH)_2$	40	.528
Hexadecane	$C_{16}H_{34}$	19	495
Iodobenzene	C_6H_5I	40	.191
Lactose	$C_{12}H_{22}O_{11}$	20	.287
	$C_{12}H_{22}O_{11}\cdot H_2O$	20	.299
Lauric acid	$C_{11}H_{23}CO_2H$	−30	.430
Levulose	$C_6H_{12}O_6$	20	.275
Malonic acid	$CH_2(CO_2H)_2$	20	.275
Maltose	$C_{12}H_{22}O_{11}$	20	.320
Mannitol	$C_6H_8(OH)_6$	0	.313
Melamine	$C_3H_6N_6$	40	.351
Myristic acid	$C_{13}H_{27}CO_2H$	0	.381
Naphthalene	$C_{10}H_8$	−130	.281
α-Naphthol	$C_{10}H_7OH$	50	240
β-Naphthol	....	61	.252
α-Naphthylamine	$C_{10}H_7NH_2$	0	.270
m-Nitroaniline	$H_2NC_6H_4NO_2$	−160	.275
o-Nitroaniline	....	−160	.269
p-Nitroaniline	....	−160	.276
Nitrobenzene	$C_6H_5NO_2$	20	.349
		100	.356
o-Nitrobenzoic acid	$NO_2C_6H_4CO_2H$	−163	.256
m-Nitrobenzoic acid	....	−160	.247
Nitronapnthalene	$C_{10}H_7NO_2$	0	.236
Oxalic acid	$(CO_2H)_2\cdot 2H_2O$	0	.338
		50	.385
Palmitic acid	$C_{15}H_{31}CO_2H$	−180	.167
		−100	.251
		−50	.306
		0	.382
		20	.430

SPECIFIC HEAT OF SOLID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Picric acid	$HOC_6H_2(NO_2)_3$	−100	.165
		0	.240
		50	.263
Phthalic acid	$C_6H_4(CO_2H)_2$	20	.232
Propionic acid	$C_2H_5CO_2H$	−33	.726
n-Propyl alcohol	C_3H_7OH	−200	.170
		−130	.497
iso-Propyl alcohol	C_3H_7OH	−200	.0507
Pyrotartaric acid	$C_5H_8O_4$	20	.301
Quinhydrone	$C_{12}H_{10}O_4$	−250	.0165
		−200	0980
		0	.256
Quinol	$C_6H_4(OH)_2$	−250	0246
		−150	.268
Quinone	$C_6H_4O_2$	−250	.0311
		−200	.113
		−150	.282
Resorcinol	$C_6H_4(OH)_2$	−160	.269
Salol	$HOC_6H_4CO_2C_6H_5$	32	.289
Stearic acid	$C_{17}H_{35}CO_2H$	15	399
Succinic acid	$(CH_2CO_2H)_2$	0	.248
Sucrose	$C_{12}H_{22}O_{11}$	20	.299
Tartaric acid	$H_2C_4H_4O_6$	36	.287
		0	.308
		50	366
Thymol	$C_{10}H_{14}O$	0	.315
Trichloroacetic acid	CCl_3CO_2H	solid	.459
Trimethyl carbinol	$(CH_3)_3COH$	−4	.559
Trinitrotoluene	$CH_3C_6H_2(NO_2)_3$	−100	.170
		0	.311
		100	385
Trinitroxylene	$(CH_3)_2C_6H(NO_2)_3$	20 to 50	423
Triphenylmethane	$(C_6H_5)_3CH$	0	.189
o-Toluic acid	$CH_3C_6H_4CO_2H$	54	.277
m-Toluic acid	....	54	239
p-Toluic acid	....	130	.271
p-Toluidine	$CH_3C_6H_4NH_2$	0	.337
		20	387
Urea	$(NH_2)_2CO$	20	.320

SPECIFIC HEAT OF HEAVY WATER

% D_2O	Temp. °C.	Specific Heat cal./g	Molar Heat cal./mol.	Observer
99.7	−20.5– 0 (solid)	0.408	8.18	Bartholomé and Clusius
97.7	0 (solid)	0.51	10.2	Jacobs
98	4 –26 (liquid)	1.018	20.4	Brown, Barnes, & Maass
98	26 –45 (liquid)	1.003	20.1	" " " "
98	26 –65 (liquid)	1.008	20.2	" " " "

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS

Specific heat is given in calories (15°) per gram per degree Centigrade. To change to joules per gram per degree Centigrade multiply by 4.185.

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C
Acetic acid	CH_3COOH	0	.468
Acetone	$(CH_3)_2CO$	0	.506
		20	.528
Acetonitrile	CH_3CN	21–76	.541
Acetophenone	$C_6H_5COCH_3$	20–193	.474
Acetyl chloride	CH_3COCl	0	.339
Allyl acetate	$CH_3CO_2C_3H_5$	0	.431
alcohol	C_3H_5OH	21–96	.665
benzoate	$C_6H_5CO_2C_3H_5$	20	.388
butyrate	$C_3H_7CO_2C_3H_5$	20	.451
chloride	CH_2CHCH_2Cl	0	.313
isobutyrate	$C_3H_7CO_2C_3H_5$	20	.448
propionate	$C_2H_5CO_2C_3H_5$	20	.451
valerate	$C_4H_9CO_2C_3H_5$	20	.451
o-Aminobenzoic acid	$H_2NC_6H_4CO_2H$	145	.435
m-Aminobenzoic acid		174	.435
p-Aminobenzoic acid		186	.444
iso-Amyl acetate	$CH_3CO_2C_5H_{11}$	20	.459
alcohol	$C_5H_{11}OH$	0	.502
		20	.535
		75 5	.688
d-prim -Amyl alcohol	$C_5H_{11}OH$	22–125	.712
tert -Amyl alcohol		20–99	.753
iso-Amyl butyrate	$C_3H_7CO_2C_5H_{11}$	20	.459
formate	$HCO_2C_5H_{11}$	20	.459
isobutyrate	$C_3H_7CO_2C_5H_{11}$	20	.459
propionate	$C_2H_5CO_2C_5H_{11}$	20	.459
succinate	$(CH_2CO_2C_5H_{11})_2$	0	.449
valerate	$C_4H_9CO_2C_5H_{11}$	20	.459
iso-Amylamine	$C_5H_{11}NH_2$	22–91	.614
Amylene	C_5H_{10}	0	.282
Anethol	$C_9H_9OCH_3$	22.48	.551
Aniline	$C_6H_5{\cdot}NH_2$	0	.478
		50	.521
		100	.547
Anisol	$C_6H_5OCH_3$	20–152	.483
Benzaldehyde	C_6H_5CHO	22–172	.428
Benzene	C_6H_6	5	.389
		20	.406
		60	.444
		90	.473
Benzoic acid	$C_6H_5CO_2H$	0	.424
Benzonitrile	C_6H_5CN	22–186	.441
β-Benzophenone	$(C_6H_5)_2CO$	3–40	.383
Benzyl alcohol	$C_6H_5CH_2OH$	20–100	.511
chloride	$C_6H_5CH_2Cl$	0	.323
Betol	$HOC_6H_4CO_2C_{10}H_7$	19–63	.356
Bromobenzene	C_6H_5Br	20	.231
o-Bromochlorobenzene	C_6H_4BrCl	0	.215
m-Bromochlorobenzene		0	.212
o-Bromoiodobenzene	C_6H_4BrI	5–100	.160
m-Bromoidobenzene		5–100	.158
Bromophenol	HOC_6H_4Br	18–77	.316
n-Butane	C_4H_{10}	0	.550
iso-Butane		0	.550
iso-Butyl acetate	$CH_3CO_2C_4H_9$	20	.459

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
n-Butyl alcohol	C_4H_9OH	2.3	.526
		19.2	.563
iso-Butyl alcohol		21–109	.716
Butyl butyrate	$C_3H_7CO_2C_4H_9$	20	.459
iso-Butyl butyrate		20	.459
n-Butyl chloride	C_4H_9Cl	20	.451
formate	$HCO_2C_4H_9$	20	.459
Butyl propionate	$C_2H_5CO_2C_4H_9$	20	.459
iso-Butyl succinate	$(CH_2CO_2C_4H_9)_2$	0	.442
Butyl valerate	$C_4H_9CO_2C_4H_9$	20	.459
n-Butyric acid	$C_3H_7CO_2H$	20–100	.515
iso-Butyric acid	$C_4H_8O_2$	20	.450
n-Butyronitrile	C_3H_7CN	21–113	.547
Caproic acid	$C_5H_{11}CO_2H$	29–105	.533
Capronitrile	$C_5H_{11}CN$	18–156	.542
Carbon tetrachloride	CCl_4	0	.198
		20	.201
Carvacrol	$C_9H_{13}OH$	24–233	.577
Catechol	$C_6H_4(OH)_2$	0	.462
Chloral	CCl_3CHO	17–53	.250
hydrate	$CCl_3CHO{\cdot}H_2O$	55–88	.470
Chlorobenzene	C_6H_5Cl	20	.309
o-Chlorobenzoic acid	$ClC_6H_4CO_2H$	0	.392
m-Chlorobenzoic acid		0	.266
p-Chlorobenzoic acid		226	.547
Chloroform	$CHCl_3$	0	.232
		15	.226
		20	.234
o-Chlorophenol	HOC_6H_4Cl	0–20	.401
Chlorotoluene	$CH_3C_6H_4Cl$	0	.316
o-Cresol	$CH_3C_6H_4OH$	0–20	.499
m-Cresol		0–20	.479
p-Cresyl methyl ether	$CH_3C_6H_4OCH_3$	0	.405
Crotonic acid	$C_3H_5CO_2H$	71.4	.500
Cyclohexanol	$C_6H_{11}OH$	15–18	.417
Cyclohexanone	$C_6H_{10}O$	15–18	.433
o-Cymene	$C_3H_7C_6H_4CH_3$	0	.400
Decylene-2	$C_{10}H_{20}$	0–50	.469
Diallyl oxalate	$(CO_2C_3H_5)_2$	20	.426
succinate	$(CH_2CO_2C_3H_5)_2$	20	.452
Diamylene	$C_{10}H_{20}$	20–130	.545
o-Dibromobenzene	$C_6H_4Br_2$	0	.180
m-Dibromobenzene		0	.175
Dibutyl oxalate	$(CO_2C_4H_9)_2$	20	.441
Dichloroacetic acid	Cl_2CHCO_2H	21–106	.350
o-Dichlorobenzene	$C_6H_4Cl_2$	0	.270
m-Dichlorobenzene		0	.270
p-Dichlorobenzene		53–99	.298
Diethylamine	$(C_2H_5)_2NH$	22.5	.518
Diethylaniline	$C_6H_5N(C_2H_5)_2$	20	.452
Diethyl carbonate	$CO(OC_2H_5)_2$	20–100	.464
ketone	$(C_2H_5)_2CO$	20–98.5	.557
malate	$HOC_2H_3(CO_2C_2H_5)_2$	24–186	.475
malonate	$CH_2(CO_2C_2H_5)_2$	20	.433
oxalate	$(CO_2C_2H_5)_2$	20	.433
succinate	$(CH_2CO_2C_2H_5)_2$	20	.452
o-Diiodobenzene	$C_6H_4I_2$	0	.136

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
m-Diiodobenzene	....	34.2–99.6	.140
Diisoamyl	$C_{10}H_{22}$	21.5–155	.590
oxalate	$(CO_2C_5H_{11})_2$	20	.449
Diisobutylamine	$(C_4H_9)_2NH$	22–130	.571
Dimethylaniline	$C_6H_5N(CH_3)_2$	0–20	.418
Dimethyl carbonate	$CO(OCH_3)_2$	19.8–88	.452
o-Dinitrobenzene	$C_6H_4(NO_2)_2$	0	.349
m-Dinitrobenzene		90	.405
p-Dinitrobenzene		0	.279
Diphenylamine	$(C_6H_5)_2NH$	53	.464
Diphenyl oxide	$(C_6H_5)_2O$	30	.399
Dipropylamine	$(C_3H_7)_2NH$	22–100	.597
Dipropyl ketone	$(C_3H_7)_2CO$	20–140	.552
malonate	$CH_2(CO_2C_3H_7)_2$	20	.433
succinate	$(CH_2CO_2C_3H_7)_2$	20	.452
Di-n-propyl oxalate	$(CO_2C_3H_7)_2$	20	.433
Dodecane	$C_{12}H_{26}$	0–50	.500
Dodecylene	$C_{12}H_{24}$	0–50	.457
Ether	$(C_2H_5)_2O$	−50	.517
		0	.529
		30	.547
		120	.803
		180	1.041
Ethyl acetate	$CH_3CO_2C_2H_5$	20	.459
acetoacetate	$CH_3COCH_2CO_2C_2H_5$	20–100	.477
alcohol	$C_2H_5.OH$	−100	.456
		0	.535
		25	.581
		100	.824
benzene	$C_6H_5C_2H_5$	30	.409
benzoate	$C_6H_5CO_2C_2H_5$	20	.389
bromide	C_2H_5Br	5–10	.216
		15–20	.215
butyrate	$C_3H_7CO_2C_2H_5$	20	.459
chloride	C_2H_5Cl	0	.368
chloroacetate	$ClCH_2CO_2C_2H_5$	9–138	.418
dichloroacetate	$Cl_2CHCO_2C_2H_5$	20	.329
formate	$HCO_2C_2H_5$	14–49	.510
iodide	C_2H_5I	0	.162
isobutyrate	$C_3H_7CO_2C_2H_5$	20	.459
propionate	$C_2H_5CO_2C_2H_5$	20	.459
sulfide	$(C_2H_5)_2S$	0	.470
		15–20	.477
trichloroacetate	$CCl_3CO_2C_2H_5$	10–81	.295
valerate	$C_4H_9CO_2C_2H_5$	20	.459
Ethylene bromide	$(CH_2Br)_2$	20	.174
chloride	$(CH_2Cl)_2$	20	.301
		60	.319
Formamide	$HCONH_2$	19	.551
Formic acid	HCO_2H	0	.437
		15.5	.511
		20–100	.526
Furfural	$(C_4H_3O)CHO$	20–100	.418
Glycerol, (glycerine)	$HOCH_2{\cdot}CHOH.-CH_2OH$	0	.540
		50	.600
		100	.669
Glycol	$(CH_2OH)_2$	0	.544
		14.9	.571

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS (Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Heptaldehyde	$C_6H_{13}CHO$	0	.365
n-Heptane (B. P. 98°)	C_7H_{16}	20	.490
iso-Heptane		0–50	.501
Heptylene (B. P., 98°)	C_7H_{14}	0–50	.488
Heptylic acid	$C_6H_{13}CO_2H$	9	.558
n-Hexadecane (B.P., 275°)	$C_{16}H_{34}$	0–50	.496
1, 5-Hexadiene	C_6H_{10}	0	.407
o-Hexahydrocresol	$CH_3C_6H_{10}OH$	15–18	.418
m-Hexahydrocresol		15–18	.422
p-Hexahydrocresol		15–18	.423
n-Hexane	C_6H_{14}	20 100	.600
Hexylene	C_6H_{12}	0–50	.506
Lauric acid	$C_{11}H_{23}CO_2H$	57	.515
Mesitylene	$C_6H_3(CH_3)_3$	0	.393
Mesityl oxide	$C_6H_{10}O$	21–121	.521
Methyl acetate	$CH_3CO_2CH_3$	15	.468
alcohol	CH_3OH	0	.566
		20	.600
Methyl aniline	$C_6H_5NHCH_3$	20–197	.513
benzoate	$C_6H_5CO_2CH_3$	0	.363
butyl ketone	$CH_3COC_4H_9$	21–127	.553
n-butyrate	$C_3H_7CO_2CH_3$	20	.459
chloroacetate	$ClCH_2CO_2CH_3$	20	.382
dichloroacetate	$Cl_2CHCO_2CH_3$	20	.311
ethyl ketone	$CH_3COC_2H_5$	20–78	.549
ethyl ketoxime	$(CH_3)(C_2H_5)CNOH$	22–152	.650
formate	HCO_2CH_3	13–29	.516
hexyl ketone	$CH_3COC_6H_{13}$	22–168	.552
isobutyl ketone	$CH_3COC_4H_9$	20	.459
isopropyl ketone	$CH_3COC_3H_7$	20 91	.525
propionate	$C_3H_7CO_2CH_3$	20	.459
trichloroacetate	$Cl_3CCO_2CH_3$	20	.267
valerate	$C_4H_9CO_2CH_3$	20	.459
o-Methylcyclohexanone	$C_7H_{12}O$	15–18	.436
m-Methycyclohexanone		15–18	.441
p-Methylcyclohexanone		15–18	.441
Methylene chloride	CH_2Cl_2	15–40	288
Myristic acid	$C_{13}H_{27}CO_2H$	56–100	.539
Naphthalene	$C_{10}H_8$	0	.313
α-Naphthol	$C_{10}H_7OH$	0	.389
β-Naphthol		0	.403
α-Naphthylamine	$C_{10}H_7NH_2$	53.2	.475
o-Nitraniline	$H_2NC_6H_4NO_2$	0	.400
m-Nitraniline		0	.392
p-Nitraniline		0	.427
Nitrobenzene	$C_6H_5NO_2$	30	.339
		120	.394
o-Nitrobenzoic acid	$O_2NC_6H_4CO_2H$	0	.314
m-Nitrobenzoic acid		0	.405
p-Nitrobenzoic acid		238	.449
Nitromethane	CH_3NO_2	17	.412
α-Nitronaphthalene	$C_{10}H_7NO_2$	58.6	.365
Nonane	C_9H_{20}	0–50	.503
Nonylene	C_9H_{18}	0–50	.485
n-Octane	C_8H_{18}	20–123	.578
Octylene	C_8H_{16}	0–50	.486
Olive oil		6 6	.471
Palmitic acid	$C_{15}H_{31}CO_2H$	65–104	.653

SPECIFIC HEAT OF LIQUID ORGANIC COMPOUNDS
(Continued)

Name	Formula	Temperature, °C.	Specific Heat Cal. 15°/g/°C.
Paraldehyde	$(CH_3CHO)_3$	0	.436
Pentadecane	$C_{15}H_{32}$	0–50	.497
Pentadecylene	$C_{15}H_{30}$	0–50	.471
iso-Pentane	C_5H_{12}	8	.527
Petroleum	....	21–58	.511
Phenetole	$C_6H_5OC_2H_5$	20	.446
Phenol	C_6H_5OH	14–26	.561
Piperidine	$C_5H_{11}N$	20–98	.523
Propane	C_3H_8	0	.576
Propionaldehyde	C_2H_5CHO	0	.522
Propionic acid	$C_2H_5CO_2H$	20–137	.560
Propionitrile	C_2H_5CN	19–95	.538
n-Propyl acetate	$CH_3CO_2C_3H_7$	20	.459
Propyl alcohol	$C_3H_7{\cdot}OH$	−100	.435
		0	.526
		25	.586
benzene	$C_6H_5C_3H_7$	0	400
Propyl benzoate	$C_6H_5CO_2C_3H_7$	20	.398
butyrate	$C_3H_7CO_2C_3H_7$	20	459
chloroacetate	$CH_2ClCO_2C_3H_7$	20	414
n-Propyl formate	$HCO_2C_3H_7$	20	.459
Propyl isobutyrate	$C_3H_7CO_2C_3H_7$	20	.459
phenyl ether	$C_6H_5OC_3H_7$	0	.429
propionate	$C_2H_5CO_2C_3H_7$	20	.459
valerate	$C_4H_9CO_2C_3H_7$	20	.459
Pseudocumene	$C_6H_3(CH_3)_3$	20	.414
Pyridine	C_5H_5N	21–108	.431
Quinol	$C_6H_4(OH)_2$	0	.492
Quinoline	C_9H_7N	0–20	.352
Quinone	$C_6H_4O_2$	0	.324
Resorcinol	$C_6H_4(OH)_2$	0	.452
Salicylaldehyde	HOC_6H_4CHO	18	.382
Salol	$HOC_6H_4CO_2C_6H_5$	44.1	.391
Stearic acid	$C_{17}H_{35}CO_2H$	74–137	.550
Tetrachloroethylene	C_2Cl_4	20	.211
Tetradecane	$C_{14}H_{30}$	0–50	.497
Tetradecylene	$C_{14}H_{28}$	0–50	.453
m-Thymol	$C_9H_{13}OH$	50	.567
Toluene	$C_6H_5CH_3$	0	.386
		50	.421
		100	.470
o-Toluic acid	$CH_3C_6H_4CO_2H$	0	.422
m-Toluic acid	....	0	.503
p-Toluic acid	....	0	.316
o-Toluidine	$CH_3C_6H_4NH_2$	22–195	.524
p-Toluidine	....	43	.598
Trichloroethylene	C_2HCl_3	20	.223
Tridecane	$C_{13}H_{28}$	0–50	.499
Tridecylene	$C_{13}H_{26}$	0–50	.457
Trinitrotoluene (2, 4, 6)	$CH_3C_6H_2(NO_2)_3$	?	.335
Turpentine, oil	....	0	.411
Undecane	$C_{11}H_{24}$	0–50	.501
Undecylene	$C_{11}H_{22}$	0–50	.482
Valeronitrile	C_4H_9CN	23–121	.520
iso-Valeric acid	$C_4H_9CO_2H$	23–93	.590
o-Xylene	$(CH_3)_2C_6H_4$	30	.411
m-Xylene	....	16–35	.387
p-Xylene	....	30	.397

SPECIFIC HEAT OF ALLOYS AND VARIOUS SOLIDS

Values given in calories per gram.

Substance.	Temp. ° C.	Sp. heat.	Observer.
Alloys			
aluminum bronze, 88.7 Cu, 11.3 Al	20–100	0.104	Louguinine
antimony bismuth tin, 21.6Sb, 36.7Bi, 41.7Sn	22–99	.046	Regnault
antimony lead, 37.1Sb, 62.9Pb	10–98	.0388	"
bell metal, 80Cu, 20Sn......	14–98	.0862	"
Bismuth tin, 63.8Bi, 36.2Sn...	20–99	.0400	"
46.9Bi, 53.1Sn............	20–99	.0450	"
56.9Bi, 43.1Sn............	17–99	.0450	Person
brass, 60Cu, 40Zn..........	−186– −79	.0743	Behn
	−79– +18	.0873	"
	20–100	.0917	Voigt
72Cu, 28Zn...............	14–98	.094	Regnault
bronze, 80Cu, 20Sn.........	15–98	.086	"
88Cu, 12Sn, 0.94P	20–100	.0874	Voigt
constantan....	0	.098	Jaeger, Diesselhorst
	100	.102	" "
German silver...............	0	.094	Tomlinson
	100	.095	"
invar, 64Fe, 36Ni	−182– +15	.095	"
	15–100	.120	"
	15–600	.126	"
lead bismuth, 39.9Pb, 60.1Bi..	16–99	.0317	Person
lead bismuth tin,			
32.5Pb, 49.0Bi, 18.5Sn......	14–80	.0600n	Person
31.8Pb, 32.0Bi, 36.2Sn.....	11–98	.0448	Regnault
lead tin, 63.7Pb, 36.3Sn......	12–99	.0407	"
46.7Pb, 53.3Sn...	10–99	.0451	"
Lipowitz alloy, 24.97Pb, ... 10.13Cd, 50.66Bi, 14.24Sn	5–50	.0345	Mazotto
manganin................	0	.097	Jaeger, Diesselhorst
	100	.095	" "
platinum iridium, 90Pt, 10Ir..	20–100	.0323	Pionchon
Rose alloy, 27.5Pb, 48.9Bi,.... 23.6 Sn	20–89	.0552	Schüz
solder, *see* lead tin			
steel, ordinary (.004C).......	20	0.107	Regnault
	100	.117	"
Wood's alloy, 25.85Pb, 6.99Cd, 52.43Bi, 14.73Sn	5–50	.0352	Mazotto
Amalgams			
50.8Pb, 49.2Hg..............	23–99	.0383	Regnault
78.3Pb, 37.1Sn, 62.9Hg.......	22–99	.0729	"
54.1Sn, 45.9Hg.............	25–99	.0659	Schüz
Asbestos...............	20–98	.195	Ulrich
Basalt.....................	20–100	.20	Mean
Calcspar...................	0–100	.2005	Lindner
Carborundum................	3–44	.162	
Cellulose, dry...............	....	.37	Mean
Cement, powder..............	200–10	.20	
Chalk......................	20–99	.214	Regnault
Charcoal....................	10	.16	Weber, 1875
Clay, dry...................	20–100	.22	Mean
Ebonite....................	20–100	.40	Louguinine, 1882
Glass, normal thermometer.....	19–100	.1988	Wachsmuth
crown.....	10–50	.161	H. Meyer
flint.....................	10–50	.117	H. Meyer

SPECIFIC HEAT OF ALLOYS AND VARIOUS SOLIDS
(Continued)

Values given in calories per gram

Substance.	Temp °C.	Sp. heat.	Observer.
Carboloy	....	.052	
Granite	12–100	.192	Joly
Ice	−200	.168	Nernst, 1910
	−180	.199	" "
	−160	.230	" "
	−140	.262	" "
	−100	.325	" "
	− 60	.392	" "
	− 20	.480	" "
	− 10	.530	" "
India rubber (Para)	?–100	.481	Gee and Terry
Leather, dry	....	.36	
Marble	0–100	.21	
Mica (Mg)	20–98	.2061	Ulrich
Paraffin	0–20	.6939	R. W. Weber
Porcelain	15–950	.26	Harker, 1905
Quartz	12–100	.188	Joly
Rock-salt	13–45	.219	Kopp
Rubber, Synthetic (Government rubber—Styrene Type)	−253	.02692	Rands, Ferguson, Prather, 1944
	−223	.08075	
	−173	.1462	
	− 73	.2685	
	− 53	.4009	
	− 33	.4123	
	− 3	.4319	
	7	4391	
	17	4465	
	27	4539	
	47	.4697	
Sugar	20	274	Hess, 1888
Vulcanite	20–100	.3312	A. M. Mayer
Wood	....	.42	

COLOR SCALE OF TEMPERATURE

This table is the result of an effort to interpret in terms of thermometric readings, the common expressions used in describing temperatures. It is obvious that the values are only approximations.

Color.	Temperature, °C.
Incipient red heat	500–550
Dark red heat	650–750
Bright red heat	850–950
Yellowish red heat	1050–1150
Incipient white heat	1250–1350
White heat	1450–1550

SPECIFIC HEAT

Variation with Temperature

The table gives the true specific heat at the temperatures named. From data of Wüst, Meuthen, and Durrer, 1918.

°C	Pb	Zn	Al	Ag	Au	Cu	Ni	Fe	Co	Quartz
0°C	0 0359	0 0878	0 2220	0 0573	0.0317	0 1008	0 1095	0.1055	0 0912	....
100	0 0336	0 0965	0.2297	0 0583	0 0320	0 1014	0 1200	0 1168	0 0993	0 2372
200	0 0313	0.1052	0.2374	0 0594	0 0322	0 1020	0 1305	0.1282	0.1073	0 2416
300	0 0290	0 1139	0 2451	0 0605	0 0325	0 1026	0 1409	0.1396	0.1154	0 2460
400	0.0266	0.1226	0.2529	0 0616	0 0328	0 1032	0 1294	0.1509	0 1235	0 2504
500	0 0259	0 1173	0 2606	0 0627	0 0330	0 1038	0.1294	0.1623	0 1316	0 2548
600	0 0252	0 1141	0 2683	0 0638	0 0333	0 1045	0 1294	0 1737	0 1396	0 2592
700	0 0246	0 1109	0 2523	0 0649	0 0335	0 1051	0 1295	0 1850	0 1477	0 2636
800	0 0239	0 1076	0 2571	0 0660	0 0338	0 1057	0 1295	0 1592	0 1558	0 2680
900	0 0233	0 1044	0 2619	0 0671	0 0341	0 1063	0 1295	0 1592	0 1639	0 2724
1000	0 0226	0 1012	0.2667	0 0637	0 0343	0 1069	0 1295	0 1448	.....	0 2768
1100	....	...	......	0 0694	0 0329	0 1028	0 1296	0.1448	0 1424	0 2812
1200	.....	....	....	0 0750	0 0346	0 1159	0 1296	0.1448	0 1454	0 2856
1300	......	...	..	0 0807	0 0364	0 1291	0 1296	0 1449	0 1483	0.2900
1400	......	....	....	....	.	....	0 1296	0 1449	0 1512	0 2944
1500	......	..	.....	..	.	..	0 1338	0 2142	0 1472	0.2988
1600	......	...	....	..	....	...	.....	0.1501	0 1472	......

SPECIFIC HEAT FOR AQUEOUS SOLUTIONS

Giving the specific heat referred to that of water at the same temperatures. Concentration of the solutions is stated as the number of molecules of water to each molecule of the solutes (anhydrous.)

Values from Marignac, Thomsen and others.

Substance	Temp. °C.	Concentration 25	50	100
Acetic acid	21–52	0.957	0.977	0.987
Aluminum sulphate	21–53	.....	.....	0.870
Ammonium acetate	17.5	0.911	0.951	0.976
chloride	18	0.881	0.937	0.966
hydroxide	18	.....	0.999	.....
nitrate	18	0.880	0.929	0.962
sulphate	19–51	0.803	0.879	0.933
Barium chloride	22–27	.....	0.780	0.875
Cadmium sulphate	12	0.696	0.813	0.893
Calcium acetate	22–52	.....	0.896	0.939
chloride	21–51	0.754	0.851	0.917
nitrate	21–51	0.760	0.846	0.911
Chromic acid	21–53	0.825	0.896	0.942
Copper chloride	19–51	0.779	0.864	0.920
nitrate	18–50	.....	0.826	0.899
sulphate	18–23	.....	0.841	0.908
Ferric chloride	0–98	0.666	0.750	0.854
Hydrochloric acid	18	.....	0.932	0.964
Lactic acid	16.5	0.947	0.970	0.982
Lead acetate	18–51	0.682	0.794	0.881
nitrate	18–51	.....	0.750	0.851
Lithium chloride	11	.....	0.941	0.973
hydroxide	13	.....	0.958	0.978
Magnesium chloride	22–52	0.772	0.866	0.923
nitrate	19–51	.....	0.832	0.903
Sulphate	18	.....	0.857	0.917
Manganese chloride	0–98	0.787	0.861	0.914
nitrate	19–51	.....	0.832	0.903
sulphate	19–51	.....	0.844	0.912
Nickel chloride	24–55	0.735	0.831	0.902
nitrate	24–55	0.717	0.823	0.895
sulphate	25–56	.....	0.837	0.910
Nitric acid	18	.....	0.930	0.963
Oxalic acid	20–52	.....	0.942	0.965
Potassium bromide	20–51	0.769	0.864	0.925
carbonate	21–52	0.760	0.851	0.916
chloride	18	0.828	0.904	0.948
chromate	20–51	.....	0.810	0.890
hydroxide	18	.....	0.916	0.954
iodide	20–51	0.715	0.830	0.906
nitrate	18–23	0.832	0.900	0.943

SPECIFIC HEAT OF AQUEOUS SOLUTIONS
(Continued)

Giving the specific heat referred to that of water at the same temperatures. Concentration of the solutions is stated as the number of molecules of water to each molecule of the solutes (anhydrous).

Values from Marignac, Thomsen and others.

Substance.	Temp. °C.	Concentration 25	50	100
Potassium oxalate	21–52	.....	0.839	0.908
sulphate	19–52	.....	.....	0.902
Silver nitrate	25–52	0.750	0.849	0.913
Sodium acetate	18	.....	0.938	0.965
bromide	20–52	0.809	0.886	0.939
carbonate	21–52	0.865	0.907	0.943
chloride	18	0.880	0.931	0.962
chromate	21–52	0.781	0.856	0.913
hydroxide	18	0.908	0.942	0.968
iodide	20–51	0.749	0.850	0.917
nitrate	18	0.863	0.918	0.950
sulphate	21–52	0.819	0.878	0.960
Strontium chloride	21–26	.....	0.814	0.894
nitrate	19–51	.....	0.817	0.890
Sulphuric acid	21	0.854	0.915	0.956
Zinc chloride	19–51	0.796	0.884	0.933
nitrate	20–52	0.718	0.823	0.899
sulphate	20–52	.....	0.842	0.911

SPECIFIC HEAT OF GASES

The following table gives values of the specific heat at constant pressure in calories per gram and the value of γ, the ratio of the specific heat at constant pressure to that at constant volume. Values are given for pressures of one atmosphere except where otherwise stated.

Gas or vapor	Sp. ht., const. press. Temp. °C	Sp. ht. cal./g	Obs.	Value of γ Temp. °C	γ	Obs.
Acetaldehyde, C_2H_4O				30	1.14	39
Acetic acid, $C_2H_4O_2$	118–140	1.50	1	136	1.15	30
	140–180	1.27	1			
Acetone, C_3H_6O	26–110	0.3470	23			
	130–230	0.4119	23			
Acetylene, C_2H_2	−71	0.3509	26	−71	1.31	26
	+15	0.3832		+15	1.26	
Air	−120 (10 atm.)	0.2719		−118	1.415	3
	(20 atm.)	0.3221		−78	1.408	3
	(40 atm.)	0.4791		+17	1.403	3
	(70 atm.)	0.7771				
	−50 (10 atm.)	0.2440				
	(20 atm.)	0.2521				
	(40 atm.)	0.2741				
	(70 atm.)	0.3121				
(Data for air compiled from various observers: 2, 6, 10, 19, 21)	+50 (20 atm.)	0.2480				
	(100 atm.)	0.2719				
	(220 atm.)	0.2961				
	100 (1 atm.)	0.2404		100	1.401	
	(20 atm.)	0.2471				
	(100 atm.)	0.2600				
	(220 atm.)	0.2841				
	400	0.2430		400	1.393	
	1000	0.2570		1000	1.365	
	1400	0.2699		1400	1.341	
	1800	0.2850		1800	1.316	
Ammonia, NH_3	15	0.5232		15	1.310	27
Amylene, C_5H_{10}	*ca* 210	0.631	9			
Argon, A	−180	0.133	26	−180	ca. 1.76	26
	+15	0.1253		+15	1.668	
Benzene, C_6H_6	80	0.260	14			
	34–115	0.301	37			
	120–220	0.370	23			
Bromine, Br	19–388	0.055	31	20–350 (0.3–1.5 atm.)	1.32	31
Carbon dioxide, CO_2	−75	0.184	26	−75	1.37	26
	+15	0.1989		+15	1.304	
Carbon disulfide, CS_2	80–190	0.157	23			
Carbon monoxide, CO	−180	0.259	26	−180	1.41	26
	+15	0.2478		+15	1.404	
Carbon tetrachloride, CCl_4	0	0.140	16	20 (0.1 atm.)	1.13	4, 34
	30	0.132	16			
	70	0.115	16			
Chlorine, Cl_2	15	0.1149		15	1.355	
Chloroform, $CHCl_3$	27–118	0.145	37	100	1.15	30
	120–230	0.157	23			
Cyanogen, CN	15	0.4095		15	1.256	
Ethane, C_2H_6	−82	0.3475	26	−82	1.28	26
	+15	0.3861		+15	1.22	
				50	1.21	7
Ethyl acetate, $C_4H_8O_2$	35–189	0.3711	37			
Ethyl alcohol, C_2H_6O	90	0.406	8, 18	90	1.13	8, 18
	100–223	0.454	23			
Ethyl bromide, C_2H_5Br	28–116	0.161	37	14 (0.3 atm.)	1.19	4
Ethyl chloride, C_2H_5Cl	10–170	0.2750	23	16 (0.3–0.5 atm.)	1.19	4
Ethyl cyanide, C_3H_5N	114–223	0.4260	23			
Ethyl ether, $C_4H_{10}O$	27–189	0.4619	37			
	35	0.4449	14	35	1.08	14

SPECIFIC HEAT OF GASES (Continued)

Gas or vapor	Sp. ht., const. press. Temp. °C	Sp. ht. cal./g	Obs.	Value of γ Temp. °C	γ	Obs.
Ethylene, C_2H_4	−91	0.3086	26	−91	1.35	26
	+15	0.3592		+15	1.255	
	15–100	0.399	23, 37	100	1.18	39
	25–200	0.430	37			
Ethylene chloride, $C_2H_4Cl_2$	111–221	0.23	23			
Helium, He	−180	1.25	26	−180	1.660	26
Hydriodic acid, HI				+20–100	1.40	31
Hydrobromic acid, HBr	+11–100	0.082	23			
Hydrochloric acid, HCl	10–190	0.185	23			
	15	0.1939		15	1.41	
				100	1.40	31
Hydrocyanic acid, HCN				65	1.31	35
Hydrogen, H_2				−185	1.605	3
	−181	2.64	26	−181	1.597	26
				−118	1.480	3
				−78	1.443	3
	−76	3.15	26	−76	1.453	26
				−21	1.420	3
	+15	3.389		+15	1.410	
	100	3.429		100	1.404	
	200	3.463		200	1.398	
(Data for hydrogen compiled from various observers 5, 21, 29)	400	3.533		400	1.387	
	600	3.602		600	1.377	
	800	3.672		800	1.367	
	1000	3.741		1000	1.358	
	2000	4.088		2000	1.318	
Hydrogen sulfide, H_2S	−57	0.292	26	−57	1.29	26
	−45	0.279	26	−45	1.30	26
	+10–190	0.243	33			
	15	0.2533		+15	1.32	
				18	1.30	32
Iodine, I	206–377	0.034	31	185	1.30	30
Krypton, Kr				19	1.68	22
Mercury, Hg				360	1.67	13
				(0.5–1 atm.)		
Methane, CH_4	−115	0.4502	15	−115	1.41	15
	−80	0.5038	26	−80	1.34	26
	−74	0.4979	15	−74	1.35	15
	+10–200	0.5931	6, 23			
	15	0.5284		+15	1.31	
Methyl alcohol, CH_4O	77	0.390	8	77	1.203	8
	100–223	0.4581	23			
Methyl ether, C_2H_6O				6–30	1.11	17
Neon, Ne				19	1.64	22
Nitric oxide, NO	−80	0.2445	26	−80	1.38	26
	−45	0.2389	26	−45	1.39	26
	+10–180	0.232	23			
	15	0.2329		+15	1.400	
Nitrogen, N_2	−181	0.256	26	−181	1.47	26
	+15	0.2477		+15	1.404	
Nitrogen peroxide, NO_2	27–67	1.620	1, 15			
Nitrous oxide, N_2O	−70	0.1900	26	−70	1.34	26
	−30	0.1998	26	−30	1.31	26
				0	1.32	39
	+15	0.2004		+15	1.303	
	25–100	0.212	23			
Oxygen, O_2	−181	0.2285	26	−181	1.45	26
	−76	0.2143	26	−76	1.415	26
	+15	0.2178		+15	1.401	
	100	0.2181	20	100	1.399	20
	200	0.2187	20	200	1.396	20

SPECIFIC HEAT OF GASES (Continued)

Gas or vapor	Sp. ht., const. press. Temp. °C	Sp. ht. cal./g	Obs	Value of γ Temp. °C	γ	Obs.
Oxygen, O_2 (*Con't*)	400	0.2213	20	400	1.391	20
	600	0.2241	20	600	1.383	20
	800	0.2278	20	800	1.375	20
	1000	0.2325	20	1000	1.365	20
	2000	0.2669	20	2000	1.303	20
Phosphorus, P				300	1.17	28
Phosphorus trichloride, PCl_3	110–250	0.135	23			
Potassium, K				850	1.77	36
				680–1000	1.69	24
Propane, C_3H_8				16 (0.5 atm.)	1.13	4
Silicon tetrachloride, $SiCl_4$	90–230	0.132	23			
Sodium, Na				750–920	1.68	24
Stannic chloride, $SnCl_4$	149–273	0.094	23			
Sulfur dioxide, SO_2	10–190	0.134	23			
	15	0.1516		15	1.29	
				20	1.27	27
Water, H_2O	100	0.4820		100	1.324	
	120	0.4769				
	140	0.4741				
	160	0.4719				
(Data for water compiled	180	0.4710				
from various observers	200	0.4710		200	1.310	
11, 12, 20)	300	0.4769		300	1.304	
	400	0.4901		400	1.301	
	500 (1 atm.)	0.5071		500	1.296	
	(10 atm.)	0.5159				
	(20 atm.)	0.5259				
Xenon, Xe				19	1.66	22

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BOILING POINT OF WATER*

(Hydrogen Scale)

Pressure mm.	Tenths of millimeters .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
700	97.714	718	722	725	729	733	737	741	745	749
701	753	757	761	765	769	773	777	781	785	789
702	792	796	800	804	808	812	816	820	824	828
703	832	836	840	844	847	851	855	859	863	867
704	871	875	879	883	887	891	895	899	902	906
705	97.910	914	918	922	926	930	934	938	942	946
706	949	953	957	961	965	969	973	977	981	985
707	989	993	996	*000	*004	*008	*012	*016	*020	*024
708	98.028	032	036	040	043	047	051	055	059	063
709	067	071	075	079	082	086	090	094	098	102
710	98.106	110	114	118	121	125	129	133	137	141
711	145	149	153	157	160	164	168	172	176	180
712	184	188	192	195	199	203	207	211	215	219
713	223	227	230	234	238	242	246	250	254	258
714	261	265	269	273	277	281	285	289	292	296
715	98.300	304	308	312	316	320	323	327	331	335
716	339	343	347	351	355	358	362	366	370	374
717	378	382	385	389	393	397	401	405	409	412
718	416	420	424	428	432	436	440	443	447	451
719	455	459	463	467	470	474	478	482	486	490
720	98.493	497	501	505	509	513	517	520	524	528
721	532	536	540	544	547	551	555	559	563	567
722	570	574	578	582	586	590	593	597	601	605
723	609	613	617	620	624	628	632	636	640	643
724	647	651	655	659	662	666	670	674	678	682
725	98.686	689	693	697	701	705	709	712	716	720
726	724	728	732	735	739	743	747	751	755	758
727	762	766	770	774	777	781	785	789	793	797
728	800	804	808	812	816	819	823	827	831	835
729	838	842	846	850	854	858	861	865	869	873
730	98.877	880	884	888	892	896	899	903	907	911
731	915	918	922	926	930	934	937	941	945	949
732	953	956	960	964	968	972	975	979	983	987
733	991	994	998	*002	*006	*010	*013	*017	*021	*025
734	99.029	032	036	040	044	048	051	055	059	063
735	99.067	070	074	078	082	085	089	093	097	101
736	104	108	112	116	119	123	127	131	135	138
737	142	146	150	153	157	161	165	169	172	176
738	180	184	187	191	195	199	203	206	210	214
739	218	221	225	229	233	236	240	244	248	252
740	99.255	259	263	267	270	274	278	282	285	289
741	293	297	300	304	308	312	316	319	323	327
742	331	334	338	342	346	349	353	357	361	364
743	368	372	376	379	383	387	391	394	398	402
744	406	409	413	417	421	424	428	432	436	439
745	99.443	447	451	454	458	462	466	469	473	477
746	481	484	488	492	495	499	503	507	510	514
747	518	522	525	529	533	537	540	544	548	551
748	555	559	563	566	570	574	578	581	585	589
749	592	596	600	604	607	611	615	619	622	626

For lower pressures see under Vapor Tension of Water

BOILING POINT OF WATER (Continued)

(Hydrogen Scale)

Pressure mm	Tenths of millimeters .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
750	99 630	633	637	641	645	648	652	656	659	663
751	667	671	674	678	682	686	689	693	697	700
752	704	708	712	715	719	723	726	730	734	738
753	741	745	749	752	756	760	764	767	771	775
754	778	782	786	790	793	797	801	804	808	812
755	99 815	819	823	827	830	834	838	841	845	849
756	852	856	860	863	867	871	875	878	882	886
757	889	893	897	900	904	908	911	915	919	923
758	926	930	934	937	941	945	948	952	956	959
759	963	967	970	974	978	982	985	989	993	996
760	100 000	004	007	011	015	018	022	026	029	033
761	037	040	044	048	052	055	059	063	066	070
762	074	077	081	085	088	092	096	099	103	107
763	110	114	118	121	125	129	132	136	140	143
764	147	151	154	158	162	165	169	173	176	180
765	100 184	187	191	195	198	202	206	209	213	216
766	220	224	227	231	235	238	242	246	249	253
767	257	260	264	268	271	275	279	283	286	290
768	293	297	300	304	308	311	315	319	322	326
769	330	333	337	341	344	348	352	355	359	363
770	100 366	370	373	377	381	384	388	392	395	399
771	403	406	410	414	417	421	424	428	432	435
772	439	442	446	450	453	457	461	464	468	472
773	475	479	483	486	490	493	497	501	504	508
774	511	515	519	522	526	530	533	537	540	544
775	100 548	551	555	559	562	566	569	573	577	580
776	584	588	591	595	598	602	606	609	613	616
777	620	624	627	631	634	638	642	645	649	653
778	656	660	663	667	671	674	678	681	685	689
779	692	696	689	703	707	710	714	718	721	725
780	100 728	732	735	739	743	746	750	753	757	761
781	764	768	772	775	779	782	786	789	793	797
782	800	804	807	811	815	818	822	825	829	833
783	836	840	843	847	851	854	858	861	865	869
784	872	876	879	883	886	890	894	897	901	904
785	100 908	912	915	919	922	926	929	933	937	940
786	944	947	951	954	958	962	965	969	972	976
787	979	983	987	990	994	997	*001	*005	*008	*012
788	101 015	019	022	026	029	033	037	040	044	047
789	051	054	058	062	065	069	072	076	079	083
790	101 087	090	094	097	101	104	108	112	115	119
791	122	126	129	133	136	140	144	147	151	154
792	158	161	165	168	172	176	179	183	186	190
793	193	197	200	204	207	211	215	218	222	225
794	229	232	236	239	243	246	250	254	257	261
795	101 264	268	271	275	278	282	286	289	293	296
796	300	303	307	310	314	317	321	324	328	332
797	335	339	342	346	349	353	356	360	363	367
798	370	374	377	381	385	388	392	395	399	402
799	406	409	413	416	420	423	427	430	434	437
800	101 441							.	.	..

MELTING AND BOILING POINTS OF THE ELEMENTS

Element	Melting point, °C	Boiling point, °C	Element	Melting point, °C	Boiling point, °C
Aluminum	659.7	1800	Neon	−248.67	−245.9
Antimony	630.5	1380	Nickel	1455	2900
Argon	−189.2	−185.7	Nitrogen	−209.86	−195.8
Arsenic	814 (36 atm)	615 (subl.)	Osmium	2700	>5300
Barium	850	1140	Oxygen	−218.4	−183
Beryllium	1350	1500	Ozone	−251.4	−112
Bismuth	271.3	1450	Palladium	1553	2200
Boron	2300	2550	Phosphorus (yel.)	44.1	280
Bromine	−7.2	58.78	Platinum	1773.5	4300
Cadmium	320.9	767	Potassium	62.3	760
Calcium	810	1170	Praseodymium	940	......
Carbon	>3500	4200	Radium	960	1140
Cerium	640	1400	Radon	−110	......
Cesium	28.5	670	Rhenium	3000	......
Chlorine	−101.6	−34.6	Rhodium	1985	>2500
Chromium	1615	2200	Rubidium	38.5	700
Cobalt	1480	3000	Ruthenium	2450	>2700
Columbium (niobium)	2500	3300	Samarium	>1300	......
Copper	1083	2300	Scandium	1200	2400
Erbium	...	......	Selenium, gray, trig	220	688
Fluorine	−223	−187	Silicon	1420	2600
Gallium	29.75	>1600	Silver	960.5	1950
Germanium	958.5	2700	Sodium	97.5	880
Gold	1063	2600	Strontium	800	1150
Hafnium	1700	>3200	Sulfur (rhomb.)	112.8	444.6
Helium	<−272.2	−268.9	(monocl.)	119.0	......
Hydrogen	−259.14	−252.7	Tantalum	2996	>4100
Indium	155	1450	Tellurium	452	1390
Iodine	113.5	184.35	Thallium	303.5	1650
Iridium	2350	>4800	Thorium	1845	>3000
Iron	1535	3000	Tin	231.89	2260
Krypton	−157 (−169)	−152.9 (−151.8)	Titanium	1800	>3000
Lanthanum	826	1800	Tungsten	3370	5900
Lead	327.4	1620	Uranium	<1150	......
Lithium	186	>1220	Vanadium	1710	3000
Magnesium	651	1110	Xenon	−112 (−140)	−107.1 (−109.1)
Manganese	1260	1900	Ytterbium	1800	......
Mercury	−38.87	356.9	Yttrium	1490	2500
Molybdenum	2620	3700	Zinc	419.47	907
Neodymium	840	......	Zirconium	1900	>2900

MELTING AND BOILING POINTS OF THE ELEMENTS

MELTING POINTS OF MIXTURES OF METALS

(*Smithsonian Physical Tables*)

Melting-points, °C.

Metals		Percentage of metal in second column.										
		0%*	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Pb	Sn.	326	295	276	262	240	220	190	185	200	216	232
	Bi.	322	290			179	145	126	168	205	.	268
	Te.	322	710	790	880	917	760	600	480	410	425	446
	Ag.	328	460	545	590	620	650	705	775	840	905	959
	Na	.	360	420	400	370	330	290	250	200	130	96
	Cu.	326	870	920	925	945	950	955	985	1005	1020	1084
	Sb.	326	250	275	330	395	440	490	525	560	600	632
Al.	Sb.	650	750	840	925	945	950	970	1000	1040	1010	632
	Cu.	650	630	600	560	540	580	610	755	930	1055	1084
	Au.	655	675	740	800	855	915	970	1025	1055	675	1062
	Ag.	650	625	615	600	590	580	575	570	650	750	954
	Zn.	654	640	620	600	580	560	530	510	475	425	419
	Fe.	653	860	1015	1110	1145	1145	1220	1315	1425	1500	1515
	Sn.	650	645	635	625	620	605	590	570	560	540	232
Sb.	Bi.	632	610	590	575	555	540	520	470	405	330	268
	Ag.	630	595	570	545	520	500	505	545	680	850	959
	Sn	622	600	570	525	480	430	395	350	310	255	232
	Zn.	632	555	510	540	570	565	540	525	510	470	419
Ni	Sn.	1455	1380	1290	1200	1235	1290	1305	1230	1060	800	232
Na.	Bi.	96	425	520	590	645	690	720	730	715	570	268
	Cd.	96	125	185	245	285	325	330	340	360	390	322
Cd.	Ag.	322	420	520	610	700	760	805	850	895	940	954
	Tl.	321	300	285	270	262	258	245	230	210	235	302
	Zn.	322	280	270	295	313	327	340	355	370	390	419
Au	Cu.	1063	910	890	895	905	925	975	1000	1025	1060	1084
	Ag.	1064	1062	1061	1058	1054	1049	1039	1025	1006	982	963
	Pt	1075	1125	1190	1250	1320	1380	1455	1530	1610	1685	1775
K.	Na.	62	17.5	−10	−3.5	5	11	26	41	58	77	97.5
	Hg	. .					90	110	135	162	265	. . .
	Tl.	62.5	133	165	188	205	215	220	240	280	305	301
Cu	Ni	1080	1180	1240	1290	1320	1355	1380	1410	1430	1440	1455
	Ag	1082	1035	990	945	910	870	830	788	814	875	960
	Sn.	1084	1005	890	755	725	680	630	580	530	440	232
	Zn.	1084	1040	995	930	900	880	820	780	700	580	419
Ag	Zn.	959	850	755	705	690	660	630	610	570	505	419
	Sn.	959	870	750	630	550	495	450	420	375	300	232
Na	Hg.	96.5	90	80	70	60	45	22	55	95	215	. . .

* The data in this table are compiled from various sources,— hence the variations in the melting point of the metals as shown in this column.

MELTING AND BOILING TEMPERATURES

Temperature of Fusion for Various Substances for Atmospheric Pressure

For the melting- and boiling-points of the chemical elements and of inorganic compounds see under Physical Constants of the Elements, and Physical Constants of Inorganic Compounds.

Substance.	Temp. of fusion ° C.	Substance.	Temp. of fusion ° C.
Acetylene	−81	German silver	1000.
Alcohol, ethyl	−130.	Glass	1100.
Brass	900.	Glycerine	17.
Butter	31–31.5	Olive oil	2–6
Camphor	177.7	Paraffin	55.
Caoutchouc, pure gum	120.	Resin	135.
Chloroform	−63.2	Sea water	−2.5
Ether	−117 6	Sugar (cane)	160.

Boiling-point for Various Substances

Giving the boiling-point at atmospheric pressure and the variation per cm. pressure near 76 cm.

Substance.	Temp. ° C.	Variation.
Acetone	57.	0.39
Acetylene	−72.2	
Alcohol, ethyl	78.3	0.34
methyl	64.7	0.35
Amyl acetate	148.	
Benzene	80.	0.43
Camphor	205.	0.56
Chloroform	61.2	0.41
Ether	34.6	0.40
Gasoline	70–90.	
Glycerine	291.	
Turpentine	159.	

MELTING POINT OF ICE—VARIATION WITH PRESSURE

(From Tamann, 1900, by permission.)

Pressure in kg. per sq.cm.	Temp. ° C.	Pressure in kg. per sq.cm.	Temp. ° C.
1	0.0	1410	−12.5
336	− 2.5	1625	−15.0
615	− 5.0	1835	−17.5
890	− 7.5	2042	−20.0
1155	−10.0	2200	−22.1

BOILING POINTS OF WATER-ALCOHOL MIXTURES

(P. N. Evans, Journal of Industrial and Engineering Chemistry.)

Boiling point, °C.	Weight per cent alcohol in		Boiling point, °C.	Weight per cent alcohol in	
	Liquid.	Vapor.		Liquid.	Vapor.
78.2	91	92	86.5	18	71
78.4	85	89	87.0	17	70
78.6	82	88	87.5	16	69
78.8	80	87	88.0	15	68
79 0	78	86	88.5	13	67
79.2	76	85	89.0	12	65
79.4	74	85	89.5	11	63
79 6	72	84	90.0	10	61
79.8	69	84	90.5	10	59
80 0	67	83	91 0	9	57
80 2	64	83	91.5	8	55
80.4	62	82	92.0	8	53
80 6	59	82	92 5	7	51
80 8	56	81	93.0	6	49
81.0	53	81	93.5	6	46
81 2	50	80	94.0	5	44
81.4	47	80	94.5	5	42
81.6	45	80	95.0	4	39
81.8	43	79	95.5	4	36
82.0	41	79	96 0	3	33
82 5	36	78	96 5	3	30
83 0	33	78	97.0	2	27
83.5	30	77	97.5	2	23
84.0	27	76	98 0	1	19
84 5	25	75	98 5	1	15
85.0	23	74	99 0	0	10
85.5	21	73	99 5	0	5
86.0	20	72	100.0	0	0

MOLECULAR ELEVATION OF THE BOILING POINT

(Most values from Hoyt, C.S. and Fink, C.K., Journal of Physical Chemistry, Vol. 41, No. 3., March, 1937.)

Molecular elevation of the boiling point showing the elevation of the boiling point in degrees C due to the addition of one gram molecular weight of the dissolved substance to 1000 grams of any one of the solvents below. The correction in the last column gives the number of degrees to be subtracted for each mm. of difference between the barometric reading and 760 mm.

Solvent	K_B	Barometric Correction per mm.
Acetic acid	3.07	0 0008
Acetone	1.71	0.0004
Aniline	3.52	0 0009
Benzene	2.53	0.0007
Bromobenzene	6.26	0 0016
Carbon bisulfide	2 34	0.0006
Carbon tetrachloride	5 03	0 0013
Chloroform	3 63	0 0009
Cyclohexane	2.79	0.0007
Ethanol (ethyl alcohol)	1 22	0.0003
Ethyl acetate	2.77	0 0007
Ethyl ether	2 02	0.0005
n-Hexane	2 75	0.0007
Methanol (methyl alcohol)	0 83	0 0002
Methyl acetate	2 15	0 0005
Nitrobenzene	5 24	0 0013
n-Octane	4 02	0 0010
Phenol	3 56	0 0009
Toluene	3.33	0 0008
Water	0 512	0 0001

MOLECULAR DEPRESSION OF THE FREEZING POINT

Showing the depression of the freezing point due to the addition of one gram molecular weight of dissolved substance, for various solvents.

Solvent	Depression for one gram molecular weight dissolved in 100 gms. °C
Acetic acid	39 0
Benzene	49 0
Benzophenone	98 0
Diphenyl	80 0
Diphenylamine	86 0
Ethylene dibromide	118 0
Formic acid	27 7
Naphthalene	68–69
Nitrobenzene	70.0
Phenol	74.0
Stearic acid	45 0
Triphenyl methane	124 5
Urethane	51 4
Water	18 5–18 7

LOWERING OF FREEZING POINT FOR AQUEOUS SOLUTIONS

The concentration of the solutions is expressed as the number of gram formula weights per 1,000 grams of water. The table gives the molal lowering of freezing point in °C for the concentration stated.

Solute	Concentration										
	0 001	0 005	0 01	0 02	0 05	0 1	0 2	0 5	1 0	2 0	5.0
$AgNO_3$			3 60	3 54	3 42	3 32	3 20	2 96	2 63	2 16	
$AlCl_3$*			7.10	6 62	6 02	5 68	5 76	7 06	9 45		
$Al(NO_3)_3$*					6 3	6 1	6 5	7 9	10 6		
$Al_2(SO_4)_3$							3 92	4 19			
$BaCl_2$	5 30	5 120	5 034	4 938	4 796	4 698	4 64		5 20		
$Ba(NO_3)_2$	5 39		5 01	4 87		4 25	3 79				
Br_2			1 95	1 90	1.875	1 870					
$CaCl_2$			5.112		4 886	4 832	4 78	4 98	5 85	7 68	
$Ca(NO_3)_2$					4 7	4 58	4 50		4 59	4 86	
$CdBr_2$		4 76	4 47		3 65	3 22					
$CdCl_2$		4 79	4.71		4 12	3 84	3 57	3 24			
CdI_2		4 06	3.86		2 69	2 27	2 1	2 1	2 25		
$Cd(NO_3)_2$		5.28	5 20	5 15		5 08	5 08		5 42	6 2	
$CdSO_4$		2.916	2.744		2 3	2.1	1 93		1.79		
Cl_2			4 0	3 816	3 145						
$CoCl_2$		5 208	5 107		4 918	4 882	4 946		6 31	8 51	
$Co(NO_3)_2$						4 6	4 5		5 5		
$CoSO_4$							2 02	1 75			
$Cr_2(SO_4)_3$*					4 6	4 2					
$Cu(NO_3)_2$						5.1	5 0		5 7	6 7	
$CuSO_4$		2 871	2 703		2 266	2.085	1 912	1.722	1.715		
$FeCl_3$				6 93	6 28	6 01	6 02	6 55	8 18	12 45	
$Fe(NO_3)_3$						6.30	6.48		9.4		
$FeSO_4$						2 39	2 10				
HCl	3 690	3 635	3 601	3 568	3 532	3.523	3 54	3 68	3 94	4 43	
HF						1.98	1 91		1 93	2 03	
HI						3 50	3 56		4 09	4 75	7.70
HIO_3					3 12	2 95	2 71	2 21	1 72	1 16	0 75
HNO_3		3 67	3 64	3 61	3 55	3 51	3 47		3 58	3 79	
H_2O_2						1 84	1 84	1 86	1 88	1.91	1 96
H_3PO_4		3.1	2 95	2 75		2 36	2 23		2 14	2 41	
H_2SO_3						2 8	2 6		2.35		
H_2SO_4		4.814	4 584		4 112	3 940	3 790		4 04	5 07	
$H_2S_2O_6$*					5 06	5 04	5 14				
KBr					3 500	3 452	3 400	3 330	3 290	3.275	
$KC_2H_3O_2$								3 78	3 92	4 22	
KCN					3 49	3 41	3 34	3.27	3.25	3 27	3 44
KCNS						3 44	3 37	3 25			
$K_2C_2O_4$*						4 46		4 18			
K_2CO_3			5 20	5 00	4 74	4 56	4 42	4 39	4 51	5.01	
KCl	3 66	3.648	3 610	3 566	3 503	3 451	3 394	3 314	3 250	3 220	
$KClO_3$			3 556	3 513	3 435	3 334					
K_2CrO_4					3 0	3 3	3 6			3 6	
$K_2Cr_2O_7$	7 06										
KF						3 39	3 35	3 36	3 39		
$K_3Fe(CN)_6$	7 10	6 53	6 26	5 98	5 60	5 30	5 00	4 55			
$K_4Fe(CN)_6$					5 72	5 18					
$KHCO_3$								3 09	2 91	2 68	
KH_2PO_4				3 59	3 47	3 34	3 19				
KI						3 54	3 44	3 38	3 37	3 40	3 50
KNO_3		3 638	3 590	3 537	3 431	3 314	3 154	2 882	2 56		
KOH		3 66	3 65	3 62	3 50	3.42	3 39	3 44	3 60	3 96	5 77
K_2SO_4	5 280	5 150	5 010		4 559	4 319	4 044				
LiCl		3 612	3 598	3 582	3 553	3 52	3 50	3.58	3 80	4.41	
$MgCl_2$			5 144		4 974	4 938	4 977	5 38	6 35	8 8	

*Concentration stated as gram formula weights per liter.

LOWERING OF FREEZING POINT (Continued)

Solute	Concentration										
	0 001	0 005	0 01	0.02	0 05	0 1	0 2	0 5	1 0	2 0	5 0
$Mg(NO_3)_2$						4 74	4 78	5 08	5 78	7 0	
$MgSO_4$	3 38	3 02	2 85		2 420	2 252	2 090		2 02		
$MnCl_2$						4 86	4.90		6 05		
$Mn(NO_3)_2$							4 92		6 00	6 64	
$MnSO_4$							2 14		2 02	2 5	
NH_3									1 94	1 94	2 06
NH_4Cl		3 617	3 582	3 544	3.489	3 442	3 392	3 34	3 33	3 34	
NH_4NO_3			3 572	3 535	3 470	3 396	3 296	3 11	2 92	2 65	2 17
$NaBr$				3 611	3 551	3 507	3.468	3 456	3 51	3 68	
$NaC_2H_3O_2$						3 59	3 58		3 78	4 14	
Na_2CO_3			5 12	4 93		4 44	4 17				
$NaCl$	3 66		3 604	3 570		3 478	3 424		3.37	3 45	
$NaClO_3$	3 682		3 588	3 547		3 433					
Na_2CrO_4						4 49	4 23		3 71		
$NaHCO_3$						3 65	3 51				
Na_2HPO_4			4 99	4 85	4 61	4 34					
NaI						3 68	3 52		3 66	3 97	
$NaNH_4HPO_4$			4 95	4 78	4 51	4 23	3 87				
$NaNO_3$			3 55	3 53		3 406	3 327		3 02	2 79	
$NaOH$			3 55	3 51	3 46	3 42	3 41	3 40	3 44	3 58	
Na_3PO_4			7 15	6 85	6 11	5 69					
Na_2S*						7 12	7 06		6 87		
Na_2SiO_3			6 6	6 42		5 32	4 71	4 02			
Na_2SO_3							4 36				
Na_2SO_4		5 2	5 04	4 874		4 344	4 057				
$NiCl_2$				5 58	5 41	5 38	5 43	5 69	6 22	8 67	
$Ni(NO_3)_2$						4 91	4 91		5 86		
$NiSO_4$		3 036	2 832	2 63	2 37	2 20	2 05		1 94		
$Pb(C_2H_3O_2)_2$					3 63	2 85	2 37				
$Pb(NO_3)_2$	5 368	5 090	4 898	4 657	4 276	3 955	3 560	2 940	2 435		
$SrCl_2$			5 3	5 10		4 82	4 80		5 83	7 54	
$Sr(NO_3)_2$			5 7	5 35		4 63	4 40		3 90		
$UO_2(NO_3)_2$					5 16	5 00	4 92		6 15		
$Zn(C_2H_3O_2)_2$						4 74	4 37				
$ZnCl_2$		5 28	5 15	5 04		4 94	4 96		5 21	5 49	
$Zn(NO_3)_2$						4 89	4 89		5 83	7 12	
$ZnSO_4$			2 80	2.65		2 29	2 12		1 87		

ORGANIC COMPOUNDS

Solute	0 005	0 01	0 02	0 05	0 1	0 2	0 5	1 0	2 0	5 0	10 0
Acetic acid					1 90			1 79		1 6	1 4
Acetone			1 86		1 85			1 79			
Aniline		1 85		1 82	1 79	1 73					
Citric acid		2 26	2 14	2 08	2 03		1 93	1 94	2 00		
Dextrose				1 86	1 86	1 87		1 92			
Ethyl acetate					1 85	1 83	1 82				
Ethylalcohol			1 83		1 83			1 83	1 84		2 2
Ethyl ether		1 67	1 67	1.70	1 72	1 70					
Glycerol		1 86				1 87	1 89	1 92		2 1	
Methyl alcohol		1 82			1 81	1 81			1 86		2 00
Oxalic acid			3 40	3 04	2 84	2 64					
Phenol					1 81	1 83	1 63				
Picric acid	3 82	3 63	3 28								
n-Propyl alcohol		1 86		1 84	1 83			1 79	1 79	1 76	
Sucrose	1 86			1 87	1 88	1 90	1 96	2 06	2 3		
d-Tartaric acid		2 34		2 12	2.05	1 98	1 94			2 35	

CORRECTION OF BOILING POINTS TO STANDARD PRESSURE

By H. B. Hass and R. F. Newton

This correction may be made by using the equation:

$$\Delta t = \frac{(273.1 + t)(2.8808 - \log p)}{\phi + .15(2.8808 - \log p)} \tag{1}$$

where Δt = degrees C to be added to the observed boiling point.
t = the observed boiling point.
$\log p$ = the logarithm of the observed pressure in millimeters of mercury.
ϕ = the entropy of vaporization at 760 mm.

The value of ϕ may be estimated from the graph and the table. Substances not included in the table may be classified by grouping them with compounds which bear a close physical or structural resemblance to them.

Example 1. Benzene boils at 20°C. at 75 mm pressure. What is its normal boiling point? We do not find benzene in the table but we find hydrocarbons in group 2, and a group 2 compound with a boiling point of 20° has a ϕ of 4.6.

Substituting in the equation:

$$\Delta t = \frac{(273.1 + 20)(2.8808 - 1.8751)}{4.60 + .15(2.8808 - 1.8751)} = 62^\circ$$

Adding this to 20° gives 82° as a first approximation.

The graph shows that the ϕ for a compound of group 2 boiling at 82° is 4.72 instead of 4.60 which we originally used. Since ϕ is in the denominator, this increase will lower our Δt by the ratio, $\frac{4.60}{4.72}$, or the corrected Δt is $62 \times \frac{4.60}{4.72} = 60.4$. Adding Δt to t, gives 80.4° as a second approximation.

The formula can best be used in a slightly different form when the reverse calculation is desired, *i.e.*, when one calculates the vapor pressure at a given temperature, lower than the normal boiling point.

$$2.8808 - \log p = \frac{\phi \Delta t}{273.1 + t - .15\Delta t} \tag{2}$$

Example 2. Alcohol boils at 78.4°C. What is its vapor pressure at 20°C.? Substituting in equation 2:

$$2.8808 - \log p = \frac{6.06 \times 58.4}{293.1 - (.15 \times 58.4)} = 1.245$$

$$\log p = 2.8808 - 1.245 = 1.6358$$

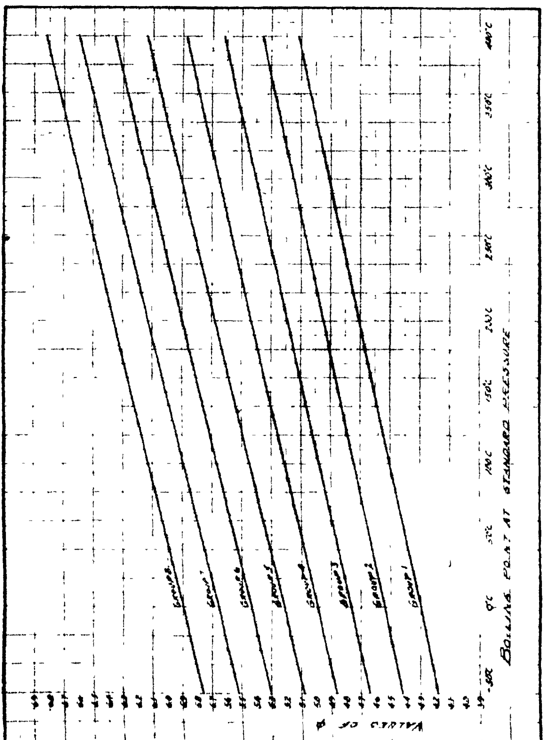
$$p = 43.2 \text{ mm.}$$

Here no second approximation is necessary, since the correct value of ϕ was taken immediately, the normal boiling point having been known.

Compound	Group	Compound	Group
Acetaldehyde	3	Carbon sulfoselenide	2
Acetic acid	4	*m p*. Chloroanilines	3
Acetic anhydride	6	Chlorinated derivatives	Same group as though Cl was H
Acetone	3		
Acetophenone	4		
Amines	3	*o.m.p.* Cresols	4
n-Amyl alcohol	8	Cyanogen	4
Anthracene	1	Cyanogen chloride	3
Anthraquinone	1	Dibenzyl ketone	2
Benzaldehyde	2	Dimethyl amine	4
Benzoic acid	5	Dimethyl oxalate	4
Benzonitrile	2	Dimethyl silicane	2
Benzophenone	2	Esters	3
Benzyl alcohol	5	Ethanol	8
Butylethylene	1	Ethers	2
Butyric acid	7	Ethylamine	4
Camphor	2	Ethylene glycol	7
Carbon monoxide	1	Ethylene oxide	3
Carbon oxysulfide	2	Formic acid	3
Carbon suboxide	2	Glycol diacetate	4

CORRECTION OF BOILING POINTS (Continued)

Compound	Group	Compound	Group
Halogen derivatives	Same group as though halogen were hydrogen	Methyl formate	4
		Methyl salicylate	2
		Methyl silicane	1
		α, β Naphthols	3
		Nitrobenzene	3
Heptylic acid	7	Nitromethane	3
Hydrocarbons	2	o.m.p. Nitrotoluenes	2
Hydrogen cyanide	3	o m.p. Nitrotoluidines	2
Isoamyl alcohol	7	Phenanthrene	1
Isobutyl alcohol	8	Phenol	5
Isobutyric acid	6	Phosgene	2
Isocaproic acid	7	Phthalic anhydride	2
Methane	1	Propionic acid	5
Methanol	7	*n*-Propyl alcohol	8
Methyl amine	5	Quinoline	2
Methyl benzoate	3	Sulfides	2
Methyl ether	3	Tetranitromethane	3
Methyl ethyl ether	3	Trichloroethylene	1
Methyl ethyl ketone	2	Valeric acid	7
Methyl fluoride	3	Water	6



CRITICAL CONSTANTS FOR GASES

Name	Formula	Temp., °C.	Pressure, atm.	Density gms. per $cm.^3$
Acetaldehyde	CH_3CHO	188	....	....
Acetic acid	CH_3CO_2H	321.6	57.2	0.351
Acetic anhydride	$(CH_3CO)_2O$	296	46	....
Acetone	$(CH_3)_2CO$	235.0	47	0.268
Acetonitrile	CH_3CN	274.7	47.7	0.240
Acetylene	C_2H_2	36	62	0.231
Air	....	−140.7	37.2	0.35;* 0.31†
Allyl alcohol	C_3H_5OH	272	....	....
Allyl sulfide	$(C_3H_5)_2S$	380	....	....
Allylene	CH_3CCH	128	....	....
Ammonia	NH_3	132.4	111.5	0.235
iso-Amyl acetate	$CH_3CO_2C_5H_{11}$	326	....	....
iso-Amyl alcohol	$C_5H_{11}OH$	307	....	....
tert.-Amyl alcohol	$C_5H_{11}OH$	272	....	....
iso-Amyl butyrate	$C_3H_7CO_2C_5H_{11}$	346	....	....
iso-Amyl formate	$HCO_2C_5H_{11}$	303	34	0.282
iso-Amyl mercaptan	$C_5H_{11}SH$	321	....	....
iso-Amyl propionate	$C_2H_5CO_2C_5H_{11}$	338	....	....
iso-Amyl sulfide	$(C_5H_{11})_2S$	391	....	....
Aniline	$C_6H_5NH_2$	426	52.4	....
Anisole	$C_6H_5OCH_3$	369	41.3	....
Argon	A	−122	48	0.531
Benzene	C_6H_6	288.5	47.7	0.304
Benzonitrile	C_6H_5CN	426	41.6	....
Bromine	Br_2	302	....	....
Bromobenzene	C_6H_5Br	397	44.6	0.486
n-Butane	C_4H_{10}	153	36	....
iso-Butane	C_4H_{10}	134	37	....
n-Butyl acetate	$CH_3CO_2C_4H_9$	306	....	....
iso-Butyl acetate	$CH_3CO_2C_4H_9$	288	31	0.281
n-Butyl alcohol	C_4H_9OH	287	48.4	....
iso-Butyl alcohol	C_4H_9OH	265	48	....
sec.-Butyl alcohol	C_4H_9OH	265	....	....
tert.-Butyl alcohol	C_4H_9OH	235	....	....
iso-Butyl butyrate	$C_3H_7CO_2C_4H_9$	338	....	....
iso-Butyl formate	$HCO_2C_4H_9$	278	38	0.288
iso-Butyl isobutyrate	$C_3H_7CO_2C_4H_9$	329	....	....
iso-Butyl isovalerate	$C_4H_9CO_2C_4H_9$	348	....	....
iso-Butyl propionate	$C_2H_5CO_2C_4H_9$	319	....	....
n-Butyric acid	$C_3H_7CO_2H$	355	....	0.302
iso-Butyric acid	$C_3H_7CO_2H$	336	....	0.304
Butyronitrile	C_3H_7CN	309	37.4	....
Capronitrile	$C_5H_{11}CN$	349	32.2	....
Carbon dioxide	CO_2	31.1	73.0	0.460
Carbon disulfide	CS_2	273	76	....
Carbon monoxide	CO	−139	35	0.311
Carbon oxysulfide	COS	105	61	....
Carbon tetrachloride	CCl_4	283.1	45.0	0.558
Chlorine	Cl_2	144.0	76.1	0.573
Chlorobenzene	C_6H_5Cl	359	44.6	0.365
Chloroform	$CHCl_3$	263	....	0.516
m-Cresol	C_7H_7OH	432	45.0	....
o-Cresol	C_7H_7OH	422	49.4	....
p-Cresol	C_7H_7OH	426	50.8	....
Cyanogen	C_2N_2	128	59	....
Cyclohexane	C_6H_{12}	281.0	40.4	0.270
Diethyl amine	$(C_2H_5)_2NH$	223.5	36.2	0.246

* Plait point. † Critical point of contact.

CRITICAL CONSTANTS FOR GASES (Continued)

Name	Formula	Temp., °C.	Pressure, atm.	Density gms. per cm.³
Diisobutyl	C_8H_{18}	277	24.5	0.237
Diisopropyl	C_6H_{14}	227.4	30.6	0.241
Dimethyl amine	$(CH_3)_2NH$	164.6	51.7	...
Dimethyl aniline	$C_6H_5N(CH_3)_2$	415	35.8	...
Dimethyl-*o*-toluidine	$C_7H_7N(CH_3)_2$	395	30.8	...
Dipropyl amine	$(C_3H_7)_2NH$	277	31	...
Ethane	C_2H_6	32.1	48.8	0.21
Ethyl acetate	$CH_3CO_2C_2H_5$	250.1	37.8	0.308
Ethyl alcohol	C_2H_5OH	243.1	63.1	0.2755
Ethyl allyl ether	$C_2H_5OC_3H_5$	245	...	...
Ethyl amine	$C_2H_5NH_2$	183.2	55.5	...
Ethyl bromide	C_2H_5Br	231	...	0.513
Ethyl butyrate	$C_3H_7CO_2C_2H_5$	293	30	0.276
Ethyl caprylate	$C_7H_{15}CO_2C_2H_5$	386	...	...
Ethyl chloride	C_2H_5Cl	187.2	52	0.33
Ethyl chloroformate	$ClCO_2C_2H_5$	<235	...	
Ethyl crotonate	$C_3H_5CO_2C_2H_5$	326	...	...
Ethyl disulfide	$(C_2H_5)_2S_2$	369	...	...
Ethyl ether	$(C_2H_5)_2O$	193.8	35.5	0.2625
Ethyl formate	$HCO_2C_2H_5$	235.3	46.65	0.323
Ethyl isobutyrate	$C_3H_7CO_2C_2H_5$	280	30	0.276
Ethyl isovalerate	$C_4H_9CO_2C_2H_5$	315	...	...
Ethyl mercaptan	C_2H_5SH	225.5	54.2	0.301
Ethyl nonylate	$C_8H_{17}CO_2C_2H_5$	400	...	...
Ethyl propionate	$C_2H_5CO_2C_2H_5$	272.9	33.0	0.2965
Ethyl propyl ether	$C_2H_5OC_3H_7$	227.4	32.1	0.258
Ethyl sulfide	$(C_2H_5)_2S$	283.8	39.1	0.279
Ethyl valerate	$C_4H_9CO_2C_2H_5$	297	...	...
Ethylene	C_2H_4	9.7	50.9	0.22
Ethylene oxide	$(CH_2)_2O$	192.0	...	...
Fluorobenzene	C_6H_5F	286	44.6	0.354
Germanium tetrachloride	$GeCl_4$	277	38	
Helium	He	−267.9	2.26	0.0693
n-Heptane	C_7H_{16}	266.8	26.8	0.234
n-Heptyl alcohol	$C_7H_{15}OH$	365	...	...
n-Hexane	C_6H_{14}	234.8	29.5	0.234
Hydrazine	N_2H_4	380	145	...
Hydrogen	H_2	−239.9	12.8	0.0310
Hydrogen bromide	HBr	90	84	...
Hydrogen chloride	HCl	51.4	81.6	0.42
Hydrogen cyanide	HCN	183.5	50	0.20
Hydrogen iodide	HI	151	82	...
Hydrogen selenide	H_2Se	138	88	...
Hydrogen sulfide	H_2S	100.4	88.9	...
Iodine	I_2	553	...	...
Iodobenzene	C_6H_5I	448	44.6	0.581
Krypton	Kr	−63	54	0.78
Mercury	Hg	>1550	>200	4–5
Methane	CH_4	−82.5	45.8	0.162
Methyl acetate	$CH_3CO_2CH_3$	233.7	46.3	0.325
Methyl alcohol	CH_3OH	240.0	78.7	0.272
Methyl amine	CH_3NH_2	156.9	73.6	...
Methyl aniline	$C_6H_5NHCH_3$	429	51.3	...
Methyl butyrate	$C_3H_7CO_2CH_3$	281.3	34.2	0.300
Methyl chloride	CH_3Cl	143.1	65.8	0.37
Methyl ethyl ether	$C_2H_5OCH_3$	164.7	43.4	0.270
Methyl ethyl sulfide	$CH_3SC_2H_5$	260	42	...
Methyl fluoride	CH_3F	44.9	62.0	...
Methyl formate	HCO_2CH_3	214.0	59.15	0.349
Methyl isobutyrate	$C_3H_7CO_2CH_3$	267.55	33.7	0.301

CRITICAL CONSTANTS FOR GASES (Continued)

Name	Formula	Temp., °C.	Pressure, atm.	Density gms per cm.³
Methyl mercaptan	CH_3SH	196.8	71.4	0.323
Methyl oxalate	$(CO_2CH_3)_2$	260	9.48	....
Methyl propionate	$C_2H_5CO_2CH_3$	257.4	39.3	0.312
Methyl sulfide	$(CH_3)_2S$	229.9	54.6	0.306
Methyl valerate	$C_4H_9CO_2CH_3$	294d	32	0.279
Methylal	$H_2C(OCH_3)_2$	224	....	....
Neon	Ne	−228.7	25.9	0.484
Nitric oxide	NO	−94	65	0.52
Nitrogen	N_2	−147.1	33.5	0.3110
Nitrogen tetroxide	N_2O_4	158	99	....
Nitrous oxide	N_2O	36.5	71.7	0.45
n-Octane	C_8H_{18}	296	24.6	0.234
n-Octyl alcohol	$C_8H_{17}OH$	385	....	....
sec.-Octyl alcohol	$C_8H_{17}OH$	364	....	....
Oxygen	O_2	−118.8	49.7	0.430
Paraldehyde	$C_6H_{12}O_3$	290	....	....
n-Pentane	C_5H_{12}	197.2	33.0	0.232
iso-Pentane	C_5H_{12}	187.8	32.8	0.234
Phenetole	$C_6H_5OC_2H_5$	374	33.8	....
Phenol	C_6H_5OH	419	60.5	....
Phosgene	$COCl_2$	182	56	0.52
Phosphine	PH_3	51	64	0.30
Phosphonium chloride	PH_4Cl	49	73	....
Propane	C_3H_8	95.6	43	....
Propionic acid	$C_2H_5CO_2H$	339.5	53.0	0.315
Propionitrile	C_2H_5CN	291.2	41.3	0.241
Propyl acetate	$CH_3CO_2C_3H_7$	276.2	32.9	0.296
n-Propyl alcohol	C_3H_7OH	263.7	49.95	0.273
iso-Propyl alcohol	C_3H_7OH	235	53	....
Propyl amine	$C_3H_7NH_2$	223.8	46.3	....
Propyl butyrate	$C_3H_7CO_2C_3H_7$	327	....	....
n-Propyl chloride	C_3H_7Cl	230	45.2	....
Propyl formate	$HCO_2C_3H_7$	264.85	40.1	0.309
Propyl isobutyrate	$C_3H_7CO_2C_3H_7$	316	....	....
Propyl isovalerate	$C_4H_9CO_2C_3H_7$	336	....	....
Propyl propionate	$C_2H_5CO_2C_3H_7$	305	....	....
Propylene	C_3H_6	92.3	45.0	....
Pyridine	C_5H_5N	344	60.0	....
Quinoline	C_9H_7N	>520	....	....
Radon	Rn	104	62	....
Silicon tetrafluoride	SiF_4	−1.5	50	....
Silicon tetrahydride	SiH_4	−3.5	48	....
Stannic chloride	$SnCl_4$	318.7	37.0	0.742
Sulfur	S	1040	....	....
Sulfur dioxide	SO_2	157.2	77.7	0.52
Sulfur trioxide	SO_3	218.3	83.6	0.630
Thiophene	C_4H_4S	317	48	....
Thymol	$C_{10}H_{13}OH$	425	....	....
Toluene	$C_6H_5CH_3$	320.6	41.6	0.292
Tolunitrile	C_7H_7CN	450	....	....
Triethyl amine	$(C_2H_5)_3N$	262	30	0.251
Trimethyl amine	$(CH_3)_3N$	161	41	....
n-Valeric acid	$C_4H_9CO_2H$	379	....	....
iso-Valeric acid	$C_4H_9CO_2H$	361	....	....
Water	H_2O	374.0	217.72	0.4
Xenon	Xe	16.6	58.2	1.155

VAN DER WAALS' CONSTANTS FOR GASES*

Name	Formula	*a*	*b*
Acetic acid	CH_3CO_2H	0.03505	0.004767
Acetic anhydride	$(CH_3CO)_2O$	0.03967	0.005639
Acetone	$(CH_3)_2CO$	0.02774	0.004437
Acetonitrile	CH_3CN	0.03503	0.005216
Acetylene	C_2H_2	0.00875	0.002293
Ammonia	NH_3	0.00831	0.001655
Amyl formate	$HCO_2C_5H_{11}$	0.05496	0.007724
Amylene	C_5H_{10}	0.03169	0.005390
iso-Amylene	C_5H_{10}	0.03604	0.006274
Aniline	$C_6H_5NH_2$	0.05282	0.006113
Argon	A	0.00268	0.001437
Benzene	C_6H_6	0.03588	0.005150
Benzonitrile	C_6H_5CN	0.06655	0.007697
Bromobenzene	C_6H_5Br	0.05692	0.006872
n-Butane	C_4H_{10}	0.02884	0.005472
iso-Butane	C_4H_{10}	0.02564	0.005098
iso-Butyl acetate	$CH_3CO_2C_4H_9$	0.05680	0.008185
iso-Butyl alcohol	C_4H_9OH	0.03394	0.005103
iso-Butyl benzene	$C_6H_5C_4H_9$	0.07692	0.009572
iso-Butyl formate	$HCO_2C_4H_9$	0.04492	0.006591
Butyronitrile	C_3H_7CN	0.05125	0.007126
Capronitrile	$C_5H_{11}CN$	0.06808	0.008858
Carbon dioxide	CO_2	0.00716	0.001905
Carbon disulfide	CS_2	0.02316	0.003431
Carbon monoxide	CO	0.00296	0.001779
Carbon oxysulfide	COS	0.00784	0.002597
Carbon tetrachloride	CCl_4	0.04064	0.006173
Chlorine	Cl_2	0.01294	0.002510
Chlorobenzene	C_6H_5Cl	0.05068	0.006485
Chloroform	$CHCl_3$	0.03023	0.004562
m-Cresol	C_7H_8O	0.06254	0.007175
Cyanogen	C_2N_2	0.01528	0.003081
Cyclohexane	C_6H_{12}	0.04347	0.006359
Cymene	$C_{10}H_{14}$	0.08403	0.010430
Decane	$C_{10}H_{22}$	0.09675	0.012970
Di-isobutyl	C_8H_{18}	0.06970	0.010250
Diethylamine	$(C_2H_5)_2NH$	0.03816	0.006216
Dimethylamine	$(CH_3)_2NH$	0.02069	0.003826
Dimethyl aniline	$C_6H_5N(CH_3)_2$	0.07473	0.008793
Diphenyl	$(C_6H_5)_2$	0.10520	0.011070
Diphenyl methane	$(C_6H_5)_2CH_2$	0.07616	0.010000
Dipropylamine	$(C_3H_7)_2NH$	0.05524	0.008124
Di-isopropyl	C_6H_{14}	0.04610	0.007453
Durene	$C_{10}H_{14}$	0.09032	0.010820
Ethane	C_2H_6	0.01074	0.002848
Ethyl acetate	$CH_3CO_2C_2H_5$	0.04076	0.006303
Ethyl alcohol	C_2H_5OH	0.02395	0.003753
Ethylamine	$C_2H_5NH_2$	0.02113	0.003754
Ethyl benzene	$C_6H_5C_2H_5$	0.05701	0.007443
Ethyl butyrate	$C_3H_7CO_2C_2H_5$	0.05993	0.008567
Ethyl isobutyrate	$C_3H_7CO_2C_2H_5$	0.05754	0.008410
Ethyl chloride	C_2H_5Cl	0.02174	0.003862
Ethyl ether	$(C_2H_5)_2O$	0.03464	0.006002
Ethyl formate	$HCO_2C_2H_5$	0.02949	0.004714
Ethyl mercaptan	C_2H_5SH	0.02240	0.003615
Ethyl propionate	$C_2H_5CO_2C_2H_5$	0.04861	0.007209
Ethyl sulfide	$(C_2H_5)_2S$	0.03737	0.005421
Ethylene	C_2H_4	0.00891	0.002551
Ethylene bromide	$(CH_2Br)_2$	0.02787	0.003868
Ethylene chloride	$(CH_2Cl)_2$	0.03370	0.004850
Ethylidene chloride	CH_3CHCl_2	0.03090	0.004790
Fluorobenzene	C_6H_5F	0.03972	0.005742
Germanium tetrachloride	$GeCl_4$	0.04504	0.006630
Helium	He	0.000068	0.001058
n-Heptane	C_7H_{16}	0.06280	0.011850

*For pressure in atm. Vol. at 0°C and 1 atm. = 1

VAN DER WAALS' CONSTANTS FOR GASES (Continued)

Name	Formula	*a*	*b*
n-Hexane	C_6H_{14}	0.04861	0.007747
Hydrogen	H_2	0.000487	0.001188
Hydrogen bromide	HBr	0.00887	0.001978
Hydrogen chloride	HCl	0.00731	0.001822
Hydrogen selenide	H_2Se	0.01050	0.002070
Hydrogen sulfide	H_2S	0.00883	0.001914
Iodobenzene	C_6H_5I	0.06592	0.007395
Krypton	Kr	0.00462	0.001776
Mercury	Hg	0.01613	0.000757
Mesitylene	C_9H_{12}	0.06840	0.008835
Methane	CH_4	0.00449	0.001910
Methyl acetate	$CH_3CO_2CH_3$	0.03047	0.004870
Methyl alcohol	CH_3OH	0.01898	0.002992
Methylamine	CH_3NH_2	0.01421	0.002675
Methyl butyrate	$C_3H_7CO_2CH_3$	0.04771	0.007004
Methyl isobutyrate	$C_3H_7CO_2CH_3$	0.04883	0.007308
Methyl chloride	CH_3Cl	0.01489	0.002894
Methyl ether	$(CH_3)_2O$	0.01609	0.003235
Methyl ethyl ether	$CH_3OC_2H_5$	0.02381	0.004364
Methyl ethyl sulfide	$CH_3SC_2H_5$	0.03833	0.006821
Methyl fluoride	CH_3F	0.00923	0.002350
Methyl formate	HCO_2CH_3	0.02160	0.003602
Methyl propionate	$C_2H_5CO_2CH_3$	0.03968	0.006070
Methyl sulfide	$(CH_3)_2S$	0.02564	0.004113
Methyl valerate	$C_4H_9CO_2CH_3$	0.05771	0.008237
Naphthalene	$C_{10}H_8$	0.07923	0.008648
Neon	Ne	0.00042	0.000763
Nitric oxide	NO	0.00267	0.001245
Nitrogen	N_2	0.00277	0.001747
Nitrogen dioxide	NO_2	0.01053	0.001975
Nitrous oxide	N_2O	0.00754	0.001971
n-Octane	C_8H_{18}	0.07440	0.010670
Oxygen	O_2	0.00271	0.001421
n-Pentane	C_5H_{12}	0.03788	0.006516
iso-Pentane	C_5H_{12}	0.03598	0.006328
Phenetole	$C_6H_5OC_2H_5$	0.07009	0.008764
Phosphine	PH_3	0.00923	0.002302
Phosphonium chloride	PH_4Cl	0.00808	0.002029
Phosphorus	P	0.10550	0.006990
Propane	C_3H_8	0.001727	0.003770
Propionic acid	$C_2H_5CO_2H$	0.04008	0.005297
Propionitrile	C_2H_5CN	0.03277	0.004750
Propyl acetate	$CH_3CO_2C_3H_7$	0.04908	0.007227
Propyl alcohol	C_3H_7OH	0.02974	0.004548
iso-Propyl alcohol	C_3H_7OH	0.02747	0.004377
Propyl amine	$C_3H_7NH_2$	0.02988	0.004865
Propyl benzene	$C_3H_7C_6H_5$	0.07146	0.009064
iso-Propyl benzene	$C_6H_5C_3H_7$	0.07105	0.009041
Propyl chloride	C_3H_7Cl	0.03170	0.005098
Propyl formate	$HCO_2C_3H_7$	0.03777	0.005724
Propylene	C_3H_6	0.01670	0.003693
Pseudo-cumene	C_9H_{12}	0.07298	0.009023
Silicon fluoride	SiF_4	0.00836	0.002487
Silicon tetrahydride	SiH_4	0.00861	0.002583
Stannic chloride	$SnCl_4$	0.05363	0.007332
Sulfur dioxide	SO_2	0.01338	0.002516
Thiophene	C_4H_4S	0.04130	0.005670
Toluene	$C_6H_5CH_3$	0.04795	0.006533
Triethylamine	$(C_2H_5)_3N$	0.05415	0.008176
Trimethylamine	$(CH_3)_3N$	0.02594	0.004841
Xenon	Xe	0.00816	0.002279
m-Xylene	$C_6H_4(CH_3)_2$	0.06051	0.007912
o-Xylene	$C_6H_4(CH_3)_2$	0.05974	0.007836
p-Xylene	$C_6H_4(CH_3)_2$	0.06165	0.008077
Water	H_2O	0.01089	0.001362

FREEZING MIXTURES

A is the proportion of the substance named in the first column to be added to the proportion of the substance given in column *B*. The table gives the temperature of the separate ingredients and the temperature attained by the mixture.

(From Smithsonian Tables.)

Substance.	*A*	*B*	Initial Temp. ° C.	Temp. ° C. attained by mixt.
$NaC_2H_3O_2$ (cryst.)	85	H_2O 100	10.7	− 4.7
NH_4Cl	30	H_2O 100	13 3	− 5 1
$NaNO_3$	75	H_2O 100	13.2	− 5.3
$Na_2S_2O_3$ (cryst.)	110	H_2O 100	10.7	− 8.0
KI	140	H_2O 100	10.8	−11.7
$CaCl_2$ (cryst.)	250	H_2O 100	10.8	−12.4
NH_4NO_3	60	H_2O 100	13.6	−13.6
$CaCl_2$	30	* Snow 100	− 1	−10.9
NH_4Cl	25	Snow 100	− 1	−15.4
NH_4NO_3	45	Snow 100	− 1	−16.75
$NaNO_3$	50	Snow 100	− 1	−17.75
NaCl	33	Snow 100	− 1	−21.3
$H_2SO_4+H_2O$ (66.1% H_2SO_4)	1	Snow 1.097	− 1	−37.0
	1	Snow 2 52	− 1	−30.0
	1	Snow 4 32	− 1	−25 0
	1	Snow 7 92	− 1	−20 0
	1	Snow 13 08	− 1	−16.0
$CaCl_2+6H_2O$	1	Snow .49	0	−19.7
	1	Snow .61	0	−39 0
	1	Snow .70	0	−54 9
	1	Snow .81	0	−40.3
	1	Snow 1 23	0	−21 5
	1	Snow 2 46	0	− 9.0
	1	Snow 4 92	0	− 4.0
Alcohol at 4°	77	Snow 73.	0	−30.0
	.	CO_2 solid	. .	−72 0
Chloroform	. .	CO_2 solid	. . . .	−77.0
Ether	. .	CO_2 solid	.	−77 0
Liquid SO_2	. .	CO_2 solid	.	−82.0
NH_4NO_3	1	H_2O 94	20	− 4.0
	1	Snow .94	0	− 4 0
	1	H_2O 1.20	10	−14.0
	1	Snow 1.20	0	−14.0
	1	H_2O 1.31	10	−17 5
	1	Snow 1 31	0	−17 5

* Or finely pulverised ice

PERCENTAGE COMPOSITION OF ANTI-FREEZE SOLUTIONS

Alcohol and Water Solutions

% alcohol by weight	Sp. gr. 20°/4° C. (68° F.)	Point of crystallization	
		Deg. C.	Deg. F.
2.5	0.99363	−1.0	30.2
4.8	0.98971	−2.0	28.4
6.8	0.98658	−3.0	26.6
11.3	0.98006	−5.0	23.0
13.8	0.97670	−6.1	21.0
16.4	0.97336	−7.5	18.5
17.5	0.97194	−8.7	16.3
18.8	0.97024	−9.4	15.1
20.3	0.96823	−10.6	12.9
22.1	0.96578	−12.2	10.0
24.2	0.96283	−14.0	6.8
26.7	0.95914	−16.0	3.2
29.9	0.95400	−18.9	−2.0
33.8	0.94715	−23.6	−10.5
39.0	0.93720	−28.7	−19.7
46.3	0.92193	−33.9	−29.0
56.1	0.90008	−41.0	−41.8
71.9	0.86311	−51.3	−60.3

Glycerol (Glycerine) and Water Solutions*

% glycerol by weight	Sp. gr. 15°/15° C. (59° F.)	Sp. gr. 20°/20° C. (68° F.)	Freezing point	
			Deg. C.	Deg. F.
10	1.02415	1.02395	−1.6	29.1
20	1.04935	1.04880	−4.8	23.4
30	1.07560	1.07470	−9.5	14.9
40	1.10255	1.10135	−15.4	4.3
50	1.12985	1.12845	−23.0	−9.4
60	1.15770	1.15605	−34.7	−30.5
70	1.18540	1.18355	−38.9	−38.0
80	1.21290	1.21090	−20.3	−5.5
90	1.23950	1.23755	−1.6	29.1
100	1.26557	1.26362	17.0	62.6

* Bosart and Snoddy, Jour. Ind. Eng. Chem. 19, 506 (1927); Lane, ibid. 17, 924 (1925). The Chemical Division of the Proctor and Gamble Co. suggest that a correction of +2° F. be added to all temperatures below zero degree Fahrenheit.

Ethylene Glycol (Prestone) and Water Solutions

% glycol by volume	Sp. gr. 15.6° C. (60° F.)	Freezing point	
		Deg. C.	Deg. F.
12.5	1.019	−3.9	25
17.0	1.026	−6.7	20
25.0	1.038	−12.2	10
32.5	1.048	−17.8	0
38.5	1.056	−23.3	−10
44.0	1.063	−28.9	−20
49.0	1.069	−34.4	−30
52.5	1.073	−40.0	−40

HEAT OF FUSION

Elements and Inorganic Compounds

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g*
Aluminum	Al	658	76.8
Ammonia	NH_3	−75	108.1
		−77.6	83.9
Antimony bromide	$SbBr_3$	94	9.76
trichloride	$SbCl_3$	73.2	13.3
trisulfide	Sb_2S_3	540	17.6
Argon	A	−190	6.71
Arsenous bromide	$AsBr_3$	31	8.94
Barium chloride	$BaCl_2$	958.9	27.5
Bismuth	Bi	268	12.64
Bromine	Br	−7.32	16.2
Cadmium	Cd	320.7	13.66
nitrate	$Cd(NO_3)_2{\cdot}4H_2O$	59.5	25.3
Caesium hydroxide	CsOH	272.3	10.8
Calcium chloride	$CaCl_2$	773 9	54.3
chloride	$CaCl_2{\cdot}6H_2O$	29	40.7
nitrate	$Ca(NO_3)_2{\cdot}4H_2O$	42.1	34.0
Carbon dioxide	CO_2	−56 2	45.3
monoxide	CO	−206	8.00
Chlorine	Cl	−103.5	23.0
Cobalt nitrate	$Co(NO_3)_2{\cdot}6H_2O$	....	30.2
Copper	Cu	1083	42.
Cupric nitrate	$Cu(NO_3)_2{\cdot}6H_2O$	24.4	29.4
Gold	Au	1064	15.8
Hydriodic acid	HI	−53	5.68
Hydrobromic acid	HBr	−86	7.67
Hydrochloric acid	HCl	−114	13 9
acid	$HCl{\cdot}2H_2O$	−18.5	34 6
Hydrogen	H	....	14 0
peroxide	H_2O_2	−1 7	74.1
Iodine	I	....	11.71
Iron, gray cast	Fe	....	5.50
white cast	...	....	7 89
slag	...	....	11.9
Lead	Pb	327	5.86
bromide	$PbBr_2$	490	12.3
chloride	$PbCl_2$	485	20.9
iodide	PbI_2	375	11.5
Lithium nitrate	$LiNO_3$	250	88.5
silicate	Li_2SiO_3	....	80.2
silicate	$Li_2SiO_3{\cdot}Li_2O$	....	62.1
Magnesium chloride	$MgCl_2{\cdot}6H_2O$	116.7	41.2
nitrate	$Mg(NO_3)_2{\cdot}6H_2O$	90	38.2
Manganese nitrate	$Mn(NO_3)_2{\cdot}6H_2O$	25.8	28.8
Mercuric bromide	$HgBr_2$	235	12.8
iodide	HgI_2	250	9.80
Mercury	Hg	−39	2.82
Nickel	Ni	1435	73 8
nitrate	$Ni(NO_3)_2{\cdot}6H_2O$	56.7	36 4
Nitric acid	HNO_3	−47	9.55
Nitrogen	N	−210	6.09
dioxide	NO	−163	18 4
pentoxide	N_2O_5	29.5	76.7
tetroxide	N_2O_4	−10.14	32.3 to 37.2
Oxygen	O	−219	3.30
Palladium	....	1545	36.3

* Gram calories (15° C.) per gram.

HEAT OF FUSION (Continued)
Elements and Inorganic Compounds

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g
Platinum	Pt	1755	27.2
Potassium	K	62	15.7
chloride	KCl	772.3	74.1
dichromate	$K_2Cr_2O_7$	397	29.7
fluoride	KF	859.9	108.
hydroxide	KOH	360.4	28.6
nitrate	KNO_3	308	25.4
Phosphorous acid, hypo-	H_3PO_2	17.4	35.0
Phosphorus	P	44.2	5.03
oxychloride	$POCl_3$	2	19.8
Rubidium chloride	$RbCl$	....	38.0
hydroxide	$RbOH$	301	15.8
Silicon tetrachloride	$SiCl_4$	70.3	10.9
Silver	Ag	961	21.07
bromide	$AgBr$	430	12.5
chloride	$AgCl$	451	30.7
		455	21.3
nitrate	$AgNO_3$	208	17.7
Sodium	Na	97	31.7
chlorate	$NaClO_3$	255	49.0
chloride	$NaCl$	804.3	124.
chromate	$Na_2CrO_4 \cdot 10H_2O$	23	39.2
fluoride	NaF	992.2	186.
hydroxide	$NaOH$	318.4	40.0
nitrate	$NaNO_3$	333	45.3
phosphate, dibasic	$Na_2HPO_4 \cdot 12H_2O$	36.1	66.8
sulfate	$Na_2SO_4 \cdot 10H_2O$	31	51.3
thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$	....	47.8
Stannic bromide	$SnBr_4$	25.5	6.26
chloride	$SnCl_4$	−33	8.40
Strontium chloride	$SrCl_2$	872.3	25.4
Sulfur	S	119	13.2
trioxide	SO_3	−30	24.0
Sulfuric acid	$H_2SO_4 \cdot H_2O$	8.56	39.1
acid	H_2SO_4	10.352	24.0
acid, pyro-	$H_2S_2O_7$	35	17.9
Thallium bromide	$TlBr$	460	12.7
monochloride	$TlCl$	427	16.6
Tin	Sn	232	14.0
Titanium tetrachloride	$TiCl_4$	−25	11.8
Water	H_2O	0	79.71
ice from sea water	H_2O	−8.7	54.0
Zinc	....	419	28.13
nitrate	$Zn(NO_3)_2 \cdot 6H_2O$	36.4	31.1

HEAT OF FUSION (Continued)

Organic Compounds

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g
Acetic acid	CH_3CO_2H	16.58	44.7
		16.7	43.2
Acetone	$(CH_3)_2CO$	−95.5	23.4
		−94.6	19.6
Acrylic acid	$C_2H_3CO_2H$	13	37.0
Allocinnamic acid	$C_6H_5C_2H_2CO_2H$	58	27.4
o-Aminobenzoic acid	$H_2NC_6H_4CO_2H$	145	35.5
m-Aminobenzoic acid	....	180	38.0
p-Aminobenzoic acid	....	188.5	36.5
tert.-Amyl alcohol	$C_5H_{11}OH$	...	12.5
Anethole	$C_3H_5C_6H_4OCH_3$	21.5	25.8
Aniline	$C_6H_5NH_2$	−7.03	21.0
Anthracene	$C_{14}H_{10}$	216.55	38.7
Anthraquinone	$(C_6H_4)_2(CO)_2$	282	37.5
Azobenzene	$(C_6H_5N)_2$	69.1	28.9
		66	28.0
		68	32.4
Azoxybenzene	$(C_6H_5)_2ON_2$	34.6	21.6
Benzene	C_6H_6	5.42	30.3
		5.40	30.2
Benzil	$(C_6H_5CO)_2$	94.94	22.2
Benzoic acid	$C_6H_5CO_2H$	121.8	33.9
Benzophenone	$(C_6H_5)_2CO$	48.25	23.5
Benzylaniline	$C_6H_5NHC_7H_7$	36	21.9
Bromal hydrate	$CBr_3CHO \cdot H_2O$	46	16.9
Bromocamphor	$C_{10}H_{15}BrO$		41.6
o-Bromochlorobenzene	C_6H_4BrCl	−12.6	15.4
m-Bromochlorobenzene	....	−21.2	15.3
p-Bromochlorobenzene		64.6	23.4
o-Bromoiodobenzene	C_6H_4BrI	21	12.2
m-Bromoiodobenzene	....	−9.3	10.3
p-Bromoiodobenzene		90.1	16.6
p-Bromophenol	HOC_6H_4Br	64	20.5
p-Bromotoluene	$CH_3C_6H_4Br$	27.6	20.9
n-Butyl alcohol	C_4H_9OH	−89.2	29.9
tert.-Butyl alcohol	C_4H_9OH	25.45	21.0
		25.4	21.9
n-Butyric acid	$C_3H_7CO_2H$	−5.7	30.1
n-Capric acid	$C_9H_{19}CO_2H$	31.2	38.9
n-Caprylic acid	$C_7H_{15}CO_2H$	16.34	35.4
Carbazole	$C_{12}H_9N$	236	42.1
Carbon tetrachloride	CCl_4	−24	4.16
Carvoxime (d)	$C_{10}H_{14}NOH$	71.5	23.3
Carvoxime (l)	....	71	23.4
Carvoxime (dl)		91	24.6
Catechol	$C_6H_4(OH)_2$	104.3	49.4
Cetyl alcohol	$C_{16}H_{33}OH$	47	33.8
Cinnamic acid	$C_6H_5C_2H_2CO_2H$	133	36.5
anhydride	$(C_6H_5C_2H_4CO)_2O$	48	28.1
Chloral alcoholate	$CCl_3CHO \cdot C_2H_5OH$	9	24.0
hydrate	$CCl_3CHO \cdot H_2O$	....	33.2
Chloroacetic acid (α)	$ClCH_2CO_2H$	61.2	31.1
acid (β)	....	56	35.1
p-Chloroaniline	$H_2NC_6H_4Cl$	69	37.2
o-Chlorobenzoic acid	$ClC_6H_4CO_2H$	140.2	39.3
m-Chlorobenzoic acid	....	154.25	36.4
p-Chlorobenzoic acid	....	239.7	49.2

Organic Compounds

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g
m-Chloronitrobenzene	$ClC_6H_4NO_2$	43.8	29.4
		44.16	31.5
p-Chloronitrobenzene	....	82	21.4
p-Cresol	$CH_3C_6H_4OH$	34	26.3
Cyanamide	H_2NCN	42.9	49.8
Cyclohexanol	$C_6H_{11}(OH)$	23.2	4.19
Dibenzyl	$(C_6H_5CH_2)_2$	51	31.0
o-Dibromobenzene	$C_6H_4Br_2$	18	12.8
m-Dibromobenzene	....	−6.9	13.4
p-Dibromobenzene	....	86	20.5
Dibromophenol (2, 4)	$HOC_6H_3Br_2$	12	14.0
Dichloroacetic acid	Cl_2CHCO_2H	10.8	14.2
o-Dichlorobenzene	$C_6H_4Cl_2$	−17.5	21.0
m-Dichlorobenzene		−24.4	20.5
p-Dichlorobenzene	....	52.7	29.7
o-Diiodobenzene	$C_6H_4I_2$	23.4	10.2
m-Diiodobenzene	....	34.2	11.6
p-Diiodobenzene	....	129	16.2
Dimethyl tartrate (d)	$(CHOH)_2(CO_2CH_3)_2$	49	21.5
Dimethyl tartrate (dl)	....	87	35.1
o-Dinitrobenzene	$C_6H_4(NO_2)_2$	116.93	32.3
m-Dinitrobenzene	....	90.08	24.7
p-Dinitrobenzene	....	173.5	40.0
Dinitrotoluene (2, 4)	$CH_3C_6H_3(NO_2)_2$	70	26.4
Diphenyl	$(C_6H_5)_2$	71	26.1
Diphenylamine	$(C_6H_5)_2NH$	53.4	25.2
Diphenylmethane	$(C_6H_5)_2CH_2$	26.3	25.2
Ethyl alcohol	C_2H_5OH	−114.4	24.9
Ethylene dibromide	$(CH_2Br)_2$	9.55	13.5
Elaidic acid	$C_{17}H_{33}CO_2H$	47	52.1
Formic acid	HCO_2H	8.0	58.9
Glutaric acid	$(CH_2)_3(CO_2H)_2$	99.3	37.4
Glycerol	$C_3H_5(OH)_3$	18	47.5
Glycol	$(CH_2OH)_2$	−11.5	43.3
		−12.3	41.6
Hydrazobenzene	$(C_6H_5NH)_2$	134	22.9
Hydrocinnamic acid	$C_6H_5C_2H_4CO_2H$	48	28.1
p-Iodotoluene	$IC_6H_4CO_2H$	34	18.8
n-Lauric acid	$C_{11}H_{23}CO_2H$	43.85	43.7
Levulinic acid	$CH_3CO(CH_2)_2CO_2H$	33	19.0
α-Menthol (l)	$C_{10}H_{19}OH$	42	18.6
Methane	CH_4	−182.6	14.5
Methyl alcohol	CH_3OH	−97	16.4
		−97.8	22.0
cinnamate	$C_6H_5C_2H_2CO_2CH_3$	34.5	26.5
fumarate	$(CHCO_2CH_3)_2$	102	57.9
oxalate	$(CO_2CH_3)_2$	49.5	42.7
phenylpropiolate	$C_6H_5C_2CO_2CH_3$	18	22.9
succinate	$(CH_2CO_2CH_3)_2$	18	35.7
Myristic acid	$C_{13}H_{27}CO_2H$	....	47.5
Naphthalene	$C_{10}H_8$	79.9	35.6
α-Naphthol	$C_{10}H_7OH$	95	38.9
β-Naphthol	....	120.6	31.3
α-Naphthylamine	$C_{10}H_7NH_2$	47.5	22.3
		48.9	22.0
		50.1	24.9
o-Nitroaniline	$H_2NC_6H_4NO_2$	69.3	27.9

HEAT OF FUSION (Continued)

Organic Compounds

Name	Formula	Temperature, °C.	Heat of Fusion Cal. (15°)/g
m-Nitroaniline	$H_2NC_6H_4NO_2$	111.8	41.0
p-Nitroaniline	....	147 5	36.5
Nitrobenzene	$C_6H_5NO_2$	5.72	22.5
o-Nitrobenzoic acid	$O_2NC_6H_4CO_2H$	145.8	40.1
m-Nitrobenzoic acid	....	141.1	27.6
p-Nitrobenzoic acid	....	239.2	52.8
α-Nitronaphthalene	$C_{10}H_7NO_2$	56	25.4
o-Nitrophenol	$HOC_6H_4NO_2$	42.8	26.8
		44.51	30.9
Palmitic acid	$C_{15}H_{31}CO_2H$	55	39.2
Paraffin	....	52.40	35.10
Paraldehyde	$(CH_3CHO)_3$	12.6	25.0
Phenanthrene	$C_{14}H_{10}$	98.2	24.3
Phenol	C_6H_5OH	25.37	29.0
Phenylacetic acid	$C_6H_5CH_2CO_2H$	74.9	25.4
		76.58	30.0
		77	32.0
Phenylhydrazine	$C_6H_5N_2H_3$	22.1	36.3
iso-Propyl alcohol	C_3H_7OH	−88.5	21.0
Quinol	$C_6H_4(OH)_2$	172.3	58.8
Quinone	$C_6H_4O_2$	112.85	40.9
Resorcinol	$C_6H_4(OH)_2$	109 65	46.2
Spermaceti	....	43.9	36.98
Stearic acid	$C_{17}H_{35}CO_2H$	64	47.6
Stilbene	$(C_6H_5CH)_2$	124	39.9
Succinic anhydride	$(CH_2CO)_2O$	119	48.7
Succinonitrile	$(CH_2CN)_2$	54.5	11.7
Thymol	$C_{10}H_{13}OH$	48.5	27.5
Tolane	$(C_6H_5C)_2$	60	28.7
o-Toluic acid	$CH_3C_6H_4CO_2H$	103.7	35.4
m-Toluic acid	....	108.75	27.6
p-Toluic acid	....	179 6	39.9
p-Toluidine	$CH_3C_6H_4NH_2$	40.01	39.9
Tribromoaniline (2, 4, 6)	$H_2NC_6H_2Br_3$	122	16.8
Tribromophenol (2, 4, 6)	$HOC_6H_2Br_3$	93	13.4
Trichloroacetic acid	CCl_3CO_2H	59.1	8 6
Trinitroglycerol	$C_3H_5(NO_3)_3$	12.3	23 0
metastable form	....	13	33.2
stable form	....	....	5.21
Trinitrotoluene (T. N. T.) (2, 4, 6)	$CH_3C_6H_2(NO_2)_3$	79	22.3
Triphenylmethane	$(C_6H_5)_3CH$	92.3	17.8
Tristearin	$(C_{17}H_{35}CO_2)_3C_3H_5$	56	45.6
n-Undecylic acid (α)	$C_{10}H_{21}CO_2H$	28.25	32 2
n-Undecylic acid (β)	....	.....	42.9
Urethane	$H_2NCO_2C_2H_5$	48.7	40.9
Veratrol (1, 2)	$C_6H_4(OCH_3)_2$	22.7	27.5
Wax (Bees')	....	61.8	42.3
p-Xylene	$C_6H_4(CH_3)_2$	16	39.3

HEAT OF VAPORIZATION

Elements and Inorganic Compounds

Name	Formula	Temperature, °C	Heat of Vaporization Cal. (15°)/g*
Air			50.97
Ammonia	NH_3	−33.4	327.1
		−20	317.6
		−10	309.7
		0	301.6
Ammonium chloride	NH_4Cl (solid)	350	78.9
Argon	A	−186	37.6
Boron chloride	BCl_3	10	38.2
Bromine	Br	63	43.7
Carbon dioxide	CO_2	−60	87.2
		−50	83.4
		−40	79.6
		−30	71.4
		−20	66.9
		−10	61.4
		0	55.0
		10	46.6
		20	35.1
		30	11.9
Carbon monoxide	CO	−192	50.4
Chlorosulfonic acid	$ClSO_3H$	151	110.2
Helium	He	−268.6	6.
Hydriodic acid	HI	−37.2	33.9
Hydrobromic acid	HBr	−69.9	48.7
Hydrochloric acid	HCl	−84.3	98.7
Hydrofluoric acid	HF	17	360.8
Hydrogen	H_2	−252.8	108.
sulfide	H_2S	−61.4	131.9
Iodine		184	23.95
Mercury		357	65.
Nitric acid	HNO_3	86.0	114.9
Nitrogen	N_2	−195.55	47.6
tetroxide	N_2O_4	18	93.4
Oxygen	O_2	−182.9	50.9
Phosphorus	P	287	130.
Phosphorus trichloride	PCl_3	78	51.4
Silicon tetrachloride	$SiCl_4$	57	36.1
Stannic chloride	$SnCl_4$	112	30.3
Sulfur chloride	S_2Cl_2	138	49.5
dioxide	SO_2	−10.08	94.9
		0	91.3
		10	87.7
		20	84.1
		30	80.8
		40	71.2
		50	73.8
		60	70.3
pentoxydichloride	$S_2O_5Cl_2$	140	61.2
trioxide	SO_3	53	118.5
Sulfuric acid	H_2SO_4	326	122.1
oxychloride	SO_2Cl_2	69.1	49.4
Sulfurous oxychloride	$SOCl_2$	82	54.5
Water	H_2O	0	595.9
		10	590.4
		20	584.9
		30	579.5

* Gram calories (15°C) per gram.

HEAT OF VAPORIZATION (Continued)

Elements and Inorganic Compounds

Name	Formula	Temperature, °C	Heat of Vaporization Cal. (15°)/g
Water	H_2O	40	574.0
		50	568.5
		60	563.2
		70	557.5
		80	551.7
		90	545.8
		100	539.55
		110	532.9
		120	525.7
		130	518.5
		140	511 1
		150	503.5
		160	495 6
		170	487 2
		180	478 6

HEAT OF VAPORIZATION (Continued)

ORGANIC COMPOUNDS

Name	Formula	Temperature, °C.	Heat of Vaporization Cal. (15°)/g
Acetaldehyde	CH_3CHO	21	136.
Acetic acid	CH_3CO_2H	118.3	96.8
anhydride	$(CH_3CO)_2O$	137	66.2
Acetone	$(CH_3)_2CO$	56.1	124.5
Acetonitrile	CH_3CN	80	174.
Acetyl chloride	CH_3COCl	51	78.9
Allyl alcohol	C_3H_5OH	96	163.
n-Amyl alcohol	$C_5H_{11}OH$	131	120.2
iso-Amyl alcohol		130.2	119.8
n-Amyl bromide	$C_5H_{11}Br$	129	48.3
n-Amyl ether	$(C_5H_{11})_2O$	170	69.5
n-Amyl iodide	$C_5H_{11}I$	155	47.6
iso-Amyl isobutyrate	$C_3H_7CO_2C_5H_{11}$	168	57.6
iso-Amyl n-valerate	$C_4H_9CO_2C_5H_{11}$	187	56.2
Amylene	C_5H_{10}	12.5	75.0
p-Anethole	$C_9H_9OCH_3$	232	71.4
Benzene	C_6H_6	80.2	94.3
Butane	C_4H_{10}	0	91.5
iso-Butane		10	82.4
		−10	87.5
n-Butyl alcohol	C_4H_9OH	116.8	141.
iso-Butyl alcohol		106.9	138.
sec.-Butyl alcohol		98.1	134.
tert-Butyl alcohol		83	130.5
n-Butyl formate	$HCO_2C_4H_9$	105.1	86.8
iso-Butyl formate		97.0	78.5
n-Butyl iodide	C_4H_9I	129.5	45.9
iso-Butyl n-valerate	$C_4H_9CO_2C_4H_9$	169	57.8
iso-Butyl isovalerate		169	60.5
n-Butyric acid	$C_3H_7CO_2H$	163.5	114.0
iso-Butyric acid	$C_3H_7CO_2H$	154	111.6
n-Butyronitrile	C_3H_7CN	117.4	114.9
Carbon disulfide	CS_2	46.25	84.1
tetrachloride	CCl_4	76.75	46.4
Carvacrol	$C_{10}H_{13}OH$	237	68.1
Chloral	CCl_3CHO	....	54.0
hydrate	$Cl_3CCHO \cdot H_2O$	96	132.
Chloroform	$CHCl_3$	61.5	59.0
Cyanogen	$(CN)_2$	0	10.3
chloride	$ClCN$	13	135.
p-Cymene	$C_{10}H_{14}$	176	67.6
Dichloroacetic acid	Cl_2CHCO_2H	194.4	77.2
n-Decane	$C_{10}H_{22}$	160	60.2
Diethyl carbonate	$CO(OC_2H_5)_2$	126	73.1
ketone	$(C_2H_5)_2CO$	101	90.8
Diethylamine	$(C_2H_5)_2NH$	58	91.0
Dimethyl carbonate	$CO(OCH_3)_2$	90	88.2
Ethane	C_2H_6	0	75.0
		−20	87.0
		−40	97.5
		−90	127.
Ethyl acetate	$CH_3CO_2C_2H_5$	0.0	102.0
alcohol	C_2H_5OH	78.3	204.
bromide	C_2H_5Br	38.4	59.9
caprylate	$C_7H_{15}CO_2C_2H_5$	207	60.5
chloride	C_2H_5Cl	4.7	92.95
		15.0	92.5
		20.0	92 2
		25.0	92.0

HEAT OF VAPORIZATION (Continued)

Organic Compounds

Name	Formula	Temperature, °C.	Heat of Vaporization Cal. (15°)/g
Ethyl			
ether	$(C_2H_5)_2O$	34.6	83.9
formate	$HCO_2C_2H_5$	53.3	97.2
iodide	C_2H_5I	71.2	45.6
nonylate	$C_8H_{17}CO_2C_2H_5$	227	58.1
propionate	$C_2H_5CO_2C_2H_5$	97.6	80.1
Ethylene bromide	$(CH_2Br)_2$	130.8	46.2
chloride	$(CH_2Cl)_2$	0.0	85.3
		82.3	77.3
oxide	$(CH_2)_2O$	13	139.
Ethylamine	$C_2H_5NH_2$	15	14.6
Ethylidene chloride	CH_3CHCl_2	0.0	76.7
		60	67.1
Formic acid	HCO_2H	101	120.0
Furane	$(CH)_4O$	31	95.3
Furfural	C_4H_3OCHO	160.5	107.5
Glycol	$(CH_2OH)_2$	197	191.
Hydrocyanic acid	HCN	20	210.
Methane	CH_4	−159	138.
Methyl acetate	$CH_3CO_2CH_3$	0.0	114.0
		56.3	98.1
alcohol	CH_3OH	64.7	262.8
n-butyrate	$C_3H_7CO_2CH_3$	102.6	79.8
chloride	CH_3Cl	−23.8	102.3
		20.0	95.3
ethyl ketone	$CH_3COC_2H_5$	78.2	106.0
ethyl ketoxime	C_4H_8NOH	182	115.9
formate	HCO_2CH_3	31.3	112.4
iodide	CH_3I	42	45.9
isobutyrate	$C_3H_7CO_2CH_3$	91.1	78.1
isopropyl ketone	$C_4H_{10}CO$	92	89.8
propionate	$C_2H_5CO_2CH_3$	79.0	87.6
Methylene chloride	CH_2Cl_2	40.5	78.6
Naphthalene	$C_{10}H_8$	218	75.5
Nitromethane	CH_3NO_2	99.9	135.
iso-Pentane	C_5H_{12}	13	88.7
Piperidine	$C_5H_{11}N$	106	89.4
Propane	C_3H_8	20	83.4
		0	89.6
		−20	95.3
		−30	98.0
Propionic acid	$C_2H_5CO_2H$	139.3	98.8
Propionitrile	C_2H_5CN	97	134.
n-Propyl acetate	$CH_3CO_2C_3H_7$	100.4	80.3
n-Propyl alcohol	C_3H_7OH	97.2	164.
iso-Propyl alcohol		82.3	159.
n-Propyl formate	$HCO_2C_3H_7$	80.0	88.1
Pyridine	C_5H_5N	114.1	107.4
Tetrachloroethane-1, 1, 2, 2	$(CHCl_2)_2$	145.0	55.1
Tetrachloroethylene	$(CCl_2)_2$	120.7	50.1
Trichloroethylene	C_2HCl_3	85.7	57.3
Turpentine	$C_{10}H_{16}$	156	68.6
n-Valeric acid	$C_4H_9CO_2H$	184.6	103.2
iso-Valeric acid		176.3	101.1
n-Valeronitrile	C_4H_9CN	129	96.3

CHANGE IN VOLUME DUE TO FUSION

The table gives the variation in volume expressed in c.cm. for one gram of the substance.

Substance.	Variation, cm.	Observer.
Aluminum.....	+0.019	Toepler, 1894
Bismuth.......	−0.0034	Toepler, 1894
Cadmium.....	+0.0064	Toepler, 1894
Iron...........	−0.0085	Wrightson, Roberts, 1881
Lead..........	+0.0034	Toepler, 1894
Tin............	+0.0039	Toepler, 1894
Water.........	−0.083*	Toepler, 1894
Zinc.	+0.0105	Toepler, 1894

*For one cubic centimeter.

FIXED TEMPERATURE FOR THERMOMETER CALIBRATION

Corrections for pressure are indicated by equations in which p indicates pressure in millimeters of mercury. and t the boiling point at normal pressure.

Points designated by an asterisk (*) are suggested by E. F. Mueller as base points to be used in defining a Standard Working Scale.

Substance	Point	Temperature thermodynamic scale °C	Condition or correction
Hydrogen	Boiling	−252 75	$+0.0044\ (p-760)$
Nitrogen.............	Vapor pressure	−195 80	$+0.0109\ (p-760)$
Liquid O_2*.	Vapor pressure	−183 00	$+0.0126\ (p-760)$ $-0.0000065\ (p-760)^2$
Isopentane	Freezing	−159 6	
Methylcyclohexane....	Freezing	−126 3	
Ether................	Rapid freezing or slow melting	−116 3	
Carbon disulfide.... ..	Freezing	−111 6	
Toluene...	Freezing	− 95.1	
Ethyl acetate	Freezing	− 83 6	
Solid CO_2*....	Vapor pressure	− 78 51	$+0.01595\ (p-760)$ $-0.000011\ (p-760)^2$
Chloroform	Freezing	− 63 5	
Chlorobenzene.	Freezing	− 45 2	
Mercury*	Freezing	− 38 87	
Carbon tetrachloride..	Freezing	− 22 9	
Ice*....	Melting	0 000	
Sodium sulfate...... .	Transition	32 384	
Ethyl alcohol.........	Boiling	78 26	76 cm. variation 0.34° per cm.
Benzene..............	Boiling	80.0	76 cm. variation 0.43° per cm.

FIXED TEMPERATURE FOR THERMOMETER CALIBRATION (Continued)

Substance	Point	Temperature thermo-dynamic scale °C	Condition or correction
Water*	Boiling	100.000	$+0.0367\ (p-760)-0.000023\ (p-760)^2$
Chlorobenzene	Boiling	132	76 cm. variation 0.50° per cm.
Xylene (m.)	Boiling	138.8	76 cm. variation 0.50° per cm.
Aniline	Boiling	184.51	76 cm. variation 0.51° per cm.
Toluidine (o.)	Boiling	199.7	76 cm. variation 0.58° per cm.
Naphthalene	Condensing	217.96	$+0.2075\ (t+273.1)\ \log_{10}\ (p/760)$
Tin	Freezing	231.85	
Diphenylamine	Boiling	302	
Benzophenone	Condensing	305.9	$+0.194\ (t+273.1)\ \log_{10}\ (p/760)$
Cadmium	Freezing	320.9	
Lead	Freezing	327.4	
Mercury	Boiling	356.9	
Potassium dichromate	Melting	397.5	
Zinc	Freezing	419.45	
Sulfur*	Condensing	444.60	$+0.0909\ (p-760)-0.000048\ (p-760)^2$
Potassium sulfate	Inversion	583.0	
Antimony*	Freezing	630.5	Approx. To be determined with resistance thermometer.
30.5 NaCl+69.5 Na_2SO_4	Melting	637.0	
Aluminum (99.85%)	Freezing	658.9	
Potassium chloride	Melting	770.3	
Sodium chloride	Melting	800.4	
Sodium sulfate	Melting	884.7	
Silver*	Freezing	960.5	(reducing atmosphere)
Gold*	Freezing	1063	
Potassium sulfate	Melting	1069.1	
Copper	Freezing	1083	(reducing armosphere)
Lithium metasilicate	Melting	1202	
Diopside	Melting	1395	
Nickel	Melting or freezing	1452	
Palladium	Freezing	1555 ±2	
Anorthite	Melting	1555.	
Platinum	Melting	1755. ±6	
Alumina	Melting	2000.	
Tungsten	Melting	3370. ±30	

PRESSURE OF AQUEOUS VAPOR

Vapor Pressure of Ice

Pressure of aqueous vapor over ice in mm of Hg for temperatures from −98 to 0°C.

Temp. °C	0	2	4	6	8
−90	000070	000048	000033	000022	000015
−80	00040	.00029	00020	.00014	.00010
−70	00194	00143	00105	00077	00056
−60	00808	00614	00464	00349	.00261
−50	.02955	0230	0178	0138	.0106
−40	.0966	.0768	0609	0481	.0378
−30	2859	2318	.1873	.1507	.1209

Temp. °C	0 0	0 2	0 4	0 6	0 8
−29	0 317	0 311	0 304	0.298	0 292
−28	0.351	0 344	0 337	0 330	0 324
−27	0 389	0 381	0 374	0 366	0.359
−26	0 430	0 422	0 414	0 405	0 397
−25	0 476	0 467	0 457	0.448	0 439
−24	0 526	0 515	0 505	0.495	0 486
−23	0 580	0 569	0 558	0 547	0 536
−22	0 640	0 627	0 615	0 603	0 592
−21	0 705	0 691	0.678	0.665	0 652
−20	0 776	0 761	0 747	0 733	0 719
−19	0 854	0 838	0 822	0 806	0 791
−18	0 939	0 921	0 904	0 887	0 870
−17	1 031	1 012	0 993	0 975	0 956
−16	1 132	1 111	1 091	1 070	1 051
−15	1 241	1 219	1 196	1 175	1 153
−14	1 361	1 336	1 312	1 288	1 264
−13	1 490	1 464	1 437	1 411	1 386
−12	1 632	1 602	1 574	1 546	1 518
−11	1 785	1 753	1 722	1 691	1 661
−10	1 950	1 916	1 883	1 849	1 817
− 9	2 131	2 093	2.057	2 021	1 985
− 8	2 326	2 285	2 246	2 207	2 168
− 7	2 537	2 493	2 450	2 408	2 367
− 6	2 765	2 718	2 672	2.626	2 581
− 5	3.013	2 962	2 912	2.862	2 813
− 4	3 280	3 225	3 171	3 117	3.065
− 3	3.568	3 509	3 451	3 393	3.336
− 2	3.880	3 816	3 753	3.691	3 630
− 1	4 217	4 147	4 079	4 012	3 946
− 0	4.579	4 504	4.431	4 359	4 287

VAPOR PRESSURE OF WATER BELOW 100°C

Pressure of aqueous vapor over water in mm of Hg for temperatures from −15.8 to 100°C. Values for fractional degrees between 50 and 89 were obtained by interpolation.

Temp. °C	0 0	0 2	0 4	0 6	0.8
−15	1.436	1.414	1.390	1.368	1.345
−14	1.560	1.534	1.511	1.485	1.460
−13	1.691	1.665	1.637	1.611	1.585
−12	1.834	1.804	1.776	1.748	1.720
−11	1.987	1.955	1.924	1.893	1.863
−10	2.149	2 116	2 084	2 050	2 018
− 9	2 326	2 289	2 254	2.219	2.184
− 8	2.514	2.475	2 437	2.399	2.362
− 7	2.715	2.674	2 633	2.593	2.553
− 6	2 931	2 887	2 843	2 800	2.757
− 5	3.163	3 115	3.069	3 022	2.976
− 4	3.410	3.359	3.309	3 259	3.211
− 3	3 673	3 620	3 567	3 514	3.461
− 2	3.956	3 898	3 841	3 785	3 730
− 1	4 258	4 196	4.135	4.075	4 016
− 0	4 579	4 513	4 448	4 385	4 320
0	4 579	4 647	4 715	4 785	4.855
1	4 926	4 998	5 070	5 144	5 219
2	5 294	5 370	5 447	5 525	5.605
3	5 685	5 766	5.848	5 931	6 015
4	6.101	6 187	6 274	6 363	6.453
5	6 543	6 635	6 728	6 822	6 917
6	7 013	7 111	7 209	7 309	7 411
7	7 513	7 617	7 722	7 828	7 936
8	8 045	8 155	8 267	8 380	8 494
9	8.609	8 727	8.845	8 965	9 086
10	9 209	9.333	9 458	9 585	9.714
11	9 844	9.976	10 109	10 244	10.380
12	10.518	10.658	10 799	10 941	11 085
13	11 231	11 379	11 528	11 680	11.833
14	11 987	12 144	12 302	12 462	12.624
15	12.788	12 953	13 121	13 290	13 461
16	13.634	13.809	13 987	14 166	14.347
17	14 530	14 715	14 903	15 092	15 284
18	15 477	15.673	15.871	16 071	16 272
19	16 477	16.685	16 894	17 105	17.319

VAPOR PRESSURE OF WATER BELOW 100°C (Continued)

Temp. °C	0 0	0 2	0.4	0.6	0.8
20	17.535	17.753	17.974	18.197	18.422
21	18.650	18.880	19.113	19.349	19.587
22	19.827	20 070	20.316	20.565	20 815
23	21 068	21.324	21.583	21.845	22.110
24	22.377	22.648	22.922	23.198	23.476
25	23.756	24.039	24.326	24.617	24 912
26	25 209	25.509	25.812	26.117	26.426
27	26.739	27.055	27 374	27.696	28 021
28	28.349	28.680	29.015	29.354	29.697
29	30.043	30.392	30.745	31.102	31.461
30	31.824	32.191	32 561	32.934	33.312
31	33.695	34 082	34 471	34 864	35 261
32	35.663	36 068	36.477	36.891	37 308
33	37.729	38 155	38 584	39.018	39 457
34	39.898	40.344	40.796	41.251	41.710
35	42 175	42.644	43 117	43.595	44 078
36	44 563	45 054	45 549	46 050	46 556
37	47.067	47 582	48.102	48.627	49.157
38	49.692	50 231	50 774	51.323	51 879
39	52.442	53.009	53.580	54.156	54 737
40	55.324	55 91	56 51	57.11	57 72
41	58.34	58 96	59 58	60.22	60 86
42	61 50	62.14	62.80	63.46	64 12
43	64 80	65.48	66.16	66.86	67 56
44	68.26	68 97	69.69	70.41	71 14
45	71 88	72 62	73.36	74.12	74 88
46	75.65	76.43	77.21	78 00	78.80
47	79 60	80 41	81 23	82.05	82 87
48	83 71	84.56	85.42	86.28	87.14
49	88.02	88.90	89.79	90.69	91.59
50	92.51	93.5	94.4	95.3	96 3
51	97 20	98.2	99.1	100.1	101.1
52	102 09	103.1	104.1	105 1	106.2
53	107 20	108.2	109.3	110 4	111 4
54	112.51	113.6	114.7	115.8	116.9
55	118.04	119.1	120.3	121.5	122.6
56	123 80	125.0	126.2	127.4	128.6
57	129.82	131.0	132.3	133.5	134.7
58	136.08	137 3	138.5	139.9	141.2
59	142.60	143.9	145.2	146 6	148.0

VAPOR PRESSURE OF WATER BELOW 100°C (Continued)

Temp. °C	0.0	0.2	0.4	0.6	0.8
60	149.38	150.7	152.1	153.5	155.0
61	156.43	157.8	159.3	160.8	162.3
62	163.77	165.2	166.8	168.3	169.8
63	171.38	172.9	174.5	176.1	177.7
64	179.31	180.9	182.5	184.2	185.8
65	187.54	189.2	190.9	192.6	194.3
66	196.09	197.8	199.5	201.3	203.1
67	204.96	206.8	208.6	210.5	212.3
68	214.17	216.0	218.0	219.9	221.8
69	223.73	225.7	227.7	229.7	231.7
70	233.7	235.7	237.7	239.7	241.8
71	243.9	246.0	248.2	250.3	252.4
72	254.6	256.8	259.0	261.2	263.4
73	265.7	268.0	270.2	272.6	274.8
74	277.2	279.4	281.8	284.2	286.6
75	289.1	291.5	294.0	296.4	298.8
76	301.4	303.8	306.4	308.9	311.4
77	314.1	316.6	319.2	322.0	324.6
78	327.3	330.0	332.8	335.6	338.2
79	341.0	343.8	346.6	349.4	352.2
80	355.1	358.0	361.0	363.8	366.8
81	369.7	372.6	375.6	378.8	381.8
82	384.9	388.0	391.2	394.4	397.4
83	400.6	403.8	407.0	410.2	413.6
84	416.8	420.2	423.6	426.8	430.2
85	433.6	437.0	440.4	444.0	447.5
86	450.9	454.4	458.0	461.6	465.2
87	468.7	472.4	476.0	479.8	483.4
88	487.1	491.0	494.7	498.5	502.2
89	506.1	510.0	513.9	517.8	521.8
90	525.76	529.77	533.80	537.86	541.95
91	546.05	550.18	554.35	558.53	562.75
92	566.99	571.26	575.55	579.87	584.22
93	588.60	593.00	597.43	601.89	606.38
94	610.90	615.44	620.01	624.61	629.24
95	633.90	638.59	643.30	648.05	652.82
96	657.62	662.45	667.31	672.20	677.12
97	682.07	687.04	692.05	697.10	702.17
98	707.27	712.40	717.56	722.75	727.98
99	733.24	738.53	743.85	749.20	754.58
100	760.00	765.45	770.93	776.44	782.00
101	787.57	793.18	798.82	804.50	810.21

VAPOR PRESSURE OF WATER ABOVE 100° C.

Based on values given by Keyes in the International Critical Tables.

Temp. °C	Pressure mm	Pressure Pounds per sq. in.	Temp. °F	Temp. °C	Pressure mm	Pressure Pounds per sq. in.	Temp. °F
100	760	14 696	212 0	145	3116 76	60 268	293 0
101	787 51	15 228	213 8	146	3203 40	61 944	294 8
102	815.86	15 776	215 6	147	3292 32	63.663	296 6
103	845 12	16 342	217 4	148	3382 76	65 412	298 4
104	875 06	16 921	219 2	149	3476.24	67 220	300 2
105	906 07	17.521	221 0	150	3570 48	69 042	302 0
106	937 92	18 136	222 8	151	3667 00	70 908	303 8
107	970 60	18 768	224 6	152	3766 56	72 833	305 6
108	1004 42	19 422	226 4	153	3866 88	74 773	307 4
109	1038.92	20 089	228 2	154	3970 24	76 772	309 2
110	1074 56	20 779	230 0	155	4075 88	78 815	311 0
111	1111 20	21 487	231 8	156	4183 80	80 901	312 8
112	1148 74	22 213	233 6	157	4293 24	83 018	314 6
113	1187 42	22 961	235 4	158	4404 96	85 178	316 4
114	1227 25	23 731	237 2	159	4519 72	87 397	318 2
115	1267 98	24 519	239 0	160	4636 00	89 646	320 0
116	1309 94	25 330	240 8	161	4755 32	91 953	321 8
117	1352 95	26 162	242 6	162	4876 92	94 304	323 6
118	1397 18	27 017	244 4	163	5000 04	96 685	325 4
119	1442 63	27 896	246 2	164	5126 96	99 139	327 2
120	1489 14	28 795	248 0	165	5256 16	101 638	329 0
121	1536 80	29 717	249 8	166	5386 88	104 165	330 8
122	1586 04	30 669	251 6	167	5521 40	106 766	332 6
123	1636 36	31 642	253 4	168	5658 20	109 412	334 4
124	1687 81	32 637	255 2	169	5798 04	112.116	336 2
125	1740 93	33 664	257 0	170	5940 92	114 879	338 0
126	1795 12	34 712	258 8	171	6085 32	117 671	339 8
127	1850 83	35 789	260 6	172	6233 52	120 537	341 6
128	1907 83	36 891	262.4	173	6383 24	123 432	343 4
129	1966 35	38.023	264 2	174	6538 28	126 430	345 2
130	2026 16	39 180	266 0	175	6694 08	129 442	347 0
131	2087 42	40 364	267 8	176	6852 92	132 514	348 8
132	2150 42	41 582	269 6	177	7015 56	135 659	350.6
133	2214 64	42 824	271 4	178	7180.48	138 848	352.4
134	2280 76	44 103	273 2	179	7349.20	142 110	354.2
135	2347 26	45 389	275 0	180	7520 20	145 417	356 0
136	2416.34	46 724	276 8	181	7694 24	148 782	357 8
137	2488 16	48.113	278 6	182	7872 08	152 221	359 6
138	2560 67	49 515	280 4	183	8052 96	155 719	361 4
139	2634 84	50.950	282 2	184	8236.88	159 275	363 2
140	2710 92	52 421	284 0	185	8423.84	162 890	365 0
141	2788 44	53 920	285 8	186	8616.12	166 609	366 8
142	2867 48	55 448	287.6	187	8809 92	170 356	368 6
143	2948 80	57 020	289.4	188	9007 52	174.177	370 4
144	3031 64	58 622	291 2	189	9208 16	178.057	372 2

VAPOR PRESSURE OF WATER ABOVE 100° C.
(Continued)

Temp. °C	Pressure mm	Pressure Pounds per sq. in.	Temp. °F	Temp. °C	Pressure mm	Pressure Pounds per sq. in.	Temp. °F
190	9413 36	182 025	374 0	235	22967 96	444 128	455 0
191	9620 08	186 022	375 8	236	23382 92	452 152	456 8
192	9831 36	190 107	377 6	237	23802 44	460 264	458 6
193	10047 20	194 281	379 4	238	24229 56	468 523	460 4
194	10265 32	198 499	381 2	239	24661 24	476 871	462 2
195	10488 76	202 819	383 0	240	25100 52	485 365	464 0
196	10715 24	207 199	384 8	241	25543 60	493 933	465 8
197	10944 76	211 637	386 6	242	25994 28	502 647	467 6
198	11179 60	216 178	388 4	243	26449 52	511 450	469 4
199	11417 48	220 778	390 2	244	26912 36	520 400	471 2
200	11659 16	225 451	392 0	245	27381 28	529 467	473 0
201	11905.40	230 213	393 8	246	27855 52	538 638	474 8
202	12155 44	235 048	395 6	247	28335 84	547 926	476 6
203	12408 52	239 942	397 4	248	28823.76	557 360	478 4
204	12666 16	244 924	399 2	249	29317 00	566 898	480 2
205	12929 12	250 008	401 0	250	29817.84	576 583	482 0
206	13197 40	255 196	402 8	251	30324 00	586 370	483 8
207	13467 96	260 428	404 6	252	30837 76	596 305	485 6
208	13742 32	265 733	406 4	253	31356 84	606 342	487.4
209	14022 76	271.156	408 2	254	31885 04	616 556	489 2
210	14305 48	276 623	410 0	255	32417 80	626 858	491 0
211	14595 04	282 222	411 8	256	32957 40	637 292	492 8
212	14888 40	287 895	413 6	257	33505 36	647 888	494 6
213	15184 80	293 626	415 4	258	34059 40	658 601	496 4
214	15488 04	299 490	417 2	259	34618 76	669 417	498 2
215	15792 80	305 383	419 0	260	35188 00	680 425	500 0
216	16104 40	311.408	420 8	261	35761 80	691 520	501.8
217	16420 56	317 522	422 6	262	36343 20	702.763	503 6
218	16742 04	323 738	424 4	263	36932 20	714 152	505.4
219	17067 32	330 028	426 2	264	37520 56	725 703	507 2
220	17395 64	336 377	428 0	265	38133 00	737.372	509 0
221	17731 56	342 872	429 8	266	38742 52	749 158	510 8
222	18072 80	349.471	431 6	267	39361 92	761 135	512.6
223	18417 84	356 143	433 4	268	39986 64	773 215	514 4
224	18766 68	362 888	435 2	269	40619 72	785 457	516 2
225	19123 12	369 781	437 0	270	41261 16	797 861	518 0
226	19482 60	376 732	438 8	271	41910 20	810 411	519.8
227	19848 92	383 815	440 6	272	42566 08	823 094	521 6
228	20219 80	390 987	442 4	273	43229 56	835 923	523 4
229	20596 76	398 276	444 2	274	43902 16	848 929	525 2
230	20978 28	405 654	446 0	275	44580 84	862 053	527.0
231	21365 12	413 134	447 8	276	45269 40	875 367	528 8
232	21757 28	420 717	449.6	277	45964 04	888 799	530 6
233	22154 00	428 388	451 4	278	46669 32	902 437	532 4
234	22558 32	436 207	453 2	279	47382 20	916 222	534 2

VAPOR PRESSURE OF WATER ABOVE 100° C. (Continued)

Temp. °C	Pressure mm	Pressure Pounds per sq. in.	Temp. °F	Temp. °C	Pressure mm	Pressure Pounds per sq. in.	Temp. °F
280	48104 20	930 183	536 0	330	96512 40	1866 245	626 0
281	48833 80	944 291	537 8	331	97758 80	1890 346	627 8
282	49570 24	958 532	539 6	332	99020 40	1914 742	629 6
283	50316 56	972 963	541 4	333	100297 20	1939 431	631 4
284	51072 76	987 586	543 2	334	101581 60	1964.267	633 2
285	51838 08	1002 385	545 0	335	102881 20	1989 398	635 0
286	52611 76	1017 345	546 8	336	104196 00	2014 822	636 8
287	53395 32	1032 497	548 6	337	105526 00	2040 540	638 6
288	54187 24	1047 810	550 4	338	106871.20	2066 552	640 4
289	54989 04	1063 314	552 2	339	108224 00	2092.710	642 2
290	55799 20	1078 980	554 0	340	109592 00	2119 163	644 0
291	56612 40	1094 705	555 8	341	110967 60	2145 763	645 8
292	57448 40	1110 871	557 6	342	112358 40	2172 657	647 6
293	58284 40	1127 036	559 4	343	113749 20	2199 550	649 4
294	59135 60	1143 496	561 2	344	115178 00	2227 179	651 2
295	59994 40	1160 102	563 0	345	116614 40	2254 954	653 0
296	60860 80	1176 856	564 8	346	118073 60	2283 171	654 8
297	61742 40	1193 903	566 6	347	119532 80	2311 387	656 6
298	62624 00	1210 950	568 4	348	121014 80	2340 044	658 4
299	63528 40	1228 439	570 2	349	122504 40	2368 848	660 2
300	64432 80	1245 927	572 0	350	124001 60	2397 799	662 0
301	65352 40	1263 709	573 8	351	125521 60	2427 191	663 8
302	66279 60	1281 638	575 6	352	127049 20	2456 730	665 6
303	67214 40	1299 714	577 4	353	128599 60	2486 710	667 4
304	68156 80	1317 937	579 2	354	130157 60	2516.837	669 2
305	69114 40	1336 454	581 0	355	131730 80	2547 258	671 0
306	70072 00	1354 971	582 8	356	133326 80	2578.119	672 8
307	71052 40	1373 929	584 6	357	134945 60	2609 422	674 6
308	72048 00	1393 181	586 4	358	136579 60	2641 018	676 4
309	73028 40	1412 139	588 2	359	138228 80	2672.908	678 2
310	74024 00	1431 390	590 0	360	139893 20	2705 093	680 0
311	75042 40	1451 083	591 8	361	141572 80	2737.571	681 8
312	76076 00	1471 070	593 6	362	143275 20	2770.490	683 6
313	77117 20	1491 203	595 4	363	144992 80	2803.703	685 4
314	78166 00	1511 484	597 2	364	146733 20	2837.357	687 2
315	79230 00	1532 058	599 0	365	148519 20	2871.892	689 0
316	80294 00	1552 632	600 8	366	150320 40	2906.722	690 8
317	81373 20	1573 501	602 6	367	152129 20	2941.698	692 6
318	82467 60	1594 663	604 4	368	153960 80	2977.116	694 4
319	83569 60	1615 972	606 2	369	155815 20	3012.974	696 2
320	84686 80	1637 575	608 0	370	157692 40	3049 273	698 0
321	85819 20	1659 472	609 8	371	159584 80	3085 866	699 8
322	86959 20	1681 516	611 6	372	161507 60	3123.047	701 6
323	88114 40	1703 854	613 4	373	163468 40	3160.963	703 4
324	89277 20	1726 339	615 2	374	165467 20	3199.613	705 2
325	90447 60	1748 971	617 0				
326	91633 20	1771 897	618 8				
327	92826 40	1794 969	620 6				
328	94042 40	1818 483	622 4				
329	95273 60	1842 291	624.2				

VAPOR PRESSURE OF MERCURY

Vapor pressure of mercury in mm. of Hg for temperatures from −38 to 400°C Note that the values for the first four lines only, are to be multiplied by 10^{-6}.

Temp. °C	0	2	4	6	8
	10^{-6}	10^{-6}	10^{-6}	10^{-6}	10^{-6}
−30	4 78	3 59	2.66	1.97	1 45
−20	18.1	14 0	10 8	8 28	6 30
−10	60 6	48.1	38 0	29 8	23 2
− 0	185.	149.	119	95 4	76 2
+ 0	000185	.000228	000276	.000335	000406
+10	.000490	.000588	000706	.000846	.001009
20	001201	.001426	.001691	.002000	002359
30	.002777	.003261	003823	004471	005219
40	.006079	.007067	008200	009497	01098
50	.01267	.01459	.01677	.01925	02206
60	02524	.02883	03287	03740	04251
70	.04825	05469	06189	.06993	07889
80	08880	.1000	1124	.1261	1413
90	1582	1769	1976	2202	2453
100	.2729	.3032	3366	.3731	4132
110	4572	.5052	5576	.6150	6776
120	.7457	.8198	9004	.9882	1 084
130	1 186	1 298	1 419	1 551	1 692
140	1.845	2 010	2 188	2 379	2 585
150	2.807	3.046	3 303	3.578	3 873
160	4 189	4 528	4 890	5 277	5 689
170	6 128	6.596	7 095	7.626	8 193
180	8 796	9 436	10 116	10 839	11 607
190	12 423	13 287	14 203	15 173	16 200
200	17 287	18.437	19 652	20 936	22 292
210	23 723	25 233	26 826	28 504	30 271
220	32 133	34 092	36 153	38.318	40 595
230	42 989	45 503	48 141	50.909	53 812
240	56.855	60 044	63 384	66 882	70 543
250	74 375	78 381	82 568	86 944	91 518
260	96 296	101 28	106 48	111 91	117 57
270	123 47	129 62	136 02	142 69	149 64
280	156 87	164 39	172 21	180 34	188 79
290	197 57	206 70	216 17	226 00	236 21
300	246.80	257 78	269 17	280 98	293 21
310	305 89	319 02	332 62	346 70	361 26
320	376 33	391 92	408 04	424 71	441 94
330	459.74	478 13	497 12	516 74	537 00
340	557.90	579 45	601.69	624 64	648 30
350	672 69	697 83	723 73	750 43	777 92
360	806.23	835 38	865 36	896 23	928 02
370	960.66	994 34	1028 9	1064 4	1100 9
380	1138 4	1177 0	1216 6	1257 3	1299 1
390	1341 9	1386 1	1431 3	1477.7	1525 2
400	1574 1	. .. .	. . . . .	. . . . . .	.

VAPOR PRESSURE OF CARBON DIOXIDE

Solid

From Bureau of Standards Journal of Research

(Mercury column, density = 13.5951 g/cm³, g = 980.665)

Pressure in microns of mercury

°C	0	1	2	3	4	5	6	7	8	9
−180	0.013	0.008	0.006	0.004	0.003	0.0017	0.0011	0.0007	0.0005	0.0003
−170	.37	.27	.20	.14	.10	.074	.052	.037	.026	.018
−160	5.9	4.6	3.6	2.7	2.1	1.58	1.19	.90	.67	.50
−150	60.5	48.8	39.2	31.4	25.1	19.9	15.8	12.4	9.8	7.6
−140	431	359	298	247	204	168	138	113	92	75

Pressure in mm of mercury

°C	0	1	2	3	4	5	6	7	8	9
−130	2.31	1.97	1.68	1.43	1.22	1.03	0.87	0.73	0.61	0.51
−120	9.81	8.57	7.46	6.49	5.63	4.88	4.22	3.64	3.13	2.69
−110	34.63	30.76	27.27	24.14	21.34	18.83	16.58	14.58	12.80	11.22
−100	104.81	94.40	84.91	76.27	68.43	61.30	54.84	48.99	43.71	38.94
− 90	279.5	254.7	231.8	210.8	191.4	173.6	157.3	142.4	128.7	116.2
− 80	672.2	618.3	568.2	521.7	478.5	438.6	401.6	367.4	335.7	306.5
− 70	1486.1	1377.3	1275.6	1180.5	1091.7	1008.9	931.7	859.7	792.7	730.3
− 60	3073.1	2865.1	2669.7	2486.3	2314.2	2152.8	2001.5	1859.7	1726.9	1602.5
− 50								3780.9	3530.2	3294.6

Liquid

°C	0	1	2	3	4	5	6	7	8	9
−50	5127.8	4922.7	4723.9	4531.1	4344.3	4163.2	3987.9	3818.2*	3653.9*	3495.0*
−40	7545	7271	7005	6746	6494	6250	6012	5781	5557	5339
−30	10718	10363	10017	9679	9350	9029	8716	8412	8115	7826
−20	14781	14331	13891	13461	13040	12630	12229	11838	11455	11082
−10	19872	19312	18764	18228	17703	17189	16686	16194	15712	15241
− 0	26142	25457	24786	24127	23482	22849	22229	21622	21026	20443
0	26142	26840	27552	28277	29017	29771	30539	31323	32121	32934
10	33763	34607	35467	36343	37236	38146	39073	40017	40980	41960
20	42959	43977	45014	46072	47150	48250	49370	50514	51680	52871
30	54086	55327	.		.	.	...	..	.	..

* Undercooled liquid.

Critical temperature = 31.0°C. Triple point, −56.602 ± 0.005°C; 3885.2 ± 0.4 mm.

VAPOR PRESSURE

Pressure and Density (or Specific Volume) of Saturated Vapor

Pressure of the saturated vapor is given in millimeters of mercury or in atmospheres as indicated; the density of the liquid and saturated vapor in g/cm³, and the specific volume in cm³/g The temperatures are stated in degrees Centigrade. The normal boiling point is the temperature for which the pressure is 1 atm. or 760 mm. Data refers to the liquid state unless otherwise indicated

The following abbreviations are used: b p., boiling point; c.p., critical point; liq., liquid; m.p., melting point: sol., solid; t.p., triple point.

Elements and Inorganic Compounds

°C	Pressure	Density g/cm³	
		liq	vap.
Aluminum Al			
liq. 1800 b p.	760 mm		

°C	Pressure	Sp Vol cm³/g	
		liq	vap
Ammonia NH_3			
−78 liq	0 0582 atm	1 3618	
−76	0 0683	1 3660	13752
−74	0 0797	1 3702	11889
−72	0 0929	1 3745	10314
−70	0 1078	1 3788	8976 2
−68	0 1246	1.3832	7837.0
−66	0 1437	1 3876	6863.3
−64	0 1651	1.3920	6028 3
−62	0 1891	1 3965	5310 0
−60	0.2161	1 4010	4690 3
−58	0.2461	1.4056	4154 0
−56	0 2796	1 4103	3688 5
−54	0 3167	1.4150	3283 4
−52	0 3578	1.4197	2929 9
−50	0.4034	1 4245	2620 7
−48	0.4536	1.4293	2349 4
−46	0.5087	1 4342	2110 8
−44	0 5693	1 4392	1900.5
−42	0 6357	1 4442	1714 7
−40	0 7083	1 4493	1550 2
−38	0 7875	1.4545	1404 2
−36	0 8738	1 4597	1274 4
−34	0 9676	1 4649	1158.7
−32	1 0695	1.4703	1055 3
−30	1 1799	1 4757	962 82
−28	1 2992	1 4811	879 92
−26	1 4281	1 4867	805 44
−24	1 5671	1 4923	738 44
−22	1 7166	1 4980	678 03
−20	1 8774	1 5037	623 48
−18	2 0499	1 5096	574 15
−16	2 2349	1 5155	529 45

°C	Pressure	Sp. Vol cm³/g	
		liq	vap.
Ammonia NH_3 (Continued)			
−14	2 4328 atm.	1 5215	488 88
−12	2 6443	1 5276	452 02
−10	2 8703	1.5338	418 46
− 8	3 1112	1.5400	387 87
− 6	3 3677	1 5464	359.95
− 4	3 6405	1 5528	334 42
− 2	3 9303	1.5594	311 04
0	4 2380	1 5660	289 62
+ 2	4 5640	1 5727	269 95
4	4 9090	1 5796	251 88
6	5 2750	1 5866	235 25
8	5 6610	1 5936	219 92
10	6 0685	1 6008	205 79
12	6 4985	1 6081	192 73
14	6 9520	1 6156	180 66
16	7 4290	1 6231	169 49
18	7 9310	1 6308	159 14
20	8 4585	1 6386	149 53
22	9 0125	1 6466	140 61
24	9 5940	1 6547	132 33
26	10 2040	1 6630	124 61
28	10 8430	1 6714	117 43
30	11 512	1.6800	110 73
32	12 212	1 6888	104 48
34	12 943	1 6977	98.640
36	13.708	1 7069	93 181
38	14 507	1.7162	88 074
40	15 339	1 7257	83 290
42	16 209	1 7354	78 806
44	17 113	1 7454	74 600
46	18 056	1 7555	70 650
48	19 038	1 7659	66 939
50	20 059	1 7766	63 448
52	21 121	1 7875	
54	22 224	1 7987	
56	23 372	1 8102	
58	24 562	1 8220	
60	25 797	1 8341	48 8
62	27 079	1 8465	
64	28 407	1 8593	
66	29 784	1 8725	
68	31 211	1 8860	
70	32 687	1 9000	37 7
72	34 227	1 9115	
74	35.813	1 9294	

°C	Pressure	Sp. Vol. cm^3/g liq.	Sp. Vol. cm^3/g vap.
Ammonia NH_3 (Continued)			
76	37.453 atm.	1.9448	
78	39.149	1.9608	
80	40.902	1.9774	29.3
82	42.712	1.9946	
84	44.582	2.0124	
86	46.511	2.0311	
88	48.503	2.0505	
90	50.558	2.0708	22.8
92	52.677	2.0920	
94	54.860	2.1143	
96	57.111	2.1377	
98	59.429	2.1623	
100	61.816	2.1885	17.6
102	64.274	2.2162	
104	66.804	2.2510	
106	69.406	2.2773	
108	72.084	2.3112	
110	74.837	2.3478	
112	77.668	2.3877	
114	80.578	2.4314	
116	83.570	2.4796	
118	86.644	2.5393	
120	89.802	2.5948	
122	93.045	2.6656	
124	96.376	2.7495	
126	99.796	2.8523	
128	103.309	2.9851	
130	106.913	3.1769	
132	110.613	3.5315	
132.9 c.p.	112.3	4.2830	

Ammonium chloride NH_4Cl

°C	Pressure	Density g/cm^3 liq.	Density g/cm^3 vap.
338.0 sol.	760. mm		
459	8360.		
520	26220.		
Antimony Sb			
818 liq.	1 mm		
1327 b.p.	760.		
Antimony bromide $SbBr_3$			
180 liq.	42 mm		.....
200	82.		.....
220	148.		.....

°C	Pressure	Density g/cm^3 liq.	Density g/cm^3 vap.
Antimony trichloride $SbCl_3$			
120 liq.	29. mm		
130	43.		....
140	64.		....
150	92.		....
160	127.		....
Antimony triiodide SbI_3			
250 liq.	23. mm		....
280	53.		....
310	115.		....
Argon A			
−189.19 t.p.	512.17 mm		
−185.66 b.p.	1.0000 atm.		
−183.15 liq.		1.37396	0.00801
−161.23	7.4332	1.22414	0.03723
−150.76		1.13851	0.06785
−150.57	13.707		
−140.80	22.185		
−135.51		0.97385	0.15994
−129.83	35 846		
−122.44 c.p.	47.996		
Arsine AsH_3			
liq.			
−55 b.p.	1.00 atm.		
−40	2.0		
−20	4.3		
0	8.4		
+20	15.		
Arsenic As			
604.3 sol.	760. mm		
Barium Ba			
887 liq.	1. mm		
1146 b.p.	760.		
Bismuth Bi			
606.8 liq.	0.001 mm		
904.	1.		
1470 b.p.	760.		
Boron chloride BCl_3			
−80 liq.	4.0 mm		
−60	18.0		
−30	116.0		
−15	251.0		
0	477.0		
Bromine Br			
−90 sol.	0.0052 mm		
−80	0.0251		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap
Bromine Br (Continued)			
−70	0.102 mm		
−60	0.357		
−50	1.09		
−40	2 98		
−30	7 45		
−20	17 1		
−10	36.6		
− 7.3 m.p	44.4		
0 liq.	65.9		
+10	109.		
20	173.		
30	264.		
40	392.		
50.	564.		
58.78 b.p.	760.		
Cadmium Cd			
219.1 sol	0.001 mm		
392.2 liq	1.		
454 6	5		
485.3	10.		
767 b.p.	760		
Caesium Cs			
112 3 liq	0.001 mm		
278 6	1.		
669.3 b p	760.		
Calcium Ca			
529 sol.	0.001 mm		
917 liq	1.		
1174 b.p.	760.		
Carbon C			
liq. 3927 b.p.	760. mm		

Carbon dioxide CO_2*

°C	Pressure	Sp. Vol. cm³/g liq.	Sp. Vol. cm³/g vap.
−56 liq.	5.2485 atm.	0.8496	
−54	5.7156	0.8554	
−52	6.2139	0.8606	
−50	6 7446	0.8658	
−48	7 3089	0.8718	
−46	7.9078	0.8780	
−44	8.5426	0.8834	
−42	9.2147	0.8897	
−40	9 9251	0.8961	
−38	10.675	0.9025	
−36	11.466	0.9091	

°C	Pressure	Sp. Vol. cm³/g liq.	Sp. Vol. cm³/g vap
Carbon dioxide CO_2 (Continued)			
−34	12.299 atm.	0.9158	
−32	13.176	0.9226	
−30	14.099	0.9302	27.19
−28	15.067	0.9381	25.40
−26	16.084	0.9452	23.71
−24	17 150	0 9533	22.11
−22	18.267	0.9615	20.62
−20	19.437	0.9699	19.22
−18	20.661	0.9794	17 95
−16	21.940	0.9892	16 78
−14	23 277	0.9990	15 70
−12	24 673	1.0091	14 73
−10	26.129	1.0194	13.83
− 8	27.648	1.0309	13.01
− 6	29.231	1.0428	12.25
− 4	30.879	1.0548	11.54
− 2	32.595	1.0683	10.88
0	34.379	1.0811	10 26
+ 2	36.235	1.0953	9 68
4	38.163	1.1099	9.13
6	40.166	1.1261	8.59
8	42 247	1.1442	8.06
10	44.406	1.1628	7.57
12	46.648	1.1834	7.04
14	48.974	1.2063	6.58
16	51.388	1.2330	6.14
18	53.895	1.2626	5.68
20	56.495	1.2953	5.26
22	59.197	1.3351	4 83
24	62.006	1.3831	4.39
26	64.928	1 4430	3 97
28	67 971	1 5267	3 53
30	71.143	1.6722	3 00
31.1 c.p.	72.947	2 1547	2 15

Carbon disulfide CS_2

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap
−70 liq.	1.6 mm		
−60	3.5		
−50	7.1		
−40	14.0		
−30	26 2		
−20	46.5		
−10	78.8		
0	127.3		
+10	198.1		
20	297.5		
30	432 7		
40	616.7		
46.25 b.p.	1.00 atm.	1.225	

* See special table preceding.

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Carbon disulfide CS_2 (Continued)			
50	1.13 atm.		....
60	1.54	.	0.0045
70	2.05		0.0058
80	2.69		0.0075
90	3.47		0.0095
100	4.42		0.012
110	5.55		0.015
120	6.90		0.018
130	8.47		0.021
140	10.3		0.026
150	12.4		0.031
160	14.9		0.035
170	17.6		0.041
180	20.8		0.052
190	24.3		0.068
200	28.3		0.084
210	32.8		0.101
220	37.8		0.122
230	43.4		0.144
240	49.6		0.178
250	56.5		0.212
260	64.1		0.247
270	72.5		0.301
273 c.p.	75.		..
Carbon monoxide CO			
−220.6 sol.	4 mm		
−209.1	50.		
−205.70	111.33		.
−192.0	1.0 atm.	0.803	0.0044
−190	1.2	0.794	0.0054
−180	3.2	0.748	0.013
−170	6.7	0.697	0.027
−160	12.4	0.639	0.046
−150	20.9	0.560	0.088
−140	33.2	0.420	0.190
−139 c.p.	35.	0.303	0.303
Chlorine Cl			
liq.			
−103 m.p.	8.9 mm		
−100	11.8		.
−90	27.8		
−80	58.7		
−70	115.		
−60	211		
−50	363.		
−40	594.		
−34.6 b.p.	760		
−30	1.23 atm	1.550	
−20	1.84	1.524	
−10	2.61	1.496	
0	3.65	1.468	0.0128
+10	4.96	1.438	0.0175
20	6.57	1.408	0.0226
Chlorine Cl (Continued)			
30	8.60 atm.	1.377	0.0300
40	11.1	1.344	0.0384
50	14.1	1.310	0.0486
60	17.6	1.375	0.0600
70	21.6	1.240	0.0740
80	26.2	1.199	0.0910
90	31.5	1.156	0.1125
100	37.6	1.109	0.136
110	44.4	1.059	0.164
120	52.4	0.998	0.206
130	61.4	0.920	0.258
140	71.4	0.750	0.405
144 c.p.	76.1	0.573	0.573
Chromium Cr			
liq.			
2200 b.p.	760. mm		..
Cobalt Co			
1254 liq.	0.001 mm		
1859	1.		...
3168 b.p.	760.		...
Copper Cu			
1320 liq.	0.001 mm		.
1707	1.		..
2310 b.p.	760.		..
Cupric chloride $CuCl_2$			
487.6 sol.	223.9 mm		.
470.5	128.8		..
407.2	22.39		...
335.2	5.0		...
318.6	3.55		....
Cupric oxide CuO			
600 sol.	1.34×10^{-7} mm		....
800	1.15×10^{-4}		....
950	6.8×10^{-4}		....
Cyanogen chloride CNCl			
−32.69 sol.	58.6 mm		.
−24.7	101.71		.
−11.41	250.67	.	.
Ferric chloride $FeCl_3$			
245.0 sol.	19.95 mm		..
292.3	316.2		.
Gold Au			
1292 liq.	0.001 mm		...
1768	1.	.	......
2611 b.p.	760.	.....	......

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Gold chloride $AuCl_3$			
100 sol.	7.0 mm		
138.5	11 0		
181	61.2		
202	154.5		
229	424 2	.	
251	808.7		
Helium He			
−271.9 liq.		0.1459	
−271.7	3. mm		..
−271.0	. . .	0 1464	..
−270.8	.	0 1466	0.001368
−269.9	197.	..	.
−269.2		0.1311	0 01176
−268.9 b.p.	1.000 atm.		.
−268.9		0.1253	0 01637
−268.4		0.1139	0.02699
−268.2	1.749		
−267.9 c.p.	2.261	0 06930	0.06930
Hydriodic acid HI			
liq.			
−35.5 b.p.	1.00 atm.	2 798	
−20	1.86		
0	3.70		
+20	6.65	2 230	
40	11.1		
60	17.3		
80	25.8		
100	37.0		. . .
120	51.6		
140	70.4		
150.5 c.p.	82.		
Hydrobromic acid HBr			
liq.			
−67.0 b.p.	1.00 atm.		
−60	1.41		
−40	3.31		
−20	6.72		
0	12 3		
+20	20.6	1.589	
40	32.5		
60	49.0		
80	71.4		
90 c.p.	85.		
Hydrochloric acid HCl			
−108 liq.	168.5 mm		
−104	226.2		
−100	329.8		
− 96	503 4		
− 88	640.3		
− 85.03 b.p.	1.00 atm.	1 191	0 0025
− 80	1.32	1 178	0 0032
− 60	3 45	1 122	0 0083
− 40	7 55	1.063	0.017
− 20	14 53	0 997	0 032

°C	Pressure	Density g/cm³ liq	Density g/cm³ vap.
Hydrochloric acid HCl (Continued)			
0	25.46 atm.	0.924	0.054
+20	41.58	0.831	0.097
40	64.52	0.697	0 180
51.5 c.p.	81.6	0.424	0.424
Hydrocyanic acid HCN			
25.65 liq.	1.00 atm.	0.695	0.0011
40	1.67		
60	3.15		
80	5.52		
100	9.16		
120	14.5		
140	22 1		
160	32 7	0.420	0.050
180	47.1	0.290	0.120
183.5 c.p.	50.	0.20	0.20
Hydrogen H_2			
liq.			
−259.14 t p.	51.4 mm		. . .
−258 46	79.9		. . .
−258.27	. .	0.07631	0 00020
−256 61	191 9		.
−254 73	397.6		.
−253.24	.	0.07134	0.00116
−252.74 b.p.	1.0000 atm.		. .
−248 50	2.8937		.
−245 73		0 06050	0 00613
−245 68	5 0566		.
−240.49	11 752		.
−239 91 c p	12 80	0 03102	0.03102
Hydrogen sulfide H_2S			
−82 liq.	172 mm		.
−78	235.		. . .
−74	339.		. .
−70	432.		.
−66	535.		
−62	660.		
−59.5 b p.	1 00 atm.	0.965	
−40	2 50		
−20	5 39		.
0	10 2		
+20	17.7		.
40	28 3		
60	43 0		
80	62 6		
100.4 c.p.	88.9		.
Iodine I			
−50 sol.	0.000037 mm		
−40	0.00019		
−30	0.00080		
−20	0.0030		
−10	0.0099		
0	0.0299		
+10	0.0808		
20	0.202		.

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Iodine I (Continued)			
30	0.471 mm		
40	1.03		
50	2.16		
60	4.31		
70	8.22		
80	15.1		
90	26.8		
100	45.5		
110	74.9		
114.15 m.p.	90 1		
120 liq.	111.		
130	157.		
140	217.		
150	294.		
160	394.		
170	521.		
180	679.		
184 35 b.p	760.		
190	869.		
Iron Fe			
1884 liq.	1 mm		
3235 b.p.	760.		
Krypton Kr			
sol.			
−169 t.p.	132.5 mm		
−160 3 liq.	386.4		
−151 8 b.p.	1.000 atm.		
−130	4.315		
− 90	24.27		
− 62.6 c.p.	54 24		
Lead Pb			
636 2 liq.	0.001 mm		
985.	1.		
Lead chloride $PbCl_2$			
400 sol.	0 00174 mm		
425	0.0058		
450	0 0178		
475	0.051		
Lead sulfide PbS			
850 sol.	2.0 mm		
917	4.0		
968	10 5		
995	17.0		
Magnesium Mg			
772 liq.	1. mm		
1070 b.p.	760.		
Manganese Mn			
liq.			
1900 b.p.	760. mm		
Mercurous chloride HgCl			
100 sol.	0.0089 mm		
120	0.016		
140	0.038		
160	0.15		
180	0.45		
310	103.0		
330	189.2		
350	329.9		
370	548.9		
Mercury Hg (See special table.)			
−76.4 sol.	10^{-9} mm		
−65.7	10^{-8}		
−58.6	10^{-7}		
−40.4	10^{-6}		
Molybdenum Mo			
2293 sol.	0.001 mm		
Neon Ne			
−257.62 sol.	0.55 mm		
−254.92	7.8		
−253.16	28.2		
−251.24	91.		
−250.22	148.		
−249.09	250.		
−248.56	317.		
−248.51 liq.	325.0		
−247.49	451.6		
−246.66	605.2		
−245 92 b p.	1 000 atm.		
−236 82	7 970		
−228.71 c p.	26.86		
Nickel Ni			
1851 liq.	1. mm		
3147 b.p.	760.		
Nitric oxide NO			
liq.			
−151 0 b.p.	1.0 atm.		
−140	3.0		
−120	14.3		
−100	46.		
− 93 c.p.	65.		
Nitrogen N_2			
sol.			
−209.86 t.p.	96.4 mm		
−198.26 liq.	561.3		
−195.78 b.p.	1.000 atm.		
−173 58	7.3705		
−152.11	25.889		
−147.13 c.p.	33.490		
Nitrogen peroxide N_2O_4			
liq.			
21.3 b.p.	1.00 atm.		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Nitrogen peroxide N_2O_4 (Continued)			
40	2.28 atm.	..	...
60	5.03	..	
80	10.3	..	
100	19.8	.	
120	35.9	.	
140	62.2	. .	
158 c.p.	99.	. . .	.
Nitrous oxide N_2O			
liq.			
−89.5 b p.	1 00 atm.	1.226	0 0031
−80	1 70	1.199	0.0050
−60	4.40	1.140	0.0122
−40	9.5	1.075	0.025
−20	18.1	1.001	0.048
0	31.3	0.910	0 087
+20	50 3	0 784	0.161
36 5	71.7	0.451	0.451
Oxygen O_2			
−210.4 liq.		1.2746	0.0000865
−204.52	36 11 mm		
−195.50	162 15		.
−186 91	493 30		
−182 95 b p	1.000 atm.		
−154 5		0.9758	0.0385
−149.25	12.506		.
−129 9	.	0 7781	0.1320
−125 28	38.571		
−118.82 c p	49 713	0.4299	0.4299
Ozone O_3			
−193.1 liq.	0 015 mm		
−173 1	1 3		
−153 1	25.4		
−133.1	182 8		
−112.4 b p.	760.		
− 5 c p.	67 atm.		
Phosphine PH_3			
−129 liq.	43.0 mm		
−121	85 7		
−113	158.3		
−101	354.2		
− 89	699.5		
− 87.5 b.p.	1.00 atm.	0 746	0 0023
− 80	1 46	0 738	0 0032
− 60	3.47	0.712	0 0073
− 40	7.1	0.684	0.014
− 20	12 9	0.651	0 025
0	21.6	0.613	0.042
20	34.2	0.566	0.067
40	51.9	0.50	0.11
51 c.p.	64.	0.30	0.30
Phosphonium chloride PH_4Cl			
−63.0 sol.	39.81 mm		....
−26 8	760.0	.	. .
0.9	5623.0		. .

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Phosphorus pentachloride PCl_5			
156.1 sol.	562.3 mm	. .	.. .
136.7	266.1	.	.
101.4	37 58		. . .
Phosphorus trioxide P_2O_3			
30 liq.	3. mm	.	.
50	9 0		
60	20.		
70	60.		
80	150.		
90	300.		
Pictet's fluid $64SO_2 + 44CO_2$ by weight			
−30	585.2 mm		
−25	676.4		
−20	744 8	.	
−15	896.8		
−10	1018 4		.
− 5	1216 0		
0	1390 8		
+ 5	1672.0		
10	1938 0		
15	2264 8		
20	2584 0		
25	2979.2		
30	3382 0		
35	3838 0		
40	4347 2		
45	4788 0		
50	5213.6		
Potassium K			
162 3 liq.	0 001 mm		
344.2	1.		
758 b.p.	760.		
Radon Rn			
−101 sol	50 mm		
− 70 5 t p	500		
− 61 8 liq	1 000 atm.		
− 50	2 065	.	
− 20	5 260	.	
10	11 40		
70	37 67		
104 4 c p.	62 44		
Selenium Se			
200 sol.	0 0015 mm		
210	0 0032		
217.4 m.p.	0.0055		
220 liq.	0.0062		
230	0 0097		
390	3 0		
400	4.0		
420	7.0		
440	11.		
460	17.		
480 liq.	28		
500	42.		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Selenium Se (Continued)			
620	313. mm		
640	420.		
660	550.		
680	700.		
688 b.p.	760.		
Selenium dioxide SeO_2			
72.0 sol	13.43 mm		
180.9	39.00		
236.9	66.07		
289.2	316.2		
317.0	760.0		
Silicon Si			
719.2 sol	0.001 mm		
1219	1.		
Silver Ag			
837 liq.	0.001 mm		
1218	1.		
1948 b.p.	760.		
Silver oxide Ag_2O			
1316 sol.	0.46 mm		
1435	3.4		
Sodium Na			
238.1 liq.	0.001 mm		
441.2	1.		
882. b.p.	760.		
Stannic chloride $SnCl_4$			
−10 liq.	2.8 mm		
10	10.3		
30	31.3		
60	112.0		
90	360.5		
114.1 b.p.	1.00 atm.	1.978	0.0085
120	1.18	1.963	0.0099
140	1.96	1.907	0.0162
Strontium Sr			
713.4 liq.	0.001 mm		
899	1.		
1154 b.p.	760.		
Sulfur S			
50 sol.	0.0002 mm		
60	0.0004		
70	0.0010		
80	0.0023		
90	0.0049		
100	0.010		
110	0.021		
114.5 m.p	0.028		
120 liq.	0.040		
130	0.074		
140	0.13		
150	0.22		
160	0.37		
170	0.59		
180	0.91		
Sulfur S (Continued)			
190	1.4 mm		
200	2.1		
210	3.1		
220	4.4		
230	6.3		
240	8.7		
250	12.		
260	16.		
270	21.		
280	28.		
290	37.		
300	48.		
310	60.		
320	76.		
330	95.		
340	118.		
350	146.		
360	179.		
370	218.		
380	263.		
390	325.		
400	376.		
410	446.		
420	525.		
430	613.		
440	711.		
444.60 b.p.	760.0		
450	821.		
460	948.		
470	1093.		
480	1257.		
490	1441.		
500	1647.		
510	1876.		
520	2130.		
530	2410.		
540	2718.		
550	3055.		
560	3423.		
570	3824.		

Sulfur dioxide SO_2

°C	Pressure	Sp. Vol. cm³/g liq.	Sp. Vol. cm³/g vap.
−70 liq.	19.9 mm		
−65	30.0		
−60	42.8		
−55	61.8		
−50	86.7	0.6423	
−45	119.6	0.6472	
−40	162.3	0.6523	
−35	217.1	0.6575	
−30	286.0	0.6627	

°C	Pressure	Sp Vol. cm^3/g liq	Sp Vol. cm^3/g vap.
Sulfur dioxide SO_2 (Continued)			
−25	373.0 mm	0.6680	
−20	478 0	0.6739	
−15	607.0	0.6798	
−10	761.0	0 6859	
− 5	947.0	0.6916	
0	1.529 atm.	0.6974	
+ 2	1.657	0 6998	
4	1.793	0.7022	
6	1.938	0.7047	
8	2.092	0.7072	156 3
10	2.256	0.7097	147.1
12	2.429	0 7123	137 0
14	2 613	0 7153	128.2
16	2 807	0.7179	119 0
18	3 012	0.7205	111 1
20	3 228	0.7231	103 1
22	3 456	0.7262	97.09
24	3 697	0.7289	90.91
26	3.951	0.7315	86.21
28	4.217	0.7348	81.30
30	4.498	0.7375	75.76
32	4 793	0 7407	70.92
34	5 102	0.7440	66 67
36	5.427	0.7474	62 50
38	5.768	0.7508	58.14
40	6 125	0.7536	54.64
42	6.499	0.7570	51 02
44	6.890	0.7610	48.08
46	7.300	0.7646	45.25
48	7.729	0.7680	42.74
50	8.176	0 7722	40 65
60	10 729	0.7918	31.85
70	13.867	0.8137	25 77
80	17 682	0.8382	20.92
90	22.268	0.8658	16 39
100	27.714	0 8977	12 94
110	34 091	0 9355	10.31
120	41 432	0 9823	8.078
130	49.705	1.0449	6.146
140	58 783	1.1363	4.554
150	68 405	1.3038	3.256

°C	Pressure	Density g/cm^3 liq	Density g/cm^3 vap.
Sulfur trioxide SO_3			
liq.			
44.6 b.p.	1.00 atm	1 807	0 003
60	2.0	1.732	0.006
80	4.3	1 639	0.013
100	8.0	1 547	0.025
120	13 3	1.465	0.037
140	20.6	1 382	0 056
160	30 3	1 296	0 086
180	43.4	1 196	0 137
200	61.1	1 058	0 233
218 3 c.p.	83.6	0 630	0 630
Thallium Tl			
412.7 liq.	0.001 mm		
748	1		
1650 b p.	760.		
Tin Sn			
1282 liq	0 001 mm		
1503	1.		
2260 b.p.	760		
Tungsten W			
3353 sol.	0.001 mm		
Xenon Xe			
liq			
−109.1 b.p.	1.000 atm.		
−100	1.629		
− 60	8 570	2 699	0.079
− 20	26.73	2 292	0 238
0.0	41 24	1 987	0.421
16 6 c.p.	58.22	1 154	1 154
Zinc Zn			
296.3 sol.	0.001 mm		
487.7 liq.	1.		
558.9	5		
594.1	10		
632.3	20		

Organic Compounds

°C	Pressure	Density g/cm^3 liq	Density g/cm^3 vap.
Acetic acid $C_2H_4O_2$			
20 liq	11.7 mm	. .	. . .
30	20 6	.	
40	34.8	.	. . .
50	56.6	.	. . .
60	88 9	.	. . .
70	136.0	. . .	. . . .
80	202 3	. .	. . . .
Acetic acid $C_2H_4O_2$ (Continued)			
90	293 7 mm		
100	417 1		
110	580.8		
118.5 b.p.	1.000 atm.	0 9380	0 003150
120	1 058	0 9362	0.003271
140	1.884	0 9091	0 005515
160	3 149	0.8829	0 00887

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.

Acetic acid $C_2H_4O_2$ (Continued)

°C	Pressure	liq.	vap.
180	5.014 atm.	0.8555	0.01370
200	7.682	0.8265	0.02052
220	11.39	0.7941	0.03021
240	16.42	0.7571	0.04327
260	23.07	0.7136	0.06165
280	31.67	0.6629	0.0883
300	42.54	0.5950	0.1331
320	56.01	0.4615	0.2417
321.6 c.p.	57.21	0.3506	0.3506

Acetone C_3H_6O

°C	Pressure	liq.	vap.
−94.8 sol.	0.017 mm	...	...
−90 liq.	0.021	...	...
−70	0.34	...	...
−50	2.4	...	...
−30	11.2	...	...
−10	38.7	...	...
5	89.1	...	...
+10	115.6	...	...
15	147.1	...	...
20	184.8	...	...
25	229.2	...	...
30	282.7	...	...
35	346.4	...	...
40	421.5	...	...
45	510.5	...	...
50	612.6	...	...
56.1 b.p	1.000 atm.	0.750	0.002
60	1.14	0.746	0.003
70	1.58	0.734	0.003
80	2.12	0.719	0.004
90	2.81	0.706	0.005
100	3.67	0.693	0.007
110	4.74	0.679	0.009
120	6.01	0.665	0.011
130	7.53	0.650	0.013
140	9.33	0.634	0.016
150	11.5	0.618	0.020
160	13.9	0.601	0.024
170	16.6	0.588	0.030
180	20.0	0.568	0.039
190	23.8	0.540	0.050
200	28.0	0.514	0.065
210	32.7	0.482	0.085
220	38.1	0.443	0.110
230	44.1	0.393	0.152
235 c.p.	47.0	0.268	0.268

Acetonitrile C_2H_3N

°C	Pressure	liq.	vap.
80 liq.	...	0.717	0.001
100	...	0.694	0.002
120	...	0.670	0.004
140	...	0.646	0.007
160	...	0.620	0.011
180	...	0.590	0.015
200	...	0.555	0.022
220	...	0.514	0.034
240	...	0.467	0.053
260	...	0.399	0.091
274.7 c.p.	...	0.240	0.240

Acetylene C_2H_2

°C	Pressure	liq.	vap.
−84.0 liq.	1.00 atm.	...	...
−81.5 t.p.	1.20	0.618	0.0021
−60	3.48	0.585	0.0056
−40	7.7	0.551	0.012
−20	14.9	0.512	0.024
0	26.3	0.464	0.045
+20	43.1	0.400	0.082
36.0	61.7	0.230	0.230

Amyl alcohol $C_5H_{12}O$

°C	Pressure	liq.	vap.
0 liq.	0.6 mm	...	...
10	1.3	...	...
20	2.8	...	...
40	10.6	...	...
60	34.1	...	...
80	95.1	...	...
100	233.3	...	...
110	350.3	...	...
120	512.3	...	...
130	730.8	...	...

iso-Amyl alcohol $C_5H_{12}O$

°C	Pressure	liq.	vap.
10 liq.	1.0 mm	...	...
20	2.3	...	...
40	9.7	...	...
60	33.3	...	...
80	95.9	...	...
100	238.6	...	...
110	358.6	...	...
120	523.3	...	...
130	743.2	...	...
140	1033.	...	...
150	1400.	...	...

Aniline C_6H_7N

°C	Pressure	liq.	vap.
50 liq.	2.4 mm	...	...
60	5.7	...	...
70	10.6	...	...
80	18.0	...	...
90	29.2	...	...
100	45.7	...	...
110	69.2	...	...
120	96.6	...	...
130	144.5	...	...

Benzene. See end of table

Benzoic acid $C_7H_6O_2$

°C	Pressure	liq.	vap.
100 liq.	1.79 mm	...	...
140	14.6	...	...
150	23.6	...	...
160	36.3	...	...
170	55.8	...	...
180	81.6	...	...
190	119.1	...	...
200	171.3	...	...
210	239.	...	...
220	331.5	...	...
230	451.	...	...

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Benzoic acid $C_7H_6O_2$ (Continued)			
240	597. mm		
250	780.		
Benzophenone $C_{13}H_{10}O$			
0 sol.	2.03×10^{-5} mm		
8	6.94×10^{-5}		
32	1.418×10^{-3}		
Benzoyl chloride C_6H_5ClO			
40 liq.	1.1 mm		
50	2.4		
60	4.8		
70	8.2		
80	13.6		
90	21.8		
100	33.9		
110	51.4		
120	75 1		
130	107.8		
140	152.0		
Bromobenzene C_6H_5Br			
30 liq.	5.67 mm		
40	9.99		
50	16.96		
60	27.61		
70	43.55		
80	66.22		
90	97.72		
100	141.1		
110	198.7		
120	274.9		
140	495.8		
156.15 b.p.	760.		
160	846.	1.2994	0.0052
180	1350.	1.2697	0.0081
200	2075.	1.2385	0.0121
220	3055.	1.2037	0.0174
240	4360.	1.1689	0.0248
260	6080.	1.1310	0.0343
397 c p.	33900.	0.4859	0.4859
iso-Butane C_4H_{10}			
−30 liq.	463. mm		
−25	544.		
−20	646.		
−15	745.		
n-Butyl alcohol $C_4H_{10}O$			
20 liq.	4.39 mm		
25	6 44		
30	9 52		
35	13 1		
40	18.6		
45	24.9		
50	33 7		
55	44.9		
60	59 2		

°C	Pressure	Density g/cm³ liq	Density g/cm³ vap.
n-Butyl alcohol $C_4H_{10}O$ (Continued)			
65	77 7 mm		
70	112.3		
75	131 3		
iso-Butyl alcohol $C_4H_{10}O$			
60 liq.	99 1 mm		
70	158 5		
80	248.9		
90	384 6		
100	583.5		
110	845.3		
120	1197.		
130	1668.		
iso-Butyl formate $C_5H_{10}O_2$			
40 liq.	84. mm		
60	200.		
80	417.		
95	687.		
97 9 b p	1 000 atm.		
100	1.067		
120	1.92		
140	3.25		
160	5 19		
180	7 89		
200	11 5		
220	16.3		
240	22.3		
260	29.8		
278 c.p.	38.		
Butyric acid $C_4H_8O_2$			
20 liq.	0.75 mm		
30	1.5		
40	3.0		
50	5.25		
60	9.35		
Camphor $C_{10}H_{16}O$			
180 liq.	380 mm		
190	490.		
200	624.		
Caproic acid $C_6H_{12}O_2$			
80 liq.	2.5 mm		
90	5.3		
100	10.6		
110	18 9		
120	31.4		
130	51.0		
135	62.6		
Carbon tetrachloride CCl_4			
−20 liq.	9 8 mm		
−15	13.5		
−10	18.5		
− 5	24.8		
0	32.9		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Carbon tetrachloride CCl_4 (Continued)			
+5	43.2 mm		
10	56.0		
15	71.7		
20	91.		
25	114.5		
30	143.0		
35	176.2		
40	215.8		
45	262.5		
50	317.1		
55	379.3		
60	450.8		
65	530.9		
70	622.3		
76.75 b.p.	760.		
80	838	1.4765	0.0061
90	1112.	1.4554	0.0080
100	1457	1.4343	0.0103
110	1880.	1.4124	0.0131
120	2390.	1.3902	0.0164
130	3000.	1.3680	0.0204
140	3725.	1.3450	0.0250
150	4555.	1.3215	0.0304
160	5535.	1.2983	0.0365
170	6640	1.2734	0.0437
180	7900.	1.2470	0.0525
190	9315.	1.2192	0.0625
200	10940.	1.1888	0.0742
210	12760.	1.1566	0.0879
220	14800	1.1227	0.1040
230	17060	1.0857	0.1232
240	19600.	1.0444	0.1464
250	22410.	0.9980	0.1754
o-Chloroaniline C_6H_6ClN			
80 liq.	7.7 mm		
100	20.7		
120	48.4		
140	101.9		
160	199.1		
180	358.5		
200	608.2		
m-Chloroaniline C_6H_6ClN			
100 liq.	9.0 mm		
120	23.1		
140	52.1		
160	107.2		
180	203.5		
200	363.1		
220	616.6		
Chlorobenzene C_6H_5Cl			
0. liq.	2.52 mm		
10	4.86		
20	8.76		
30	15.45		
40	26.00		
Chlorobenzene C_6H_5Cl (Continued)			
50	41.98 mm		
60	65.54		
70	97.90		
80	144.75		
90	208.35		
100	292.75		
110	402.55		
120	542.80		
130	718.95		
132 b.p.	760.		
140	939.5	0.9723	0.0043
160	1535.	0.9480	0.0068
180	2370.	0.9224	0.0102
200	3520.	0.8955	0.0151
220	5055.	0.8672	0.0214
240	7050.	0.8356	0.0300
260	9650.	0.8016	0.0417
359.2 c.p.	33900.	0.3654	0.3654
o-Chlorobenzoic acid $C_7H_5ClO_2$			
100 sol.	0.1803 mm		
m-Chlorobenzoic acid $C_7H_5ClO_2$			
100.63 sol.	0.197 mm		
p-Chlorobenzoic acid $C_7H_5ClO_2$			
100 sol.	0.045 mm		
Chloroform $CHCl_3$			
−60 liq.	0.81 mm		
−50	2.06		
−40	4.7		
−30	10.0		
−20	19.6		
−10	34.75		
0	61.0		
+10	100.5		
20	159.6		
25	199.1		
30	246.0		
35	301.3		
40	366.4		
45	439.0		
50	526.0		
55	625.2		
60	739.6		
60.9 b.p.	760.0		
70	1019.		
80	1403.		
90	1880.		
100	2430.		
110	3100.		
120	3890.		
130	4860.		
140	5950.		
150	7080		
160	8800.		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
o-Cresol C_7H_8O			
60 liq.	3.55 mm		
80	11.5		
100	31.6		
120	74.1		
140	158.1		
160	308.3		
180	566.9		
m-Cresol C_7H_8O			
60 liq.	1.76 mm		
80	6.37		
100	19.05		
120	48.6		
140	106.9		
160	219.3		
180	411.2		
p-Cresol C_7H_8O			
60 liq.	1.7 mm		
80	6.17		
100	18.3		
120	47.4		
140	105.0		
160	216.8		
180	407.4		
Cyanogen C_2N_2			
−25 liq.	629.8 mm		
−21.17 b.p.	1.000 atm		
−20	1.055		
0	2.414		
+20	4.85		
40	8.80		
60	14.8		
80	23.4		
100	35.3		
120	51.5		
128.3 c.p.	59.7		
Cyclohexane C_6H_{12}			
liq			
80.75 b.p.	760. mm	0.7199	0.0029
100	1304.	0.6988	0.0049
120	2140.	0.6775	0.0080
140	3355.	0.6553	0.0123
160	5040.	0.6313	0.0184
180	7285.	0.6060	0.0265
200	10130.	0.5773	0.0380
220	13690.	0.5443	0.0534
240	18140.	0.5058	0.0746
260	23590.	0.4537	0.1097
281.0 c.p.	30835.	0.2703	0.2703
Cymene $C_{10}H_{14}$			
0 liq	4.65 mm		
20	6.3		
40	10.95		
60	21.4		
Cymene $C_{10}H_{14}$ (Continued)			
80	43.55 mm		
100	87.85		
120	169.25		
140	304.65		
160	519.6		
p-Dibromobenzene $C_6H_4Br_2$			
84.0 sol.	7.586 mm		
52.8	0.6607		
21.0	0.0158		
Diethylamine $C_4H_{11}N$			
54.0 liq.	724. mm		
55.4 b.p.	1.000 atm.	0.668	0.003
60	1.16	0.663	0.003
80	2.13	0.640	0.005
100	3.67	0.616	0.008
120	5.92	0.591	0.014
140	9.10	0.562	0.022
160	13.4	0.528	0.035
180	18.9	0.489	0.053
200	25.8	0.438	0.080
220	34.4	0.339	0.150
223.5 c.p.	36.2	0.246	0.246
Diethylaniline $C_{10}H_{15}N$			
60 liq.	2.7 mm		
80	6.8		
100	16.2		
120	38.2		
140	80.6		
160	158.0		
180	291.7		
200	504.0		
220	837.0		
Dimethylamine C_2H_7N			
6.05 liq	724 mm		
7.2 b.p.	1.000 atm.		
20	1.66		
40	3.32		
60	6.04		
80	10.2		
100	16.0		
120	23.9		
140	34.4		
160	48.0		
164.6 c.p.	51.7		
Dinitrophenol-2, 4 $C_6H_4N_2O_5$			
100 sol.	0.228 mm		
Diphenyl $C_{12}H_{10}$			
210 liq.	243. mm		
220	330		
225	376.5		
230	426.6		
235	482.		

°C	Pressure	Density g/cm³ liq	Density g/cm³ vap
Diphenyl $C_{12}H_{10}$ (Continued)			
240	542 9 mm		
245	609 5		
250	681 6		
Ethane C_2H_6			
−140 liq.	14 1 mm		
−130	39 5		
−120	94 7		
−110	202 8		
−100	393 8		
− 90	705 2		
− 88 62 b.p.	1.000 atm.	0 546	0.00206
− 80	1.556	0.535	0.00311
− 60	3.743	0.509	0.00707
− 40	7.672	0.482	0.0141
− 20	14.02	0.453	0 0260
0	23.56	0 416	0.0463
+ 20	37.28	0 363	0 085
32 2 c p	48.2	0.220	0.220
Ethyl acetate $C_4H_8O_2$			
−20 liq.	6 5 mm		
−10	12 9		
0	24.2		
+10	42 8		
20	72 8		
30	118 7		
40	186 3		
50	282 3		
60	415 3		
70	596 3		
77 15 b.p.	1 000 atm	0 8283	0 003230
80	1 093	0 8245	0.003495
100	2 000	0 7972	0.006158
120	3.404	0 7683	0.01030
140	5 461	0.7378	0 01650
160	8 349	0 7033	0 02577
180	12 27	0 6653	0 03883
200	17 45	0 6210	0 05797
220	24 15	0 5648	0 08905
240	32 68	0 4778	0 1499
250 1 c.p.	37.80	0.3077	0.3077
Ethyl alcohol C_2H_6O			
−65 liq.	0 021 mm		
−60	0.045		
−55	0 087		
−50	0.12		
−45	0.24		
−40	0 39		
−35	0 63		
−30	1 04		
−25	1 63		
−20	2 5		
−15	3 65		
−10	5 6		
− 5	8.3		
0	12 2		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Ethyl alcohol C_2H_6O (Continued)			
+5	17.3 mm		
10	23 6		
15	32 2		
20	43 9		
25	59 0		
30	78 8		
35	103 7		
40	135 3		
45	174 0		
50	222 2		
55	280 6		
60	352 7		
65	448 8		
70	542.5		
75	666.1		
78 3 b.p.	1.000 atm.	0.7365	0 00165
80	1 069	0.7348	0.00174
90	1 562	0.7251	0.00250
100	2 228	0.7157	0.00351
110	3 107	0 7057	0.00486
120	4 243	0 6925	0.00658
130	5 685	0.6789	0.00877
140	7 486	0 6631	0.01152
150	9 700	0.6489	0 01488
160	12 39	0 6329	0 01916
170	15 61	0 6165	0.02446
180	19 44	0 5984	0.03115
190	23 94	0 5782	0 0397
200	29 20	0 5568	0.0508
210	35 31	0 5291	0.0655
220	42 38	0 4958	0.0854
230	50 53	0.4550	0.1135
240	59.92	0.3825	0 1715
243 1 c.p.	63 11	0 2755	0.2755
Ethylamine C_2H_7N			
15.45 liq	724. mm		
16 6 b.p.	1 000 atm.		
20	1 14		
40	2.34		
60	4 35		
80	7 48		
100	12.1		
120	18 5		
140	27.0		
160	38 4		
180	52 9		
183 2 c.p.	55 5		
Ethyl bromide C_2H_5Br			
−20 liq	59. mm		
−10	101.		
0	165.		
+10	257.		
20	386.		
30	564.		
40	802.		
50	1113.		
60	1512.		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap
Ethyl chloride C_2H_5Cl			
liq.			
12.2 b.p.	1 00 atm.	0.9060	0 00285
20	1 33	0.8943	0 00372
40	2.55	0.8633	0 00692
60	4 50	0.8306	0 0120
80	7.41	0.7958	0 0190
100	11 5	0.7575	0 0294
120	17.2	0.715	0.043
140	24.7	0.665	0 064
160	34.3	0.602	0 099
180	46 6	0.494	0 178
187 c p.	51.6	0.331	0.331
Ethylene C_2H_4			
liq.			
−103.8 b.p.	1.00 atm.	0 569	0.0022
−100	1.24	0.564	0 0026
− 80	3 35	0.534	0 0063
− 60	7.38	0.500	0 0133
− 40	14 2	0 461	0 025
− 20	24 8	0.414	0 046
0	40 6	0.345	0 088
+ 9.6 c p.	50.6	0.210	0.210
Ethylene bromide $C_2H_4Br_2$			
−28 21 sol.	1 51 mm		
−12 30	2.65		
0	3 47		
6 54	6 16		
−10 liq	2 5		
0	3 9		
Ethylene oxide C_2H_4O			
−60 liq.	15 3 mm		
−40	64 1		
−20	196 4		
−10	316.3		
0	493 1		
+10	738 0		
Ethyl ether $C_4H_{10}O$			
−119 8 sol	0 0027 mm		
−117.3	0 0065		
−100 liq	0 05		
− 80	0 6		
− 60	4 1		
− 40	19 0		
− 30	37.6		
− 10	112.3		
0	185 3		
+ 5	233 2		
10	291 7		
15	360 7		
20	442.2		
25	537.0		
30	647 3		
34.6 b p.	1 000 atm.	0 6962	0.003162
40	1 212	0.6894	0.003731
50	1 680	0 6764	0 005079
Ethyl ether $C_4H_{10}O$ (Continued)			
60	2 275 atm.	0.6658	0.006771
70	3 021	0.6532	0.00892
80	3.939	0.6402	0.01155
90	5.054	0 6250	0.01477
100	6 394	0.6105	0.01867
110	7.987	0.5942	0.02349
120	9.861	0.5764	0.02934
130	12.05	0.5580	0.03638
140	14.58	0.5385	0.04488
150	17.48	0.5179	0 05551
160	20.80	0.4947	0.06911
170	24.57	0.4658	0.08731
180	28 81	0.4268	0.1135
185	31.12	0.4018	0.1320
190	33 57	0.3663	0.1620
193.8 c p.	35.52	0.2625	0.2625
Ethyl formate $C_3H_6O_2$			
−20 liq.	22 5 mm		
0	72 4		
+20	192 5		
40	446 7		
54.35 b.p	1 000 atm.	0.8767	0 002843
60	1 208	0.8689	0.003370
80	2 251	0.8409	0 006098
100	3 883	0.8112	0 01032
120	6 290	0.7796	0.01657
140	9 674	0.7448	0.02564
160	14 26	0 7058	0.03876
180	20 28	0 6610	0.05747
200	28 00	0 6066	0.08621
220	37 70	0.5290	0.1379
230	43 39	0 4635	0 1890
235.3 c p.	46 65	0 3232	0.3232
Ethyl iodide C_2H_5I			
0 liq.	41 5 mm		
10	68 5		
20	108 5		
30	167 5		
40	251 5		
50	364 0		
60	512 0		
Ethyl propionate $C_5H_{10}O_2$			
0 liq	8 3 mm		
20	27 75		
40	77 9		
60	188 0		
80	403.6		
99.0 b.p	1.000 atm.	0 7964	0.003480
100	1 027	0 7951	0 003580
120	1.828	0 7692	0 00620
140	3.042	0 7413	0 01024
160	4.788	0.7115	0 01615
180	7.206	0 6795	0 02469
200	10.45	0 6443	0.03676
220	14 73	0.6027	0.05435
240	20 28	0.5501	0.08230

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Ethyl propionate $C_5H_{10}O_2$ (Continued)			
260	27.40 atm.	0.4744	0.1337
270	31.69	0.4018	0.1957
272.9 c.p.	33.03	0.2965	0.2965
Ethyl sulfide $C_4H_{10}S$			
20 liq.	63.8 mm		
40	137.0		
60	283.5		
80	539.5		
90.3 b.p.	1.000 atm.	0.765	0.003
100	1.32	0.755	0.003
120	2.26	0.732	0.005
140	3.66	0.709	0.008
160	5.68	0.684	0.011
180	8.36	0.656	0.017
200	12.0	0.625	0.027
220	16.6	0.590	0.041
240	22.3	0.549	0.061
260	29.3	0.494	0.094
280	37.6	0.395	0.175
283.8 c.p.	39.1	0.279	0.279
Formic acid CH_2O_2			
2 sol.	9.7 mm		
4	11.6		
6	14.1		
8	17.4		
10 liq	18.9		
20	33.1		
30	52.2		
40	82.6		
50	125.9		
60	189.7		
70	279.6		
80	398.1		
90	552.1		
100	753.4		
Glycol $C_2H_6O_2$			
120 liq	39 mm		
130	62		
140	96.8		
150	147.9		
160	218.8		
170	316.2		
180	446.2		
190	615.9		
Heptane C_7H_{16}			
0 liq.	11.45 mm		
10	20.5		
20	35.5		
30	58.35		
40	92.05		
50	140.9		
60	208.9		
70	302.3		
80	426.6		
90	588.8		
Heptane C_7H_{16} (Continued)			
100	795.2 mm		
110	1047.		
120	1367.		
Hydroquinol $C_6H_6O_2$			
155.0 sol.	5.9 mm		
164.3	10		
150 liq.	4.0		
170	15.2		
190	37.7		
200	55.7		
210	79.8		
230	158.5		
250	291.8		
270	509.3		
o-Hydroxybenzoic acid $C_7H_6O_3$			
100 sol.	0.397 mm		
m-Hydroxybenzoic acid $C_7H_6O_3$			
101.06 sol.	0.00149 mm		
p-Hydroxybenzoic acid $C_7H_6O_3$			
100.91 sol.	0.00030 mm		
Iodobenzene C_6H_5I			
30 liq.	1.48 mm		
40	2.24		
50	4.85		
60	8.30		
70	13.65		
80	21.78		
90	33.50		
100	50.23		
110	73.88		
120	105.4		
130	148.3		
140	204.9		
150	276.7		
160	367.3		
170	479.7		
180	618.7		
188.45 b.p.	760.		
200	991.	1.5470	0.0073
220	1520.	1.5124	0.0108
240	2245.	1.4764	0.0156
260	3220.	1.4384	0.0220
448 c.p.	33900.	0.5814	0.5814
Mesitylene C_9H_{12}			
0 liq.	15.6 mm		
20	27.15		
40	48.9		
60	87.35		
80	150.8		
100	247.25		
120	381.1		
140	550.05		
160	740.35		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Methane CH_4			
−182 liq.	94.0 mm	.	
−178	152.1	..	
−176	190.5	....	....
−161 5 b.p.	1.00 atm	0.4245	0 0018
−160	1 13	0.4222	0.0020
−140	4.38	0.3916	0.0068
−120	11.84	0.3547	0.0175
−100	25.7	0.3050	0.0413
− 82.1 c.p	45.8	0.1615	0.1615
Methyl acetate $C_3H_6O_2$			
−135 sol.	0.00354 mm	. . .	. .
− 20 liq.	19.		
0	62.1		
20	169.8		
40	400 4		
57.15 b.p.	1.000 atm.	0.8840	0 002830
60	1.104	0.8800	0 003076
80	2.092	0.8519	0 005618
100	3.659	0.8221	0 009671
120	5.998	0.7893	0 01570
140	9.325	0.7532	0.02454
160	13.88	0.7133	0 03731
180	19.95	0.6671	0 05682
200	27.84	0.6100	0 08658
220	37.92	0 5281	0.1416
233.7 c.p.	46.31	0 3252	0 3252
Methyl alcohol CH_4O			
liq.			
64 7 b.p.	1.000 atm.	0.7510	0.001222
80	1.764	0 7355	0 002084
100	3.452	0 7140	0.003984
120	6.255	0.6900	0 007142
140	10.63	0.6640	0 01216
160	17.11	0.6340	0 01994
180	26.35	0.5980	0 03186
200	39.08	0.5530	0.05075
220	56.18	0.4900	0 08635
230	66.67	0 4410	0.1187
240.0 c.p.	78.67	0.2722	0.2722
Methylamine CH_5N			
liq.			
− 6 6 b.p	1.000 atm.		
0	1.33		
+ 20	2.92		
40	5.93	.	
60	10.15		
80	16.7		
100	25.9		.
120	38.5		. . .
140	55.1		
156 9 c.p.	73.6		.
Methyl n-butyrate $C_5H_{10}O_2$			
0 liq.	7.3 mm		.
20	24.5	.	. . .
40	69 2	.	. . . .
Methyl n-butyrate $C_5H_{10}O_2$ (Continued)			
60	167 5 mm		.
80	361.4		.
100	700.7		
102.75 b.p.	1.000 atm.	0.8035	0 003595
120	1.649	0 7816	0.005708
140	2.756	0 7551	0.009294
160	4 359	0.7270	0.01459
180	6.587	0.6964	0 02215
200	9.593	0.6633	0.03268
220	13 55	0.6251	0.04831
240	18.69	0.5773	0 07143
260	25.25	0.5166	0 1091
280	33.58	0.3812	0.2201
281.3 c p.	34.19	0.3002	0 3002
Methyl iso-butyrate $C_5H_{10}O_2$			
0	12.1 mm	.	
20	38.9		
40	104.7		
60	243 8		
80	505 0		
92.3 b p.	1 000 atm.	0.8040	0.003617
100	1 257	0 7945	0.004472
120	2 193	0 7680	0.007628
140	3 588	0 7396	0.01224
160	5.569	0 7095	0.01903
180	8 280	0.6767	0.02869
200	11.89	0.6411	0.04228
220	16.59	0 5961	0.06289
240	22.64	0.5386	0 09615
260	30.32	0.4495	0.1623
267.55 c.p.	33.72	0.3012	0 3012
Methyl chloride CH_3Cl			
liq			
− 24.0 b.p.	1.00 atm.	0 997	0 00255
− 20	1.18	0.990	0.00297
0	2.50	0 955	0 00599
+ 20	4.75	0 918	0.0110
40	8 33	0 878	0 0189
60	13.6	0 832	0 032
80	21.2	0 783	0 049
100	31 4	0.725	0.075
120	45 0	0 647	0.120
140	62 6	0 497	0 238
143 2 c.p.	65.8	0.365	0.365
Methylene bromide CH_2Br_2			
0 liq.	11.5 mm		.
10	20 4		.
20	34 7		
30	56.4		
Methylene chloride CH_2Cl_2			
0 liq.	147. mm		.
10	229 7		
20	348.9		
30	511.4		:

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Methyl ether C_2H_6O			
liq.			
− 23.7 b.p.	1.000 atm.	0.7222	0.0024
− 20	1.17	0.7174	0.0027
− 10	1.74	0.7040	0.0039
0	2.54	0.6905	0.0055
+ 10	3.59	0.6759	0.0076
20	4.95	0.6610	0.0104
30	6.62	0.6455	0.0142
40	8.69	0.6292	0.0188
50	11.25	0.6116	0.0241
60	14.27	0.5932	0.0306
70	17.90	0.5735	0.0385
80	22.10	0.5517	0.0484
90	26.9	0.5257	0.0623
100	32.6	0.4950	0.0810
110	39.0	0.4575	0.1060
115	42.5	0.4350	0.1222
120	46.3	0.4040	0.1465
125	50.3	0.3510	0.1930
126.9 c.p.	52.0	0.2714	0.2714
Methyl ethyl ether C_3H_8O			
liq.			
7.5 b.p.	1.000 atm.	0.716	0.003
10	1.10	0.713	0.004
20	1.61	0.700	0.006
30	2.29	0.687	0.008
40	3.14	0.672	0.010
50	4.24	0.658	0.013
60	5.56	0.644	0.016
70	7.21	0.628	0.019
80	9.16	0.612	0.023
90	11.4	0.596	0.029
100	14.2	0.579	0.034
110	17.3	0.560	0.040
120	20.9	0.540	0.050
130	25.0	0.516	0.064
140	29.6	0.487	0.082
150	34.7	0.450	0.109
160	40.5	0.401	0.153
164.7 c.p.	43.4	0.270	0.270
Methyl ethyl ketone C_4H_8O			
20 liq.	77.5 mm	...	...
30	121.4		
40	188.4		
50	300.0		
Methyl formate $C_2H_4O_2$			
− 20 liq.	67.7 mm		..
0	195.0		
+ 20	476.4		
31.9 b.p.	1.000 atm.	0.9569	0.002468
40	1.355	0.9447	0.003236
60	2.608	0.9133	0.006039
80	4.610	0.8803	0.01049
100	7.614	0.8452	0.01723
120	11.91	0.8070	0.02688
Methyl formate $C_2H_4O_2$ (Continued)			
140	17.83 atm.	0.7638	0.04124
160	25.64	0.7136	0.06231
180	35.76	0.6521	0.09434
200	48.50	0.5658	0.1524
214.0 c.p.	59.15	0.3489	0.3489
Methyl iodide CH_3I			
0 liq.	141.2 mm	.	.
10	220.2		.
20	331.4		
30	483.4		..
Methyl propionate $C_4H_8O_2$			
− 20 liq.	5.6 mm		.
0	21.9		..
+ 20	66.2		
40	169.3		
60	380.3		
79.7 b.p.	1.000 atm.	0.8412	0.003173
80	1.006	0.8408	0.003199
100	1.851	0.8137	0.005714
120	3.165	0.7852	0.009569
140	5.096	0.7553	0.01529
160	7.812	0.7221	0.02356
180	11.50	0.6856	0.03552
200	16.38	0.6445	0.05236
220	22.68	0.5938	0.07812
240	30.70	0.5220	0.1236
Methyl salicylate $C_8H_8O_3$			
216 liq.	645.5 mm		
218	677.2		
220	710.2		
222	744.3		
224	779.8		
225	798.1		
Methyl sulfide C_2H_6S			
liq.			
35.8 b.p.	1.000 atm.	0.831	0.002
40	1.15	0.826	0.003
60	2.15	0.803	0.003
80	3.68	0.777	0.006
100	5.97	0.750	0.010
120	9.14	0.721	0.016
140	13.4	0.689	0.026
160	19.1	0.652	0.040
180	26.2	0.610	0.063
200	35.6	0.559	0.092
220	47.0	0.486	0.146
229.9 c.p.	54.6	0.306	0.306
Naphthalene $C_{10}H_8$			
85 liq.	9.8 mm		
90	12.5		
100	18.9		
110	28.3	.	.
225	887.		.

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Naphthalene $C_{10}H_8$ (Continued)			
230	988. mm		
235	1098.		
240	1218.		
245	1347.		
250	1487.		
α-Naphthol $C_{10}H_8O$			
120 liq.	2.8 mm		
140	7.4		
160	17 9		
180	37.5		
200	74 7		
220	139 0		
240	243.2		
260	403 7		
280	639.6		
β-Naphthol $C_{10}H_8O$			
140 liq.	5.8 mm		
160	13.6		
180	29 5		
200	59.2		
220	111 5		
240	198.5		
260	336 2		
280	544.3		
300	848.7		
m-Nitroacetanilide $C_8H_8N_2O_3$			
100 sol.	0.0042 mm		
p-Nitroacetanilide $C_8H_8N_2O_3$			
100 sol.	0.0021 mm		
p-Nitroaniline $C_6H_6N_2O_2$			
100 sol.	0.0136 mm		
Nitrobenzene $C_6H_5NO_2$			
80 liq.	7.5 mm		
90	12.9		
100	20.85		
110	32.5		
p-Nitrobenzoic acid $C_7H_5NO_4$			
100 sol.	0.0096 mm		
Nitroglycerol $C_3H_7NO_5$			
20 liq.	0.00025 mm		
30	0.00083		
40	0.0024		
50	0.0073		
60	0.0188		
70	0.043		
80	0.098		
90	0.23		
n-Octane C_8H_{18}			
−20 liq.	0 64 mm		
0	2 94		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
n-Octane C_8H_{18} (Continued)			
+20	10.45 mm		
40	30.85		
60	77.55		
80	174.8		
100	353.6		
120	646.4		
140	1114.		
iso-Pentane C_5H_{12}			
−20 liq.	100 00 mm		
0	257 35		
+20	572 2		
40	1140.5		
Phosgene CCl_2O			
liq. 7.95 b.p.	1 00 atm.	1 409	0 005
20	1 55	1 381	0.007
40	2 97	1.332	0.012
60	5 25	1.280	0 020
80	8.68	1.224	0 030
100	13 6	1 165	0 046
120	20 3	1.100	0.072
140	29 1	1 017	0.112
160	40.4	0.903	0 182
180	54 4	0.685	0.359
182 c.p.	56.	0.520	0.520
Picric acid $C_6H_3N_3O_7$			
100.4 sol.	0.00249 mm		
Propane C_3H_8			
−38.4 liq.	1050. mm		
−30.85	1368.		
Propyl acetate $C_5H_{10}O_2$			
0	7.0 mm		
20	25.0		
40	70 9		
60	171.9		
80	373 0		
100	723.8		
101.55 b.p.	1 000 atm.	0 7938	0.003495
120	1.703	0.7702	0 005760
140	2.851	0 7435	0 009497
160	4.518	0 7149	0.01489
180	6 832	0.6835	0 02268
200	9 947	0.6488	0.03390
220	14 05	0 6087	0.05025
240	19.36	0 5586	0.07576
260	26 13	0.4908	0.1205
276.2 c.p.	32.91	0.2957	0.2957
n-Propyl alcohol C_3H_8O			
0 liq.	3.44 mm		
5	5 04		
10	7.26		

VAPOR PRESSURE (Continued)

°C	Pressure	Density g/cm³ liq	Density g/cm³ vap.
n-Propyl alcohol C_3H_8O (Continued)			
15	10.3		
20	14.5		
25	20.1		
30	27.6		
35	37.4		
40	50.2		
45	66.4		
50	87.2		
55	113.6		
60	147.0		
65	186.8		
70	239.0		
75	301.0		
80	376.0		
85	466.		
90	574.		
95	697.		
97.4 b.p.	1.000 atm.	0 7351	0 00208
100	1.100	0.7325	0 00226
110	1.577	0.7220	0.00320
120	2.208	0.7110	0 00443
130	3.022	0 6995	0 00605
140	4.055	0 6875	0.00805
150	5.341	0 6740	0 01060
160	6.915	0 6600	0.01380
170	8.817	0 6450	0.01770
180	11.08	0 6285	0 0225
190	13.75	0 6110	0 0282
200	16.86	0 5920	0 0353
210	20.46	0.5715	0 0442
220	24.57	0.5485	0 0556
230	29.26	0.5230	0 0704
240	34 57	0.4920	0 0904
250	40.55	0.4525	0 1180
260	47.27	0.3905	0 1610
263 7 c.p.	49 95	0 2734	0.2734
Propylene C_3H_6			
−127 4 liq	3 mm		
−110 4	15		
− 34 4	1307.		
Propyl formate $C_4H_8O_2$			
0	21 4 mm		
20	63 9		
40	163.6		
60	364 9		
80	734 5		
80.9 b.p.	1 000 atm.	0.8330	0 003136
100	1.769	0 8080	0.005432
120	3.010	0.7811	0 009033
140	4.821	0.7523	0 01422
160	7 343	0.7209	0.02179
180	10.74	0 6873	0.03236
200	15.20	0.6487	0.04717
220	20.94	0.6024	0.06897
240	28.27	0.5438	0.1045

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
Propyl formate $C_4H_8O_2$ (Continued)			
260	37.54 atm.	0.4404	0.1848
264.85 c.p.	40.13	0 3093	0.3093
Quinoline C_9H_7N			
80 liq.	3.1 mm		
100	8.5		
120	20 7		
140	45.3		
160	91.4		
Turpentine $C_{10}H_{16}$			
0 liq	2 1 mm		
10	2.9		
20	4 4		
30	6 9		
40	10.8		
50	17 0		
60	26.5		
70	40 6		
80	61 3		
90	90.6		
100	131.1		
110	186.0		
120	257.0		
130	349.0		
140	464.0		
155	605 0		
160	686 0		
165	775 0		
Tetrachloroethylene C_2Cl_4			
40 liq.	41 mm		
60	104		
80	226		
100	438.5		
Toluene C_7H_8			
30 liq.	36.7 mm		
40	59 1		
50	92 6		
60	139 5		
70	202 4		
80	289 7		
90	404 6		
100	557.2		
p-Toluic acid $C_8H_8O_2$			
100 sol.	0.216 mm		
o-Toluidine C_7H_9N			
40 liq.	1.1 mm		
60	3.7		
80	10.5		
100	27.2		
120	62 3		
140	129 9		
160	250.2		
180	450.2		
200	762.9		

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
m-Toluidine C_7H_9N			
60 liq.	3.4 mm		
80	9.4		
100	23.9		
120	54.8		
140	115.5		
160	224.9		
180	410.6		
200	706.7		
p-Toluidine C_7H_9N			
40 liq	1.1 mm		
60	3.7		
80	10.5		
100	26.6		
120	60.6		
140	126.3		
160	244.0		
180	441.3		
200	753.0		
Trichloroethylene C_2HCl_3			
25 liq.	73. mm		
30	94.		
40	149.		
50	224.		
60	324.5		
70	453.0		
80	618.0		
Trinitrotoluene $C_7H_5N_3O_6$			
80 liq.	0.042 mm		
85	0.053		
90	0.067		
95	0.085		
100	0.106		
Urethane $C_3H_7NO_2$			
120 liq.	103. mm		
140	203.		
160	392.		
Valeric acid $C_5H_{10}O_2$			
60 liq.	2.07 mm		
80	9.3		
Valeric acid $C_5H_{10}O_2$ (Continued)			
100	28.2 mm		
120	70.5		
140	159.6		
160	336.1		
180	660.7		
iso-Valeric acid $C_5H_{10}O_2$			
10 liq	0.2 mm		
30	0.75		
50	2.9		
70	9 4		
90	27.3		
110	69.8		
130	159.8		
150	338.3		
o-Xylene C_8H_{10}			
0 liq	4.0 mm		
20	10.05		
40	23.7		
60	52.4		
80	108.9		
100	213.1		
120	393.85		
140	689.9		
m-Xylene C_8H_{10}			
0 liq.	1.75 mm		
20	6.43		
40	19.48		
60	50.59		
80	115.72		
100	238 22		
120	448.85		
140	784.64		
p-Xylene C_8H_{10}			
0 liq.	8 29 mm		
20	16.35		
40	34.00		
60	70.64		
80	142 04		
100	270 46		
120	481 33		
140	794.84		

Benzene C_6H_6

°C	Pressure	Density g/cm³ liq.	Density g/cm³ vap.
80 2 b.p.	760 mm		
90	1008	0 8041	0 0036
100	1335	0 7927	0 0047
110	1740	0 7809	0 0060
120	2230	0 7692	0 0077
130	2820	0 7568	0 0096
140	3520	0.7440	0 0118
150	4335	0 7310	0 0144
160	5300	0.7185	0 0173
170	6385	0 7043	0 0209
180	7620	0 6906	0 0249
190	9040	0 6758	0 0298
200	10650	0 6605	0 0355
220	14520	0 6255	0 0502
240	19350	0 5851	0 0714
260	25350	0 5328	0 1038
280	32800	0 4514	0 1660
288 5	36400	0.3045	

VAPOR PRESSURE

Variation with Temperature

The following table gives the value of the constants a and b in the following equation:

$$\log_{10} p = -\frac{0.05223a}{T} + b$$

where p is the pressure in mm of mercury of the saturated vapor at the absolute temperature T. ($T = t°C + 273.1$).

Elements and Inorganic Compounds

Compound	Formula	Temp range °C	a	b
Aluminum oxide	Al_2O_3	1840 to 2200 liq.	540,000	14 22
Ammonia	NH_3	−127 to −78 sol.	31,211	9.9974
Ammonium bromide	NH_4Br	250 to 400 sol.	90,208	9.9404
Ammonium chloride	NH_4Cl	100 to 400 sol	83,486	10.0164
Ammonium cyanide	NH_4CN	7 to 17 sol.	41,484	9.978
Ammonium iodide	NH_4I	300 to 400 sol.	95,730	10.2700
Ammonium sulfhydrate	NH_4HS	6 to 40 sol.	46,025	10 7500
Antimony	Sb	1070 to 1325 liq	189,000	9.051
Argon	A	−208 to −189 sol.	7,814 5	7.5741
		−189 to −183 liq.	6,826 0	6 9605
Arsenic	As	800 to 860 liq.	47,100	6.692
		440 to 815 sol.	133,000	10.800
Arsenous oxide	As_2O_3	100 to 310 sol.	111,350	12 127
		315 to 490 liq.	52,120	6.513
Barium	Ba	930 to 1130 liq.	350,000	15.765
Bismuth	Bi	1210 to 1420 liq.	200,000	8.876
Bismuth trichloride	$BiCl_3$	91 to 213 sol.	13,125	2.681
Cadmium	Cd	150 to 320 9 sol.	109,000	8.564
		500 to 840 liq.	99,900	7.897
Cadmium iodide	CdI_2	385 to 450 liq.	122,200	9.269
Caesium	Cs	200 to 350 liq	73,400	6 949
Caesium chloride	CsCl	986 to 1295 liq	163,200	8 340

VAPOR PRESSURE (Continued)

Compound	Formula	Temp. range °C	*a*	*b*
Calcium	Ca	960 to 1110 liq.	370,000	16 240
Carbon	C	3880 to 4430 liq.	540,000*	9 596*
Carbon dioxide	CO_2	−135 to −56 7 sol.	26,179 3	9 9082
Carbon monoxide	CO	−290 to −206 liq.	6,354	6 976
Chlorine	Cl	−154 to −103 sol.	29,293	9 950
Cobalt	Co	2375 liq.	309,000	7 571
Copper	Cu	2100 to 2310 liq.	468,000	12 344
Cuprous chloride	Cu_2Cl_2	878 to 1369 liq.	80,700	5 454
Cyanogen	$(CN)_2$	−72 to −28 sol.	32,437	9 6539
		−32 to −6 liq.	23,750	7 808
Ferrous chloride	$FeCl_3$	700 to 930 sol.	135,200	8.33
Gold	Au	2315 to 2500 liq.	385,000	9 853
Hydriodic acid	HI	−97 to −51 sol.	24,160	8 259
		−50 to −34 liq.	21,580	7 630
Hydrobromic acid	HBr	−114 to −86 sol.	22,420	8 734
		−86 to −66 liq.	17,960	7 427
Hydrochloric acid	HCl	−158 to −110 sol.	19,588	8 4430
Hydrocyanic acid	HCN	−8 to +27 liq	27,830	7 7446
Hydrofluoric acid	HF	−83 to +48 liq	25,180	7 370
Hydrogen peroxide	H_2O_2	10 to 90 liq	48,530	8 853
Hydrogen sulfide	H_2S	−110 to −83 sol.	20,690	7 880
Iron	Fe	2220 to 2450 liq	309,000	7 482
Krypton	Kr	−189 to −169 sol.	10,065	7.1770
		−169 to −150 liq.	9,377.0	6 92387
Lead	Pb	525 to 1325 liq.	188,500	7 827
Lead bromide	$PbBr_2$	735 to 918 liq.	118,000	8 064
Lead chloride	$PbCl_2$	500 to 950 liq.	141,900	8 961
Lithium bromide	LiBr	1010 to 1265 liq.	152,700	8 068
Lithium chloride	LiCl	1045 to 1325 liq.	155,900	7 939
Lithium fluoride	LiF	1398 to 1666 liq.	218,400	8 753
Lithium iodide	LiI	940 to 1140 liq	143,600	8 011
Magnesium	Mg	900 to 1070 liq.	260,000	12 993

* Based on boiling point of 3927° C or 4200° absolute.

VAPOR PRESSURE (Continued)

Compound	Formula	Temp. range °C	*a*	*b*
Manganese	Mn	1510 to 1900 liq.	267,000	9.300
Mercuric bromide	$HgBr_2$	111 to 235 sol	79,800	10.181
		238 to 331 liq.	61,250	8.284
Mercuric chloride	$HgCl_2$	60 to 130 sol.	85,030	10.888
		130 to 270 sol.	78,850	10.094
		275 to 309 liq.	61,020	8.409
Mercuric iodide	HgI_2	100 to 250 sol.	82,340	10.057
		266 to 360 liq.	62,770	8.115
Mercury	Hg	−80 to −38.87 sol.	73,000	10.383
		400 to 1300 liq	58,700	7.752
Molybdenum	Mo	1800 to 2240 sol.	680,000	10.844
Nitrogen	N_2	−215 to −210 sol.	6,881.3	7.66558
Nitrogen dioxide	NO	−200 to −161 sol.	16,423	10.048
		−163.7 to −148 liq.	13,040	8.440
Nitrogen monoxide	N_2O	−144 to −90 sol.	23,590	9.579
		−90.1 to −88.7 liq.	16,440	7.535
Nitrogen pentoxide	N_2O_5	−30 to +30 sol.	57,180	12.647
Nitrogen tetroxide	N_2O_4	−100 to −40 sol.	55,160	13.400
		−40 to −10 sol.	45,440	11.214
		−8 to +43.2 liq.	33,430	8.814
Nitrogen trioxide	N_2O_3	−25 to 0 liq.	39,400	10.30
Phosphorus (white)	P	20 to 44.1 sol.	63,123	9.6511
Phosphorus (violet)	P	380 to 590 sol.	108,510	11.0842
Platinum	Pt	1425 to 1765 sol.	486,000	7.786
Potassium	K	260 to 760 liq.	84,900	7.183
Potassium bromide	KBr	906 to 1063 liq.	168,100	8.2470
		1095 to 1375 liq.	163,800	7.936
Potassium chloride	KCl	906 to 1105 liq.	174,500	8.3526
		1116 to 1418 liq.	169,700	8.130
Potassium fluoride	KF	1278 to 1500 liq.	207,500	9.000
Potassium hydroxide	KOH	1170 to 1327 liq.	136,000	7.330
Potassium iodide	KI	843 to 1028 liq.	157,600	8.0957
		1063 to 1333 liq	155,700	7.949

VAPOR PRESSURE (Continued)

Compound	Formula	Temp. range °C	a	b
Rubidium	Rb	250 to 370 liq.	76,000	6 976
Rubidium chloride	RbCl	1142 to 1395 liq.	198,600	9.111
Silicon	Si	1200 to 1320 sol.	170,000	5.950
Silicon dioxide	SiO_2	1860 to 2230 liq.	506,000	13.43
Silver	Ag	1650 to 1950 liq.	250,000	8.762
Silver chloride	AgCl	1255 to 1442 liq.	185,500	8.179
Sodium	Na	180 to 883 liq.	103,300	7.553
Sodium bromide	NaBr	1138 to 1394 liq.	161,600	7.948
Sodium chloride	NaCl	976 to 1155 liq.	180,300	8.3297
		1156 to 1430 liq.	185,800	8.548
Sodium cyanide	NaCN	800 to 1360 liq.	155,520	7.472
Sodium fluoride	NaF	1562 to 1701 liq.	218,200	8.640
Sodium hydroxide	NaOH	1010 to 1402 liq.	132,000	7.030
Sodium iodide	NaI	1063 to 1307 liq.	165,100	8.371
Stannic chloride	$SnCl_4$	−52 to −38 sol.	46,740	9.824
Strontium	Sr	940 to 1140 liq.	360,000	16.056
Sulfur dioxide	SO_2	−95 to −75 sol.	35,827	10.5916
Sulfur trioxide	SO_3	24 to 48 liq.	43,450	10.022
Thallium	Tl	950 to 1200 liq.	120,000	6.140
Thallium chloride	TlCl	665 to 807 liq.	105,200	7.974
Tin	Sn	1950 to 2270 liq.	328,000	9.643
Tungsten	W	2230 to 2770 sol.	897,000	9.920
Zinc	Zn	250 to 419.4 sol.	133,000	9.200
		600 to 985 liq.	118,000	8.108

Organic Compounds

Compound	Formula	Temp. range °C	a	b
Acetaldehyde	C_2H_4O	−24.3 to +27.5 liq	27,707	7.8206
Acetic acid	$C_2H_4O_2$	−35 to 10 sol.	41,689	8.502
Acetic anhydride	$C_4H_6O_3$	100 to 140 liq	45,585	8.688

Compound	Formula	Temp. range °C	a	b
Acetylene	C_2H_2	−140 to −82 sol.	21,914	8.933
Aniline	C_6H_7N	145 to185 liq.	45,951.6	8 1278
Anthracene	$C_{14}H_{10}$	100 to 600 sol.	70,390	8 706
		100 to 160 liq.	72,000	8 91
		223 to 342 liq.	59,219	7.910
Anthraquinone	$C_{14}H_8O_2$	224 to 286 sol.	110,040	12.305
Benzene	C_6H_6	−58 to −30 sol.	42,904	9.556
		−30 to +5 sol.	44,222	9 846
		0 to 42 liq.	34,172	7 9622
		42 to 100 liq.	32,295	7.6546
Benzoic acid	$C_7H_6O_2$	60 to 110 sol.	63,820	9 033
Benzophenone	$C_{13}H_{10}O$	260 to 308 liq.	58,221	8.137
Benzoyl chloride	C_7H_5ClO	140 to 200 liq.	45,416	7.9245
Benzyl alcohol	C_7H_8O	100 to 135 liq.	59,491	9.5152
		135 to 205 liq.	53,118	8.6977
Butane	C_4H_{10}	−100 to +12 liq.	23,450	7.395
iso-Butane	C_4H_{10}	−115 to −34 liq	21,273	7.25
n-Butyl alcohol	$C_4H_{10}O$	75 to 117.5 liq.	46,774	9.1362
Butyric acid	$C_4H_8O_2$	80 to 165 liq.	51,103	9.010
Bromobenzene	C_6H_5Br	−26 to −15 liq.	42,500	8.075
p-Bromochlorobenzene	C_6H_4BrCl	23 to 63 sol.	69,755	11.629
Camphor	$C_{10}H_{16}O$	0 to 180 sol.	53,559	8.799
Carbon tetrachloride	CCl_4	−70 to −50 sol.	34,608	8.05
		−19 to +20 liq.	33,914	8.004
Chlorobenzene	C_6H_5Cl	−35 to −15 liq.	42,250	8.500
Cyclohexane	C_6H_{12}	−5 to +5 sol.	37,394	8.594
p-Dichlorobenzene	$C_6H_4Cl_2$	30 to 50 sol.	72,218	12.480
Dichloroethane-1,1	$C_2H_4Cl_2$	0 to 30 liq.	31,706	7.909
Dichloroethane-1,2	$C_2H_4Cl_2$	0 to 30 liq	35,598	8.126
Diphenylamine	$C_{12}H_{11}N$	278 to 284 liq	57,350	8 088
Ethyl chloride	C_2H_5Cl	−30 to +30 liq	26,319	7 691
Ethylene	C_2H_4	−160 to −104 liq.	14,396	7.330

VAPOR PRESSURE (Continued)

Compound	Formula	Temp. range °C	*a*	*b*
Ethylene bromide	$C_2H_4Br_2$	10 to 150 liq	38,082	7 792
Heptane.....	C_7H_{16}	−63 to −40 liq	37,358	8 2585
Hexane.... .	C_6H_{14}	−10 to +90 liq.	31,679	7 724
Iodobenzene	C_6H_5I	−30 to +18 liq	43,000	7 500
Methane.....	CH_4	−194 to −184 sol.	9,896.2	7 6509
		−174 to −163 liq.	8,516.9	6 8626
Methyl alcohol	CH_4O	−62 to −44 liq	39,234	8 9547
		−10 to +80 liq	38,324	8 8017
Methyl chloride	CH_3Cl	−47 to −10 liq.	21,988	7 481
Methyl ether.. .	C_2H_6O	−70 to −20 liq.	23,025	7 720
Methyl fluoride..	CH_3F	−102 to −76 liq.	17,053	7 445
Methyl salicylate	$C_8H_8O_3$	175 to 215 liq.	48,670	8.008
Naphthalene ..	$C_{10}H_8$	0 to 80 sol.	71,401	11 450
		120 to 200 liq.	47,362	7 927
o-Nitroaniline..	$C_6H_6N_2O_2$	150 to 260 liq.	63,881	8.8684
m-Nitroaniline	$C_6H_6N_2O_2$	170 to 260 liq.	65,880	8.8188
p-Nitroaniline	$C_6H_6N_2O_2$	190 to 260 liq.	77,345	9 5595
Nitrobenzene	$C_6H_5NO_2$	112 to 209 liq	48,955	8 192
Nitromethane.	CH_3NO_2	47 to 100 liq	36,914	8 033
Oxalic acid	$C_2H_2O_4$	55 to 105 sol.	90,502.6	12 2229
n-Pentane .	C_5H_{12}	−20 to +50 liq.	27,691	7 558
Phenol.	C_6H_6O	116 to 180 liq.	49,644	8 587
Phthalic anhydride	$C_8H_4O_3$	160 to 285 liq.	54,920	8 022
Propane .	C_3H_8	−136 to −40 liq.	19,037	7 217
Propionic acid .	$C_3H_6O_2$	20 to 140 liq.	46,150	8.715
n-Propyl alcohol	C_3H_8O	−45 to −10 liq.	47,274	9.5180
Propyl bromide	C_3H_7Br	0 to 30 liq.	32,430	7.821
Propyl chloride	C_3H_7Cl	0 to 50 liq.	28,894	7.593
Propylene	C_3H_6	−95 to −48 liq.	19,693	7 4463
Quinoline .	C_9H_7N	180 to 240 liq.	49,720	7 969
Tetrachloroethane-1, 1, 1, 2	$C_2H_2Cl_4$	105 to 145 liq.	36,508	7 605
Tetrachloroethane-1, 1, 2, 2 .	$C_2H_2Cl_4$	26 to 145 liq.	39,729	7.846
Toluene	C_7H_8	−92 to +15 liq.	39,198	8 330

LOWERING OF VAPOR PRESSURE BY SALTS IN AQUEOUS SOLUTIONS

The table gives the reduction of the vapor pressure in millimeters due to the presence of the number of grammolecules of salt per liter of water given at the head of the columns, at the temperature 100° C, at which temperature the vapor pressure of pure water is 760 millimeters.

(From Smithsonian Tables.)

Substance	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0
$Al_2(SO_4)_3$	12.8	36.5							
$AlCl_3$	22.5	61 0	179 0	318.0					
BaS_2O_6	6.6	15.4	34 4						
$Ba(OH)_2$	12.3	22.5	39.0						
$Ba(NO_3)_2$	13 5	27.0							
$Ba(ClO_3)_2$	15.8	33.3	70.5	108.2					
$BaCl_2$	16.4	36.7	77.6						
$BaBr_2$	16 8	38 8	91.4	150.0	204.7				
CaS_2O_6	9 9	23.0	56.0	106.0					
$Ca(NO_3)_2$	16.4	34.8	74.6	139 3	161.7	205 4			
$CaCl_2$	17.0	39.8	95.3	166.6	241 5	319 5			
$CaBr_2$	17.7	44.2	105 8	191.0	283.3	368 5			
$CdSO_4$	4 1	8.9	18 1						
CdI_2	7.6	14.8	33 5	52.7					
$CdBr_2$	8.6	17.8	36.7	55.7	80.0				
$CdCl_2$	9.6	18.8	36 7	57.0	77 3	99.0			
$Cd(NO_3)_2$	15 9	36.1	78.0	122.2					
$Cd(ClO_3)_2$	17 5								
$CoSO_4$	5 5	10.7	22.9	45.5					
$CoCl_2$	15.0	34.8	83 0	136.0	186.4				
$Co(NO_3)_2$	17.3	39.2	89 0	152.0	218 7	282.0	332 0		
$FeSO_4$	5 8	10.7	24.0	42.4					
H_3BO_3	6.0	12.3	25.1	38 0	51.0				
H_3PO_4	6 6	14 0	28.6	45.2	62.0	81.5	103.0	146.9	189.5
H_3AsO_4	7.3	15 0	30.2	46 4	64.9				
H_2SO_4	12.9	26 5	62.8	104.0	148.0	198 4	247 0	343.2	
KH_2PO_4	10 2	19.5	33.3	47 8	60.5	73 1	85 2		
KNO_3	10.3	21.1	40 1	57 6	74.5	88.2	102.1	126 3	148.0
$KClO_3$	10.6	21.6	42.8	62.1	80.0				
$KBrO_3$	10.9	22.4	45.0						
$KHSO_4$	10 9	21.9	43.3	65 3	85.5	107 8	129.2	170.0	
KNO_2	11.1	22.8	44.8	67 0	90.0	110 5	130.7	167.0	198.8
$KClO_4$	11.5	22.3							
KCl	12.2	24 4	48.8	74.1	100.9	128.5	152.2		
$KHCO_3$	11.6	23.6	59 0	77 6	104.2	132.0	160 0	210 0	255 0
KI	12.5	25 3	52 2	82 6	112.2	141 5	171.8	225.5	278 5
$K_2C_2O_4$	13.9	28.3	59.8	94.2	131.0				
K_2WO_4	13.9	33.0	75 0	123.8	175.4	226 4			
K_2CO_3	14 4	31.0	68 3	105 5	152.0	209 0	258.5	350 0	
KOH	15 0	29.5	64.0	99.2	140.0	181.8	223.0	309.5	387.8
K_2CrO_4	16 2	29.5	60 0						
$LiNO_3$	12.2	25 9	55.7	88.9	122 2	155 1	188.0	253.4	309 2
$LiCl$	12.1	25.5	57.1	95.0	132.5	175 5	219.5	311 5	393.5
$LiBr$	12.2	26 2	60 0	97 0	140.0	186.3	241.5	341.5	438.0
Li_2SO_4	13.3	28.1	56.8	89.0					
$LiHSO_4$	12 8	27 0	57 0	93.0	130.0	168 0			
LiI	13.6	28 6	64 7	105 2	154.5	206.0	264.0	357 0	445.0
Li_2SiF_6	15.4	34.0	70.0	106.0					
$LiOH$	15 9	37 4	78 1						
Li_2CrO_4	16 4	32 6	74.0	120 0	171 0				
$MgSO_4$	6 5	12.0	24.5	47 5					
$MgCl_2$	16.8	39.0	100.5	183 3	277.0	377 0			
$Mg(NO_3)_2$	17 6	42 0	101.0	174.8					

LOWERING OF VAPOR PRESSURE BY SALTS IN AQUEOUS SOLUTIONS (Continued)

Substance	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0
$MgBr_2$	17.9	44.0	115.8	205.3	298.5				
$MgH_2(SO_4)_2$	18.3	46.0	116.0						
$MnSO_4$	6.0	10.5	21.0						
$MnCl_2$	15.0	34.0	76.0	122.3	167.0	209.0			
NaH_2PO_4	10.5	20.0	36.5	51.7	66.8	82.0	96.5	126.7	157.1
$NaHSO_4$	10.9	22.1	47.3	75.0	100.2	126.1	148.5	189.7	231.4
$NaNO_3$	10.6	22.5	46.2	68.1	90.3	111.5	131.7	167.8	198.8
$NaClO_3$	10.5	23.0	48.4	73.5	98.5	123.3	147.5	196.5	223.5
$(NaPO_3)_6$	11.6								
$NaOH$	11.8	22.8	48.2	77.3	107.5	139.1	172.5	243.3	314.0
$NaNO_2$	11.6	24.4	50.0	75.0	98.2	122.5	146.5	189.0	226.2
Na_2HPO_4	12.1	23.5	43.0	60.0	78.7	99.8	122.1		
$NaHCO_3$	12.9	24.1	48.2	77.6	102.2	127.8	152.0	198.0	239.4
Na_2SO_4	12.6	25.0	48.9	74.2					
$NaCl$	12.3	25.2	52.1	80.0	111.0	143.0	176.5		
$NaBrO_3$	12.1	25.0	54.1	81.3	108.8	136.0			
$NaBr$	12.6	25.9	57.0	89.2	124.2	159.5	197.5	268.0	
NaI	12.1	25.6	60.2	99.5	136.7	177.5	221.0	301.5	370.0
$Na_4P_2O_7$	13.2	22.0							
Na_2CO_3	14.3	27.3	53.5	80.2	111.0				
$Na_2C_2O_4$	14.5	30.0	65.8	105.8	146.0				
Na_2WO_4	14.8	33.6	71.6	115.7	162.6				
Na_3PO_4	16.5	30.0	52.5						
$(NaPO_3)_3$	17.1	36.5							
NH_4NO_3	12.8	22.0	42.1	62.7	82.9	103.8	121.0	152.2	180.0
$(NH_4)_2SiFl_6$	11.5	25.0	44.5						
NH_4Cl	12.0	23.7	45.1	69.3	94.2	118.5	138.2	179.0	213.8
NH_4HSO_4	11.5	22.0	46.8	71.0	94.5	118.	139.0	181.2	218.0
$(NH_4)_2SO_4$	11.0	24.0	46.5	69.5	93.0	117.0	141.8		
NH_4Br	11.9	23.9	48.8	74.1	99.4	121.5	145.5	190.2	228.5
NH_4I	12.9	25.1	49.8	78.5	104.5	132.3	156.0	200.0	243.5
$NiSO_4$	5.0	10.2	21.5						
$NiCl_2$	16.1	37.0	86.7	147.0	212.8				
$Ni(NO_3)_2$	16.1	37.3	91.3	156.2	235.0				
$Pb(NO_3)_2$	12.3	23.5	45.0	63.0					
$Sr(SO_3)_2$	7.2	20.3	47.0						
$Sr(NO_3)_2$	15.8	31.0	64.0	97.4	131.4				
$SrCl_2$	16.8	38.8	91.4	156.8	223.3	281.5			
$SrBr_2$	17.8	42.0	101.1	179.0	267.0				
$ZnSO_4$	4.9	10.4	21.5	42.1	66.2				
$ZnCl_2$	9.2	18.7	46.2	75.0	107.0	153.0	195.0		
$Zn(NO_3)_2$	16.6	39.0	93.5	157.5	223.8				

HEAT CONDUCTIVITY

Giving the quantity of heat in calories which is transmitted per second through a plate one centimeter thick across an area of one square centimeter when the temperature difference is one degree Centigrade.

Metals

Substance	Temp. °C.	Conductivity	Observer
Aluminum	−160	0.514	Lees, 1908
	18	0.480	Jaeger & Diesselhorst, 1900
	18	0.504	Lees, 1908
	100	0.492	Jaeger & Diesselhorst, 1900
	100	0.49	Angell, 1911
	200	0.55	"
	300	0.64	"
	400	0.76	"
	600	1.01	"
Antimony	0	0.0442	Lorenz, 1881
	100	0.040	"
	0–30	0.042	Berget, 1890
Bismuth	−186	0.025	Macchia, 1907
	0	0.0177	Lorenz
	18	0.0194	Jaeger & Diesselhorst, 1900
	100	0.0161	Jaeger & Diesselhorst, 1900
Brass (70Cu+30Zn)	−160	0.181	Lees, 1908
(70Cu+30Zn)	17	0.260	" "
yellow	0	0.204	Lorenz
red	0	0.246	"
Bronze, aluminum (90Cu, 10Al)	....	0.18	Van Aubel
Cadmium	−160	0.239	Lees, 1908
	0	0.220	Lorenz
	18	0.222	Jaeger & Diesselhorst, 1900
	100	0.216	Jaeger & Diesselhorst, 1900
Constantan	18	0.054	Jaeger & Diesselhorst, 1900
(60Cu, 40Ni)	100	0.064	Jaeger & Diesselhorst, 1900
Copper, pure	−160	1.097	Lees, 1908
	13	1.00	Angström, 1863
	18	0.918	Jaeger & Diesselhorst, 1900

HEAT CONDUCTIVITY (Continued)

METALS

Substance	Temp. ° C.	Conductivity	Observer
Copper, pure........	100	0.908	Jaeger & Diesselhorst, 1900
	100–197	1.043	Hering, 1910
	100–268	0.969	"
	100–370	0.931	"
	100–541	0.902	"
	100–837	0.858	"
German silver.......	0	0.070	Lorenz, 1881
	100	0.089	"
(52Cu, 26Zn, 22Ni)	....	0.10	Glage, 1905
Gold...............	17	0.705	Barratt, 1914
	18	0.700	Jaeger & Diesselhorst, 1900
	100	0.703	Jaeger & Diesselhorst, 1900
Iridium............	17	0.141	Barratt, 1914
Iron, pure..........	18	0.161	Jaeger & Diesselhorst
	100	0.151	" "
	100–727	0.202	Hering, 1910
	100–1245	0.191	"
wrought..........	–160	0.152	Lees, 1908
	18	0.144	Jaeger & Diesselhorst
	100	0.143	" "
cast............	18	0.109	" "
	100	0.108	" "
	54	0.114	Callendar
	102	0.111	"
Steel...............	–160	0.113	Lees, 1908
	18	0.115	" "
	18	0.108	Jaeger & Diesselhorst
	100	0.107	" "
Lead...............	–160	0.092	Lees, 1908
	18	0.083	Jaeger & Diesselhorst
	100	0.082	" "
Magnesium.........	0–100	0.376	Lorenz, 1881
Manganin..........	18	0.15186	Jaeger & Diesselhorst
(84Cu, 4Ni, 12Mn)	100	0.06310	" "
	–160	0.035	Lees, 1908
Mercury...........	0	0.0148	H. F. Weber, 1880
	50	0.0189	" "
	17	0.0197	R. Weber, 1902
Molybdenum.......	17	0.346	Barratt, 1914
Nickel.............	–160	0.129	Lees, 1908

METALS

Substance	Temp. ° C.	Conductivity	Observer
Nickel	18	0.142	Jaeger & Diesselhorst, 1900
	100	0.138	Jaeger & Diesselhorst, 1900
	300	0.126	Angell, 1911
	600	0.088	"
	800	0.068	"
	1200	0.058	"
Palladium	18	0.1683	Jaeger & Diesselhorst, 1900
	100	0.182	
Platinum	18	0.1664	Jaeger & Diesselhorst, 1900
	100	0.1733	Jaeger & Diesselhorst, 1900
Platinum-iridium. 10 % Ir	17	0.074	Barratt, 1914
Platinum-rhodium 10 % Rh	17	0.072	Barratt, 1914
Platinoid	18	0.060	Lees, 1908
Rhodium	17	0.210	Barratt, 1914
Silver, pure	-160	0.998	Lees, 1908
	18	0.974	"
	18	1.006	Jaeger & Diesselhorst, 1900
	100	0.992	Jaeger & Diesselhorst, 1900
Tin	-160	0.192	Lees, 1908
	0	0.1528	Lorenz, 1881
	18	0.155	Jaeger & Diesselhorst, 1900
	100	0.145	Jaeger & Diesselhorst, 1900
	100	0.1423	Lorenz, 1881
Tantalum	17	0.130	Barratt, 1914
Tungsten	17	0.476	"
	18	0.35	Coolidge
Wood's alloy	....	0.0319	H. F. Weber
Zinc	-160	0.278	Lees, 1908
	18	0.2653	Jaeger & Diesselhorst
	100	0.2619	" "

HEAT CONDUCTIVITY (Continued)

VARIOUS SOLIDS

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Asbestos fiber, 500° C. .	0.00019	Randolph, 1912
paper.	0.0006	. . . .
	0.0004	Lees-Chorlton, 1896
Basalt.	0.0052	Hecht, 1903
Brick, common red. . . .	0.0015	Herschel-Lebour & Dunn, 1879
Blotting paper.	0.00015	Lees-Charlton, 1896
Carbon.	0.01	
Carborundum.	0.0005	Lorenz
brick, 150°–1200°. .	0.032–0.027	Wologdine
Cardboard.	0.0005	. . . .
Cement, Portland	0.00071	Lees-Chorlton, 1896
Chalk.	0.0020	Herschel-Lebour & Dunn, 1879
Concrete, cinder.	0.00081	. . . .
stone.	0.0022	Norton
Cork.	0.00072	G. Forbes, 1875
	0.00013	Lees, 1892–8
Cotton wool.	0.000043	G. Forbes
felted.	0.000033	"
Diatomic earth.	0.00013	Hutton-Blard
Earth's crust, ave . . .	0.004	. . . .
Ebonite.	0.00042	Lees
	0.00014	Barratt, 1914
Eiderdown, d = .109. .	0.000046	Peclet, 1878
Felt.	0.000087	. . . .
Fiber, red.	0.0011	Barratt, 1914
Fire brick.	0.00028	Hutton-Blard
	0.0011	Barratt, 1914
Flannel.	0.00023	
Gas carbon, 20°.	0.0085	Barratt, 1914
100°.	0.0095	"
Glass		
crown (window) . .	0.0025	Lees, 1892–8
flint.	0.002	"
Jena.	0.001–0.002	"
soda, 20°.	0.0017	Barratt, 1914
100°.	0.0018	"
Granite, 100°.	0.0045–0.0050	Poole, 1912
500°.	0.0040	"
Graphite.	0.012	. . . .
Graphite brick, 300° to 700°.	0.24	Wologdine, 1909

VARIOUS SOLIDS (Continued)

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Gutta percha	0.00048	Péclet, 1878
Gypsum	0.0031	R. Weber, 1878
Haircloth, felt	0.000042	G. Forbes
Ice	0.005	....
	0.0039	....
	0.0022	Forbes, 1875
Infusorial earth, 100°	0.00034	Skinner
300°	0.00040	"
pressed bricks, 100°	0.00030	"
Lamp black, 100	0.00007	Randolph, 1912
Leather, cowhide	0.00042	Lees-Chorlton, 1896
chamois	0.00015	" "
Lime	0.00029	Hutton-Blard
Linen	0.00021	Lees-Chorlton, 1896
Magnesia, MgO	0.00016–0.00045	Hutton-Blard
brick, 50°–1130°	0.0027–0.0072	Wologdine, 1909
Magnesium carbonate, 100°	0.00023	Skinner
300°	0.00025	"
Marble	0.0071	Lees, 1892–8
Mica, perpendicular to cleavage plane	0.0018	Lees
Paper	0.0003	"
Paraffine	0.0006	"
0°	0.00023	R. Weber, 1878
Plaster of Paris	0.00070	Lees-Chorlton, 1896
Porcelain	0.0025	Lees, 1892–8
165°–1055°	0.0039–0.0047	Wologdine, 1909
Quartz, parallel to axis	0.030	Lees, 1892–8
perpendicular to axis	0.016	"
Rubber, para	0.00045	"
Sand, dry	0.00093	Herschel-Lebour & Dunn, 1879
Sandstone	0.0055	Herschel-Lebour & Dunn, 1879
Sawdust	0.00012	G. Forbes, 1875
Silica, fused, 20°	0.00237	Barratt, 1914
100°	0.00255	"
Silica brick, 100° to 1000° C	0.002–0.003	Wologdine, 1909
Silk	0.000095	Lees-Chorlton, 1896
Slate	0.004700	Lees, 1892–8

HEAT CONDUCTIVITY (Continued)

Various Solids (Continued)

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Snow, compact	0.00051	Hjeltström
Soil, dry	0.00033	Lees-Chorlton, 1896
Wax, bees'	0.00009	G. Forbes
Wood, fir ǁ to axis	0.00030	....
perpendicular to axis	0.00009	....

Liquids

Substance	Conductivity	Observer
Acetic acid	0.00047	H. F. Weber
Amyl alcohol	0.000328	"
Aniline, 12°	0.00041	....
Benzole, 5°	0.000333	H. F. Weber
Carbon disulphide, 9° to 15°	0.000343	"
Chloroform, 9°–15°	0.000288	"
Ether, 9°–15°	0.000303	"
Ethyl alcohol	0.000423	"
Glycerine, 9°–15°	0.000637	Graetz
Methyl alcohol	0.000495	H. F. Weber
Oils: olive	0.000395	Wachsmuth
castor	0.000425	"
petroleum, 13°	0.000355	Graetz
turpentine	0.000325	"
Vaseline, 25°	0.00044	Lees
Water, 4°	0.00138	H. F. Weber
0°	0.00120	"
17°	0.00131	R. Weber
20°	0.00143	Milner & Chattock

Gases

Substance	Conductivity	Observer
Air, 0°	0.0000568	Winklemann
Argon, 0°	0.0000389	Schwarze
Ammonia gas, 0°	0.0000458	Winklemann
Carbon dioxide, 0°	0.0000307	"
monoxide	0.0000499	"
Ethylene	0.0000395	"
Helium, 0°	0.000339	Schwarze
Hydrogen, 0°	0.000327	Winklemann
100°	0.000369	Graetz
Methane, 7°–8°	0.0000647	Winklemann
Nitric oxide, NO, 8°	0.0000460	"
Nitrogen, 7°–8°	0.0000524	"
Nitrous oxide, N_2O	0.0000350	
Oxygen, 7°–8°	0.0000563	

THERMAL CONDUCTIVITY OF MATERIALS

(Bureau of Standards Letter Circular No. 227)

D = Density in pounds per cubic foot.
K = Thermal conductivity in B.T.U. per hour, square foot, and temperature gradient of 1 degree Fahrenheit per inch thickness. The lower the conductivity, the greater the insulating values.

Soft Flexible Materials in Sheet Form

		D	K
Dry Zero	Kapok between burlap or paper..	1.0	0.24
		2.0	0.25
Cabots Quilt	Eel grass between kraft paper....	3.4	0.25
		4.6	0.26
Hair Felt	Felted cattle hair...............	11.0	0.26
		13.0	0.26
Balsam Wool	Chemically treated wood fibre....	2.2	0.27
Hairinsul	75% hair 25% jute............	6.3	0.27
	50% hair 50% jute............	6.1	0.26
Linofelt	Flax fibres between paper..	4.9	0.28
Thermofelt	Jute and asbestos fibres, felted...	10.0	0.37
	Hair and asbestos fibres. felted...	7.8	0.28

Loose Materials

Rock Wool	Fibrous material made from rock,	6.0	0 26
	also made in sheet form, felted and	10.0	0.27
	confined with wire netting.......	14.0	0.28
		18.0	0.29
Glass Wool	Pyrex glass, curled..............	4 0	0.29
		10.0	0.29
Sil-O-Cel	Powdered diatomaceous earth....	10.6	0.31
Regranulated	Fine particles..................	9.4	0.30
Cork	about 3/16 inch particles.........	8.1	0.31
Thermofill	Gypsum in powdered form.......	26.	0.52
		34.	0.60
Sawdust	Various.........................	12.0	0.41
	redwood..	10.9	0.42
Shavings	Various, from planer....	8.8	0.41
Charcoal	From maple, beech and birch,		
	coarse..........................	13.2	0.36
	6 mesh	15.2	0.37
	20 mesh.......................	19.2	0.39

Semi-flexible Materials in Sheet Form

Flaxlinum	Flax fibre......................	13.0	0 31
Fibrofelt	Flax and rye fibre...............	13.6	0.32

THERMAL CONDUCTIVITY OF MATERIALS (Continued)

Semi-rigid Materials in Board Form

Corkboard	No added binder; very low density	5.4	0.25
Corkboard	No added binder; low density....	7.0	0.27
Corkboard	No added binder; medium density	10.6	0.30
Corkboard	No added binder; high density ..	14.0	0.34
Eureka	Corkboard with asphaltic binder .	14.5	0 32
Rock Cork	Rock wool block with binder..... Also called "Tucork"	14.5	0.326
Lith	Board containing rock wool, flax and straw pulp..................	14.3	0.40

Stiff Fibrous Materials in Sheet Form

Insulite	Wood pulp................	16.2	0.34
		16.9	0.34
Celotex	Sugar cane fibre....	13.2	0 34
		14.8	0.34

*Masonite............	K = 0 33
*Inso-board...	0.33
*Maizewood............	0 33 to 0.39
*Cornstalk Pith Board	0 24 to 0.30
*Maftex...........................	0.34

Cellular Gypsum

Insulex or Pyrocell	8	0.35
	12	0.44
	18	0.59
	24	0.77
	30	1.00

Woods (Across Grain)

Balsa...	7.3	0.33
	8 8	0.38
	20	0.58
Cypress......	29	0.67
White pine.	32	0.78
Mahogany......	34	0.90
Virginia pine . .	34	0.98
Oak......	38	1.02
Maple......................... ..	44	1.10

Miscellaneous Building Materials

(Data taken from various sources)

	K		K
Cinder concrete ..	2 to 3	Limestone ..	4 to 9
Building gypsum.	About 3	Concrete	6 to 9
Plaster..........	2 to 5	Sandstone ..	8 to 16
Building brick	3 to 6	Marble.	14 to 20
Glass..............	5 to 6	Granite...........	13 to 28

* From various commercial laboratories and the work of O. R. Sweeney at Iowa State College.

TEMPERATURE OF SATURATED STEAM

The following table gives the temperature of saturated water vapor in degrees Centigrade and degrees Fahrenheit corresponding to gauge pressure in pounds from 0 to 3184. Zero gauge pressure corresponds to an absolute pressure of 14.696 pounds per square inch.

Gauge pressure lbs./in.²	Temp. °F	Temp. °C
0	212.0	100.0
1	215.4	101.9
2	218.5	103.6
3	221.5	105.3
4	224.4	106.9
5	227.1	108.4
6	229.6	109.8
7	232.3	111.3
8	234.7	112.6
9	237.0	113.9
10	239.4	115.2
11	241.5	116.4
12	243.7	117.6
13	245.8	118.8
14	247.8	119.9
15	249.8	121.0
16	251.6	122.0
17	253.4	123.0
18	255.4	124.1
19	257.0	125.0
20	258.8	126.0
21	260.4	126.9
22	262.0	127.8
23	263.7	128.7
24	265.3	129.6
25	266.7	130.4
26	268.3	131.3
27	269.8	132.1
28	271.2	132.9
29	272.7	133.7
30	274.1	134.5
31	275.4	135.2
32	276.8	136.0
33	278.1	136.7
34	279.3	137.4
35	280.6	138.1
36	281.8	138.8
37	283.1	139.5
38	284.4	140.2
39	285.6	140.9
40	286.7	141.5
41	288.0	142.2
42	289.0	142.8
43	290.1	143.4
44	291.2	144.0
45	292.3	144.6
46	293.5	145.3
47	294.4	145.8
48	295.5	146.4
49	296.6	147.0
50	297.7	147.6
51	298.6	148.1
52	299.7	148.7
53	300.7	149.3
54	301.6	149.8

Gauge pressure lbs./in.²	Temp. °F	Temp. °C
55	302.5	150.3
56	303.6	150.9
57	304.5	151.4
58	305.4	151.9
59	306.3	152.4
60	307.4	153.0
61	308.3	153.5
62	309.2	154.0
63	309.9	154.4
64	310.8	154.9
65	311.7	155.4
66	312.6	155.9
67	313.5	156.4
68	314.2	156.8
69	315.1	157.3
70	316.0	157.8
71	316.8	158.2
72	317.7	158.7
73	318.4	159.1
74	319.3	159.6
75	320.0	160.0
76	320.9	160.5
77	321.6	160.9
78	322.3	161.3
79	323.1	161.7
80	323.8	162.1
81	324.7	162.6
82	325.4	163.0
83	326.1	163.4
84	326.8	163.8
85	327.6	164.2
86	328.3	164.6
87	329.0	165.0
88	329.7	165.4
89	330.4	165.8
90	331.2	166.2
91	331.9	166.6
92	332.6	167.0
93	333.1	167.3
94	333.9	167.7
95	334.6	168.1
96	335.1	168.4
97	335.8	168.8
98	336.6	169.2
99	337.3	169.6
100	337.8	169.9
101	338.5	170.3
102	339.1	170.6
103	339.8	171.0
104	340.5	171.4
105	341.1	171.7
106	341.6	172.0
107	342.3	172.4
108	342.9	172.7
109	343.6	173.1

Gauge pressure lbs./in.²	Temp. °F	Temp. °C
110	344.1	173.4
111	344.7	173.7
112	345.4	174.1
113	345.9	174.4
114	346.5	174.7
115	347.2	175.1
116	347.7	175.4
117	348.3	175.7
118	348.8	176.0
119	349.5	176.4
120	350.1	176.7
121	350.6	177.0
122	351.1	177.3
123	351.7	177.6
124	352.2	177.9
125	352.9	178.3
126	353.5	178.6
127	354.0	178.9
128	354.6	179.2
129	355.1	179.5
130	355.6	179.8
131	356.2	180.1
132	356.7	180.4
133	357.3	180.7
134	357.8	181.0
135	358.3	181.3
136	358.9	181.6
137	359.2	181.8
138	359.8	182.1
139	360.3	182.4
140	360.9	182.7
141	361.4	183.0
142	361.9	183.3
143	362.3	183.5
144	362.8	183.8
145	363.4	184.1
146	363.9	184.4
147	364.5	184.7
148	364.8	184.9
149	365.4	185.2
150	365.9	185.5
151	366.4	185.8
152	366.8	186.0
153	367.3	186.3
154	367.9	186.6
155	368.2	186.8
156	368.8	187.1
157	369.3	187.4
158	369.7	187.6
159	370.2	187.9
160	370.6	188.1
161	371.1	188.4
162	371.7	188.7
163	372.0	188.9
164	372.6	189.2

TEMPERATURE OF SATURATED STEAM (Continued)

Gauge pressure lbs./in.^{2}	Temp. °F	Temp. °C	Gauge pressure lbs./in.^{2}	Temp. °F	Temp. °C	Gauge pressure lbs./in.^{2}	Temp. °F	Temp. °C
165	372.9	189.4	**225**	397.2	202.9	**285**	417.2	214.0
166	373.5	189.7	226	397.6	203.1	286	417.6	214.2
167	373.8	189.9	227	397.9	203.3	287	417.9	214.4
168	374.4	190.2	228	398.3	203.5	288	418.1	214.5
169	374.7	190.4	229	398.7	203.7	289	418.5	214.7
170	375.3	190.7	230	399.0	203.9	290	418.8	214.9
171	375.8	191.0	231	399.4	204.1	291	419.0	215.0
172	376.2	191.2	232	399.7	204.3	292	419.4	215.2
173	376.5	191.4	233	400.1	204.5	293	419.7	215.4
174	376.9	191.6	234	400.3	204.7	294	419.9	215.5
175	377.4	191.9	**235**	400.8	204.9	**295**	420.3	215.7
176	377.8	192.1	236	401.2	205.1	296	420.6	215.9
177	378.3	192.4	237	401.5	205.3	297	420.8	216.0
178	378.7	192.6	238	401.9	205.5	298	421.2	216.2
179	379.2	192.9	239	402.3	205.7	299	421.3	216.3
180	379.6	193.1	240	402.6	205.9	300	421.7	216.5
181	379.9	193.3	241	403.0	206.1	301	422.1	216.7
182	380.5	193.6	242	403.3	206.3	302	422.2	216.8
183	380.8	193.8	243	403.7	206.5	303	422.6	217.0
184	381.4	194.1	244	404.1	206.7	304	423.0	217.2
185	381.7	194.3	**245**	404.4	206.9	**305**	423.1	217.3
186	382.1	194.5	246	404.8	207.1	306	423.5	217.5
187	382.6	194.8	247	405.0	207.2	307	423.9	217.7
188	383.0	195.0	248	405.3	207.4	308	424.0	217.8
189	383.4	195.2	249	405.7	207.6	309	424.4	218.0
190	383.7	195.4	250	406.0	207.8	310	424.6	218.1
191	384.1	195.6	251	406.4	208.0	311	424.9	218.3
192	384.6	195.9	252	406.8	208.2	312	425.3	218.5
193	385.0	196.1	253	407.1	208.4	313	425.5	218.6
194	385.3	196.3	254	407.3	208.5	314	425.8	218.8
195	385.9	196.6	**255**	407.7	208.7	**315**	426.2	219.0
196	386.2	196.8	256	408.0	208.9	316	426.4	219.1
197	386.6	197.0	257	408.4	209.1	317	426.7	219.3
198	387.0	197.2	258	408.7	209.3	318	426.9	219.4
199	387.5	197.5	259	408.9	209.4	319	427.3	219.6
200	387.9	197.7	260	409.3	209.6	320	427.5	219.7
201	388.2	197.9	261	409.6	209.8	321	427.8	219.9
202	388.6	198.1	262	410.0	210.0	322	428.0	220.0
203	388.9	198.3	263	410.4	210.2	323	428.4	220.2
204	389.3	198.5	264	410.7	210.4	324	428.5	220.3
205	389.8	198.8	**265**	410.9	210.5	**325**	428.9	220.5
206	390.2	199.0	266	411.3	210.7	326	429.3	220.7
207	390.6	199.2	267	411.6	210.9	327	429.4	220.8
208	390.9	199.4	268	412.0	211.1	328	429.8	221.0
209	391.3	199.6	269	412.2	211.2	329	430.0	221.1
210	391.6	199.8	270	412.5	211.4	330	430.3	221.3
211	392.2	200.1	271	412.9	211.6	331	430.5	221.4
212	392.5	200.3	272	413.2	211.8	332	430.9	221.6
213	392.9	200.5	273	413.4	211.9	333	431.1	221.7
214	393.3	200.7	274	413.8	212.1	334	431.4	221.9
215	393.6	200.9	**275**	414.1	212.3	**335**	431.6	222.0
216	394.0	201.1	276	414.5	212.5	336	432.0	222.2
217	394.3	201.3	277	414.7	212.6	337	432.1	222.3
218	394.7	201.5	278	415.0	212.8	338	432.5	222.5
219	395.1	201.7	279	415.4	213.0	339	432.7	222.6
220	395.4	201.9	280	415.8	213.2	340	433.0	222.8
221	395.8	202.1	281	415.9	213.3	341	433.2	222.9
222	396.1	202.3	282	416.3	213.5	342	433.6	223.1
223	396.5	202.5	283	416.7	213.7	343	433.9	223.3
224	396.9	202.7	284	417.0	213.9	344	434.1	223.4

TEMPERATURE OF SATURATED STEAM (Continued)

Gauge pressure lbs./in.^{2}	Temp. °F	Temp °C	Gauge pressure lbs./in.^{2}	Temp. °F	Temp. °C	Gauge pressure lbs./in.^{2}	Temp. °F	Temp. °C
345	434.3	223.5	585	486.1	252.3	960	541.6	283.1
346	434.7	223.7	590	487.0	252.8	970	542.8	283.8
347	434.8	223.8	595	487.9	253.3	980	544.1	284.5
348	435.2	224.0	600	488.8	253.8	990	545.2	285.1
349	435.4	224.1	605	489.7	254.3	1000	546.4	285.8
350	435.7	224.3	610	490.6	254.8	1010	547.7	286.5
351	435.9	224.4	615	491.5	255.3	1020	548.8	287.1
352	436.3	224.6	620	492.3	255.7	1030	550.0	287.8
353	436.5	224.7	625	493.2	256.2	1040	551.1	288.4
354	436.6	224.8	630	494.1	256.7	1050	552.4	289.1
355	437.0	225.0	635	495.0	257.2	1060	553.5	289.7
356	437.2	225.1	640	495.7	257.6	1070	554.7	290.4
357	437.5	225.3	645	496.6	258.1	1080	555.8	291.0
358	437.7	225.4	650	497.5	258.6	1090	556.9	291.6
359	438.1	225.6	655	498.2	259.0	1100	558.0	292.2
360	438.3	225.7	660	499.1	259.5	1110	559.0	292.8
365	439.5	226.4	665	499.8	259.9	1120	560.1	293.4
370	440.8	227.1	670	500.7	260.4	1130	561.2	294.0
375	442.0	227.8	675	501.4	260.8	1140	562.5	294.7
380	443.3	228.5	680	502.3	261.3	1150	563.5	295.3
385	444.6	229.2	685	503.1	261.7	1160	564.6	295.9
390	445.8	229.9	690	504.0	262.2	1170	565.5	296.4
395	447.1	230.6	695	504.7	262.6	1180	566.6	297.0
400	448.2	231.2	700	505.6	263.1	1190	567.7	297.6
405	449.4	231.9	705	506.3	263.5	1200	568.8	298.2
410	450.5	232.5	710	507.0	263.9	1210	569.8	298.8
415	451.8	233.2	715	507.7	264.3	1220	570.7	299.3
420	452.8	233.8	720	508.6	264.8	1230	571.8	299.9
425	453.9	234.4	725	509.4	265.2	1240	572.9	300.5
430	455.2	235.1	730	510.1	265.6	1250	573.8	301.0
435	456.3	235.7	735	510.8	266.0	1260	574.9	301.6
440	457.3	236.3	740	511.7	266.5	1270	576.0	302.2
445	458.4	236.9	745	512.4	266.9	1280	576.9	302.7
450	459.5	237.5	750	513.1	267.3	1290	578.0	303.3
455	460.6	238.1	755	513.9	267.7	1300	578.8	303.8
460	461.7	238.7	760	514.6	268.1	1310	579.7	304.3
465	462.7	239.3	765	515.3	268.5	1320	580.8	304.9
470	463.8	239.9	770	516.0	268.9	1330	581.7	305.4
475	464.9	240.5	775	516.7	269.3	1340	582.8	306.0
480	466.0	241.1	780	517.5	269.7	1350	583.7	306.5
485	467.1	241.7	785	518.2	270.1	1360	584.6	307.0
490	468.0	242.2	790	518.9	270.5	1370	585.5	307.5
495	469.0	242.8	795	519.6	270.9	1380	586.6	308.1
500	470.1	243.4	800	520.3	271.3	1390	587.5	308.6
505	471.0	243.9	805	521.1	271.7	1400	588.4	309.1
510	472.1	244.5	810	521.8	272.1	1410	589.3	309.6
515	473.0	245.0	820	523.2	272.9	1420	590.4	310.2
520	474.1	245.6	830	524.7	273.7	1430	591.3	310.7
525	475.0	246.1	840	525.9	274.4	1440	592.2	311.2
530	476.1	246.7	850	527.4	275.2	1450	593.1	311.7
535	477.0	247.2	860	528.6	275.9	1460	594.0	312.2
540	477.9	247.7	870	530.1	276.7	1470	594.9	312.7
545	478.8	248.2	880	531.3	277.4	1480	595.8	313.2
550	479.8	248.8	890	532.6	278.1	1490	596.7	313.7
555	480.7	249.3	900	534.0	278.9	1500	597.6	314.2
560	481.6	249.8	910	535.3	279.6	1510	598.5	314.7
565	482.5	250.3	920	536.5	280.3	1520	599.2	315.1
570	483.4	250.8	930	537.8	281.0	1530	600.1	315.6
575	484.3	251.3	940	539.1	281.7	1540	601.0	316.1
580	485.2	251.8	950	540.3	282.4	1550	601.9	316.6

TEMPERATURE OF SATURATED STEAM (Continued)

Gauge pressure lbs./in.²	Temp. °F	Temp. °C	Gauge pressure lbs./in.²	Temp. °F	Temp. °C	Gauge pressure lbs./in.²	Temp. °F	Temp. °C
1560	602.6	317.0	**2110**	644.4	340.2	**2660**	678.4	359.1
1570	603.5	317.5	2120	645.1	340.6	2670	678.9	359.4
1580	604.4	318.0	2130	645.8	341.0	2680	679.5	359.7
1590	605.3	318.5	2140	646.3	341.3	2690	680.0	360.0
1600	606.0	318.9	2150	647.1	341.7	2700	680.5	360.3
1610	606.9	319.4	2160	647.8	342.1	2710	681.1	360.6
1620	607.8	319.9	2170	648.5	342.5	2720	681.6	360.9
1630	608.5	320.3	2180	649.0	342.8	2730	682.2	361.2
1640	609.4	320.8	2190	649.8	343.2	2740	682.7	361.5
1650	610.2	321.2	2200	650.3	343.5	2750	683.2	361.8
1660	611.1	321.7	**2210**	651.0	343.9	**2760**	684.0	362.2
1670	612.0	322.2	2220	651.7	344.3	2770	684.5	362.5
1680	612.7	322.6	2230	652.3	344.6	2780	685.0	362.8
1690	613.4	323.0	2240	653.0	345.0	2790	685.6	363.1
1700	614.3	323.5	2250	653.5	345.3	2800	686.1	363.4
1710	615.0	323.9	2260	654.3	345.7	2810	686.5	363.6
1720	615.9	324.4	2270	654.8	346.0	2820	687.0	363.9
1730	616.6	324.8	2280	655.5	346.4	2830	687.6	364.2
1740	617.4	325.2	2290	656.1	346.7	2840	688.1	364.5
1750	618.3	325.7	2300	656.8	347.1	2850	688.6	364.8
1760	619.0	326.1	**2310**	657.3	347.4	**2860**	689.2	365.1
1770	619.9	326.6	2320	658.0	347.8	2870	689.7	365.4
1780	620.6	327.0	2330	658.6	348.1	2880	690.3	365.7
1790	621.3	327.4	2340	659.3	348.5	2890	690.8	366.0
1800	622.0	327.8	2350	659.8	348.8	2900	691.3	366.3
1810	622.8	328.2	2360	660.6	349.2	2910	691.7	366.5
1820	623.7	328.7	2370	661.1	349.5	2920	692.2	366.8
1830	624.4	329.1	2380	661.8	349.9	2930	692.8	367.1
1840	625.1	329.5	2390	662.4	350.2	2940	693.3	367.4
1850	625.8	329.9	2400	663.1	350.6	2950	693.9	367.7
1860	626.5	330.3	**2410**	663.6	350.9	**2960**	694.2	367.9
1870	627.4	330.8	2420	664.2	351.2	2970	694.8	368.2
1880	628.2	331.2	2430	664.9	351.6	2980	695.3	368.5
1890	628.9	331.6	2440	665.4	351.9	2990	695.8	368.8
1900	629.6	332.0	2450	666.0	352.2	3000	696.4	369.1
1910	630.3	332.4	2460	666.7	352.6	3010	696.7	369.3
1920	631.0	332.8	2470	667.2	352.9	3020	697.3	369.6
1930	631.8	333.2	2480	667.9	353.3	3030	697.8	369.9
1940	632.5	333.6	2490	668.5	353.6	3040	698.4	370.2
1950	633.2	334.0	2500	669.0	353.9	3050	698.7	370.4
1960	633.9	334.4	**2510**	669.7	354.3	**3060**	699.3	370.7
1970	634.6	334.8	2520	670.3	354.6	3070	699.8	371.0
1980	635.4	335.2	2530	670.8	354.9	3080	700.3	371.3
1990	636.1	335.6	2540	671.5	355.3	3090	700.7	371.5
2000	636.8	336.0	2550	672.1	355.6	3100	701.2	371.8
2010	637.5	336.4	2560	672.6	355.9	3110	701.8	372.1
2020	638.2	336.8	2570	673.2	356.2	3120	702.1	372.3
2030	639.0	337.2	2580	673.7	356.5	3130	702.7	372.6
2040	639.5	337.5	2590	674.4	356.9	3140	703.2	372.9
2050	640.2	337.9	2600	675.0	357.2	3150	703.6	373.1
2060	640.9	338.3	**2610**	675.5	357.5	**3160**	704.1	373.4
2070	641.7	338.7	2620	676.0	357.8	3170	704.5	373.6
2080	642.4	339.1	2630	676.6	358.1	3180	705.0	373.9
2090	642.9	339.4	2640	677.3	358.5	3184	705.2	*374.0
2100	643.6	339.8	2650	677.8	358.8	..		....

* Critical point.

PROPERTIES OF SATURATED STEAM

1875

The heat units used are the large calorie, 15° to 16° C and the B T U., 62° to 63° F. The heat of the liquid, q, is the heat required to raise unit mass of water from 0° C (32° F) to the temperature indicated. The heat of vaporization, r, is the heat required to vaporize unit mass of water at the indicated temperature and pressure. Total heat involved, $H = r + q$.

The heat of vaporization overcomes external pressure and changes the state from liquid to vapor at constant temperature and pressure. If u is the

	Total pressure, (Gauge pressure plus atmospheric pressure)			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		
Temperature, degrees Centigrade.	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B T.U per pound.	Calories per kilogram.	B.T.U. per pound.	Temperature, degrees Fahrenheit
t	p	p	p	q	q	r	r	ρ	ρ	t
0	4 579	0 00623	0 0886	0 00	0 0	595 4	1071 7	565 3	1017 5	**32**
1	4 924	0 00670	0 0952	1 01	1 8	594 9	1070 8	564 7	1016 4	**33.8**
2	5 290	0 00719	0 1023	2 02	3 6	594 4	1069 9	564 0	1015 3	**35.6**
3	5 681	0 00772	0 1099	3 03	5 5	593 9	1069 0	563 4	1014 2	**37.4**
4	6 097	0 00829	0 1179	4 03	7 3	593 3	1068 0	562 8	1013 1	**39.2**
5	6 541	0 00889	0.1265	5 04	9 1	592 8	1067 1	562 2	1011 9	**41**
6	7 011	0 00953	0 1356	6 04	10 9	592 3	1066 1	561 5	1010 7	**42.8**
7	7 511	0 01021	0 1453	7 05	12 7	591 8	1065 2	560 9	1009 6	**44.6**
8	8 042	0 01093	0 1555	8 05	14 5	591 2	1064 2	560 2	1008 5	**46.4**
9	8 606	0 01170	0 1664	9 05	16 3	590 7	1063 3	559 6	1007 4	**48.2**
10	9 205	0 01252	0 1780	10 06	18 1	590 2	1062 3	559 0	1006 2	**50**
11	9 840	0 01338	0 1903	11 06	19 9	589 6	1061 3	558 3	1005 0	**51.8**
12	10 513	0 01429	0 2033	12 06	21 7	589 1	1060 4	557 7	1003 9	**53.6**
13	11 226	0 01526	0 2171	13 06	23 5	588 6	1059 4	557 1	1002 7	**55.4**
14	11 980	0 01629	0 2317	14 06	25 3	588 1	1058 5	556 5	1001 6	**57.2**
15	12 779	0 01737	0 2471	15 06	27 1	587 6	1057 6	555 9	1000 5	**59**
16	13 624	0 01852	0 2635	16 06	28 9	587 0	1056 6	555 2	999 4	**60.8**
17	14 517	0 01974	0 2807	17 06	30 7	586 5	1055 7	554 6	998 3	**62.6**
18	15 460	0 02102	0 2990	18 06	32 5	585 9	1054 7	553 9	997 1	**64.4**
19	16 456	0 02237	0 3182	19 06	34 3	585 4	1053 8	553 3	996 0	**66.2**
20	17.51	0 02381	0 3386	20 06	36 1	584.9	1052 8	552 7	994 8	**68**
21	18 62	0 02532	0 3601	21 06	37 9	584 4	1051 9	552 1	993 7	**69.8**
22	19 79	0 02691	0.3827	22 06	39 7	583 9	1051 0	551 5	992 6	**71.6**
23	21.02	0 02858	0 4065	23 06	41 5	583 3	1050 0	550 8	991 4	**73.4**
24	22 32	0 03035	0 4316	24 06	43 3	582 8	1049 1	550 2	990 3	**75.2**
25	23 69	0 03221	0.4581	25 05	45 1	582 3	1048 1	549 5	989 1	**77**
26	25 13	0 03417	0 4860	26 05	46.9	581 8	1047 2	548 9	988 0	**78.8**
27	26.65	0 03623	0 5154	27 05	48 7	581 2	1046 2	548 2	986 9	**80.6**
28	28 25	0 03841	0 5463	28 05	50 5	580 7	1045 2	547 6	985 7	**82.4**
29	29 94	0 04071	0 5790	29 04	52 3	580 2	1044 3	547 0	984 6	**84.2**
30	31 71	0 04311	0 6132	30 04	54.1	579 6	1043 3	546 3	983 4	**86**

SATURATED STEAM

English Units

change in volume the external work is pu and the corresponding amount of heat is Apu where A is the reciprocal of the mechanical equivalent of heat. The part of the heat of vaporization not used in external work is considered used in changing the state from liquid to vapor. The heat required for this work may be represented by $\rho = r - Apu$.

(From Peabody, Steam and Entropy Tables, John Wiley and Sons, Inc., publishers, by permission.)

	Heat equivalent of external work.				Specific volume.		Density.		
Temperature, degrees Centigrade.	Calories per kilogram.	B T.U. per pound.	Entropy of the liquid.	Entropy of vaporization	Cubic meters per kilo.	Cubic feet per pound.	Kilos per cubic meter.	Pounds per cubic foot.	Temperature, degrees Fahrenheit.
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
0	30 1	54 2	0 0000	2 1804	206 3	3304	0 00485	0.000303	32
1	30 2	54 4	0 0037	2 1706	192.7	3087	0.00519	0 000324	33.8
2	30 4	54 6	0 0074	2 1609	180 0	2884	0 00556	0 000347	35.6
3	30 5	54 8	0 0110	2 1513	168 2	2694	0 00595	0 000371	37.4
4	30 5	54 9	0 0146	2 1416	157 2	2518	0 00636	0 000397	39.2
5	30 6	55 2	0 0183	2 1320	147 1	2356	0 00680	0 000424	41
6	30 8	55 4	0 0219	2 1225	137 7	2206	0 00726	0 000453	42.8
7	30 9	55 6	0 0256	2 1130	129 0	2067	0 00775	0 000484	44.6
8	31 0	55 7	0 0290	2 1036	120 9	1937	0 00827	0 000516	46.4
9	31 1	55 9	0 0326	2 0943	113 4	1816	0 00882	0 000551	48.2
10	31 2	56 1	0 0361	2.0850	106 3	1703	0 00941	0 000587	50
11	31 3	56 3	0 0397	2 0758	99 8	1599	0 01002	0 000625	51.8
12	31 4	56 5	0 0433	2 0667	93 7	1502	0 01067	0 000666	53.6
13	31 5	56 7	0 0467	2 0576	88 1	1411	0 01135	0 000709	55.4
14	31 6	56 9	0 0502	2 0486	82 9	1327	0 01206	0 000754	57.2
15	31 7	57 1	0 0537	2 0396	77 9	1248	0 01283	0 000801	59
16	31 8	57 3	0 0571	2 0308	73 3	1174	0 01364	0 000852	60.8
17	31 9	57 4	0 0607	2 0220	69 1	1105	0 01447	0 000905	62.6
18	32 0	57 6	0 0641	2 0132	65 1	1041	0 01536	0 000961	64.4
19	32 1	57 8	0 0675	2 0045	61 3	982	0 01631	0 001018	66.2
20	32 2	58 0	0 0709	1 9959	57 8	926	0 01730	0 001080	68
21	32 3	58 2	0 0743	1 9873	54 5	873	0 01835	0 001145	69.8
22	32 4	58 4	0 0776	1 9788	51 5	824	0 01942	0 001214	71.6
23	32 5	58 6	0 0811	1 9703	48.60	778	0 02058	0 001286	73.4
24	32 6	58 8	0 0845	1 9620	45 92	735	0 02178	0 001361	75.2
25	32 8	59 0	0 0878	1 9536	43.40	695	0 02304	0 001439	77
26	32 9	59 2	0 0911	1 9453	41 05	657	0 02436	0 001522	78.8
27	33 0	59 3	0 0945	1 9370	38 83	622	0 02575	0 001608	80.6
28	33 1	59 5	0 0978	1 9288	36 74	589	0 02722	0 001698	82.4
29	33 2	59 7	0 1011	1 9207	34.78	557	0 02875	0 001795	84.2
30	33 3	59 9	0 1044	1 9126	32 95	528	0 03035	0 001894	86

Temperature, degrees Centigrade.	Total pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
31	33.57	0.04564	0.6492	31.04	55.9	579.1	1042.4	545.7	982.2	**87.8**
32	35.53	0.04830	0.6871	32.04	57.7	578.6	1041.4	545.1	981.0	**89.6**
33	37.59	0.05111	0.7269	33.04	59.5	578.0	1040.4	544.4	979.9	**91.4**
34	39.75	0.05404	0.7687	34.03	61.3	577.4	1039.4	543.7	978.7	**93.2**
35	42.02	0.05713	0.8126	35.03	63.1	576.9	1038.5	543.1	977.6	**95**
36	44.40	0.06037	0.8586	36.03	64.9	576.4	1037.5	542.5	976.4	**96.8**
37	46.90	0.06376	0.9068	37.02	66.6	575.8	1036.5	541.8	975.2	**98.6**
38	49.51	0.06731	0.9574	38.02	68.4	575.3	1035.5	541.2	974.0	**100.4**
39	52.26	0.07105	1.0105	39.02	70.2	574.7	1034.5	540.5	972.8	**102.2**
40	55.13	0.07495	1.0661	40.02	72.0	574.2	1033.5	539.9	971.7	**104**
41	58.14	0.07905	1.1243	41.01	73.8	573.6	1032.5	539.2	970.5	**105.8**
42	61.30	0.08334	1.1854	42.01	75.6	573.1	1031.5	538.6	969.3	**107.6**
43	64.59	0.08782	1.2492	43.01	77.4	572.5	1030.5	537.9	968.2	**109.4**
44	68.05	0.09252	1.3159	44.01	79.2	571.9	1029.4	537.2	966.9	**111.2**
45	71.66	0.09743	1.3858	45.00	81.0	571.3	1028.4	536.5	965.7	**113**
46	75.43	0.10256	1.4587	46.00	82.8	570.8	1027.4	535.8	964.5	**114.8**
47	79.38	0.10792	1.5350	47.00	84.6	570.2	1026.4	535.1	963.3	**116.6**
48	83.50	0.11353	1.6147	48.00	86.4	569.6	1025.3	534.4	962.0	**118.4**
49	87.80	0.11937	1.6979	48.99	88.2	569.0	1024.3	533.7	960.8	**120.2**
50	92.30	0.12549	1.7849	49.99	90.0	568.4	1023.2	533.0	959.6	**122**
51	96.99	0.13187	1.8756	50.99	91.8	567.8	1022.2	532.3	958.4	**123.8**
52	101.88	0.13852	1.9701	51.99	93.6	567.3	1021.2	531.7	957.2	**125.6**
53	106.99	0.14546	2.0689	52.99	95.4	566.8	1020.2	531.1	956.0	**127.4**
54	112.30	0.15268	2.172	53.98	97.2	566.2	1019.1	530.4	954.7	**129.2**
55	117.85	0.16023	2.279	54.98	99.0	565.6	1018.1	529.7	953.5	**131**
56	123.61	0.16806	2.390	55.98	100.8	565.1	1017.1	529.1	952.3	**132.8**
57	129.63	0.17624	2.506	56.98	102.6	564.5	1016.1	528.4	951.1	**134.6**
58	135.89	0.18475	2.627	57.98	104.4	563.9	1015.1	527.7	949.9	**136.4**
59	142.41	0.19362	2.754	58.97	106.2	563.4	1014.1	527.1	948.7	**138.2**
60	149.19	0.20284	2.885	59.97	108.0	562.8	1013.1	526.4	947.5	**140**
61	156.24	0.21242	3.021	60.97	109.8	562.2	1012.0	525.7	946.3	**141.8**
62	163.58	0.2224	3.163	61.97	111.6	561.7	1011.0	525.1	945.1	**143.6**
63	171.20	0.2328	3.310	62.97	113.4	561.1	1009.9	524.4	943.8	**145.4**
64	179.13	0.2435	3.464	63.98	115.2	560.5	1008.9	523.7	942.6	**147.2**
65	187.36	0.2547	3.623	64.98	117.0	559.9	1007.8	523.0	941.3	**149**
66	195.92	0.2664	3.789	65.98	118.8	559.3	1006.8	522.3	940.1	**150.8**
67	204.80	0.2784	3.960	66.98	120.6	558.8	1005.8	521.7	938.9	**152.6**
68	214.02	0.2910	4.139	67.98	122.4	558.2	1004.7	521.0	937.6	**154.4**
69	223.58	0.3040	4.324	68.98	124.2	557.6	1003.6	520.3	936.3	**156.2**
70	233.53	0.3175	4.516	69.98	126.0	556.9	1002.5	519.5	935.0	**158**

SATURATED STEAM (Continued)

Temperature, degrees Centigrade. t	Heat equivalent of external work. Calories per kilogram. Apu	Heat equivalent of external work. B.T.U. per pound. Apu	Entropy of the liquid. θ	Entropy of vaporization. $\frac{r}{T}$	Specific volume. Cubic meters per kilo. s	Specific volume. Cubic feet per pound. s	Density. Kilos per cubic meter. $\frac{1}{s}$	Density. Pounds per cubic foot. $\frac{1}{s}$	Temperature, degrees Fahrenheit. t
31	33 4	60 2	0 1077	1 9046	31 24	501	0 03201	0 001996	**87.8**
32	33 5	60 4	0 1110	1 8966	29 62	474 7	0 03376	0 002107	**89.6**
33	33 6	60 5	0 1142	1 8886	28 08	449 7	0 03561	0 002224	**91.4**
34	33 7	60 7	0 1175	1 8806	26 62	426 5	0 03757	0 002345	**93.2**
35	33 8	60 9	0 1207	1 8728	25 25	404 7	0 03960	0 002471	**95**
36	33 9	61 1	0 1239	1 8650	23 98	384 2	0 04170	0 002603	**96.8**
37	34 0	61 3	0 1272	1 8572	22 78	364 9	0 04390	0 002740	**98.6**
38	34 1	61 5	0 1304	1 8494	21 65	346 8	0 04619	0 002884	**100.4**
39	34 2	61 7	0 1336	1 8417	20 58	329 7	0 04859	0 003033	**102.2**
40	34 3	61 8	0 1368	1 8341	19 57	313 5	0 0511	0 003190	**104**
41	34 4	62 0	0 1399	1 8265	18 61	298 0	0 0537	0 003356	**105.8**
42	34 5	62 2	0 1431	1 8189	17 69	283 3	0 0565	0 003530	**107.6**
43	34 6	62 3	0 1463	1 8113	16 82	269 5	0 0595	0 003711	**109.4**
44	34 7	62 5	0 1494	1 8038	16 01	256 5	0 0625	0 003899	**111.2**
45	34 8	62 7	0 1526	1 7963	15 25	244 4	0 0656	0 004092	**113**
46	35 0	62 9	0 1557	1 7889	14 54	233 0	0 0688	0 004292	**114.8**
47	35 1	63 1	0 1588	1 7815	13 86	222 1	0 0722	0 004502	**116.6**
48	35 2	63 3	0.1619	1 7742	13 21	211 7	0 0757	0 004724	**118.4**
49	35 3	63 5	0 1650	1 7669	12 60	201 9	0 0794	0 00495	**120.2**
50	35 4	63 6	0 1682	1 7597	12 02	192 6	0 0832	0 00519	**122**
51	35 5	63 8	0 1713	1 7525	11 47	183 8	0 0872	0 00544	**123.8**
52	35 6	64 0	0 1743	1 7454	10 96	175 5	0 0912	0 00570	**125.6**
53	35 7	64 2	0 1774	1 7383	10 47	167 7	0 0955	0 00596	**127.4**
54	35 8	64 4	0 1804	1 7312	10 00	160 3	0 1000	0 00624	**129.2**
55	35 9	64 6	0 1835	1 7242	9 56	153 2	0 1046	0 00653	**131**
56	36 0	64 8	0 1865	1 7173	9 14	146 5	0 1094	0 00683	**132.8**
57	36 1	65 0	0 1895	1 7104	8 74	140 1	0 1144	0 00713	**134.6**
58	36 2	65 2	0 1925	1 7035	8 36	134 0	0 1196	0 00746	**136.4**
59	36 3	65 4	0 1955	1 6967	8 00	128 3	0 1250	0 00779	**138.2**
60	36 4	65 6	0 1986	1 6899	7 66	122 8	0 1305	0 00814	**140**
61	36 5	65 7	0 2016	1 6831	7 34	117 6	0 1362	0 00850	**141.8**
62	36 6	65 9	0 2046	1 6764	7 03	112 7	0 1422	0 00887	**143.6**
63	36 7	66 1	0 2075	1 6696	6 74	108 0	0 1484	0 00926	**145.4**
64	36 8	66 3	0 2105	1 6629	6 46	103 5	0 1548	0 00966	**147.2**
65	36 9	66 5	0 2135	1 6563	6 19	99 2	0 1615	0 01008	**149**
66	37 0	66 7	0 2164	1 6497	5 94	95 1	0 1684	0 01051	**150.8**
67	37 1	66 9	0 2194	1 6431	5 70	91.3	0 1754	0 01095	**152.6**
68	37 2	67 1	0 2223	1 6366	5 47	87 6	0 1828	0 01142	**154.4**
69	37 3	67 3	0 2253	1 6300	5 25	84 1	0 1905	0.01189	**156.2**
70	37 4	67 4	0 2282	1 6235	5.04	80 7	0 1984	0 01239	**158**

Temperature, degrees Centigrade.	Total pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
71	243 8	0 3315	4 715	70 98	127 8	556 4	1001 5	518 8	933 9	**159.8**
72	254 5	0 3460	4 921	71 99	129 6	555 8	1000 4	518 1	932 6	**161.6**
73	265 6	0 3611	5 136	72 99	131 4	555 2	999 4	517 4	931 4	**163.4**
74	277 1	0 3767	5 358	73 99	133 2	554 6	998 3	516 7	930 1	**165.2**
75	289 0	0 3929	5 589	74 99	135 0	554 0	997 3	516 0	928 8	**167**
76	301 3	0 4096	5 826	76 00	136 8	553 4	996 2	515 3	927 6	**168.8**
77	314 0	0 4269	6 072	77 00	138 6	552 9	995 2	514 7	926 4	**170.6**
78	327 2	0 4449	6 327	78 00	140 4	552 3	994 1	514 0	925 2	**172.4**
79	340 9	0 4635	6 592	79 01	142 2	551 7	993 0	513 3	923 9	**174.2**
80	355 1	0 4828	6 867	80 01	144 0	551 1	991 9	512 6	922 6	**176**
81	369 7	0 5026	7 150	81 02	145 8	550 5	990 8	511 9	921 3	**177.8**
82	384 9	0 5233	7 443	82 02	147 6	549 9	989 8	511.2	920.1	**179.6**
83	400 5	0 5445	7 745	83 03	149 4	549 3	988 7	510 5	918 8	**181.4**
84	416 7	0 5665	8 058	84 03	151 2	548 7	987 6	509 8	917 6	**183.2**
85	433 5	0 5894	8 383	85 04	153 1	548 1	986.5	509 1	916 3	**185**
86	450 8	0 6129	8 717	86 04	154 9	547 4	985 4	508 3	915 0	**186.8**
87	468 6	0 6371	9 062	87 05	156 7	546 8	984 3	507 6	913 7	**188.6**
88	487 1	0 6623	9 419	88 06	158 5	546 2	983 2	506 9	912 5	**190.4**
89	506 1	0 6881	9 787	89 06	160 3	545 6	982 1	506 2	911 2	**192.2**
90	525 8	0 7149	10 167	90 07	162 1	544 9	980 9	505 4	909 9	**194**
91	546 1	0 7425	10 560	91 08	163 9	544 3	979 8	504 7	908 5	**195.8**
92	567 1	0 7710	10 966	92 08	165 7	543 7	978 7	504 0	907 2	**197.6**
93	588 7	0 8004	11 384	93 09	167 5	543 1	977 6	503 3	906 0	**199.4**
94	611 0	0 8307	11 815	94 10	169 3	542 5	976 5	502 6	904 7	**201.2**
95	634 0	0 8620	12 260	95 11	171 2	541 9	975 4	501 9	903 4	**203**
96	657 7	0 8942	12 718	96 12	173 0	541 2	974 2	501 1	902 1	**204.8**
97	682 1	0 9274	13 190	97 12	174 8	540 6	973 1	500 4	900 8	**206.6**
98	707 3	0 9616	13 678	98 13	176 6	539 9	971 9	499 6	899 4	**208.4**
99	733 3	0 9970	14 180	99 14	178 5	539 3	970 8	498 9	898 2	**210.2**
100	760 0	1 0333	14 697	100 2	180 3	538 7	969 7	498 2	896 9	**212**
101	787 5	1 0707	15 229	101 2	182 1	538 1	968 5	497 5	895 5	**213.8**
102	815 9	1 1093	15 778	102 2	183 9	537 4	967 3	496 8	894 1	**215.6**
103	845.1	1 1490	16 342	103 2	185.7	536 8	966 2	496 1	892 9	**217.4**
104	875 1	1 1898	16 923	104 2	187 6	536 2	965 1	495 4	891 6	**219.2**
105	906 1	1 2319	17 522	105 2	189 4	535 6	964 0	494 7	890 3	**221**
106	937 9	1 2752	18 137	106 2	191 2	534 9	962 8	493 9	889 0	**222.8**
107	970 6	1 3196	18 769	107 2	193 0	534 2	961 6	493 1	887 6	**224.6**
108	1004 3	1 3653	19 420	108 2	194 8	533 6	960 5	492 4	886 3	**226.4**
109	1038 8	1.4123	20 089	109 3	196.7	532.9	959 3	491 6	885 0	**228.2**
110	1074.5	1 4608	20 777	110 3	198 5	532 3	958 1	490 9	883 6	**230**

SATURATED STEAM (Continued)

	Heat equivalent of external work.				Specific volume.		Density.		
Temperature, degrees Centigrade. t	Calories per kilogram. $A\,pu$	B.T.U. per pound. $A\,pu$	Entropy of the liqud. θ	Entropy of vaporization. $\frac{r}{T}$	Cubic meters per kilo. s	Cubic feet per pound. s	Kilos per cubic meter. $\frac{1}{s}$	Pounds per cubic foot. $\frac{1}{s}$	Temperature, degrees Fahrenheit t
71	37 6	67 6	0 2311	1 6171	4 838	77 5	0 2067	0.01290	**159.8**
72	37 7	67 8	0 2340	1 6107	4 647	74 4	0 2152	0 01344	**161.6**
73	37 8	68 0	0 2369	1 6044	4 466	71 5	0 2239	0 01398	**163.4**
74	37 9	68 2	0 2398	1 5981	4 294	68.8	0 2329	0.01453	**165.2**
75	38 0	68 5	0 2427	1 5918	4 130	66 2	0 2421	0 01510	**167**
76	38 1	68 6	0 2456	1 5856	3 973	63 7	0 2517	0 01570	**168.8**
77	38 2	68 8	0 2484	1 5793	3 822	61 2	0 2616	0.01634	**170.6**
78	38 3	68 9	0 2513	1 5731	3 676	58 8	0 2720	0 01700	**172.4**
79	38 4	69 1	0 2541	1 5670	3 537	56 6	0 2827	0.01767	**174.2**
80	38 5	69 3	0 2570	1 5609	3 404	54 5	0 2938	0.01835	**176**
81	38 6	69 5	0 2598	1 5548	3 277	52 5	0 3052	0.01905	**177.8**
82	38.7	69 7	0 2626	1 5487	3 156	50 6	0 3168	0 01976	**179.6**
83	38.8	69 9	0 2654	1 5426	3 040	48 71	0 3289	0 02053	**181.4**
84	38 9	70 0	0 2682	1 5366	2 929	46 92	0 3414	0.02131	**183.2**
85	39 0	70 2	0 2711	1 5307	2 824	45 23	0 3541	0.02211	**185**
86	39 1	70 4	0 2739	1 5247	2 723	43 62	0 3672	0 02293	**186.8**
87	39 2	70 6	0 2767	1 5187	2 627	42 08	0 3807	0 02376	**188.6**
88	39 3	70 7	0 2795	1.5128	2 534	40 59	0 3946	0 02463	**190.4**
89	39 4	70 9	0 2823	1 5069	2 444	39 15	0 4091	0.02554	**192.2**
90	39 5	71 0	0 2851	1 5010	2 358	37 77	0 4241	0 02648	**194**
91	39 6	71 3	0 2879	1 4952	2 275	36 45	0 4395	0 02743	**195.8**
92	39 7	71 5	0 2906	1 4894	2 197	35 19	0 4552	0 02842	**197.6**
93	39 8	71 6	0 2934	1 4836	2 122	34 00	0 4713	0 02941	**199.4**
94	39 9	71 8	0 2961	1 4779	2 050	32 86	0 4878	0 03043	**201.2**
95	40 0	72 0	0 2989	1 4723	1 980	31 75	0 505	0 03149	**203**
96	40 1	72 1	0 3016	1 4666	1 913	30 67	0 523	0 03260	**204.8**
97	40 2	72 3	0 3043	1 4609	1 849	29 63	0 541	0 03375	**206.6**
98	40 3	72 5	0 3070	1 4552	1 787	28 64	0 560	0 03492	**208.4**
99	40 4	72 6	0 3097	1 4496	1 728	27 69	0 579	0 03611	**210.2**
100	40 5	72 8	0 3125	1 4441	1 671	26 78	0 598	0.03734	**212**
101	40 6	73 0	0 3152	1 4386	1 617	25 90	0 618	0 03861	**213.8**
102	40 6	73 2	0 3179	1 4330	1 564	25 06	0 639	0 03990	**215.6**
103	40 7	73 3	0 3205	1 4275	1 514	24 25	0 661	0 04124	**217.4**
104	40 8	73 5	0 3232	1 4220	1 465	23 47	0 683	0 04261	**219.2**
105	40 9	73 7	0 3259	1 4165	1 419	22 73	0 705	0 04400	**221**
106	41 0	73 8	0 3286	1 4111	1.374	22 01	0 728	0 04543	**222.8**
107	41 1	74 0	0 3312	1 4057	1 331	21 31	0 751	0 04692	**224.6**
108	41 2	74 2	0 3339	1 4003	1 289	20 64	0 776	0 04845	**226.4**
109	41 3	74 3	0 3365	1 3949	1 248	19 99	0 801	0 0500	**228.2**
110	41 4	74.5	0 3392	1 3895	1.209	19 37	0 827	0 0516	**230**

Temperature, degrees Centigrade.	Total pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
111	1111 1	1 5106	21 486	111 3	200 3	531 6	956 9	490 2	882 3	**231.8**
112	1148 7	1 5617	22 214	112 3	202 1	530 9	955 7	489.4	880 9	**233.6**
113	1187 4	1 6144	22 962	113 3	203 9	530 3	954 5	488 7	879 5	**235.4**
114	1227 1	1 6684	23 729	114 3	205 8	529 6	953 3	487 9	878 2	**237.2**
115	1267 9	1 7238	24 518	115 3	207 6	528 9	952 1	487 1	876 8	**239**
116	1309 8	1 7808	25 328	116 4	209 4	528 2	950 8	486 3	875 4	**240.8**
117	1352 8	1 8393	26 160	117 4	211 2	527 5	949 5	485 5	873 9	**242.6**
118	1397 0	1 8993	27 015	118 4	213 0	526 9	948 4	484 8	872 6	**244.4**
119	1442 4	1 9611	27 893	119 4	214 9	526 2	947 2	484 0	871 3	**246.2**
120	1488 9	2 0243	28 792	120 4	216 7	525 6	946 0	483 4	870 0	**248**
121	1536 6	2 0891	29 715	121 4	218 5	524 9	944 8	482 6	868 6	**249.8**
122	1585 7	2 1556	30 664	122 5	220 4	524 2	943 5	481 8	867 1	**251.6**
123	1636 0	2 2241	31 637	123 5	222 2	523 5	942 3	481 0	865 8	**253.4**
124	1687 5	2 2943	32 64	124 5	224 1	522 8	941 0	480 2	864 3	**255.2**
125	1740 5	2 3663	33 66	125 5	225 9	522 1	939 8	479 4	863 0	**257**
126	1794 7	2 4401	34 71	126 5	227 7	521 4	938 6	478 6	861 6	**258.8**
127	1850 3	2 5156	35 78	127 5	229 5	520 7	937 3	477 8	860 2	**260.6**
128	1907 3	2 5931	36 88	128 6	231 4	520 0	936 1	477 0	858 8	**262.4**
129	1965 8	2 6726	38 01	129 6	233 3	519 3	934 8	476 3	857 4	**264.2**
130	2025 6	2 7540	39 17	130 6	235 1	518 6	933 6	475 5	856 0	**266**
131	2086 9	2 8373	40 36	131 6	236 9	517 9	932 3	474 7	854 6	**267.8**
132	2149 8	2 9227	41 57	132 6	238 7	517 3	931 1	474 0	853 2	**269.6**
133	2214 0	3 0101	42 81	133 7	240 6	516 6	929 8	473 3	851 8	**271.4**
134	2280 0	3 0999	44 09	134 7	242 4	515 9	928 5	472 5	850 4	**273.2**
135	2347 5	3 1916	45 39	135 7	244 2	515 1	927 2	471 6	848 9	**275**
136	2416 5	3 2854	46 73	136 7	246 0	514 4	925 9	470 8	847 5	**276.8**
137	2487 3	3 3816	48 10	137 7	247 9	513 7	924 6	470 1	846 1	**278.6**
138	2559 7	3 4801	49 50	138 8	249 7	513 0	923 3	469 3	844 6	**280.4**
139	2633 8	3 581	50 93	139 8	251 6	512 3	922 1	468 5	843 3	**282.2**
140	2709 5	3 684	52 39	140 8	253 4	511 5	920 7	467 6	841 8	**284**
141	2787 1	3 789	53 89	141 8	255 3	510 7	919 3	466 8	840 2	**285.8**
142	2866 4	3 897	55 43	142 8	257 1	510 1	918 1	466 1	838 9	**287.6**
143	2947 7	4 008	57 00	143 9	259 0	509 3	916 7	465 3	837 4	**289.4**
144	3030 5	4 121	58 60	144 9	260 8	508 6	915 4	464 4	835 9	**291.2**
145	3115 3	4 236	60 24	145 9	262 7	507 8	914 1	463 6	834 5	**293**
146	3202 1	4 354	61 92	146 9	264 5	507 1	912 8	462 8	833 1	**294.8**
147	3290 8	4 474	63 64	148 0	266 4	506 4	911 5	462 0	831 6	**296.6**
148	3381 3	4 597	65 39	149 0	268 2	505 6	910 1	461 2	830 1	**298.4**
149	3474 0	4 723	67 18	150 0	270 1	504 9	908 8	460 4	828 7	**300.2**
150	3568 7	4 852	69.01	151.0	271 9	504 1	907 4	459 5	827 2	**302**

SATURATED STEAM (Continued)

Temperature, degrees Centigrade.	Heat equivalent of external work. Calories per kilogram.	Heat equivalent of external work. B.T.U. per pound.	Entropy of the liquid.	Entropy of vaporization.	Specific volume. Cubic meters per kilo.	Specific volume. Cubic feet per pound.	Density. Kilos per cubic meter.	Density. Pounds per cubic foot.	Temperature, degrees Fahrenheit.
t	Apu	Apu	θ	$\frac{r}{T}$	γs	s	$\frac{1}{s}$	$\frac{1}{s}$	t
111	41 4	74 6	0 3418	1 3842	1.172	18 77	0 853	0.0533	**231.8**
112	41 5	74 8	0 3445	1 3789	1 136	18 20	0 880	0 0550	**233.6**
113	41 6	75 0	0 3471	1 3736	1 101	17 64	0 908	0 0567	**235.4**
114	41 7	75 1	0 3498	1 3683	1 068	17 10	0 936	0 0585	**237.2**
115	41 8	75 3	0 3524	1 3631	1 036	16 59	0 965	0 0603	**239**
116	41 9	75 4	0 3550	1 3579	1 005	16 09	0 995	0 0622	**240.8**
117	42 0	75 6	0 3576	1 3527	0 9746	15 61	1 026	0 0641	**242.6**
118	42.1	75 8	0 3602	1 3475	0 9460	15 16	1 057	0 0659	**244.4**
119	42 2	75 9	0 3628	1 3423	0 9183	14 72	1 089	0 0679	**246.2**
120	42 2	76 0	0 3654	1 3372	0 8914	14 28	1 122	0 0700	**248**
121	42 3	76 2	0 3680	1 3321	0 8653	13 86	1 156	0 0721	**249.8**
122	42 4	76 4	0 3705	1 3269	0 8401	13 46	1 190	0 0743	**251.6**
123	42 5	76 5	0 3731	1 3218	0 8158	13 07	1 226	0 0765	**253.4**
124	42 6	76 7	0 3756	1 3167	0 7924	12 69	1 262	0 0788	**255.2**
125	42 7	76 8	0 3782	1 3117	0 7698	12 33	1 299	0 0811	**257**
126	42 8	77 0	0 3807	1 3067	0 7479	11 98	1 337	0 0835	**258.8**
127	42 9	77 1	0 3833	1 3017	0.7267	11 64	1 376	0 0859	**260.6**
128	43 0	77 3	0 3858	1 2967	0 7063	11 32	1 416	0 0883	**262.4**
129	43 0	77 4	0 3884	1 2917	0 6867	11 00	1 456	0 0909	**264.2**
130	43 1	77 6	0 3909	1 2868	0 6677	10 70	1 498	0 0935	**266**
131	43 2	77 7	0 3934	1 2818	0 6493	10 40	1 540	0 0961	**267.8**
132	43 3	77 9	0 3959	1 2769	0 6315	10 12	1 583	0 0988	**269.6**
133	43 3	78 0	0 3985	1 2720	0 6142	9 839	1 628	0 1016	**271.4**
134	43 4	78 1	0 4010	1 2672	0.5974	9 569	1 674	0 1045	**273.2**
135	43 5	78 3	0 4035	1 2623	0 5812	9 309	1 721	0 1074	**275**
136	43 6	78 4	0 4060	1 2574	0 5656	9 060	1 768	0 1104	**276.8**
137	43 6	78 5	0 4085	1 2526	0 5506	8 820	1 816	0 1134	**278.6**
138	43 7	78 7	0 4110	1 2479	0 5361	8 587	1 865	0 1165	**280.4**
139	43 8	78 8	0 4135	1 2431	0 5219	8 360	1 916	0 1196	**282.2**
140	43.9	78 9	0 4160	1 2383	0 5081	8 140	1 968	0 1229	**284**
141	43 9	79 1	0 4185	1 2335	0 4948	7 926	2 021	0 1262	**285.8**
142	44 0	79 2	0 4209	1 2288	0 4819	7 719	2 075	0 1296	**287.6**
143	44 0	79 3	0 4234	1 2241	0 4694	7 519	2 130	0 1330	**289.4**
144	44 2	79 5	0 4259	1 2194	0 4574	7 326	2 186	0 1365	**291.2**
145	44 2	79 6	0 4283	1 2147	0 4457	7 139	2 244	0 1401	**293**
146	44 3	79 7	0 4307	1 2100	0 4343	6 957	2 303	0 1437	**294.8**
147	44 4	79 9	0 4332	1 2054	0 4232	6 780	2 363	0 1475	**296.6**
148	44 4	80 0	0 4356	1 2008	0.4125	6 609	2 424	0 1513	**298.4**
149	44 5	80 1	0 4380	1 1962	0 4022	6 443	2 486	0 1552	**300.2**
150	44 6	80 2	0 4405	1 1916	0 3921	6 282	2 550	0 1592	**302**

Temperature, degrees Centigrade.	Total pressure.			Heat of the liquid.		Heat of vaporization		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	*p*	*p*	*p*	*q*	*q*	*r*	*r*	*ρ*	*ρ*	*t*
151	3665 3	4.984	70 88	152 1	273 8	503 4	906 1	458 7	825 7	**303.8**
152	3764 1	5 118	72 79	153 1	275 6	502 6	904 7	457 9	824 2	**305.6**
153	3864 9	5 255	74 74	154 1	277 4	501 9	903 3	457 1	822 7	**307.4**
154	3968	5 395	76 73	155 1	279 2	501 1	901 9	456 3	821 2	**309.2**
155	4073	5 538	78 76	156 2	281 1	500 3	900 5	455 4	819 6	**311**
156	4181	5 684	80 84	157 2	283 0	499 6	899 2	454 6	818 2	**312.8**
157	4290	5 833	82 96	158 2	284 8	498 8	897 8	453 8	816 7	**314.6**
158	4402	5 985	85 12	159 3	286 7	498 1	896 5	453 0	815 3	**316.4**
159	4517	6 141	87 33	160 3	288 5	497 3	895 1	452 1	813 7	**318.2**
160	4633	6 300	89 59	161 3	290 4	496 5	893 7	451 2	812 2	**320**
161	4752	6 462	91 89	162 3	292 2	495 7	892 3	450 4	810 7	**321.8**
162	4874	6 628	94 25	163 4	294 1	494 9	890 9	449 5	809 2	**323.6**
163	4998	6 796	96 65	164 4	295 9	494 2	889 5	448 7	807 7	**325.4**
164	5124	6 967	99 09	165 4	297 7	493 4	888 1	447 9	806 2	**327.2**
165	5253	7 142	101 58	166 5	299 6	492 6	886 7	447 0	804 7	**329**
166	5384	7 320	104 11	167 5	301 5	491 9	885 4	446 3	803 3	**330.8**
167	5518	7 502	106 71	168 5	303 3	491 1	883 9	445 4	801 7	**332.6**
168	5655	7 688	109 35	169 5	305 1	490 3	882 5	444 6	800 1	**334.4**
169	5794	7 877	112 04	170 6	307 0	489 5	881 0	443 7	798 5	**336.2**
170	5937	8 071	114 79	171 6	308 9	488 7	879 6	442 8	797 0	**338**
171	6081	8 268	117 59	172 6	310 7	487 9	878 3	441 9	795 6	**339.8**
172	6229	8 469	120 45	173 7	312 6	487 1	876 9	441 1	794 1	**341.6**
173	6379	8 673	123 36	174 7	314 5	486 3	875 4	440 2	792 5	**343.4**
174	6533	8 882	126 33	175 7	316 3	485 5	873 9	439 4	790 9	**345.2**
175	6689	9 094	129 35	176 8	318 2	484 7	872 4	438 5	789 3	**347**
176	6848	9 310	132 43	177 8	320 0	483 9	871 0	437 7	787 8	**348.8**
177	7010	9 531	135 56	178 8	321 8	483 1	869 5	436 8	786 2	**350.6**
178	7175	9 755	138 75	179 9	323 7	482 3	868 1	436 0	784 7	**352.4**
179	7343	9 983	142 00	180 9	325 6	481 4	866 6	435 0	783 1	**354.2**
180	7514	10 216	145.30	181 9	327 5	480 6	865 1	434 2	781 5	**356**
181	7688	10 453	148 67	183 0	329 3	479 8	863 6	433 3	779 9	**357.8**
182	7866	10 695	152 11	184 0	331 2	479 0	862 2	432 5	778 4	**359.6**
183	8046	10 940	155 60	185 0	333 0	478 2	860 7	431 6	776 9	**361.4**
184	8230	11 189	159 15	186 1	334 9	477 4	859 2	430 8	775 3	**363.2**
185	8417	11 444	162 77	187 1	336 8	476 6	857 7	429 9	773 7	**365**
186	8608	11 703	166 46	188 1	338 6	475 7	856 3	429 0	772 2	**366.8**
187	8802	11 967	170 21	189 2	340 5	474 8	854 7	428 0	770 5	**368.6**
188	8999	12 235	174 02	190 2	342 4	474 0	853 2	427 2	768 9	**370.4**
189	9200	12 508	177.90	191 2	344 2	473 2	851 7	426 3	767 4	**372.2**
190	9404	12 786	181 85	192 3	346 1	472 3	850 2	425 4	765 8	**374**

SATURATED STEAM (Continued)

Temperature, degrees Centigrade. t	Heat equivalent of external work. Calories per kilogram. Apu	Heat equivalent of external work. B.T.U. per pound. Apu	Entropy of the liquid. θ	Entropy of vaporization. $\frac{r}{T}$	Specific volume. Cubic meters per kilo. s	Specific volume. Cubic feet per pound. s	Density. Kilos per cubic meter. $\frac{1}{s}$	Density. Pounds per cubic foot. $\frac{1}{s}$	Temperature, degrees Fahrenheit. t
151	44 6	80 4	0 4429	1 1870	0 3824	6 126	2 615	0 1632	**303.8**
152	44 7	80 5	0 4453	1.1824	0 3729	5 974	2 682	0.1674	**305.6**
153	44 8	80 6	0 4477	1 1778	0 3637	5 826	2 750	0 1716	**307.4**
154	44 8	80 7	0 4501	1 1733	0 3548	5 683	2 818	0 1759	**309.2**
155	44 9	80 9	0 4525	1 1688	0 3463	5 546	2 888	0 1803	**311**
156	45 0	81 0	0 4549	1 1644	0 3380	5 413	2 959	0 1847	**312.8**
157	45 0	81 1	0 4573	1 1599	0 3298	5 282	3 032	0 1893	**314.6**
158	45 1	81 2	0 4596	1 1554	0 3218	5 154	3 108	0 1940	**316.4**
159	45 2	81 4	0 4620	1 1509	0 3140	5 029	3 185	0 1988	**318.2**
160	45 3	81 5	0 4644	1 1465	0 3063	4 906	3 265	0 2038	**320**
161	45 3	81.6	0 4668	1.1421	0 2989	4 789	3 345	0 2088	**321.8**
162	45 4	81 7	0 4692	1 1377	0 2920	4.677	3 425	0 2138	**323.6**
163	45 5	81 8	0 4715	1 1333	0 2855	4 571	3 503	0 2188	**325.4**
164	45 5	81 9	0 4739	1 1289	0 2792	4 469	3 582	0 2238	**327.2**
165	45 6	82 0	0 4763	1 1245	0 2729	4 368	3 664	0 2289	**329**
166	45 6	82 1	0 4786	1 1202	0 2666	4 268	3 751	0 2343	**330.8**
167	45 7	82 2	0 4810	1 1159	0 2603	4 168	3 842	0 2399	**332.6**
168	45 7	82 4	0 4833	1.1115	0 2540	4 070	3 937	0 2457	**334.4**
169	45 8	82 5	0 4857	1 1072	0 2480	3 975	4 032	0 2516	**336.2**
170	45 9	82 6	0 4880	1 1029	0 2423	3 883	4 127	0 2575	**338**
171	46 0	82 7	0 4903	1 0987	0 2368	3 794	4 223	0 2636	**339.8**
172	46 0	82 8	0 4926	1 0944	0 2314	3 709	4 322	0 2696	**341.6**
173	46 1	82 9	0 4949	1 0901	0 2262	3 626	4 421	0 2758	**343.4**
174	46 1	83 0	0 4972	1 0859	0 2212	3 545	4 521	0 2821	**345.2**
175	46 2	83 1	0 4995	1 0817	0 2164	3 467	4 621	0 2884	**347**
176	46 2	83 2	0 5018	1 0775	0 2117	3 391	4 724	0 2949	**348.8**
177	46 3	83 3	0 5041	1 0733	0 2072	3 318	4 826	0 3014	**350.6**
178	46 3	83 4	0 5064	1 0691	0 2027	3 247	4 933	0 3080	**352.4**
179	46 4	83 5	0 5087	1 0649	0 1983	3 177	5 04	0 3148	**354.2**
180	46 4	83 6	0 5110	1 0608	0 1941	3.109	5 15	0 3217	**356**
181	46 5	83 7	0 5133	1 0567	0 1899	3 041	5 27	0 3288	**357.8**
182	46 5	83 8	0 5156	1 0525	0 1857	2 974	5 38	0 3362	**359.6**
183	46 6	83 8	0 5178	1 0484	0 1817	2 911	5 50	0 3435	**361.4**
184	46 6	83 9	0 5201	1 0443	0 1778	2 849	5 62	0 3510	**363.2**
185	46 7	84 0	0 5224	1 0403	0 1740	2 787	5 75	0 3588	**365**
186	46 7	84 1	0 5246	1 0362	0 1702	2 727	5 88	0 3667	**366.8**
187	46 8	84 2	0 5269	1 0321	0 1666	2 669	6 00	0 3746	**368.6**
188	46 8	84 3	0 5291	1 0280	0 1632	2 614	6 13	0 3826	**370.4**
189	46 9	84 3	0 5314	1 0240	0 1598	2 560	6 26	0 3906	**372.2**
190	46 9	84 4	0 5336	1 0200	0 1565	2 507	6 39	0 3989	**374**

	Total pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		
Temperature, degrees Centigrade.	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram	B T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Temperature, degrees Fahrenheit.
t	p	p	p	q	q	r	r	ρ	ρ	t
191	9612	13 068	185 87	193 3	347 9	471 5	848 7	424 5	764 2	**375.8**
192	9823	13 355	189.96	194 4	349 8	470 6	847.1	423 6	762 5	**377.6**
193	10038	13.647	194 11	195 4	351 7	469 8	845 6	422 8	761 0	**379.4**
194	10256	13.944	198 33	196 4	353 5	468 9	844 1	421 9	759 4	**381.2**
195	10479	14.247	202 64	197 5	355 4	468 1	842 5	421 0	757 7	**383**
196	10705	14 554	207 01	198 5	357 3	467 2	841 0	420 1	756 1	**384.8**
197	10934	14 866	211 45	199 5	359 2	466 4	839 5	419 2	754 6	**386.6**
198	11168	15 184	215 96	200 6	361 1	465 6	838 0	418 4	753 0	**388.4**
199	11406	15 507	220 56	201 6	362 9	464 7	836 4	417 4	751 3	**390.2**
200	11647	15 835	225 23	202 7	364 8	463 8	834 8	416 5	749 7	**392**
201	11893	16 169	229 98	203 7	366 7	462 9	833 3	415 6	748 1	**393.8**
202	12142	16 508	234 80	204 7	368 5	462 1	831 8	414 8	746 6	**395.6**
203	12395	16 852	239 71	205 8	370 4	461 2	830 2	413 8	744 9	**397.4**
204	12653	17 202	244 69	206 8	372 3	460 3	828 6	412 9	743 3	**399.2**
205	12915	17 558	249 75	207 9	374 1	459 4	827 0	412 0	741 6	**401**
206	13181	17 921	254 89	208 9	376 0	458 6	825 4	411 1	740 0	**402.8**
207	13452	18 289	260 13	210 0	377 9	457 7	823 8	410 2	738 3	**404.6**
208	13727	18 663	265 45	211 0	379 8	456 8	822 2	409 3	736 7	**406.4**
209	14006	19 042	270 85	212 0	381 6	455 9	820 6	408 4	735 1	**408.2**
210	14290	19 428	276 34	213 1	383 5	455 0	819 1	407 5	783 6	**410**
211	14578	19 820	281 91	214 1	385 4	454 1	817 4	406 6	731 9	**411.8**
212	14871	20 218	287 57	215 2	387 3	453 2	815 8	405 7	730 2	**413.6**
213	15168	20 622	293 31	216 2	389 2	452 4	814 3	404 9	728 7	**415.4**
214	15470	21 033	299 16	217 3	391 1	451 5	812 7	404 0	727 1	**417.2**
215	15778	21 452	305 10	218 3	392 9	450 6	811 0	403 1	725 4	**419**
216	16090	21 876	311 14	219 3	394 8	449 6	809 3	402 1	723 7	**420.8**
217	16406	22 306	317 26	220 4	396 7	448 7	807 7	401 2	722 1	**422.6**
218	16728	22 743	323 48	221 4	398 5	447 8	806 1	400 3	720 5	**424.4**
219	17055	23 188	329 81	222 5	400 4	446 9	804 5	399 4	718 9	**426.2**
220	17387	23 639	336 24	223 5	402 3	446 0	802 9	398 5	717 3	**428**

SATURATED STEAM (Concluded)

Temperature, degrees Centigrade.	Heat equivalent of external work.		Entropy of the liquid.	Entropy of vaporization.	Specific volume.		Density.		Temperature, degrees Fahrenheit.
	Calories per kilogram.	B.T.U. per pound.			Cubic meters per kilo.	Cubic feet per pound.	Kilos per cubic meter.	Pounds per cubic foot.	
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
191	47 0	84 5	0 5358	1 0160	0 1533	2 456	6 52	0 4072	**375.8**
192	47 0	84.6	0 5381	1 0120	0 1501	2 405	6 66	0.4158	**377.6**
193	47 0	84.6	0 5403	1 0080	0 1470	2 355	6 80	0 4246	**379.4**
194	47 0	84 7	0 5426	1 0040	0 1440	2 306	6 94	0 4336	**381.2**
195	47 1	84 8	0 5448	1 0000	0 1411	2 259	7 09	0.4426	**383**
196	47 1	84.9	0 5470	0 9961	0 1382	2 214	7 23	0 4516	**384.8**
197	47 2	84 9	0 5492	0 9922	0 1354	2 169	7 38	0 4610	**386.6**
198	47 2	85.0	0 5514	0 9882	0 1327	2 126	7 53	0 4704	**388.4**
199	47 3	85 1	0 5536	0 9843	0 1300	2 083	7 69	0 4801	**390.2**
200	47 3	85 1	0 5558	0 9804	0 1274	2 041	7 84	0 4900	**392**
201	47 3	85 2	0 5580	0 9765	0 1249	2 001	8 00	0 4998	**393.8**
202	47 3	85 2	0 5602	0 9727	0 1225	1 962	8 16	0 510	**395.6**
203	47 4	85 3	0 5624	0 9688	0.1201	1 923	8 33	0 520	**397.4**
204	47 4	85 3	0.5646	0 9650	0 1177	1 885	8 50	0 531	**399.2**
205	47 4	85 4	0 5668	0 9611	0 1153	1 847	8 67	0 541	**401**
206	47 5	85 4	0 5690	0 9572	0 1130	1 810	8 85	0.552	**402.8**
207	47 5	85 5	0.5712	0 9534	0.1108	1 774	9 03	0 564	**404.6**
208	47 5	85 5	0 5733	0 9496	0 1086	1 739	9 21	0 575	**406.4**
209	47.5	85 5	0 5755	0 9458	0 1065	1 705	9 39	0 587	**408.2**
210	47 5	85 5	0 5777	0 9420	0 1044	1 673	9 58	0 598	**410**
211	47 5	85.5	0 5799	0 9382	0 1024	1 640	9 77	0 610	**411.8**
212	47 5	85 6	0 5820	0 9344	0 1004	1 608	9 96	0 622	**413.6**
213	47 5	85.6	0 5842	0 9307	0 0984	1 577	10 16	0 634	**415.4**
214	47 5	85 6	0 5863	0 9269	0 0965	1 546	10 36	0 647	**417.2**
215	47 5	85 6	0 5885	0 9232	0 0947	1 516	10 56	0 660	**419**
216	47 5	85 6	0 5906	0 9195	0 0928	1 486	10 78	0 673	**420.8**
217	47 5	85 6	0 5927	0 9157	0 0910	1 458	10 99	0 686	**422.6**
218	47 5	85 6	0 5948	0 9120	0 0893	1 430	11 20	0 699	**424.4**
219	47 5	85 6	0 5969	0 9084	0 0876	1 403	11 41	0 713	**426.2**
220	47 5	85 6	0 5991	0.9047	0 0860	1 376	11 62	0 727	**428**

Ammonia, NH_3

Temp. °F	Abs. press. sat. vap.		Heat content abv. −40°F BTU/lb.		Ht. of vaporiz. BTU/lb.	Heat content abv. −40°C g-cal./g		Ht. of vaporiz. g-cal./g	Temp. °C
	lb./in.²	kg/cm²	Liq.	Vap.		Liq.	Vap.		
−60	5 55	0 390	−21 2	589 6	610 8	−11 8	327 6	339 3	−51 11
−58	5 93	417	−19 1	590 4	609 5	−10 6	328 0	338.6	−50 00
−56	6 33	445	−17 0	591 2	608 2	− 9 44	328 4	337 9	−48 89
−54	6 75	475	−14 8	592 1	606 9	− 8 22	328 9	337 2	−47 78
−52	7.20	.506	−12 7	592.9	605.6	− 7.06	329.4	336 4	−46 67
−50	7 67	0 539	−10 6	593 7	604 3	− 5 89	329 8	335 7	−45 56
−48	8 16	574	− 8 5	594 4	602 9	− 4 7	330 2	334 9	−44 44
−46	8 68	.610	− 6.4	595 2	601 6	− 3.6	330.7	334 2	−43 33
−44	9 23	649	− 4 3	596 0	600 3	− 2 4	331 1	333 5	−42 22
−42	9.81	.690	− 2 1	596 8	598 9	− 1.2	331 6	332 7	−41 11
−40	10.41	0.7319	0 0	597 6	597 6	0 0	332 0	332 0	−40 00
−38	11.04	.7762	+ 2 1	598 3	596 2	+ 1 2	332 4	331 2	−38 89
−36	11 71	.8233	4 3	599 1	594 8	2 4	332 8	330 4	−37 78
−34	12 41	8725	6 4	599 9	593 5	3 6	333 3	329 7	−36 67
−32	13 14	.9238	8 5	600 6	592 1	4 7	333 7	328 9	−35 56
−30	13 90	0 9773	10 7	601 4	590 7	5 94	334 1	328 2	−34 44
−28	14 71	1 034	12 8	602 1	589 3	7 11	334 5	327 4	−33 33
−26	15 55	1 093	14 9	602 8	587 9	8 28	334 9	326 6	−32 22
−24	16 42	1 154	17 1	603 6	586 5	9 50	335 3	325 8	−31 11
−22	17 34	1 219	19 2	604 3	585 1	10 7	335 7	325 1	−30 00
−20	18 30	1 287	21 4	605 0	583 6	11 9	336 1	324 2	−28 89
−18	19 30	1 357	23 5	605 7	582 2	13 1	336 5	323 4	−27 78
−16	20 34	1 430	25 6	606 4	580 8	14 2	336 9	322 7	−26 67
−14	21 43	1 507	27 8	607 1	579 3	15 4	337 3	321 8	−25 56
−12	22 56	1 586	30 0	607.8	577 8	16 7	337 7	321 0	−24 44
−10	23 74	1 669	32 1	608.5	576 4	17 8	338 1	320 2	−23 33
− 8	24 97	1 756	34 3	609 2	574 9	19 1	338 4	319 4	−22 22
− 6	26 26	1 846	36 4	609 8	573 4	20 2	338 8	318 6	−21 11
− 4	27 59	1 940	38 6	610 5	571 9	21.4	339 2	317 7	−20 00
− 2	28 98	2 037	40 7	611 1	570 4	22 6	339.5	316 9	−18 89
0	30 42	2 139	42 9	611 8	568 9	23 8	339 9	316 1	−17 78
2	31 92	2 244	45 1	612 4	567 3	25 1	340 2	315 2	−16 67
4	33 47	2 353	47 2	613 0	565 8	26 2	340 6	314 3	−15 56
6	35 09	2 467	49 4	613 6	564 2	27 4	340 9	313 4	−14 44
8	36 77	2 585	51 6	614 3	562 7	28 7	341 3	312 6	−13 33
10	38 51	2 708	53 8	614 9	561 1	29 9	341 6	311 7	−12 22
12	40 31	2 834	56 0	615 5	559 5	31 1	341 9	310 8	−11 11
14	42 18	2 966	58 2	616 1	557 9	32 3	342 3	309 9	−10 00
16	44 12	3 102	60 3	616 6	556 3	33 5	342 6	309 1	− 8 89
18	46 13	3 243	62 5	617 2	554 7	34 7	342 9	308 2	− 7 78
20	48 21	3 390	64 7	617 8	553 1	35 9	343 2	307 3	− 6 67
22	50 36	3 541	66 9	618 3	551 4	37 2	343 5	306 3	− 5 56
24	52 59	3 697	69 1	618 9	549 8	38 4	343 8	305 4	− 4 44
26	54 90	3 860	71 3	619 4	548 1	39 6	344.1	304 5	− 3 33
28	57 28	4 027	73 5	619 9	546 4	40 8	344 4	303 6	− 2 22

Ammonia, NH_3

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density sat. vap. lb./ft.³	Density sat. vap. kg/m³	Dens. liq. lb./ft.³	Entropy from −40°F BTU/lb./°F Liq.	Entropy from −40°F BTU/lb./°F Vap.	Temp. °C
−60	44 73	2 792	0 02235	0 3580	43.91	−0 0517	1 4769	−51 11
−58	42 05	2 625	02378	3809		− 0464	1 4713	−50 00
−56	39 56	2 470	02528	4049		− 0412	1 4658	−48.89
−54	37 24	2 325	02685	4301		− 0360	1 4604	−47 78
−52	35 09	2 191	02850	4565		− 0307	1 4551	−46 67
−50	33 08	2 065	0 03023	0 4842	43 49	−0.0256	1 4497	−45 56
−48	31 20	1 948	03205	5134		− 0204	1 4445	−44 44
−46	29 45	1 839	03395	5438		− 0153	1 4393	−43 33
−44	27 82	1 737	03595	5758		− .0102	1 4342	−42 22
−42	26 29	1 641	03804	6093		− .0051	1 4292	−41 11
−40	24 86	1 552	0 04022	0 6442	43 08	0.0000	1 4242	−40 00
−38	23 53	1 469	04251	6809		.0051	1 4193	−38 89
−36	22 27	1 390	04489	7190		0101	1 4144	−37 78
−34	21 10	1 317	04739	7591		0151	1 4096	−36 67
−32	20 00	1 249	04999	8007		.0201	1 4048	−35 56
−30	18 97	1 184	0 05271	0 8443	42 65	0 0250	1 4001	−34 44
−28	18 00	1 124	05555	8898		0300	1 3955	−33 33
−26	17 09	1 067	05850	9371		0350	1 3909	−32 22
−24	16 24	1 014	06158	9864		.0399	1 3863	−31 11
−22	15 43	0 9633	06479	1 038		.0448	1 3818	−30 00
−20	14 68	0 9164	0 06813	1 091	42.22	0 0497	1 3774	−28 89
−18	13 97	8721	07161	1 147		.0545	1 3729	−27 78
−16	13 29	8297	07522	1 205		0594	1 3686	−26 67
−14	12 66	7903	07898	1 265		.0642	1 3643	−25 56
−12	12 06	7529	08289	1 328		0690	1 3600	−24 44
−10	11 50	0 7179	0 08695	1 393	41 78	0 0738	1 3558	−23 33
− 8	10 97	6848	09117	1 460		0786	1 3516	−22 22
− 6	10 47	6536	09555	1 531		0833	1 3474	−21 11
− 4	9 991	6237	1001	1 603		.0880	1 3433	−20 00
− 2	9 541	5956	1048	1 679		.0928	1 3393	−18 89
0	9 116	0 5691	0 1097	1 757	41.34	0.0975	1 3352	−17 78
2	8 714	5440	1148	1 839		.1022	1 3312	−16 67
4	8 333	5202	1200	1 922		1069	1 3273	−15 56
6	7 971	4976	1254	2 009		.1115	1 3234	−14 44
8	7 629	4763	1311	2 100		.1162	1 3195	−13 33
10	7 304	0 4560	0 1369	2 193	40.89	0 1208	1 3157	−12 22
12	6 996	4367	1429	2 289		1254	1 3118	−11 11
14	6 703	4185	1492	2 390		1300	1 3081	−10 00
16	6 425	4011	1556	2 492		1346	1 3043	− 8 89
18	6 161	3846	1623	2 600		1392	1 3006	− 7 78
20	5 910	0 3690	0 1692	2 710	40.43	0.1437	1 2969	− 6.67
22	5 671	3540	1763	2 824		.1483	1 2933	− 5 56
24	5 443	3398	1837	2 943		1528	1 2897	− 4 44
26	5 227	3263	1913	3 064		.1573	1 2861	− 3 33
28	5 021	3135	.1992	3 191		.1618	1 2825	− 2 22

Ammonia, NH_3 (Continued)

Temp. °F	Abs. press. sat. vap. lb./in.²	Abs. press. sat. vap. kg/cm²	Heat content abv. −40°F BTU/lb. Liq.	Heat content abv. −40°F BTU/lb. Vap.	Ht. of vaporiz. BTU/lb.	Heat content abv. −40°C g-cal./g Liq.	Heat content abv. −40°C g-cal./g Vap.	Ht. of vaporiz. g-cal /g	Temp. °C
30	59 74	4 200	75 7	620 5	544 8	42 1	344 7	302 7	− 1 11
32	62 29	4.379	77.9	621 0	543 1	43 3	345 0	301 7	0 00
34	64 91	4 564	80 1	621 5	541 4	44 5	345 3	300 8	+ 1 11
36	67 63	4 755	82 3	622 0	539 7	45 7	345.6	299 8	2 22
38	70 43	4 952	84 6	622 5	537 9	47 0	345.8	298 8	3 33
40	73 32	5 155	86 8	623 0	536 2	48 2	346 1	297 9	4 44
42	76 31	5 365	89.0	623 4	534 4	49 4	346 3	296 9	5 56
44	79 38	5 581	91 2	623 9	532 7	50 7	346 6	295 9	6 67
46	82 55	5 804	93.5	624 4	530 9	51 9	346 9	294 9	7.78
48	85 82	6 034	95 7	624.8	529 1	53.2	347 1	293 9	8 89
50	89 19	6 271	97.9	625.2	527.3	54 4	347 3	292 9	10 00
52	92 66	6 515	100.2	625.7	525.5	55 67	347.6	291 9	11 11
54	96 23	6 766	102 4	626 1	523.7	56 89	347 8	290 9	12 22
56	99 91	7 024	104 7	626 5	521 8	58 17	348 1	289 9	13 33
58	103 7	7 291	106 9	626.9	520 0	59 39	348 3	288 9	14 44
60	107 6	7 565	109 2	627 3	518 1	60 67	348 5	287 8	15 56
62	111 6	7 846	111 5	627 7	516 2	61 94	348 7	286 8	16 67
64	115 7	8 135	113 7	628 0	514 3	63 17	348 9	285 7	17 78
66	120 0	8 437	116 0	628 4	512 4	64 44	349 1	284 7	18 89
68	124 3	8 739	118 3	628 8	510 5	65 72	349 3	283 6	20 00
70	128 8	9 056	120 5	629 1	508 6	66 94	349 5	282 6	21 11
72	133 4	9 379	122 8	629 4	506 6	68 22	349 7	281 4	22 22
74	138 1	9 709	125 1	629 8	504 7	69 50	349 9	280 4	23 33
76	143 0	10 05	127 4	630 1	502 7	70 78	350 1	279 3	24.44
78	147 9	10 40	129 7	630 4	500 7	72 06	350 2	278 2	25 56
80	153 0	10 76	132 0	630 7	498 7	73 33	350 4	277.1	26 67
82	158 3	11 13	134 3	631 0	496 7	74 61	350 6	275 9	27 78
84	163 7	11 51	136 6	631 3	494 7	75 89	350 7	274.8	28 89
86	169 2	11 90	138 9	631 5	492 6	77 17	350 8	273 7	30 00
88	174 8	12 29	141 2	631 8	490 6	78 44	351 0	272 6	31 11
90	180 6	12 70	143 5	632 0	488 5	79 72	351.1	271 4	32 22
92	186 6	13 12	145 8	632 2	486 4	81 00	351 2	270 2	33 33
94	192 7	13 55	148 2	632 5	484 3	82 33	351 4	269 1	34 44
96	198 9	13 98	150 5	632 6	482 1	83 61	351 4	267 8	35 56
98	205 3	14 43	152 9	632.9	480.0	84 94	351.6	266.7	36 67
100	211 9	14 90	155 2	633 0	477.8	86 22	351.7	265 4	37 78
102	218 6	15 37	157 6	633 2	475 6	87 56	351.8	264 2	38 89
104	225 4	15 85	159 9	633 4	473 5	88 83	351 9	263 1	40 00
106	232 5	16 35	162.3	633 5	471 2	90 17	351 9	261 8	41 11
108	239 7	16 85	164 6	633 6	469 0	91 44	352 0	260 6	42 22
110	247 0	17 37	167 0	633 7	466 7	92 78	352 1	259 3	43 33
112	254 5	17 89	169 4	633 8	464 4	94 11	352 1	258 0	44 44
114	262 2	18 43	171 8	633 9	462 1	95 44	352 2	256 7	45 56
116	270 1	18 99	174 2	634 0	459 8	96 78	352 2	255 4	46.67
118	278 2	19.56	176 6	634.0	457 4	98 11	352 2	254 1	47 78
120	286 4	20 14	179 0	634 0	455 0	99 45	352 2	252 8	48 89
122	294 8	20 73	181 4	634 0	452.6	100 8	352 2	251.4	50 00
124	303 4	21 33	183 9	631 0	450 1	102.2	352 2	250 1	51 11

Ammonia, NH_3 (Continued)

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density sat. vap. lb./ft.³	Density sat. vap. kg/m³	Dens. liq. lb./ft.³	Entropy from −40°F BTU/lb./°F Liq.	Entropy from −40°F BTU/lb./°F Vap.	Temp. °C
30	4 825	0 3012	0 2073	3.321	39 96	0 1663	1 2790	− 1 11
32	4 637	2895	2156	3 453		1708	1 2755	0 00
34	4 459	2784	.2243	3.593		1753	1 2721	+ 1 11
36	4 289	2678	2332	3 735		1797	1 2686	2 22
38	4.126	2576	.2423	3.881		1841	1 2652	3 33
40	3 971	0 2479	0.2518	4 033	39 49	0 1885	1.2618	4 44
42	3 823	2387	2616	4 190		1930	1 2585	5 56
44	3 682	2299	2716	4 350		1974	1 2552	6 67
46	3 547	2214	2819	4 515		.2018	1 2519	7 78
48	3 418	2134	2926	4 687		2062	1 2486	8 89
50	3 294	0 2056	0 3036	4 863	39.00	0 2105	1 2453	10 00
52	3 176	.1983	3149	5 044		2149	1 2421	11 11
54	3 063	1912	3265	5 230		2192	1 2389	12 22
56	2 954	1844	3385	5 422		.2236	1 2357	13 33
58	2 851	1780	3508	5 619		2279	1 2325	14 44
60	2 751	0 1717	0 3635	5 823	38 50	0 2322	1 2294	15 56
62	2 656	1658	3765	6 031		2365	1 2262	16 67
64	2 565	.1601	3899	6 245		2408	1 2231	17 78
66	2 477	1546	4037	6 466		2451	1 2201	18 89
68	2 393	1494	4179	6 694		2494	1 2170	20 00
70	2 312	0 1443	0 4325	6 928	38 00	0 2537	1 2140	21 11
72	2 235	1395	4474	7 166		2579	1 2110	22 22
74	2 161	1349	4628	7 413		2622	1 2080	23 33
76	2 089	.1304	4786	7 666		2664	1 2050	24 44
78	2 021	1262	4949	7 927		2706	1 2020	25 56
80	1 955	0 1220	0 5115	8 193	37 48	0 2749	1 1991	26 67
82	1 892	1181	5287	8 469		.2791	1 1962	27 78
84	1 831	1143	5462	8 749		2833	1.1933	28 89
86	1 772	1106	5643	9 039		2875	1 1904	30 00
88	1 716	1071	.5828	9 335		2917	1.1875	31 11
90	1 661	0 1037	.0 6019	9 641	36 95	0 2958	1.1846	32 22
92	1 609	1004	6214	9 954		3000	1 1818	33 33
94	1 559	09733	.6415	10 28		3041	1 1789	34 44
96	1 510	.09427	.6620	10 60		3083	1 1761	35 56
98	1 464	09140	6832	10 94		3125	1 1733	36 67
100	1 419	0 08859	0 7048	11 29	36 40	0 3166	1 1705	37 78
102	1 375	08584	7270	11 65		3207	1 1677	38 89
104	1 334	08328	7498	12 01		3248	1 1649	40 00
106	1 293	08072	7732	12 39		3289	1 1621	41 11
108	1 254	07829	.7972	12 77		3330	1 1593	42 22
110	1 217	0 07598	0 8219	13 17	35 84	0 3372	1 1566	43 33
112	1 180	07367	8471	13 57		3413	1 1538	44 44
114	1 145	07148	8730	13 98		3453	1 1510	45 56
116	1 112	06942	8996	14 41		3495	1 1483	46 67
118	1 079	06736	9269	14 85		3535	1 1455	47 78
120	1 047	0 06536	0 9549	15 30	35.26	0 3576	1.1427	48 89
122	1.017	06349	9837	15 76		3618	1 1400	50 00
124	0 987	0616	1 0132	16 229		3659	1 1372	51 11

Carbon Dioxide, CO_2

Temp. °F	Abs. press sat. vap.		Heat content abv. 32°F BTU/lb.		Heat of vaporiz. BTU/lb.	Heat content abv. 0°C g-cal./g		Heat of vaporiz. g-cal./g	Temp. °C
	lb./in.²	kg/cm²	Liq.	Vap.		Liq.	Vap.		
−20	220 6	15 51	−23.96	102.0	126 0	−13 31	56 67	70 00	−28 89
−18	228 4	16 06	−23.13	102 1	125 2	−12 85	56 72	69 56	−27 78
−16	236 4	16 62	−22.30	102 2	124 5	−12 39	56 78	69 17	−26 67
−14	244 6	17 20	−21.46	102 2	123 7	−11 92	56 78	68 72	−25 56
−12	253 0	17.79	−20 61	102.3	122 9	−11 45	56 83	68 28	−24 44
−10	261 7	18 40	−19 76	102 3	122 0	−10 98	56 83	67 78	−23 33
− 8	270 6	19 03	−18 90	102 3	121 2	−10 50	56 83	67 33	−22 22
− 6	279 7	19 66	−18 04	102 3	120 3	−10 02	56 83	66 83	−21 11
− 4	289 1	20 33	−17 17	102 3	119 5	− 9 539	56 83	66 39	−20 00
− 2	298 7	21 00	−16 29	102 3	118 6	− 9 050	56 83	65 89	−18 89
0	308 6	21 70	−15 41	102 2	117 7	− 8 561	56 78	65 39	−17 78
2	318 7	22 41	−14 51	102 2	116 7	− 8 061	56 78	64 83	−16 67
4	329 1	23.14	−13 61	102 1	115 8	− 7 561	56 72	64 33	−15 56
6	339 8	23 89	−12 71	102 1	114 8	− 7 061	56 72	63 78	−14 44
8	350 7	24 66	−11 79	102.0	113 8	− 6 550	56 67	63 22	−13 33
10	361 8	25 44	−10 87	101 9	112 8	− 6 039	56 61	62 67	−12 22
12	373 3	26 25	− 9 934	101 8	111 7	− 5 519	56 56	62 06	−11 11
14	385 0	27 07	− 8.992	101 7	110 7	− 4.996	56 50	61 50	−10 00
16	397 1	27 92	− 8 038	101 5	109.6	− 4 466	56 39	60 89	− 8 89
18	409 4	28 78	− 7 076	101 4	108 5	− 3 931	56 33	60 28	− 7 78
20	422 0	29 67	− 6 102	101 2	107 3	− 3 390	56 22	59 61	− 6 67
22	434 9	30 58	− 5 117	101 0	106 1	− 2 843	56 11	58 94	− 5 56
24	448 1	31 50	− 4 121	100 8	104 9	− 2 289	56 00	58 28	− 4 44
25	454 8	31.98	− 3 618	100 7	104 3	− 2 010	55 94	57 94	− 3 89
27	468.5	32 94	− 2 601	100 5	103 1	− 1 445	55 83	57 28	− 2 78
29	482.5	33.92	− 1 570	100 2	101 8	− 0 8722	55 67	56 56	− 1 67
31	496 8	34 93	− 0 525	99 98	100 5	− 0 292	55 54	55 83	− 0 56
33	511 4	35 95	+ 0 531	99 69	99 16	+ 0 295	55 38	55 09	+ 0 56
35	526 4	37 01	1 604	99 38	97 77	0.8911	55 21	54 32	1 67
37	541 7	38 09	2.697	99 05	96 35	1.498	55 03	53 53	2 78
39	557 4	39 19	3 806	98 69	94 88	2 114	54 83	52 71	3 89
41	573 4	40 31	4 932	98 31	93 37	2.740	54 62	51 87	5 00
43	589 8	41 47	6 080	97 90	91 82	3 378	54 39	51 01	6 11
45	606 5	42 64	7 251	97 46	90 21	4 028	54 14	50 12	7 22
47	623 6	43 84	8 443	96 99	88 55	4 691	53 88	49 19	8 33
49	641 1	45 07	9 664	96 50	86 83	5 369	53 61	48 24	9 44
51	659 0	46 33	10 91	95 97	85 06	6 061	53 32	47 26	10 56
53	677 3	47 62	12 19	95 40	83 21	6 772	53 00	46 23	11 67
55	695 9	48 93	13 49	94 78	81 29	7 494	52 66	45 16	12 78
57	714 9	50 26	14.84	94 13	79 30	8.244	52.29	44 06	13 89
59	734 3	51 63	16 22	93 44	77.22	9 011	51 91	42 90	15.00
61	754 2	53 03	17 65	92 69	75 04	9 806	51.49	41 69	16 11
63	774 5	54.45	19 13	91 88	72 75	10 63	51.04	40 42	17.22
65	795 1	55 90	20 66	91 01	70 35	11 48	50 56	39 08	18.33
67	816 2	57 38	22 25	90 07	67 81	12 36	50 04	37 67	19 44
69	837 8	58 90	23 92	89 04	65 12	13.29	49 47	36 18	20 56
71	859 8	60 45	25 67	87 92	62 25	14 26	48.84	34 58	21 67
73	882 2	62 02	27 52	86 69	59 17	15 29	48 16	32 87	22.78
75	905 1	63 63	29 50	85.33	55 83	16 39	47 41	31 02	23.89
77	928 4	65 27	31 62	83 80	52 17	17 57	46 56	28 98	25 00
79	952 2	66 95	33 95	82 06	48 11	18 86	45 59	26 73	26 11
81	976 5	68 65	36 54	80 03	43 49	20 30	44 46	24 16	27 22
83	1001 0	70 377	39 53	77 60	38 07	21 96	43 11	21 15	28 33
85	1027 0	72 205	43 18	74 47	31 29	23 99	41 37	17 38	29 44
86	1039 0	73 049	45 45	72 46	27 00	25 25	40 26	15 00	30 00
87	1052 0	73 963	48 32	69 84	21 52	26 84	38 80	11 96	30 56
88	1065 0	74 877	52 78	65 62	12 84	29 32	36 46	7 133	31 11

PROPERTIES (Continued)

Carbon Dioxide, CO_2

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density sat. vap. lb /ft.³	Density sat. vap. kg/m³	Dens. liq. lb./ft.³	Entropy from 32°F BTU/lb./°F Liq.	Entropy from 32°F BTU/lb./°F Vap.	Temp. °C
−20	0 4166	0 02601	2 401	38 46	64 34	−0 0514	0 2353	−28 89
−18	4018	02508	2 489	39 87	64 15	− .0495	.2342	−27 78
−16	3876	02420	2 580	41 33	63 94	− .0476	2331	−26 67
−14	3739	02334	2 674	42 83	63 73	− 0458	2319	−25 56
−12	.3608	02252	2 772	44 40	63 49	− 0439	.2307	−24 44
−10	0 3482	0 02174	2 872	46 00	63 25	−0 0420	0 2296	−23 33
− 8	3360	02098	2 976	47 67	63 01	− 0401	2284	−22 22
− 6	.3243	02025	3 083	49 38	62 76	− 0382	2273	−21 11
− 4	.3131	01955	3 194	51 16	62 50	− 0362	.2261	−20 00
− 2	3022	01887	3 309	53 00	62 23	− .0343	.2249	−18 89
0	0 2918	0 01822	3 427	54 89	61 95	−0 0324	0 2237	−17 78
2	2817	01759	3 550	56 86	61 65	− 0304	2225	−16 67
4	2720	01698	3 676	58 88	61 36	− .0285	2213	−15 56
6	.2627	01640	3 807	60 98	61 07	− 0266	.2201	−14 44
8	.2537	01584	3 942	63 14	60 77	− 0246	.2189	−13 33
10	0 2450	0 01529	4 082	65 39	60 48	−0 0226	0 2176	−12 22
12	2366	01477	4 227	67 71	60 18	− 0206	2164	−11 11
14	.2285	01426	4 377	70 11	59 88	− .0186	2151	−10 00
16	2207	01378	4 532	72 59	59 58	− 0166	2139	− 8 89
18	2131	01330	4 692	75 16	59 27	− 0146	2126	− 7 78
20	0 2058	0 01285	4 859	77 83	58 95	−0 0126	0 2113	− 6 67
22	1987	01240	5 031	80 59	58 64	− 0105	2100	− 5 56
24	1919	01198	5 211	83 47	58 31	− 0085	2087	− 4 44
25	1886	01177	5 303	84 94	58 14	− 0074	2080	− 3 89
27	1821	01137	5 492	87 97	57 81	− 0053	2066	− 2 78
29	0 1758	0 01097	5 688	91 11	57 47	−0 0032	0 2053	− 1 67
31	.1697	01059	5 892	94 38	57 12	− 0011	2039	− 0 56
33	1639	01023	6 103	97 76	56 77	+ 0011	2025	+ 0 56
35	.1581	009870	6 323	101 3	56 41	.0033	2010	1 67
37	1526	009527	6 553	105 0	56 03	0055	.1996	2 78
39	0 1472	0 009189	6 792	108 8	55 65	0 0077	0 1981	3 89
41	1420	.008865	7 040	112 8	55 25	0099	.1965	5 00
43	.1370	008553	7 300	116 9	54 84	.0122	.1950	6 11
45	1321	008247	7 571	121 3	54 41	.0146	1934	7 22
47	1273	007947	7 854	125 8	53 97	.0169	1918	8 33
49	0 1227	0 007660	8 151	130 6	53 51	0 0193	0.1901	9 44
51	1182	.007379	8 461	135 5	53 04	0218	.1884	10 56
53	.1138	007104	8 787	140 8	52 55	0243	.1867	11 67
55	1095	006836	9 132	146 3	52 05	.0268	.1849	12 78
57	1053	006574	9 497	152 1	51 53	.0294	1830	13 89
59	0 1012	0 006318	9 880	158 3	50 99	0 0321	0 1811	15 00
61	0972	00607	10 29	164 8	50 42	.0348	.1790	16 11
63	0933	00582	10 72	171 7	49 80	.0377	1770	17.22
65	0894	00558	11 18	179 1	49 14	.0406	.1748	18 33
67	0856	00534	11 67	186 9	48 44	.0436	1725	19 44
69	0 0819	0 00511	12 21	195 6	47 69	0 0468	0 1701	20 56
71	0782	00488	12 82	205 4	46 87	.0501	.1675	21 67
73	0745	00465	13 43	215.1	45 99	.0536	1647	22 78
75	0708	00442	14 13	226.3	45 05	.0573	1618	23 89
77	0671	00419	14 90	238 7	44 06	.0613	1585	25 00
79	0 0633	0 00395	15 81	253 2	43 04	0 0656	0 1550	26 11
81	0592	00370	16 90	270 7	41 95	0704	.1509	27 22
83	0548	00342	18 25	292 3	40 62	.0759	.1461	28 33
85	0500	00312	20 00	320 4	38 76	.0826	.1401	29 44
86	0474	00296	21 09	337 8	37 41	0868	.1363	30 00
87	0 0446	0 00278	22 42	359 1	35 34	0 0921	0.1314	30 56
88	0401	00250	24 95	399.6	32 79	.1002	1237	31 11

Sulfur Dioxide, SO_2

Temp. °F	Abs. press. sat. vap. lb./in.²	Abs. press. sat. vap. kg/cm²	Heat content abv. −40°F BTU/lb. Liq.	Heat content abv. −40°F BTU/lb. Vap.	Ht. of vaporiz. BTU/lb.	Heat content abv. −40°C g-cal./g Liq.	Heat content abv. −40°C g-cal./g Vap.	Ht. of vaporiz. g-cal./g	Temp. °C
−40	3 136	0.2205	0 00	178 61	178 61	0.00	99.228	99 228	−40 00
−30	4 331	.3045	2 93	179.90	176 97	1 63	99 945	98.317	−34 44
−20	5.883	.4136	5 98	181 07	175 09	3 32	100 59	97 272	−28 89
−10	7 863	.5528	9 16	182 13	172 97	5 09	101.18	96 095	−23.33
0	10 35	7277	12 44	183.07	170 63	6 911	101 71	94 795	−17.78
2	10 91	0.7670	13 12	183 25	170.13	7.289	101.81	94 517	−16 67
4	11 50	.8085	13 78	183 41	169 63	7 656	101 89	94 239	−15 56
5	11 81	8303	14 11	183 49	169 38	7 839	101 94	94 100	−15 00
6	12 12	.8521	14 45	183 57	169 12	8 028	101 98	93 956	−14 44
8	12 75	.8964	15.13	183 73	168 60	8 406	102 07	93 667	−13 33
10	13 42	0 9435	15 80	183.87	168 07	8 778	102 15	93 372	−12 22
12	14 12	.9927	16 48	184 01	167 53	9 156	102 23	93 072	−11 11
14	14 84	1.043	17 15	184 14	166 97	9 528	102 30	92 761	−10 00
16	15 59	1 096	17 84	184 28	166 44	9 911	102 38	92 467	− 8 89
18	16 37	1 1509	18 52	184 40	165 88	10 29	102 44	92 156	− 7 78
20	17 18	1 208	19.20	184 52	165 32	10 67	102 51	91 845	− 6 67
22	18 03	1 268	19 90	184 64	164 74	11 06	102 58	91 522	− 5 56
24	18 89	1 328	20 58	184 74	164 16	11 43	102 63	91 200	− 4 44
26	19 80	1 392	21 26	184 84	163 58	11 81	102 69	90 878	− 3 33
28	20 73	1.457	21.96	184 94	162 98	12 20	102 74	90 545	− 2 22
30	21 70	1 526	22 64	185 02	162 38	12 58	102 79	90 211	− 1.11
32	22 71	1 597	23 33	185 10	161 77	12 96	102 83	89 872	0 00
34	23 75	1 670	24 03	185 18	161 15	13 35	102 88	89 528	+ 1 11
36	24 82	1 745	24 72	185 25	160 53	13 73	102 92	89 183	2 22
38	25 95	1.824	25 42	185 31	159 89	14 12	102 95	88 828	3 33
40	27 10	1 905	26 12	185 37	159 25	14 51	102 98	88 472	4 44
42	28 29	1 989	26 81	185 42	158 61	14 89	103 01	88 117	5 56
44	29 52	2 075	27 51	185 46	157 95	15 28	103 03	87 750	6 67
46	30 79	2 165	28 21	185 50	157 29	15 67	103 06	87 383	7 78
48	32 10	2.257	28 92	185 54	156 62	16 07	103 08	87 011	8 89
50	33 45	2.352	29.61	185.56	155 95	16 45	103 09	86 639	10 00
52	34 86	2 451	30 31	185 58	155 27	16 84	103.10	86 261	11 11
54	36 31	2 553	31 00	185 59	154 59	17 22	103 11	85 883	12 22
56	37 80	2 658	31.72	185.61	153 89	17 62	103 12	85 495	13 33
58	39 33	2 765	32 42	185.61	153 19	18 01	103 12	85 106	14 44
60	40 93	2 878	33 10	185 59	152 49	18 39	103 11	84 717	15 56
62	42 58	2 994	33 79	185 57	151 78	18 77	103 09	84.322	16 67
64	44 27	3 112	34 49	185 55	151 06	19.16	103 08	83 922	17 78
66	46 00	3 234	35 19	185.53	150 34	19 55	103 07	83 522	18 89
68	47 78	3 359	35 88	185 50	149 62	19 93	103 06	83 122	20 00
70	49 62	3 489	36 58	185 46	148 88	20 32	103 03	82 711	21 11
72	51 54	3 624	37 28	185 42	148 14	20 71	103 01	82 300	22 22
74	53 48	3 760	37 97	185.37	147 40	21 09	102 98	81 889	23 33
76	55 48	3 901	38 67	185 31	146 64	21 48	102 95	81 467	24 44
78	57 56	4 047	39 36	185 24	145.88	21 87	102 91	81 045	25 56
80	59 68	4 196	40 05	185 17	145 12	22 25	102 87	80 622	26 67
82	61 88	4 351	40 73	185.09	144 36	22 63	102 83	80 200	27 78
84	64 14	4 509	41 43	185 01	143 58	23 02	102 78	79 767	28 89
86	66 45	4 672	42 12	184 92	142 80	23 40	102 73	79 333	30 00
88	68 84	4.840	42 80	184 82	142 02	23 78	102 68	78 900	31 11
90	71 25	5.009	43 50	184 72	141 22	24 17	102 62	78 456	32 22
92	73 70	5 182	44 19	184.61	140 42	24 55	102 56	78 011	33 33
94	76 30	5 364	44 86	184 49	139 62	24 92	102 49	77 567	34 44
96	79 03	5 556	45 54	184 37	138 83	25 30	102 43	77 128	35 56
98	81 77	5 749	46 22	184 25	138 03	25 68	102 36	76 683	36 67
100	84 52	5 942	46 90	184.10	137 20	26 06	102 28	76 222	37 78

Sulfur Dioxide, SO_2

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density sat. vap. lb./ft.³	Density sat. vap. kg/m³	Dens. liq. lb./ft.³	Entropy from −40°F BTU/lb./°F Liq.	Entropy from −40°F BTU/lb./°F Vap.	Temp. °C
−40	22 42	1.400	0 04460	0 7144	95.79	0 00000	0 42562	−40 00
−30	16.56	1 034	.06039	0 9673	94.94	.00674	41864	−34 44
−20	12.42	0 7754	08119	1.301	94.10	01366	41192	−28 89
−10	9.44	.5893	1025	1.642	93 27	02075	.40544	−23 33
0	7.280	.4545	1374	2 201	92.42	.02795	39917	−17 78
2	6.923	0.4322	0 1444	2 313	92 25	0 02941	0 39794	−16 67
4	6 584	.4110	1501	2 404	92 08	.03084	.39670	−15 56
5	6 421	.4009	.1558	2 496	92 00	03155	.39609	−15 00
6	6 266	.3912	.1596	2 556	91.91	.03228	39547	−14 44
8	5.967	.3725	1676	2 685	91 74	03373	39426	−13 33
10	5 682	0 3547	0 1760	2.819	91 58	0 03519	0 39306	−12 22
12	5.417	.3382	.1846	2.957	91.41	03664	39185	−11 11
14	5 164	.3224	1936	3 101	91 24	03808	.39065	−10 00
16	4 926	.3075	2030	3 252	91 07	.03953	38946	− 8 89
18	4.701	.2935	2127	3 407	90 89	04098	38827	− 7 78
20	4 487	0 2801	0 2228	3 569	90.71	0 04241	0 38707	− 6 67
22	4 287	2676	2332	3 735	90 53	.04385	38589	− 5 56
24	4.096	.2557	.2441	3 910	90.33	.04528	38471	− 4 44
26	3 915	.2444	2559	4 099	90.15	.04671	38354	− 3 33
28	3.744	.2337	2671	4 278	89.96	.04814	.38237	− 2 22
30	3 581	0 2236	0 2800	4 485	89 76	0 04956	0 38119	− 1 11
32	3 437	2146	2909	4 660	89 58	05099	38003	0 00
34	3 283	.2050	3046	4 879	89 39	.05242	37887	+ 1 11
36	3 144	.1963	3181	5 095	89.18	05384	37772	2 22
38	3 013	.1881	3319	5.316	89 00	05527	37657	3 33
40	2 887	0 1802	0 3464	5 549	88 81	0 05668	0 37541	4 44
42	2 769	.1729	.3611	5 784	88 62	05809	37425	5 56
44	2 656	1658	3765	6 031	88 43	05949	37311	6 67
46	2 548	1591	3925	6 287	88 24	06090	37197	7 78
48	2 446	1527	4088	6.548	88 05	06231	37083	8 89
50	2 348	0 1466	0 4259	6.822	87 87	0 06370	0 36969	10 00
52	2.256	1408	4433	7.101	87 67	06509	36857	11 11
54	2.167	1353	.4615	7 392	87 51	06646	36743	12 22
56	2 083	1300	4801	7 690	87 31	06785	36629	13 33
58	2 003	1250	4992	7.996	87.13	06923	36517	14 44
60	1.926	0 1202	0.5194	8 320	86 95	0 07060	0 36405	15 56
62	1 853	.1157	.5396	8 643	86 77	.07196	36293	16 67
64	1 783	.1113	.5609	8 984	86 59	.07333	.36181	17.78
66	1 716	1071	.5827	9 334	86 41	07469	.36070	18 89
68	1.652	.1031	6054	9 697	86 22	07602	.35958	20.00
70	1 590	0 09926	0 6290	10 08	86 02	0 07736	0 35846	21 11
72	1 532	09564	6527	10 45	85 82	07871	.35736	22 22
74	1 476	09214	.6777	10 86	85 62	08003	.35624	23 33
76	1 422	08877	7030	11 26	85 42	08135	.35512	24 44
78	1 371	.08559	7295	11 69	85 23	08268	35401	25 56
80	1.321	0 08247	0 7570	12 13	85 03	0 08399	0 35291	26 67
82	1 274	07953	7850	12 57	84 84	.08525	35177	27 78
84	1 229	.07672	8140	13 04	84 64	.08653	35065	28 89
86	1 185	.07398	.8440	13 52	84.44	.08783	34954	30 00
88	1.144	.07142	8740	14 00	84 25	.08910	.34843	31 11
90	1.104	0.06892	0 9058	14 51	84 05	0 09038	0.34731	32 22
92	1 065	06649	9390	15 04	83 86	.09165	34620	33 33
94	1.028	.06418	9730	15 59	83 67	09389	.34508	34 44
96	0 9931	.06200	1.007	16 13	83 47	09411	.34397	35.56
98	0 9591	05987	1 043	16 71	83 27	.09532	.34285	36.67
100	0.9262	0 05782	1.080	17 30	83 07	0 09657	0 34173	37 78

Butane, $CH_3(CH_2)_2CH_3$

Temp. °F	Abs. press. sat. vap. lb./in.²	Abs. press. sat. vap. kg/cm²	Heat content abv. 32°F BTU/lb. Liq.	Heat content abv. 32°F BTU/lb. Vap.	Ht. of vaporiz. BTU/lb.	Heat content abv. 0°C g-cal./g Liq.	Heat content abv. 0°C g-cal./g Vap.	Ht. of vaporiz. g-cal./g	Temp. °C
0	7.3	0.51	−17.2	153.3	170.5	−9.56	85.17	94.72	−17.78
10	9.2	0.65	−11.7	156.8	168.5	−6.50	87.11	93.61	−12.22
20	11.6	0.816	−6.7	160.3	167.0	−3.7	89.06	92.78	−6.67
30	14.4	1.01	−1.2	164.3	165.5	−0.67	91.28	91.94	−1.11
40	17.7	1.24	+4.3	167.8	163.5	+2.4	93.22	90.83	+4.44
50	21.6	1.52	9.8	171.3	161.5	5.4	95.17	89.72	10.00
60	26.3	1.85	15.8	175.3	159.5	8.78	97.39	88.61	15.56
70	31.6	2.22	21.3	178.8	157.5	11.8	99.33	87.50	21.11
80	37.6	2.64	27.3	182.3	155.0	15.2	101.3	86.11	26.67
90	44.5	3.13	33.8	185.8	152.0	18.8	103.2	84.44	32.22
100	52.2	3.67	39.8	189.3	149.5	22.1	105.2	83.06	37.78
110	60.8	4.27	46.3	193.3	147.0	25.7	107.4	81.67	43.33
120	70.8	4.98	52.8	196.3	143.5	29.3	109.1	79.72	48.89
130	81.4	5.72	59.3	199.8	140.5	32.9	111.0	78.06	54.44
140	92.6	6.51	66.3	203.8	137.5	36.8	113.2	76.39	60.00

Isobutane, $(CH_3)_3CH$

Temp. °F	Abs. press. sat. vap. lb./in.²	Abs. press. sat. vap. kg/cm²	Heat content abv. 32°F BTU/lb. Liq.	Heat content abv. 32°F BTU/lb. Vap.	Ht. of vaporiz. BTU/lb.	Heat content abv. 0°C g-cal./g Liq.	Heat content abv. 0°C g-cal./g Vap.	Ht. of vaporiz. g-cal./g	Temp. °C
−20	7.50	0.527	−25.5	140.0	165.5	−14.2	77.78	91.94	−28.89
−10	9.28	0.652	−21.0	142.0	163.0	−11.7	78.89	90.56	−23.33
0	11.6	0.816	−16.5	144.0	160.5	−9.17	80.00	89.17	−17.78
+10	14.6	1.03	−11.5	147.0	158.5	−6.39	81.67	88.06	−12.22
20	18.2	1.28	−6.5	149.5	156.0	−3.6	83.06	86.67	−6.67
30	22.3	1.57	−1.0	152.5	153.5	−0.56	84.72	85.28	−1.11
40	26.9	1.89	+4.5	155.5	151.0	+2.5	86.39	83.89	+4.44
50	32.5	2.28	10.5	159.0	148.5	5.83	88.33	82.50	10.00
60	38.7	2.72	16.5	162.5	146.0	9.17	90.28	81.11	15.56
70	45.8	3.22	23.0	166.5	143.5	12.8	92.50	79.72	21.11
80	53.9	3.79	30.0	170.5	140.5	16.7	94.72	78.06	26.67
90	63.3	4.45	37.0	174.5	137.5	20.6	96.94	76.39	32.22
100	73.7	5.18	44.5	179.0	134.5	24.7	99.44	74.72	37.78
110	85.1	5.98	52.5	183.5	131.0	29.2	101.9	72.78	43.33
120	98.0	6.89	60.5	188.0	127.5	33.6	104.4	70.83	48.89
130	112.0	7.87	69.5	193.5	124.0	38.6	107.5	68.89	54.44
140	126.8	8.915	78.5	199.0	120.5	43.6	110.6	66.94	60.00

Propane, C_3H_8

Temp. °F	Abs. press. sat. vap. lb./in.²	Abs. press. sat. vap. kg/cm²	Heat content abv. 32°F BTU/lb. Liq.	Heat content abv. 32°F BTU/lb. Vap.	Ht. of vaporiz. BTU/lb.	Heat content abv. 0°C g-cal./g Liq.	Heat content abv. 0°C g-cal./g Vap.	Ht. of vaporiz. g-cal./g	Temp. °C
−70	7.37	0.518	−55.2	134.3	189.5	−30.7	74.61	105.3	−56.67
−60	9.72	0.683	−50.2	136.8	187.0	−27.9	76.00	103.9	−51.11
−50	12.6	0.886	−44.7	139.8	184.5	−24.8	77.67	102.5	−45.56
−40	16.2	1.14	−39.7	141.8	181.5	−22.1	78.78	100.8	−40.00
−30	20.3	1.43	−34.2	144.8	179.0	−19.0	80.44	99.44	−34.44
−20	25.4	1.79	−29.2	146.8	176.0	−16.2	81.56	97.78	−28.89
−10	31.4	2.21	−23.7	149.8	173.5	−13.2	83.22	96.39	−23.33
0	38.2	2.69	−18.2	152.3	170.5	−10.1	84.61	94.72	−17.78
+10	46.0	3.23	−12.7	155.3	168.0	−7.06	86.28	93.33	−12.22
20	55.5	3.90	−7.2	157.8	165.0	−4.0	87.67	91.67	−6.67
30	66.3	4.66	−1.2	160.8	162.0	−0.67	89.33	90.00	−1.11
40	78.0	5.48	+4.8	163.8	159.0	+2.7	91.00	88.33	+4.44
50	91.8	6.45	10.8	166.8	156.0	6.00	92.67	86.67	10.00
60	107.1	7.530	16.8	169.8	153.0	9.33	94.33	85.00	15.56
70	124.0	8.718	22.8	172.3	149.5	12.7	95.72	83.06	21.11
80	142.8	10.04	29.3	175.3	146.0	16.3	97.39	81.11	26.67
90	164.0	11.53	35.8	178.3	142.5	19.9	99.06	79.17	32.22
100	187.0	13.15	42.3	180.8	138.5	23.5	100.4	76.94	37.78
110	213.0	14.98	48.8	182.8	134.0	27.1	101.6	74.44	43.33
120	240.0	16.87	55.3	184.3	129.0	30.7	102.4	71.67	48.89

PROPERTIES (Continued)

Butane, $CH_3(CH_2)_2CH_3$

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density of sat. vap. lb./ft.³	Density of sat. vap. kg/m³	Density of liq. lb./ft.³	Density of liq. kg/m³	Temp. °C
0	11.1	0 693	0 0901	1.44	38.59	618.1	−17.78
10	8.95	.559	.112	1 79	38.24	612.5	−12.22
20	7.23	.451	.138	2 21	37.89	606.9	− 6.67
30	5.90	.368	.169	2.71	37.54	601.3	− 1.11
40	4.88	.305	.205	3 28	37 19	595.7	+ 4.44
50	4 07	.254	.246	3 94	36.82	589.8	10 00
60	3 40	.212	.294	4 71	36 45	583.9	15 56
70	2.88	.180	347	5 56	36.06	577.6	21.11
80	2.46	154	.407	6 52	35 65	571 0	26 67
90	2 10	.131	.476	7 62	35.24	564.5	32.22
100	1 81	113	.552	8 84	34.84	558.1	37.78
110	1.58	.0986	633	10.1	34.41	551.2	43.33
120	1 38	.0862	.725	11.6	33.96	544.0	48 89
130	1 21	.0755	826	13 2	33.49	536.4	54.44
140	1 07	.0668	.934	15 0	32 98	528 3	60.00

Isobutane, $(CH_3)_3CH$

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density of sat. vap. lb./ft.³	Density of sat. vap. kg/m³	Density of liq. lb./ft.³	Density of liq. kg/m³	Temp. °C
−20	10 5	0 655	0.0952	1 52	38 35	614 3	−28 89
−10	8 91	.556	.112	1 79	37 95	607.9	−23 33
0	7 17	448	139	2 23	37.60	602 3	−17 78
+10	5.75	.359	.174	2.79	37.20	595.9	−12.22
20	4.68	.292	.214	3 43	36.80	589.5	− 6.67
30	3 86	241	259	4 15	36 40	583 1	− 1 11
40	3.22	.201	.311	4.98	36.00	576 6	+ 4 44
50	2.71	169	.369	5 91	35.60	570.2	10 00
60	2.28	142	.439	7.03	35.20	563.8	15 56
70	1.94	.121	.515	8 25	34.80	557.4	21 11
80	1 66	.104	.602	9.64	34.35	550.2	26 67
90	1.42	0886	.704	11 3	33.90	543.0	32 22
100	1.23	0768	.813	13 0	33.45	535.8	37.78
110	1 07	0668	.935	15.0	33.00	528.6	43.33
120	0 926	0578	1.08	17 3	32.50	520.6	48 89
130	0 811	0506	1.23	19.7	32.00	512 6	54 44
140	0 716	0447	1 32	21 1	31 80	509 4	60.00

Propane, C_3H_8

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density of sat. vap. lb./ft.³	Density of sat. vap. kg/m³	Density of liq. lb./ft.³	Density of liq. kg/m³	Temp. °C
−70	12.9	0 805	0 0775	1.24	37.40	599 1	−56.67
−60	9 93	620	.111	1 78	37.00	592 7	−51.11
−50	7 74	483	.129	2 07	36.60	586.3	−45 56
−40	6 13	.383	.163	2 61	36.19	579.7	−40 00
−30	4 93	.308	.203	3 25	35.78	573.1	−34 44
−20	4 00	.250	.250	4 00	35.37	566.6	−28 89
−10	3 26	.204	.307	4.92	34.96	560.0	−23 33
0	2 71	.169	.369	5.91	34.54	553.3	−17 78
+10	2 27	.142	.441	7 06	34.12	546.5	−12 22
20	1 90	.119	.526	8 43	33.67	539.3	− 6.67
30	1.60	.0999	.625	10 0	33.20	531.8	− 1.11
40	1.37	0855	.730	11.7	32.73	524.3	+ 4 44
50	1 18	0737	.847	13.6	32.24	516.4	10 00
60	1 01	.0631	.990	15.9	31.75	508.6	15.56
70	0 883	.0551	1.13	18.1	31.24	500.4	21 11
80	0 770	0481	1.30	20 8	30.70	491.8	26 67
90	0 673	.0420	1.49	23 9	30.15	482.9	32.22
100	0 591	.0369	1.69	27 1	29 58	473.8	37.78
110	0 519	.0324	1.96	31 4	28 85	462.1	43.33
120	0.459	0287	2.18	34.9	28 30	453 3	48.89

Difluorodichloromethane, CCl_2F_2 ("F-12")

Temp. °F	Abs. press. sat. vap. lb /in.²	kg/cm²	Heat content abv. −40°F BTU/lb. Liq.	Vap.	Ht. of vaporiz. BTU/lb.	Heat content abv. −40°C g-cal./g Liq.	Vap.	Ht. of vaporiz. g-cal./g	Temp. °C
−40	9 32	0 655	0	73.50	73 50	0	40 83	40.83	−40 00
−30	12 02	0 845	2 03	74 70	72.67	1 13	41 50	40 37	−34 44
−20	15 28	1 074	4 07	75 87	71.80	2.26	42 15	39.89	−28 89
−10	19 20	1 350	6.14	77 05	70 91	3.41	42.81	39.39	−23 33
0	23 87	1 678	8.25	78 21	69.96	4 58	43 45	38.87	−17 78
+10	29 35	2 064	10 39	79 36	68.97	5 772	44 09	38 32	−12 22
20	35 75	2.513	12 55	80 49	67.94	6.972	44 72	37 74	− 6 67
30	43 16	3.034	14.76	81 61	66 85	8 200	45 34	37 14	− 1 11
40	51 68	3 633	17 00	82 71	65 71	9 444	45.95	36 51	+ 4 44
50	61 39	4 316	19 27	83.78	64.51	10 71	46 54	35.84	10 00
60	72 41	5 091	21 57	84 82	63 25	11 98	47.12	35 14	15 56
70	84 82	5.963	23.90	85 82	61.92	13 28	47 68	34 40	21 11
80	98 76	6 944	26 28	86 80	60.52	14 60	48 22	33.62	26 67
90	114 3	8 036	28.70	87 74	59 04	15 94	48 74	32 80	32 22
100	131 6	9 252	31 16	88 62	57.46	17.31	49 23	31 92	37 78
110	150 7	10 60	33 65	89.43	55.78	18 69	49 68	30 99	43 33
120	171 8	12 08	36.16	90 15	53.99	20 09	50 08	29 99	48 89

Carbon Disulfide, CS_2

Temp. °F	Abs. press. sat. vap. lb./in.²	kg/cm²	Heat content abv. 32°F BTU/lb. Liq.	Vap.	Ht. of vaporiz. BTU/lb.	Heat content abv. 0°C g-cal./g Liq.	Vap.	Ht. of vaporiz. g-cal./g	Temp. °C
0	1 10	0 0773	− 8 60	156 90	165 5	− 4 78	87 167	91 94	−17 78
10	1 46	103	− 5 60	158 90	164 5	− 3.11	88 278	91 39	−12 22
20	1 89	133	− 3 00	160 20	163.2	− 1 67	89 000	90 67	− 6 67
30	2 36	166	− 0 50	161 70	162.2	− 0 28	89 833	90 11	− 1 11
40	3 03	.213	+ 2 05	163.25	161 2	+ 1.14	90 695	89 56	+ 4 44
50	3.90	274	4 24	164 24	160.0	2.36	91 245	88 89	10 00
60	4.95	348	7.20	166 40	159.2	4 00	92 445	88 44	15 56
70	5 85	411	9 80	167 90	158.1	5 44	93 278	87.83	21 11
80	7.30	513	11 70	168 60	156.9	6 500	93 667	87 17	26 67
90	9 15	643	13.80	169 40	155.6	7.667	94.111	86 44	32 22
100	11 08	7790	16 15	170 55	154 4	8 972	94.750	85 78	37 78
110	13 50	.9491	18 30	171 50	153 2	10 17	95.278	85 11	43 33
120	16 10	1.132	20 01	172 01	152.0	11.12	95.561	84 44	48 89

Carbon Tetrachloride, CCl_4

20	0 40	0 028	− 2 00	92.45	94.45	− 1 11	51 36	52 47	− 6 67
30	0 60	042	− 0 25	93.45	93.70	− 0 14	51 92	52 06	− 1 11
40	0 84	059	+ 1.60	94 80	93.20	+ 0.889	52 67	51 78	+ 4 44
60	1.42	100	5 95	98 15	92.20	3 31	54 53	51 22	15 56
70	1 85	130	8 20	99.53	91 40	4 56	55 29	50 78	21 11
80	2 40	169	9 80	99 87	90.07	5 44	55 48	50 04	26 67
90	3 12	219	11 60	101 62	90.02	6.444	56 46	50 01	32 22
100	4 00	281	13 40	102 80	89 40	7.444	57 11	49 67	37 78
110	4 89	.344	15 80	104 50	88.70	8.778	58.06	49 28	43 33
120	5 95	418	18 06	105 90	87.90	10 03	58 83	48 83	48 89

Ethyl Ether, $(C_2H_5)_2O$

0	1 3	0 091	−18.00	153 00	171.0	−10.00	85 000	95 00	−17 78
10	1.8	.13	−12 0	158 43	170.4	− 6.67	88 017	94 67	−12 22
20	2 5	.18	− 6 50	163 50	170.0	− 3.61	90.833	94.44	− 6 67
30	3.4	.24	− 1.50	167.90	169.4	− 0.833	93 278	94.11	− 1 11
40	4.4	.31	+ 4 00	172.40	168.4	+ 2.22	95.778	93 56	+ 4 44
50	5 5	.39	9 57	177 17	167 6	5.32	98.428	93 11	10 00
70	8 8	.62	20 04	185.44	165 4	11 13	103 02	91 89	21 11
80	10 9	.766	26 40	190 60	164 2	14 67	105 89	91 22	26 67
90	13 4	942	31 50	194 50	163 0	17 50	108.06	90.56	32 22
100	16 0	1 12	36 50	197 50	161 5	20 28	109 72	89 72	37 78

Difluorodichloromethane, CCl_2F_2 ("F-12")

Temp. °F	Spec. vol sat. vap. ft³/lb.	Spec. vol sat. vap. m³/kg	Density of vap. lb./ft.³	Density of vap. kg/m³	Dens. liq. lb /ft.³	Entropy from −40°F BTU/lb./°F Liq.	Entropy from −40°F BTU/lb./°F Vap.	Temp. °C
−40	3.911	0 2442	0 2557	4.096	94 58	0	0.17517	−40 00
−30	3.088	1928	.3238	5 187	93 59	0 00471	.17387	−34.44
−20	2.474	.1544	4042	6 474	92.58	.00940	.17275	−28.89
−10	2.003	.1250	.4993	7.998	91 57	.01403	.17175	−23 33
0	1.637	.1022	.6109	9 785	90 52	.01869	17091	−17 78
+10	1.351	08434	7402	11.86	89 45	.02328	.17015	−12 22
20	1.121	.06998	8921	14 29	88.37	.02783	.16949	− 6.67
30	0.939	0586	1 065	17 06	87 24	.03233	16887	− 1 11
40	.792	0494	1 263	20 23	86 10	.03680	.16833	+ 4 44
50	673	0420	1.485	23 79	84 94	.04126	16785	10.00
60	575	0359	1.740	27.87	83 78	.04568	16741	15 56
70	493	0308	2 028	32.48	82 60	05009	.16701	21.11
80	.425	0265	2 353	37.69	81 39	05446	16662	26 67
90	368	.0230	2 721	43 58	80 11	05882	.16624	32.22
100	.319	0199	3 135	50 22	78 80	06316	16584	37 78
110	.277	.0173	3 610	57 82	77 46	06749	16542	43.33
120	240	0150	4 167	66 75	76 02	07180	16495	48 89

Carbon Disulfide, CS_2

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density sat. vap. lb./ft.³	Density sat. vap. kg/m³	Temp. °C
0	53 76	3 356	0 0186	0 2979	−17 78
10	43 47	2 714	.0230	.3684	−12 22
20	34 84	2 175	.0287	.4597	− 6 67
30	29.49	1.841	0339	5430	− 1 11
40	23.52	1.468	0425	6808	+ 4 44
50	20 60	1.286	.0482	7721	10 00
60	18 00	1 124	.0555	8890	15.56
70	13.20	0 824	.0758	1 214	21.11
80	10 40	0.649	.0961	1 539	26 67
90	8 30	0 518	.1204	1 929	32 22
100	7 03	0.439	.1369	2 193	37.78
110	5 80	0 362	.1724	2 762	43 33
120	5 10	0 318	.1960	3.140	48 89

Carbon Tetrachloride, CCl_4

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density sat. vap. lb./ft.³	Density sat. vap. kg/m³	Temp. °C
20	69 5	4 34	0 01438	0 2303	− 6.67
30	53 0	3.31	.01886	3021	− 1.11
40	40 0	2.50	02500	4005	+ 4 44
60	24 0	1 50	.04166	6673	15 56
70	19 5	1.22	.05128	.8214	21.11
80	16 0	0 999	.06345	1.016	26.67
90	13 0	0 812	07692	1 232	32 22
100	10 0	0 624	1000	1 602	37.78
110	8 5	0 53	.1176	1 884	43.33
120	7 5	0 47	1333	2 135	48 89

Ethyl Ether, $(C_2H_5)_2O$

Temp. °F	Spec. vol. sat. vap. ft.³/lb.	Spec. vol. sat. vap. m³/kg	Density sat. vap. lb./ft.³	Density sat. vap. kg/m³	Temp. °C
0	38 0	2.37	0 0263	0.4213	−17.78
10	32 5	2 03	0332	5318	−12 22
20	27.0	1.69	0372	5959	− 6 67
30	21 4	1.34	0468	.7496	− 1.11
40	17.0	1.06	0588	9419	+ 4 44
50	13.2	0.824	.0757	1.213	10.00
70	7 8	0.49	.1280	2 050	21.11
80	6 2	0.39	1620	2.595	26.67
90	5.1	0.32	.1960	3.140	32 22
100	4 5	0 28	2220	3 556	37 78

Methyl Chloride, CH_3Cl

Temp. °F	Abs. press. sat. vap. lb./in.^{2}	Abs. press. sat. vap. kg/cm^2	Heat content abv. 32°F BTU/lb. Liq	Heat content abv. 32°F BTU/lb. Vap	Ht. of vaporiz. BTU/lb.	Heat content abv. 0°C g-cal./g Liq.	Heat content abv. 0°C g-cal./g Vap.	Ht. of vaporiz. g-cal /g	Temp. °C
−20	11 75	0 8261	−19 0	167 36	186 36	−10 6	92 978	103 53	−28 89
−10	15 0	1.055	−15.38	168.83	184 21	− 8 544	93.795	102 34	−23 33
− 5	16 79	1 180	−13 58	169.54	183 12	− 7 544	94 189	101 73	−20 56
0	18 8	1 32	−11 75	170.23	181 98	− 6 528	94 572	101 10	−17 78
+ 5	21 0	1.48	− 9 93	170.96	180 84	− 5 517	94 978	100 47	−15 00
10	23 3	1.64	− 8.06	171.58	179.65	− 4 478	95 322	99 806	−12 22
15	25 9	1 82	− 6 74	172 24	178 47	− 3 744	95 689	99 150	− 9 44
20	28 8	2 02	− 4 32	172 95	177 27	− 2 400	96 083	98 483	− 6 67
25	31 8	2 24	− 2.48	173 63	176 10	− 1 378	96 461	97 833	− 3 89
30	35 2	2 47	− 0.62	174 28	174.90	− 0 344	96 822	97 167	− 1 11
35	38 7	2.72	+ 1.75	174 92	173 77	+ 0 972	97.178	96 539	+ 1 67
40	42 6	3 00	3 15	175.57	172 42	1.75	97 539	95 789	4 44
45	46 9	3 30	5 04	176.20	171 16	2 80	97 889	95 089	7 22
50	51 5	3.62	6.88	176 78	169 90	3 82	98 211	94 389	10 00
55	56 4	3.97	8 80	177 45	168 65	4 89	98.583	93 695	12 78
60	61 6	4 33	10 70	178 05	167 35	5 944	98 917	92 972	15.56
65	67 3	4 73	12 62	178 64	166 02	7.011	99 245	92.233	18 33
70	73 3	5 15	14.52	179.17	164.65	8 067	99 539	91 472	21 11
75	79 2	5 57	16 46	179 78	163.28	9 144	99 878	90.711	23 89
80	85 3	6 00	18 36	180 24	161 88	10 20	100 13	89 933	26 67
85	94 1	6 62	20 12	180 74	160 48	11.18	100 41	89 156	29 44
90	102 1	7 178	22 13	181 22	159.09	12 29	100 68	88 383	32 22
95	110 3	7 755	24 07	181 76	157.70	13 37	100 98	87 611	35 00
100	118 8	8 352	26 06	182 36	156.30	14 48	101 31	86 833	37 78

Mercury, Hg

Temp. °F	Abs. press. sat. vap. lb./in.^{2}	Abs. press. sat. vap. kg/cm^2	Heat content abv. 32°F BTU/lb. Liq.	Heat content abv. 32°F BTU/lb. Vap.	Ht. of vaporiz. BTU/lb.	Heat content abv. 0°C g-cal./g Liq.	Heat content abv. 0°C g-cal./g Vap	Ht. of vaporiz. g-cal./g	Temp. °C
402	0 4	0 03	13 81	141 96	128.15	7 672	78 867	71 195	205 56
444	0 8	0 06	15 36	142 60	127 24	8 533	79 222	70 689	228 89
458	1 0	0 07	15 89	142 81	126 92	8 828	79 339	70 511	236 67
485	1 5	0 11	16 90	143 23	126 33	9 389	79 572	70 183	251 67
505	2 0	0 14	17 65	143 54	125 89	9 806	79 745	69 939	262 78
558	4 0	0 28	19.62	144 34	124 72	10 90	80 189	69 289	292 22
591	6 0	0 42	20.87	144.86	123 99	11 59	80 478	68 883	310 56
617	8 0	0 56	21.81	145 24	123 43	12 12	80 689	68 572	325 00
637	10 0	0 703	22 58	145 56	122 98	12 54	80 867	68 322	336 11
676	15 0	1 05	24 04	146 16	122 12	13 36	81 200	67 844	357 78
706	20 0	1 41	25.15	146 61	121 46	13 97	81 450	67 478	374 44
730	25 0	1 76	26 05	146 98	120 93	14 47	81 656	67 183	387 78
751	30 0	2 11	26 81	147 29	120.48	14 89	81 828	66 933	399 44
769	35 0	2 46	27.49	147 57	120,08	15 27	81 983	66 711	409 44
785	40 0	2 81	28.08	147 81	119.73	15 60	82 117	66 517	418 33
799	45 0	3 16	28 62	148 04	119 42	15 90	82 245	66 344	426 11
812	50	3 5	29 11	148 24	119.13	16 17	82 356	66 183	433 33
836	60	4 2	29.99	148 60	118.61	16 66	82 556	65 894	446.67
857	70	4 9	30 75	148.90	118.15	17 08	82 722	65 639	458 33
875	80	5 6	31 44	149 19	117.75	17 47	82 883	65 417	468 33
892	90	6 3	32 06	149 44	117 38	17 81	83 022	65 211	477 78
907	100	7 03	32 63	149 68	117.05	18 13	83 156	65 028	486 11
921	110	7 73	33 16	149 90	116 74	18 42	83 278	64 856	493 89
934	120	8 44	33 66	150.10	116.44	18 70	83 389	64 689	501 11
947	130	9 14	34 12	150 29	116 17	18 96	83 495	64 539	508 33
958	140	9 84	34 55	150 47	115 92	19 19	83 595	64 400	514 44
969	150	10 5	34 96	150 63	115.67	19 42	83 683	64 261	520 56
1000	180	12 7	36 09	151.10	115 01	20 05	83 945	63 894	537 78

PROPERTIES (Concluded)

Methyl Chloride, CH_3Cl

Temp. °F	Spec. vol. sat. vap.		Spec. vol. liq.		Density sat. vap.		Density of liq.		Temp. °C
	ft.³/lb.	m³/kg	ft.³/lb.	m³/kg	lb /ft.³	kg/m³	lb./ft.³	kg/m³	
−20	8.09	.505	015827	0009880	0 124	1 98	63 185	1012.1	−28.89
−10	6 46	.403	.015985	0009979	.155	2 48	62 560	1002.1	−23.33
− 5	5 80	362	.016013	.0009997	.172	2.76	62 450	1000 3	−20.56
0	5.18	.323	.016146	001008	.193	3.09	61.936	992.09	−17.78
+ 5	4 68	.292	.016228	.001013	.214	3 42	61.623	987.08	−15.00
10	4.18	.261	.016310	001018	.239	3.83	61 311	982.08	−12 22
15	3.88	.242	.016388	001023	258	4 13	61 022	977 45	− 9.44
20	3 41	.213	.016474	001028	.293	4 70	60 702	972.32	− 6.67
25	3 09	.193	.016552	001033	324	5 18	60 415	967.73	− 3 89
30	2 81	.175	.016645	.001039	.356	5.70	60.077	962 31	− 1 11
35	2 50	.156	.016746	001045	.400	6.41	59 715	956 51	+ 1 67
40	2 31	.144	.016809	001049	.433	6.93	59 492	952 94	4.44
45	2 10	.131	.016929	001057	.476	7.63	59.069	946.17	7 22
50	1.93	.120	017023	001063	.518	8 30	58.745	940.98	10.00
55	1.75	.109	.017118	001069	.571	9.16	58 419	935.76	12 78
60	1 61	.101	017219	001075	.621	9 95	58 077	930.28	15 56
65	1 47	.0918	017318	001081	680	10 9	57 742	924 91	18.33
70	1.34	.0837	017421	001088	746	12 0	57.403	919 48	21 11
75	1 24	0774	.017526	.001094	.806	12 9	57.058	913.96	23.89
80	1 14	.0712	.017632	.001101	.877	14 1	56 714	908 44	26.67
85	1 05	0655	.017740	.001108	.952	15 3	56 369	902 92	29.44
90	0 98	.061	.017850	001114	1 02	16 3	56.022	897 36	32 22
95	0 91	.057	.017961	001121	1 10	17 6	55 675	891 80	35 00
100	0 85	053	018074	001128	1.18	18 8	55 327	886 23	37 78

Mercury, Hg

Temp °F	Spec. vol. sat. vap.		Density of sat. vap.		Entropy above 32°F BTU/lb./°F			Temp °C
	ft.³/lb.	m³/kg	lb./ft.³	kg/m³	Liq.	Vap.	Evap.	
402	114 50	7.1480	0 008733	0 1399	.0209	1696	.1487	205.56
444	59 72	3 728	016745	0 26822	.0227	.1635	.1408	228.89
458	48 45	3 025	02064	0 3306	.0233	.1616	.1383	236.67
485	33 14	2 069	03017	0 4833	0244	.1581	.1337	251.67
505	25 32	1 581	03948	0 6324	0251	.1556	.1305	262 78
558	13 26	0 8278	07540	1 208	0271	.1497	.1226	292 22
591	9 096	.5678	10993	1 7609	0283	.1462	.1179	310.56
617	6 9630	43469	14361	2 3003	0292	.1439	.1147	325 00
637	5 6610	.35341	.17664	2 8294	0299	.1420	.1121	336 11
676	3 8923	.24299	25691	4 1152	0312	.1387	.1075	357.78
706	2 983	1862	.3352	5 369	0322	.1364	.1042	374 44
730	2 429	.1516	.4117	6.595	0330	.1346	.1016	387.78
751	2.053	.1282	.4871	7 802	0336	.1331	.0995	399 44
769	1 7815	.11122	.5613	8 991	0342	.1319	0977	409.44
785	1 5762	.098399	.6344	10 16	0346	.1308	.0962	418 33
799	1 4147	088317	7069	11 32	0351	.1300	.0949	426 11
812	1 284	08016	.7788	12 47	0355	.1291	.0936	433 33
836	1 086	.06780	9204	14 74	0361	.1276	.0915	446 67
857	0 9436	05891	1 0597	16 974	0367	.1265	.0898	458.33
875	.8349	.05212	1 1977	19.185	.0372	.1254	.0882	468 33
892	.7497	04680	1 3338	21.365	0377	.1247	.0870	477.78
907	.6811	.04252	1 4682	23.518	.0381	.1237	.0856	486 11
921	.6242	.03897	1 6020	25 661	.0385	.1230	.0845	493 89
934	.5767	.03600	1 7340	27.775	.0389	.1224	.0835	501.11
947	.5360	.03346	1 8656	29 883	.0392	.1218	.0826	508.33
958	.5012	.03129	1 9952	31 959	0395	.1213	.0818	514 44
969	.4706	.02938	2 125	34 04	.0398	.1207	.0809	520 56
1000	.3990	02491	2 506	40.14	0406	1194	0788	537 78

HIGH AND LOW TEMPERATURES

Absolute zero, −273.18° C.

M p. of helium	−272 2° C.
B.p. of helium	−268 9
M p. of hydrogen......	−259 18
B.p. of hydrogen	−252.8
B.p. of liquid air	−192
Industrial furnaces.....	1700° C.
Bunsen burner...... .	1870
Oxy-hydrogen flame. .	2800
Tungsten tube furnace (Forsythe) . .	2800
Carbon arc furnace (Forsythe)	3200
Oxy-acetylene flame .	3500° C
Tungsten arc under pressure (Luckey)... . .	4785
Cored carbon arc (Suits).	5500
Iron welding arc (Suits)	6020
Tungsten arc, max. (Suits)...............	6440
Exploding wires by high voltage discharge (Anderson).......... . .	19700
The Sun (Coblentz) .	6000° K.
Stars, max. estimated	30000° K.

SCALE OF FUSIBILITY

Number	Mineral	Approximate fusing point	Notes
1	Stibnite	525° C	Fuses easily in a candle flame.
2	Chalcopyrite	800° C	Fuses slowly in a gas flame.
3	Almandite	1050° C	Only finest splinters rounded in a gas flame.
4	Actinolite	1200° C	Standard-size fragments are rounded easily before the blowpipe
5	Orthoclase	1300° C	Standard-size fragments are rounded with difficulty before the blowpipe
6	Bronzite	1400° C	Only finest splinters rounded on points with difficulty before the blowpipe.
7	Quartz	>1400° C	Entirely infusible before the blowpipe

CONSTANT TEMPERATURE BATHS

The following substances may be utilized between the temperatures indicated (boiling points) by using pressures from 10 to 76 cm. The second temperature given is the boiling point at the latter pressure Several of the liquids are inflammable and must be used with caution.

Substance	Temperature °C
Ethyl chloride	−31.3 to 12 2
Ethyl ether	−12 1 to 34 5
Carbon disulfide	−4.8 to 46 3
Acetone	7 5 to 56 1
Chloroform	9.7 to 61.2
Methyl alcohol	20 62 to 64 5
Ethyl alcohol	34 4 to 78 5
Benzene	25 8 to 79 8
Water	51 7 to 100
Toluene	51 8 to 110 5
Chlorobenzene	70.3 to 132 1
Isoamyl acetate	142 5
Bromobenzene	90 7 to 156.2
Aniline	119 4 to 184.4
Naphthalene	144 3 to 217.9
Methyl salicylate	151. to 223 3
Isoamyl benzoate	262.
Diphenylamine	221 to 302.0
Benzophenone	224 to 305 4
Mercury	261.5 to 356 9
Sulfur	330 7 to 444 6
Zinc	758 to 907

*

HYGROMETRIC AND BAROMETRIC TABLES

CONVERSION TABLE FOR BAROMETRIC READINGS

U. S. inches to cm.

Inches.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
27.0	68.580	.606	.631	.656	.682	.707	.733	.758	.783	.809
27.1	.834	.860	.885	.910	.936	.961	.987	*.012	*.037	*.063
27.2	69.088	.114	.139	.164	.190	.215	.241	.266	.291	.317
27.3	.342	.368	.393	.418	.444	.469	.495	.520	.545	.571
27.4	.596	.622	.647	.672	.698	.723	.749	.774	.799	.825
27.5	.850	.876	.901	.926	.952	.977	*.002	*.028	*.053	*.079
27.6	70.104	.130	.155	.180	.206	.231	.257	.282	.307	333
27.7	.358	.384	.409	.434	.460	.485	.511	.536	.561	.587
27.8	.612	.638	.663	.688	.714	.739	.765	.790	.815	.841
27.9	.866	.892	.917	.942	.968	.993	*.018	*.044	*.069	*.095
28.0	71.120	.146	.171	.196	.222	.247	.273	.298	.323	.349
28.1	.374	.400	.425	.450	.476	.501	.527	.552	.577	.603
28.2	.628	.654	.679	.704	.730	.755	.781	.806	.831	857
28.3	.882	.908	.933	.958	.984	*.009	*.035	*.060	*.085	*.111
28.4	72.136	.162	.187	.212	.238	.263	.289	.314	.339	.365
28.5	.390	.416	.441	.466	.492	.517	.543	.568	.593	.619
28.6	.644	.670	.695	.720	.746	.771	.797	.822	.847	873
28.7	.898	.924	.949	.974	*.000	*.025	*.051	*.076	*.101	*.127
28.8	73.152	.178	.203	.228	.254	.279	.305	.330	.355	.381
28.9	.406	.432	.457	.482	.508	.533	.559	.584	.609	.635
29.0	.660	.686	.711	.736	.762	.787	.813	.838	.863	.889
29.1	.914	.940	.965	.990	*.016	*.041	*.067	*.092	* 117	*.143
29.2	74.168	.194	.219	.244	.270	.295	.321	.346	.371	.397
29.3	.422	.448	.473	.498	.524	.549	.575	.600	.625	.651
29.4	.676	.702	.727	.752	.778	.803	.829	.854	.879	.905
29.5	.930	.956	.981	*.006	*.032	*.057	*.083	*.108	*.133	*.159
29.6	75.184	.210	.235	.260	.286	.311	.337	.362	.387	.413
29.7	.438	.464	.489	.514	.540	.565	.591	.616	.641	.667
29.8	.692	.718	.743	.768	.794	.819	.845	.870	.895	.921
29.9	.946	.972	.997	*.022	*.048	*.073	*.099	*.124	*.149	*.175
30.0	76.200	.226	.251	.277	.302	.327	.353	.378	.404	.429
30.1	.454	.480	.505	.531	.556	.581	.607	.632	.658	.683
30.2	.708	.734	.759	.785	.810	.835	.861	.886	.912	.937
30.3	.962	.988	*.013	* 039	*.064	*.089	*.115	*.140	*.166	*.191
30.4	77.216	.242	.267	.293	318	.343	.369	.394	.420	.445
30.5	.470	.496	.521	.547	.572	.597	.623	.648	.674	.699
30.6	.724	.750	.775	.801	.826	.851	.877	.902	.928	.953
30.7	.978	*.004	*.029	*.055	*.080	*.105	*.131	*.156	*.182	*.207
30.8	78.232	.258	.283	.309	.334	.359	.385	410	.436	.461
30.9	.486	.512	.537	.563	.588	.613	.639	.664	.690	.715

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

U. S. Inches to Millibars

Based on the relation 1 inch of mercury at 32°F represents a pressure of 33.8639 millibars.
Note: Figures in last nine columns to be preceded by 7, 8 or 9 as indicated.

Inches	00	01	.02	03	04	05	.06	07	08	.09
23 0	7 78 87	79 21	79 55	79.89	80 22	80 56	80 90	81 24	81 58	81 92
23 1	7 82 26	82 59	82 93	83 27	83 61	83 95	84 29	84 63	84 97	85 30
23 2	7 85 64	85 98	86.32	86.66	87 00	87.34	87 67	88 01	88.35	88 69
23 3	7 89 03	89 37	89 71	90 04	90 38	90 72	91 06	91 40	91 74	92 08
23 4	7 92.42	92 75	93.09	93.43	93 77	94 11	94 45	94 79	95 12	95 46
23.5	7 95 80	96 14	96 48	96 82	97 16	97 49	97 83	98 17	98 51	98 85
23.6	7 99 19	99.53	99 87	*00 20	*00 54	*00 88	*01 22	*01 56	*01 90	*02 24
23 7	8 02 57	02 91	03 25	03 59	03 93	04 27	04 61	04 94	05 28	05 62
23 8	8 05 96	06 30	06 64	06 98	07 32	07 65	07 99	08 33	08 67	09 01
23 9	8 09 35	09 69	10 02	10 36	10 70	11.04	11 38	11.72	12 06	12 39
24 0	8 12 73	13 07	13 41	13 75	14 09	14 43	14 77	15 10	15 44	15 78
24 1	8 16 12	16 46	16 80	17 14	17 47	17 81	18 15	18 49	18 83	19 17
24 2	8 19 51	19 85	20 18	20 52	20 86	21 20	21 54	21 88	22 22	22 55
24 3	8 22 89	23 23	23 57	23 91	24 25	24 59	24 92	25 26	25 60	25 94
24 4	8 26 28	26 62	26 96	27 30	27 63	27 97	28 31	28 65	28 99	29 33
24 5	8 29 67	30 00	30 34	30 68	31 02	31 36	31 70	32 04	32 37	32 71
24 6	8 33 05	33 39	33 73	34 07	34 41	34 75	35 08	35 42	35 76	36 10
24 7	8 36 44	36 78	37 12	37 45	37 79	38 13	38 47	38 81	39 15	39 49
24 8	8 39 82	40 16	40 50	40 84	41 18	41 52	41 86	42 20	42 53	42 87
24 9	8 43 21	43 55	43 89	44 23	44 57	44 90	45 24	45 58	45 92	46 26
25 0	8 46 60	46 94	47 27	47 61	47 95	48 29	48 63	48 97	49 31	49 65
25 1	8 49 98	50 32	50 66	51 00	51 34	51 68	52 02	52 35	52 69	53 03
25 2	8 53 37	53 71	54 05	54 39	54 72	55 06	55 40	55 74	56 08	56 42
25 3	8 56 76	57 10	57 43	57 77	58 11	58 45	58 79	59 13	59 47	59 80
25 4	8 60 14	60 48	60 82	61 16	61 50	61.84	62 17	62 51	62 85	63 19
25 5	8 63 53	63 87	64 21	64 55	64 88	65 22	65 56	65 90	66 24	66 58
25 6	8 66 92	67 25	67 59	67 93	68 27	68 61	68 95	69 29	69 62	69 96
25 7	8 70 30	70 64	70 98	71 32	71 66	72 00	72 33	72 67	73 01	73 35
25 8	8 73 69	74 03	74 37	74 70	75 04	75 38	75 72	76 06	76 40	76 74
25 9	8 77.08	77 41	77 75	78 09	78 43	78 77	79 11	79 45	79 78	80 12
26 0	8 80 46	80 80	81 14	81 48	81 82	82 15	82 49	82 83	83 17	83 51
26 1	8 83 85	84 19	84 53	84 86	85 20	85 54	85 88	86 22	86 56	86 90
26.2	8 87 23	87 57	87 91	88 25	88 59	88 93	89 27	89 60	89 94	90 28
26 3	8 90 62	90 96	91 30	91 64	91 98	92 31	92 65	92 99	93 33	93 67
26 4	8 94 01	94 35	94 68	95 02	95.36	95 70	96 04	96 38	96 72	97 05
26.5	8 97 39	97 73	98 07	98 41	98 75	99 09	99 43	99 76	*00 10	*00 44
26 6	9 00 78	01 12	01 46	01 80	02 13	02 47	02 81	03 15	03 49	03 83
26 7	9 04 17	04 50	04 84	05 18	05 52	05 86	06 20	06 54	06 88	07 21
26 8	9 07 55	07 89	08 23	08 57	08 91	09 25	09 58	09 92	10 26	10 60
26 9	9 10 94	11 28	11 62	11 95	12 29	12 63	12 97	13 31	13 65	13 99
27 0	9 14 33	14 66	15 00	15 34	15 68	16 02	16 36	16 70	17 03	17 37
27.1	9 17 71	18 05	18 39	18 73	19 07	19.40	19 74	20 08	20 42	20 76
27 2	9 21.10	21 44	21 78	22 11	22 45	22 79	23 13	23 47	23 81	24 15
27.3	9 24 48	24 82	25 16	25 50	25 84	26 18	26 52	26 85	27 19	27 53
27.4	9 27 87	28.21	28 55	28 89	29 23	29 56	29 90	30 24	30 58	30 92

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

U. S. Inches to Millibars (Continued)

Note: Figures in last nine columns to be preceded by 9 or 10 as indicated.

Inches	00	01	02	03	.04	.05	.06	.07	08	.09
27 5	9 31 26	31 60	31 93	32 27	32 61	32 95	33.29	33 63	33 97	34.31
27 6	9 34 64	34.98	35.32	35.66	36 00	36.34	36 68	37.01	37.35	37.69
27 7	9 38 03	38 37	38 71	39.05	39.38	39.72	40.06	40 40	40.74	41.08
27 8	9 41 42	41 76	42 09	42 43	42 77	43 11	43.45	43.79	44.13	44.46
27 9	9 44 80	45 14	45 48	45.82	46.16	46.50	46.83	47 17	47.51	47.85
28 0	9 48 19	48.53	48 87	49 21	49.54	49.88	50 22	50 56	50 90	51.24
28 1	9 51 58	51 91	52 25	52.59	52.93	53.27	53.61	53 95	54.28	54.62
28 2	9 54 96	55 30	55 64	55.98	56.32	56.66	56.99	57 33	57.67	58.01
28 3	9 58 35	58 69	59 03	59 36	59 70	60.04	60.38	60 72	61.06	61.40
28 4	9 61 73	62 07	62 41	62.75	63.09	63.43	63.77	64 11	64.44	64.78
28 5	9 65 12	65 46	65 80	66.14	66.48	66 81	67 15	67 49	67.83	68.17
28 6	9 68.51	68 85	69.18	69.52	69 86	70.20	70.54	70 88	71 22	71.56
28 7	9 71.89	72.23	72 57	72.91	73 25	73 59	73.93	74 26	74.60	74.94
28 8	9 75 28	75.62	75.96	76.30	76.63	76.97	77.31	77 65	77.99	78.33
28 9	9 78.67	79.01	79 34	79.68	80.02	80.36	80.70	81 04	81.38	81 71
29 0	9 82 05	82 39	82 73	83 07	83.41	83.75	84 08	84 42	84 76	85.10
29 1	9 85 44	85 78	86 12	86 46	86.79	87.13	87.47	87 81	88 15	88.49
29.2	9 88 83	89 16	89 50	89 84	90.18	90.52	90 86	91 20	91.53	91.87
29 3	9 92 21	92 55	92 89	93.23	93 57	93 91	94.24	94 58	94.92	95.26
29 4	9 95 60	95 94	96 28	96 61	96 95	97.29	97.63	97 97	98 31	98.65
29 5	9 98 99	99 32	99 66	*00 00	*00 34	*00 68	*01.02	*01 36	*01.69	*02 03
29 6	10 02 37	02 71	03 05	03 39	03.73	04.06	04.40	04 74	05.08	05 42
29 7	10 05 76	06 10	06 44	06.77	07 11	07 45	07.79	08 13	08.47	08.81
29 8	10 09 14	09 48	09 82	10 16	10 50	10 84	11 18	11 51	11.85	12.19
29 9	10 12 53	12.87	13 21	13.55	13.89	14.22	14.56	14.90	15 24	15 58
30 0	10 15 92	16 26	16 59	16 93	17 27	17 61	17 95	18 29	18 63	18 96
30 1	10 19 30	19 64	19.98	20 32	20.66	21.00	21 34	21 67	22 01	22 35
30 2	10 22 69	23 03	23 37	23 71	24 04	24 38	24 72	25 06	25 40	25.74
30 3	10 26 08	26 41	26 75	27.09	27.43	27.77	28.11	28 45	28 79	29 12
30 4	10 29 46	29 80	30 14	30.48	30.82	31.16	31.49	31 83	32 17	32 51
30 5	10 32 85	33 19	33 53	33 86	34.20	34 54	34 88	35 22	35 56	35 90
30 6	10 36 24	36 57	36 91	37 25	37.59	37.93	38 27	38.61	38 94	39 28
30 7	10 39 62	39 96	40 30	40 64	40 98	41.31	41 65	41 99	42.33	42 67
30 8	10 43 01	43 35	43 69	44.02	44 36	44 70	45.04	45 38	45.72	46 06
30 9	10 46 39	46 73	47 07	47 41	47 75	48.09	48 43	48 76	49 10	49 44
31 0	10 49 78	50.12	50 46	50.80	51 14	51 47	51.81	52 15	52 49	52 83
31 1	10 53 17	53 51	53 84	54 18	54.52	54.86	55.20	55.54	55.88	56 22
31 2	10 56 55	56 89	57 23	57 57	57 91	58 25	58.59	58.92	59.26	59 60
31 3	10 59 94	60 28	60 62	60 96	61 29	61.63	61.97	62 31	62 65	62.99
31 4	10 63 33	63.67	64 00	64 34	64.68	65.02	65.36	65 70	66.04	66 37
31 5	10 66 71	67 05	67 39	67 73	68.07	68.41	68 74	69 08	69.42	69 76
31 6	10 70 10	70 44	70 78	71.12	71.45	71.79	72.13	72 47	72.81	73.15
31 7	10 73 49	73.82	74 16	74 50	74.84	75.18	75.52	75 86	76.19	76 53
31.8	10 76 87	77 21	77.55	77 89	78.23	78.57	78.90	79 24	79.58	79 92
31 9	10 80 26	80.60	80 94	81.27	81.61	81.95	82.29	82.63	82.97	83 31

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

Centimeters to Millibars

Based on the relation 1 centimeter of mercury at 0°C represents a pressure of 13.3322 millibars.

Note: Figures in last nine columns to be preceded by 9.

Centi-meters	00	.01	.02	.03	.04	.05	.06	.07	.08	09
68 0	9 06 59	06 72	06 86	06 99	07 12	07 26	07 39	07 52	07 66	07 79
68 1	9 07 92	08 06	08.19	08 32	08 46	08 59	08 72	08 86	08.99	09 12
68 2	9 09 26	09 39	09.52	09 66	09 79	09 92	10 06	10 19	10.32	10 46
68 3	9 10 59	10.72	10 86	10 99	11 12	11 26	11 39	11.52	11 66	11 79
68 4	9 11 92	12.06	12.19	12 32	12.46	12 59	12 72	12.86	12 99	13 12
68 5	9 13 26	13.39	13.52	13 66	13 79	13 92	14 06	14 19	14 32	14 46
68 6	9 14 59	14.72	14.86	14 99	15 12	15.26	15 39	15 52	15 66	15 79
68 7	9 15 92	16.06	16.19	16.32	16 46	16 59	16 72	16 86	16 99	17 12
68 8	9 17 26	17.39	17 52	17 66	17.79	17 92	18 06	18 19	18 32	18 46
68 9	9 18.59	18.72	18.86	18.99	19 12	19 26	19 39	19 52	19.66	19 79
69 0	9 19 92	20 06	20.19	20 32	20 46	20.59	20 72	20 86	20 99	21 12
69.1	9 21 26	21 39	21 52	21.65	21 79	21 92	22 05	22 19	22 32	22 45
69 2	9 22 59	22.72	22 85	22 99	23 12	23 25	23.39	23 52	23 65	23 79
69 3	9 23 92	24 05	24.19	24 32	24 45	24 59	24 72	24 85	24 99	25 12
69 4	9 25 25	25 39	25.52	25 65	25.79	25 92	26 05	26 19	26 32	26 45
69.5	9 26 59	26 72	26.85	26 99	27 12	27 25	27 39	27 52	27 65	27 79
69 6	9 27 92	28 05	28 19	28.32	28 45	28 59	28 72	28 85	28 99	29 12
69 7	9 29 25	29 39	29 52	29 65	29 79	29 92	30 05	30 19	30 32	30 45
69 8	9 30 59	30 72	30.85	30 99	31 12	31 25	31 39	31 52	31 65	31 79
69 9	9 31 92	32 05	32 19	32 32	32 45	32 59	32 72	32 85	32 99	33 12
70 0	9 33 25	33 39	33 52	33 65	33 79	33 92	34 05	34 19	34 32	34 45
70 1	9 34 59	34 72	34 85	34.99	35 12	35 25	35 39	35 52	35 65	35 79
70 2	9 35 92	36 05	36.19	36 32	36 45	36 59	36 72	36 85	36.99	37 12
70 3	9 37 25	37 39	37 52	37 65	37 79	37 92	38 05	38 19	38 32	38 45
70 4	9 38 59	38 72	38 85	38.99	39 12	39 25	39 39	39 52	39 65	39 79
70 5	9 39 92	40 05	40 19	40 32	40 45	40 59	40 72	40 85	40 99	41 12
70 6	9 41 25	41 39	41 52	41.65	41.79	41 92	42 05	42 19	42 32	42 45
70 7	9 42 59	42 72	42 85	42.99	43.12	43 25	43 39	43 52	43 65	43 79
70 8	9 43 92	44 05	44 19	44 32	44 45	44 59	44 72	44 85	44 99	45 12
70 9	9 45 25	45 39	45 52	45 65	45 79	45 92	46 05	46 19	46 32	46 45
71 0	9 46 59	46 72	46 85	46 99	47.12	47 25	47 39	47 52	47 65	47 79
71 1	9 47 92	48 05	48 19	48 32	48 45	48 59	48 72	48 85	48 99	49 12
71 2	9 49 25	49 39	49 52	49 65	49 79	49 92	50 05	50 19	50 32	50 45
71 3	9 50 59	50 72	50 85	50 99	51 12	51 25	51 39	51 52	51 65	51 79
71 4	9 51 92	52 05	52 19	52 32	52 45	52.59	52.72	52 85	52 99	53 12
71 5	9 53 25	53 39	53.52	53 65	53 79	53 92	54 05	54 19	54 32	54 45
71 6	9 54 59	54 72	54.85	54.99	55 12	55 25	55 39	55 52	55 65	55 79
71 7	9 55 92	56 05	56.19	56.32	56 45	56 59	56 72	56 85	56 99	57 12
71 8	9 57 25	57 39	57.52	57 65	57.79	57 92	58 05	58 19	58 32	58 45
71 9	9 58 59	58 72	58.85	58 99	59 12	59 25	59 39	59 52	59 65	59 79
72 0	9 59 92	60.05	60 19	60.32	60 45	60.59	60 72	60 85	60 98	61.12
72 1	9 61 25	61.38	61.52	61 65	61.78	61.92	62 05	62 18	62 32	62 45
72.2	9 62 58	62 72	62.85	62 98	63.12	63.25	63.38	63 52	63 65	63 78
72 3	9 63 92	64 05	64.18	64 32	64 45	64 58	64 72	64 85	64 98	65 12
72 4	9 65 25	65 38	65.52	65 65	65 78	65 92	66 05	66 18	66 32	66 45
72 5	9 66 58	66 72	66 85	66 98	67 12	67 25	67 38	67 52	67 65	67 78
72 6	9 67 92	68 05	68.18	68.32	68 45	68 58	68 72	68 85	68 98	69 12
72 7	9 69 25	69 38	69.52	69 65	69 78	69 92	70 05	70 18	70 32	70 45
72.8	9 70 58	70 72	70 85	70.98	71.12	71 25	71 38	71 52	71 65	71 78
72 9	9 71 92	72 05	72 18	72.32	72 45	72 58	72 72	72 85	72 98	73 12

CONVERSION TABLE FOR BAROMETRIC READINGS (Continued)

Centimeters to Millibars (Continued)

Note: Figures in last nine columns to be preceded by 9 or 10.

Centimeters	.00	.01	02	.03	.04	.05	.06	.07	.08	.09
73 0	9 73 25	73 38	73 52	73 65	73 78	73 92	74 05	74 18	74 32	74 45
73 1	9 74 58	74 72	74 85	74 98	75 12	75 25	75 38	75 52	75 65	75 78
73 2	9 75 92	76.05	76 18	76.32	76.45	76.58	76 72	76 85	76 98	77 12
73 3	9 77 25	77 38	77 52	77 65	77 78	77 92	78 05	78 18	78 32	78 45
73 4	9 78 58	78 72	78 85	78 98	79.12	79 25	79.38	79 52	79 65	79.78
73 5	9 79 92	80 05	80 18	80 32	80 45	80 58	80 72	80 85	80 98	81 12
73 6	9 81 25	81 38	81.52	81 65	81 78	81 92	82 05	82 18	82 32	82 45
73 7	9 82 58	82 72	82 85	82 98	83 12	83 25	83 38	83 52	83 65	83 78
73 8	9 83 92	84 05	84 18	84 32	84 45	84 58	84 72	84 85	84 98	85 12
73 9	9 85.25	85.38	85 52	85 65	85 78	85 92	86 05	86 18	86 32	86 45
74 0	9 86.58	86.72	86 85	86 98	87 12	87 25	87 38	87 52	87 65	87 78
74 1	9 87 92	88 05	88 18	88 32	88 45	88 58	88 72	88 85	88 98	89 12
74 2	9 89 25	89.38	89 52	89 65	89 78	89 92	90 05	90.18	90 32	90 45
74 3	9 90.58	90 72	90 85	90 98	91 12	91 25	91 38	91 52	91 65	91 78
74 4	9 91.92	92.05	92 18	92 32	92 45	92.58	92 72	92 85	92 98	93 12
74 5	9 93 25	93 38	93 52	93 65	93 78	93 92	94 05	94 18	94 32	94 45
74 6	9 94 58	94 72	94 85	94 98	95 12	95 25	95 38	95 52	95 65	95 78
74 7	9 95 92	96 05	96 18	96 32	96 45	96 58	96 72	96 85	96 98	97 12
74 8	9 97 25	97 38	97 52	97 65	97 78	97 92	98 05	98 18	98 32	98 45
74 9	9 98.58	98 72	98 85	98.98	99.12	99.25	99 38	99.52	99 65	99 78
75 0	9 99.92	*00 05	*00 18	*00 31	*00 45	*00.58	*00 71	*00 85	*00 98	*01 11
75 1	10 01 25	01 38	01 51	01 65	01 78	01 91	02 05	02 18	02 31	02 45
75 2	10 02 58	02 71	02 85	02 98	03 11	03.25	03 38	03 51	03 65	03 78
75 3	10 03 91	04 05	04 18	04 31	04 45	04 58	04 71	04 85	04 98	05 11
75 4	10 05 25	05 38	05 51	05 65	05 78	05 91	06 05	06.18	06 31	06 45
75 5	10 06 58	06 71	06 85	06 98	07 11	07.25	07 38	07 51	07 65	07 78
75 6	10 07 91	08 05	08 18	08 31	08 45	08 58	08 71	08 85	08 98	09 11
75 7	10 09.25	09 38	09 51	09 65	09 78	09 91	10 05	10 18	10 31	10 45
75 8	10 10 58	10 71	10 85	10 98	11 11	11 25	11 38	11 51	11 65	11 78
75 9	10 11 91	12 05	12 18	12.31	12 45	12 58	12.71	12 85	12 98	13 11
76 0	10 13 25	13 38	13 51	13 65	13 78	13 91	14 05	14 18	14 31	14 45
76 1	10 14 58	14 71	14 85	14 98	15 11	15 25	15 38	15 51	15 65	15 78
76 2	10 15 91	16 05	16 18	16 31	16 45	16 58	16 71	16 85	16 98	17 11
76 3	10 17 25	17 38	17 51	17 65	17 78	17.91	18 05	18 18	18 31	18 45
76 4	10 18.58	18 71	18 85	18.98	19 11	19.25	19 38	19 51	19 65	19 78
76 5	10 19 91	20 05	20 18	20.31	20 45	20 58	20 71	20 85	20 98	21 11
76 6	10 21 25	21 38	21 51	21 65	21 78	21 91	22 05	22 18	22.31	22 45
76 7	10 22 58	22 71	22 85	22 98	23 11	23 25	23 38	23 51	23 65	23 78
76 8	10 23 91	24 05	24 18	24 31	24 45	24 58	24 71	24 85	24 98	25 11
76 9	10 25 25	25 38	25 51	25.65	25 78	25 91	26 05	26 18	26 31	26 45
77 0	10 26 58	26 71	26 85	26 98	27 11	27 25	27 38	27.51	27 65	27 78
77 1	10 27 91	28 05	28 18	28 31	28 45	28 58	28 71	28.85	28 98	29 11
77 2	10 29 25	29 38	29 51	29 65	29 78	29 91	30 05	30 18	30 31	30 45
77 3	10 30 58	30 71	30 85	30 98	31 11	31 25	31 38	31 51	31 65	31 78
77 4	10 31 91	32 05	32 18	32 31	32 45	32 58	32 71	32 85	32 98	33 11
77 5	10 33 25	33 38	33 51	33 65	33 78	33 91	34 05	34 18	34 31	34 45
77 6	10 34 58	34 71	34 85	34 98	35 11	35 25	35 38	35 51	35 65	35 78
77 7	10 35 91	36 05	36 18	36 31	36 45	36 58	36 71	36 85	36 98	37 11
77 8	10 37 25	37 38	37 51	37 65	37.78	37 91	38 05	38 18	38 31	38 45
77 9	10 38 58	38 71	38 85	38 98	39 11	39 24	39 38	39.51	39 64	39.78

TEMPERATURE CORRECTION FOR BAROMETER READINGS

Brass Scale—Metric Units

To reduce readings of a mercurial barometer with a brass scale to 0°C subtract the appropriate quantity as found in the table. These values are based on the coefficient of expansion of mercury $(181792 + 0.175t + 0.035116t^2) \times 10^{-9}$, and of brass 0.0000184 per °C. Corrections are in millimeters.

Temp. °C	Observed height in millimeters								
	620	630	640	650	660	670	680	690	700
0	0 00	0 00	0.00	0.00	0.00	0 00	0 00	0 00	0 00
1	.10	10	.10	.11	.11	.11	11	11	11
2	.20	21	21	21	.22	22	22	23	23
3	.30	31	.31	.32	.32	33	33	34	34
4	.40	41	.42	.42	.43	.44	.44	45	46
5	0.51	0 51	0.52	0 53	0.54	0 55	0 56	0 56	0 57
6	.61	.62	.63	.64	.65	.66	.67	.68	69
7	71	.72	73	74	75	.77	78	79	80
8	.81	.82	.84	.85	.86	.87	89	90	91
9	.91	92	.94	.95	97	98	1 00	1 01	1 03
10	1.01	1 03	1 04	1 06	1 08	1 09	1 11	1 13	1 14
11	1.11	1 13	1 15	1.17	1 18	1 20	1 22	1 24	1 26
12	1 21	1 23	1 25	1 27	1 29	1 31	1 33	1 35	1 37
13	1.31	1 34	1.36	1 38	1 40	1 42	1 44	1 46	1 48
14	1.41	1 44	1.46	1 48	1.51	1 53	1 55	1 57	1 60
15	1 52	1 54	1.56	1.59	1.61	1 64	1 66	1 69	1 71
16	1 62	1 64	1 67	1.69	1 72	1 75	1 77	1 80	1 82
17	1 72	1 74	1 77	1 80	1 83	1 86	1 88	1 91	1 94
18	1 82	1 85	1 88	1 91	1 93	1 96	1 99	2 02	2 05
19	1.92	1 95	1.98	2 01	2 04	2.07	2 10	2 13	2 17
20	2 02	2 05	2.08	2 12	2.15	2 18	2 21	2 25	2 28
21	2 12	2 15	2.19	2 22	2 26	2 29	2 32	2 36	2 39
22	2 22	2 26	2 29	2 33	2 36	2 40	2 43	2 47	2 51
23	2 32	2 36	2 40	2 43	2 47	2 51	2 54	2 58	2 62
24	2.42	2.46	2.50	2 54	2 58	2 62	2 66	2 69	2 73
25	2.52	2 56	2.60	2 64	2 68	2 72	2 77	2 81	2 85
26	2 62	2 66	2.71	2.75	2 79	2 83	2 88	2 92	2 96
27	2 72	2 77	2 81	2 85	2 90	2 94	2 99	3 03	3 07
28	2 82	2 87	2 91	2 96	3 00	3 05	3 10	3 14	3 19
29	2 92	2 97	3 02	3.06	3 11	3 16	3 21	3 25	3 30
30	3 02	3 07	3 12	3 17	3 22	3 27	3 32	3 36	3 41
31	3.12	3 17	3 22	3 27	3 32	3 37	3 43	3 48	3.53
32	3 22	3.28	3 33	3 38	3 43	3 48	3 54	3 59	3 64
33	3 32	3 38	3 43	3 48	3 54	3 59	3.64	3 70	3 75
34	3 42	3 48	3.53	3.59	3 64	3.70	3.75	3.81	3 87
35	3 52	3 58	3 64	3.69	3 75	3.81	3 86	3 92	3 98

CORRECTION FOR BAROMETER (Continued)

Brass Scale—Metric Units

Temp. °C	Observed height in millimeters								
	710	720	730	740	750	760	770	780	790
0	0.00	0 00	0 00	0 00	0 00	0 00	0.00	0 00	0 00
1	.12	12	12	12	.12	.12	.13	13	.13
2	23	24	24	24	.25	.25	25	25	.26
3	35	35	36	36	37	.37	.38	38	39
4	.46	47	48	.48	49	.50	.50	51	52
5	0 58	0 59	0 60	0 60	0 61	0.62	0 63	0 64	0 64
6	70	71	71	72	73	74	75	76	77
7	81	82	83	85	86	.87	88	89	.90
8	93	94	95	97	98	99	1 01	1 02	1 03
9	1 04	1 06	1 07	1 09	1 10	1 12	1.13	1 15	1 16
10	1 16	1 17	1 19	1 21	1 22	1 24	1 26	1 27	1.29
11	1 27	1 29	1 31	1 33	1 35	1 36	1 38	1 40	1 42
12	1 39	1 41	1 43	1 45	1 47	1 49	1 51	1 53	1.55
13	1 50	1 53	1 55	1 57	1.59	1 61	1 63	1 65	1 67
14	1 62	1 64	1 67	1 69	1.71	1 73	1 76	1 78	1 80
15	1 74	1 76	1 78	1 81	1 83	1 86	1 88	1 91	1 93
16	1 85	1 88	1 90	1 93	1 96	1 98	2 01	2 03	2 06
17	1 97	1 99	2 02	2 05	2 08	2 10	2 13	2 16	2 19
18	2 08	2 11	2 14	2 17	2 20	2 23	2 26	2 29	2 32
19	2 20	2 23	2 26	2 29	2 32	2 35	2 38	2 41	2 44
20	2 31	2 34	2 38	2 41	2 44	2 47	2 51	2 54	2 57
21	2 43	2 46	2 50	2 53	2 56	2 60	2 63	2 67	2 70
22	2 54	2 58	2 61	2 65	2 69	2 72	2 76	2 79	2 83
23	2 66	2 69	2 73	2 77	2 81	2 84	2 88	2 92	2 96
24	2 77	2 81	2 85	2 89	2 93	2 97	3 01	3 05	3 08
25	2 89	2 93	2 97	3 01	3 05	3 09	3 13	3 17	3 21
26	3 00	3 04	3 09	3 13	3 17	3 21	3 26	3 30	3 34
27	3 12	3 16	3 20	3 25	3 29	3 34	3 38	3 42	3.47
28	3 23	3 28	3 32	3 37	3 41	3 46	3 51	3 55	3 60
29	3 35	3 39	3 44	3 49	3 54	3 58	3 63	3 68	3 72
30	3 46	3 51	3 56	3 61	3 66	3 71	3 75	3 80	3.85
31	3 58	3 63	3 68	3 73	3 78	3 83	3 88	3 93	3 98
32	3 69	3 74	3 79	3 85	3 90	3 95	4 00	4 05	4 11
33	3 81	3 86	3 91	3 97	4 02	4 07	4 13	4 18	4 23
34	3 92	3 98	4 03	4 09	4 14	4 20	4 25	4 31	4 36
35	4 03	4 09	4 15	4 21	4 26	4 32	4 38	4 43	4 49

CORRECTION FOR BAROMETER (Continued)

BRASS SCALE—ENGLISH UNITS

Standard Temperature of scale 62° F; of mercury, 32° F. Zero correction at 28.5° F; subtract corrections above, add below. Owing to the difference in the standard temperature of English and metric scales, readings taken in inches to be reduced to centimeters should *first* be corrected for temperature.

Temp. ° F	Observed height in inches								
	23.0 in.	23.5 in.	24.0 in.	24.5 in.	25.0 in.	25.5 in.	26.0 in.	26.5 in.	27.0 in.
0	+ 060	+ 061	+ 063	+ 064	+ 065	+ 067	+ 068	+ 069	+ 070
2	056	057	058	060	061	062	063	065	065
4	052	053	054	055	056	057	058	060	061
6	.047	048	049	051	052	053	054	055	056
8	.043	044	045	.046	047	048	049	050	051
10	039	040	.041	.042	042	043	044	045	046
12	035	036	.036	037	038	039	039	.040	041
14	031	031	032	033	033	.034	035	035	036
16	026	.027	028	028	029	029	030	031	031
18	.022	023	.023	024	024	.025	025	026	026
20	018	018	019	019	020	020	020	021	021
22	014	014	.014	.015	015	015	016	016	016
24	010	010	.010	.010	011	011	011	011	011
26	005	.006	006	006	006	006	006	006	006
28	+ 001	+.001	+ 001	+ 001	+ 001	+ 001	+ 001	+ 002	+ 002
30	− 003	− 003	−.003	−.003	− 003	− 003	− 003	− 003	− 003
32	007	007	.007	008	008	008	008	008	008
34	011	011	.012	012	012	012	013	.013	013
36	015	016	.016	016	017	017	.017	.018	018
38	.020	.020	.020	021	021	022	.022	.023	023
40	024	024	.025	025	026	026	027	027	028
42	028	029	029	030	030	031	032	032	033
44	032	033	033	034	035	036	036	037	038
46	036	037	038	039	039	040	041	.042	043
48	.040	041	.042	043	.044	.045	046	.047	047
50	045	046	046	048	048	050	050	052	052
52	049	050	051	052	053	054	055	056	057
54	053	054	055	057	057	059	060	061	062
56	057	058	.060	061	062	063	064	066	067
58	061	.063	.064	065	066	068	069	071	072
60	065	067	068	070	071	073	074	076	077
62	069	071	073	074	076	077	079	080	082
64	074	.075	077	079	080	082	083	085	086
66	078	.079	.081	083	085	087	088	090	091
68	082	.084	.085	088	089	091	.093	095	096
70	086	088	090	092	094	096	097	100	101
72	090	092	094	096	098	.100	102	104	106
74	094	096	098	101	103	105	107	109	111
76	098	101	103	105	107	110	111	114	116
78	103	.105	.107	110	112	114	.116	119	120
80	107	109	.111	114	116	119	121	123	125
82	111	113	116	119	121	123	125	128	130
84	115	118	120	123	125	128	130	133	135
86	119	122	124	127	130	133	135	138	140
88	.123	126	129	132	134	.137	.139	143	145
90	127	130	133	136	138	.142	144	147	.150
92	132	134	137	141	143	146	.149	152	.154
94	136	139	142	145	147	151	153	157	159
96	140	143	.146	150	152	155	158	161	164
98	144	147	.150	.154	156	160	163	.166	.169
100	148	151	154	158	161	164	167	171	.174

CORRECTION FOR BAROMETER (Continued)

Brass Scale—English Units

Temp. °F	Observed height in inches								
	27.5 in.	28.0 in.	28 5 in.	29 0 in.	29.5 in.	30 0 in.	30 5 in.	31.0 in.	31.5 in.
0	.072	073	.075	076	.077	.078	.080	.081	.082
2	.067	068	.069	.070	.072	.073	.074	.075	077
4	.062	063	064	.065	.066	.067	.069	.070	.071
6	.057	058	.059	.060	.061	.062	.063	.064	.065
8	.052	053	.054	.054	.056	.056	.057	.058	.059
10	.047	.047	.048	.049	.050	.051	.052	.053	.054
12	.042	.042	.043	.044	.045	.045	.046	.047	.048
14	.037	.037	038	.039	.039	.040	.041	.041	042
16	.032	.032	033	.033	.034	.034	.035	036	.036
18	.027	.027	028	.028	.029	.029	.030	.030	.031
20	.022	.022	.022	.023	.023	.024	.024	024	.025
22	.017	.017	.017	.017	018	.018	.018	.019	.019
24	.012	.012	012	.012	012	013	.013	.013	013
26	.007	.007	007	.007	007	007	007	.007	008
28	+.002	+ 002	+ 002	+ 002	+.002	+.002	+ 002	+.002	+.002
30	— 003	— 003	— 004	— 004	—.004	— 004	— 004	—.004	— 004
32	.008	009	009	009	009	009	.009	.009	010
34	.013	014	.014	014	014	.015	.015	.015	015
36	.018	.019	019	019	020	.020	.020	.021	021
38	.023	024	024	.025	025	.026	.026	.026	.027
40	.028	029	030	.030	031	031	.032	.032	.033
42	.033	.034	.035	.035	036	036	.037	.038	.038
44	.038	.039	.040	.040	041	042	.043	043	.044
46	.043	.044	045	046	047	047	.048	.049	050
48	.048	.049	050	051	052	053	.054	.054	.055
50	.053	054	055	.056	.057	.058	.059	.060	061
52	.058	059	061	.061	.063	064	.065	.066	.067
54	.063	064	066	067	.068	069	.070	.071	.073
56	.068	069	071	072	073	.074	076	077	.078
58	.073	.074	.076	.077	.079	.080	.081	.082	.084
60	.078	080	081	.082	084	085	087	.088	090
62	.083	085	086	088	089	091	.092	094	.095
64	088	090	092	093	095	.096	.098	.099	.101
66	.093	.095	097	.098	100	101	.103	.105	107
68	.098	.100	.102	.103	105	.107	.109	.110	.113
70	103	.105	.107	.109	.111	112	.115	.116	118
72	.108	.110	.112	.114	.116	.118	.120	.122	.124
74	.113	.115	.117	.119	.121	.123	.126	.127	130
76	118	.120	.122	.124	.127	.128	.131	.133	.135
78	.123	.125	.128	.129	.132	.134	.137	.138	.141
80	.128	.130	133	135	.137	.139	.142	.144	147
82	133	.135	.138	.140	.143	.145	.148	.149	152
84	.138	.140	.143	145	148	150	.153	.155	.158
86	.143	.145	148	150	153	155	159	.161	164
88	.148	.150	.153	.155	.159	.161	.164	.166	.169
90	153	.155	158	.161	.164	.166	.170	.172	175
92	.158	.160	163	.166	.169	.172	175	.177	181
94	.163	.165	.169	171	175	.177	180	.183	186
96	.168	.170	.174	.176	.180	.182	.186	.188	.192
98	.172	.175	.179	.181	.185	.188	.191	.194	.197
100	.177	.180	.184	.187	.190	193	.197	.200	.203

TEMPERATURE CORRECTION, GLASS SCALE

METRIC

To reduce readings of a mercurial barometer with a glass scale to 0° C. subtract the appropriate quantity as found in table.

Temp. ° C.	Observed height in centimeters.								
	70 cm.	71 cm.	72 cm.	73 cm.	74 cm.	75 cm.	76 cm.	77 cm.	78 cm.
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	.012	.012	.013	.013	.013	.013	.013	.013	.014
2	.025	.025	.025	.026	.026	.026	.026	.027	.027
3	.036	.036	.037	.037	.038	.038	.039	.039	.040
4	.048	.049	.049	.050	.051	.051	.052	.053	.053
5	0.060	0.061	0.062	0.063	0.064	0.064	0.065	0.066	0.067
6	.073	.074	.074	.076	.077	.077	.078	.079	.080
7	.085	.086	.087	.088	.089	.091	.092	.093	.094
8	.096	.098	.099	.100	.101	.103	.104	.105	.107
9	.109	.110	.111	.113	.114	.116	.117	.119	.120
10	0.121	0.122	0.124	0.126	0.127	0.129	0.130	0.132	0.134
11	.133	.135	.137	.138	.140	.142	.144	.146	.147
12	.144	.146	.148	.150	.152	.154	.156	.158	.160
13	.157	.159	.161	.163	.165	.167	.169	.171	.174
14	.169	.171	.174	.176	.178	.180	.183	.185	.187
15	0.181	0.184	0.186	0.189	0.191	0.193	0.196	0.198	0.201
16	.194	.196	.199	.201	.204	.207	.209	.212	.214
17	.205	.208	.210	.213	.216	.219	.221	.224	.227
18	.217	.220	.223	.226	.229	.232	.235	.238	.241
19	.230	.233	.236	.239	.242	.245	.248	.251	.254
20	0.242	0.245	0.248	0.252	0.255	0.258	0.261	0.264	0.268
21	.254	.258	.261	.264	.268	.271	.275	.278	.281
22	.266	.269	.273	.276	.280	.283	.287	.290	.294
23	.278	.282	.285	.289	.293	.296	.300	.304	.308
24	.290	.294	.298	.302	.306	.310	.313	.317	.321
25	0.303	0.307	0.311	0.315	0.319	0.323	0.327	0.331	0.335
26	.315	.319	.323	.327	.332	.336	.340	.344	.348
27	.326	.331	.335	.339	.344	.348	.352	.357	.361
28	.339	.343	.348	.352	.357	.361	.366	.370	.375
29	.351	.356	.360	.365	.370	.374	.379	.384	.388
30	0.363	0.368	0.373	0.378	0.383	0.387	0.392	0.397	0.402

MASS OF WATER VAPOR IN SATURATED AIR

Mass in grams per cubic meter.

(From Smithsonian Tables.)

Temp. ° C.	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
−20	0.892	0.810	0.737	0.673	0.613	0.557	0.505	0.457	0.413	0.373
−10	2.154	1.978	1.811	1.658	1.519	1.395	1.282	1.177	1.079	0.982
− 0	4.835	4.468	4.130	3.813	3.518	3.244	2.988	2.752	2.537	2.340
+ 0	4.835	5.176	5.538	5.922	6.330	6.761	7.219	7.703	8.215	8.757
10	9.330	9.935	10.574	11.249	11.961	12.712	13.505	14.339	15.218	16.144
20	17.118	18.143	19.222	20.355	21.546	22.796	24.109	25.487	26.933	28.450
30	30.039	31.704	33.449	35.275	37.187	39.187	41.279	43.465	45.751	48.138

REDUCTION OF BAROMETER TO SEA LEVEL

The correction to be added to reduce barometric readings to "sea level" values depends principally on three factors: The temperature of the air column (assumed) from the station to sea level, the altitude of the station, and the value of the reading itself. Two tables are provided. Table I is entered with the altitude and assumed temperature and a factor "2000 m" taken out. Table II is entered with the above factor and the approximate barometer reading and the final correction taken out.

The correction is to be added. If B_0 is the corrected or sea level value; B the barometer reading at the station; C the correction,—

$$C = B_0 - B = B\,(10^m - 1)$$

The actual barometer reading at the station should be corrected for temperature of the mercury column by the usual methods before entering the tables or applying the sea level correction.

A complete explanation of the theory of the corrections and a more extended set of tables will be found in the Smithsonian Meteorological Tables.

Latitude Factor

The influence of the latitude on the value of the correction is usually negligible, being overshadowed by uncertainties in the assumed temperature of the air column. For cases where this correction is desirable the table below is provided. The value of the temperature-altitude factor "2000 m" obtained in Table I is corrected for latitude by subtracting for latitudes 0-45° and adding for latitudes from 45-90° the values found. With this corrected value of "2000 m" Table II is entered for the value of the correction.

LATITUDE FACTOR

To be used in connection with Tables I and II, either English or metric units, to obtain latitude corrections to temperature-altitude factor. For latitudes 0-45° subtract the correction. For latitudes 45-90° add the correction.

Temp.—Alt. from Table I	Latitude			
	0°	15°	30°	45°
100	0 3	0 2	0.1	0.0
200	0 5	0 5	0 3	0.0
300	0.8	0 7	0 4	0.0
	90°	75°	60°	45°

REDUCTION OF BAROMETER TO SEA LEVEL (Continued)

METRIC UNITS—TABLE I

Values of the temperature-altitude factor (2000 m.) for entering table II.

Altitude in meters	Assumed temperature of air column °C									
	−16°	−8°	0°	+4°	+8°	+12°	+16°	+20°	+24°	+28°
10	1.2	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
50	5 8	5.6	5.4	5.3	5.2	5.2	5.1	5 0	4.9	4.9
100	11.5	11.2	10.8	10.7	10.5	10.3	10 2	10.0	9.9	9.7
150	17.3	16.7	16.2	16.0	15.7	15.5	15.3	15.0	14.8	14.6
200	23.0	22.3	21.6	21.3	21.0	20.7	20.3	20 0	19.7	19.5
250	28.8	27.9	27.0	26.6	26.2	25.8	25 4	25.0	24.7	24 3
300	34.5	33.5	32.5	32.0	31.5	31.0	30.5	30.1	29.6	29.2
350	40.3	39.0	37.9	37.3	36.7	36.2	35.6	35.1	34.6	34.0
400	46.0	44.6	43.3	42.6	42.0	41.3	40.7	40.1	39.5	38.9
450	51.8	50.2	48.7	47.9	47.2	46.5	45.8	45.1	44.4	43 8
500	57 5	55.8	54.1	53.3	52.4	51.6	50.9	50 1	49.4	48 6
550	63 3	61.4	59.5	58.6	57.7	56.8	55.9	55.1	54.3	53.5
600	69.0	66.9	64.9	63.9	62.9	62.0	61.0	60.1	59.2	58.3
650	74.8	72.5	70.3	69.2	68.2	67 1	66.1	65 1	64.2	63.2
700	80.6	78.1	75.7	74.6	73.4	72.3	71.2	70.1	69.1	68.1
750	86.3	83.7	81.1	79.9	78.7	77.5	76.3	75.1	74.0	72.9
800	92.1	89.2	86.5	85.2	83.9	82.6	81.4	80 1	79.0	77.8
850	97.8	94.8	92.0	90.5	89.2	87.8	86.4	85 2	83.9	82.7
900	103.6	100.4	97 4	95.9	94 4	93.0	91.5	90.2	88.8	87.5
950	109.3	106.0	102.8	101.2	99.6	98.1	96.6	95 2	93.8	92.4
1000	115.1	111.5	108.2	106.5	104.9	103.3	101.7	100.2	98.7	97.3
1050	120.8	117.1	113.6	111.8	110.1	108.4	106.8	105.2	103.6	102.1
1100	126.6	122.7	119.0	117.2	115.4	113.6	111.9	110 2	108.6	107.0
1150	132.3	128.3	124.4	122.5	120.6	118.8	117.0	115 2	113.5	111 8
1200	138.1	133 8	129.8	127.8	125.9	123.9	122.0	120 2	118.4	116.7
1250	143.8	139.4	135 2	133.1	131.1	129.1	127.1	125.2	123.4	121 6
1300	149.6	145.0	140.6	138.5	136.3	134.3	132.2	130.2	128.3	126.4
1350	155.3	150.6	146.0	143.8	141.6	139.4	137.3	135.2	133.2	131.3
1400	161.1	156.2	151.4	149.1	146.8	144.6	142.4	140.2	138.2	136.2
1450	166.8	161.7	156.8	154.5	152.1	149.7	147.5	145.3	143.1	141.0
1500	172.6	167.3	162.3	159.8	157.3	154.9	152.5	150 3	148.0	145 9
1550	178.3	172.9	167.7	165.1	162.6	160.1	157.6	155.3	153.0	150 7
1600	184.1	178.5	173.1	170.4	167.8	165.2	162.7	160 3	157.9	155.6
1650	189.8	184.0	178.5	175.7	173.0	170.4	167.8	165.3	162.8	160 5
1700	195.6	189.6	183.9	181.1	178.3	175.6	172.9	170.3	167.8	165.3
1750	201.4	195.2	189.3	186.4	183.5	180.7	178.0	175.3	172.7	170.2
1800	207.1	200.8	194.7	191.7	188.8	185.9	183.1	180.3	177.6	175.0
1850	212.9	206.3	200.1	197.0	194.0	191.0	188.1	185.3	182.6	179 9
1900	218.6	211.9	205.5	202.4	199.3	196.2	193.2	190 3	187.5	184 8
1950	224.4	217.5	210 9	207.7	204.5	201.4	198.3	195.3	192 4	189 6
2000	230.1	223.0	216.3	213.0	209.7	206.5	203.4	200.3	197.4	194.5
2050	235.9	228.6	221.7	218.3	215.0	211.7	208.5	205.3	202.3	199.3
2100	241.6	234.2	227.1	223.7	220.2	216.8	213.5	210.4	207.2	204.2
2150	247.4	239.8	232.5	229.0	225.5	222.0	218.6	215.4	212.2	209.1
2200	253.1	245.4	237.9	234.3	230.7	227.2	223.7	220.4	217.1	213.9
2250	258.9	250.9	243.4	239.6	235.9	232.3	228.8	225.4	222.0	218.8
2300	264.6	256.5	248.8	245.0	241.2	237.5	233.9	230.4	227.0	223.6
2350	270.4	262.1	254.2	250.3	246.4	242.7	239.0	235.4	231.9	228 5
2400	276.1	267.7	259.6	255.6	251.7	247.8	244.0	240.4	236.8	233.4
2450	281.9	273.2	265.0	260.9	256.9	253.0	249.1	245.4	241.8	238.2
2500	287.6	278.8	270.4	266.2	262.2	258.1	254.2	250.4	246.7	243.1
2550	293.4	284.4	275.8	271.6	267.4	263.3	259.3	255.4	251.6	247.9
2600	299.1	290.0	281.2	276.9	272.6	268.5	264.4	260.4	256.6	252.8
2650	304.9	295.5	286.6	282.2	277.9	273.6	269.5	265.4	261.5	257.7
2700	310 6	301.1	292.0	287.5	283 1	278.8	274.5	270.4	266.4	262.5
2750	316.4	306.7	297.4	292.9	288.4	283.9	279.6	275.4	271.4	267.4
2800	322.1	312.3	302.8	298.2	293.6	289.1	284.7	280.4	276.3	272.2
2850	327.9	317.8	308.2	303.5	298.8	294.3	289.8	285.4	281.2	277.1
2900	333.6	323.4	313.6	308.8	304.1	299.4	294.9	290.4	286.2	282.0
2950	339.4	329.0	319.0	314.2	309.3	304.6	299.9	295.5	291.1	286.8
3000	345.1	334 5	324 4	319.5	314.6	309.7	305.0	300 5	296.0	291.7

REDUCTION OF BAROMETER TO SEA LEVEL (Continued)

METRIC UNITS—TABLE II

Values of Correction to be Added

Temp.—alt.—factor	Barometer reading 780 mm	760 mm	740 mm	720 mm	700 mm	
1	0.9	0 9	0 9	0 8	0 8	
5	4 5	4 4	4 3	4 2	4 0	
10	9 0	8 8	8 6	8 3	8 1	
15	13 6	13 2	12 9	12 5	12 2	
20	18 2	17 7	17 2	16 8	16 3	
25	22 8	22 2	21 6	21 0	20 4	
30	27 4	26 7	26 0	25.3	24 6	
35	.	31 2	30 4	29 6	28 8	

Temp.—alt.—factor	760 mm	740 mm	720 mm	700 mm	680 mm	660 mm
40	35 8	34 9	33 9	33 0	32 0	31.1
45	40 4	39 3	38 3	37 2	36 2	35 1
50	45 0	43 8	42 7	41 5	40 3	39 1
55	49 7	48 4	47 1	45 8	44 5	43 1
60		52 9	51 5	50 1	48 6	47 2
65		57 5	55 9	54 4	52 8	51.3
70		62 1	60 4	58 7	57 1	55 4
75		66 7	64 9	63 1	61 3	59 5

Temp.—alt.—factor	720 mm	700 mm	680 mm	660 mm	640 mm
80	69 5	67 5	65 6	63 7	61 7
85	74 0	72 0	69 9	67 9	65 8
90	78 6	76 4	74 2	72 1	69 9
95	83 2	80 9	78 6	76 3	74 0
100	87 9	85 4	83 0	80 5	78 1
105		89 9	87 4	84 8	82 2
110		94 5	91 8	89 1	86 4
115		99 1	96 3	93 4	90 6
120		103 7	100 7	97 8	94 8
125		108 3	105 3	102 2	99 1

Temp.—alt.—factor	680 mm	660 mm	640 mm	620 mm	600 mm
125	105 3	102 2	99 1	96 0	92 9
130	109 8	106 6	103 3	100 1	96 9
135	114 3	111 0	107 6	104 3	100 9
140	118 9	115 4	111 9	108 4	104 9
145	123 5	119 9	116 3	112 6	109 0
150	128 2	124 4	120 6	116 9	113 1
155	....	128 9	125 0	121 1	117 2
160	..	133 5	129 4	125 4	121 4
165		138 1	133 9	129 7	125 5
170	.	142 7	138 4	134 0	129 7

Temp.—alt.—factor	Barometer reading 640 mm	620 mm	600 mm	580 mm	560 mm
170	138 4	134 0	129 7	125 4	121.1
175	142 9	138.4	133 9	129 5	125 0
180	147 4	142 8	138 2	133 6	129 0
185	151 9	147 2	142 4	137 7	132 9
190	156 5	151 6	146 7	141 8	136 9
195	161 1	156 1	151 0	146 0	141 0
200	165 7	160 5	155 4	150 2	145 0
205	170.4	165 0	159.7	154 4	149.1
210	....	169 6	164.1	158 6	153.2
215	...	174 1	168 5	162 9	157.3

Temp.—alt.—factor	620 mm	600 mm	580 mm	560 mm	540 mm
215	174 1	168 5	162 9	157 3	151.7
220	178 7	172 9	167 2	161 4	155 7
225	183 3	177.4	171 5	165 6	159 7
230	188 0	181.9	175 8	169 8	163 7
235	192 6	186 4	180 2	174 0	167 8
240	...	191 0	184 6	178 2	171 9
245	...	195 5	189 0	182 5	176 0
250	.. .	200 1	193 4	186 8	180 1
255	...	204 7	197 9	191 1	184 3
260	...	209 4	202 4	195 4	188 4

Temp.—alt.—factor	580 mm	560 mm	540 mm	520 mm	
260	202 4	195 4	188 4	181 5	
265	206 9	199 8	192 6	185 5	
270	211 5	204 2	196 9	189 6	
275	216 0	208 6	201 1	193 7	
280	220 6	213 0	205 4	197 8	
285	225 2	217 5	209 7	201 9	
290	229 9	222 0	214 0	206 1	
295	....	226 5	218 4	210 3	
300		231 0	222 8	214 5	

Temp.—alt.—factor	560 mm	540 mm	520 mm	500 mm	480 mm
305	235 6	227 2	218 8	210 3	201 9
310	240 2	231 6	223 0	214 4	205 9
315	244 8	236 0	227 3	218 6	209 8
320	249 4	240 5	231 6	222 7	213 8
325	254 1	245 0	236 0	226 9	217 8
330	.	249 6	240 3	231 1	221 8
335		254.1	244.7	235 3	225 9
340		258 7	249 1	239 6	230 0
345		263 3	253 6	243 8	234 1

REDUCTION OF BAROMETER TO SEA LEVEL (Continued)

ENGLISH UNITS—TABLE I

Values of the temperature-altitude factor (2000 m.) for entering table II.

Altitude feet	Assumed temperature of air column °F									
	−20	0	+10	+20	+30	+40	+50	+60	+70	+80
200	7 4	7 1	6 9	6 8	6 6	6 5	6 3	6 2	6 1	6 0
400	14 8	14 1	13 8	13 5	13 2	13 0	12 7	12 4	12 2	11 9
600	22 2	21 2	20 7	20 3	19 9	19 5	19 0	18 6	18.2	17 9
800	29 6	28.3	27 7	27 1	26 5	25 9	25 4	24 8	24 3	23 8
1000	37 0	35 3	34 6	33 8	33 1	32 4	31 7	31.1	30.4	29 8
1200	44 3	42 4	41 5	40 6	39 7	38 9	38 1	37 3	36.5	35 8
1400	51 7	49 5	48 4	47 4	46 4	45 4	44.4	43 5	42 6	41 7
1600	59 1	56 5	55 3	54 1	53 0	51.9	50 8	49 7	48.7	47 7
1800	66 5	63 6	62 2	60 9	59 6	58 4	57 1	55 9	54 7	53 6
2000	73 9	70 6	69 1	67 7	66 2	64 8	63 4	62 1	60 8	59 6
2200	81 3	77 7	76 0	74 4	72 9	71 3	69 8	68 3	66 9	65 5
2400	88.7	84 8	82 9	81 2	79 5	77 8	76 1	74 5	73 0	71 5
2600	96 1	91 8	89 9	87 9	86 1	84 3	82 5	80 7	79 1	77 5
2800	103 5	98 9	96 8	94 7	92 7	90 8	88 8	87 0	85 1	83 4
3000	110.9	106 0	103 7	101.5	99 3	97 2	95.2	93 2	91 2	89 4
3200	118 2	113 0	110 6	108 2	106 0	103 7	101 5	99 4	97 3	95 3
3400	125 6	120 1	117 5	115 0	112 6	110 2	107 9	105 6	103 4	101 3
3600	133 0	127 2	124 4	121 8	119 2	116 7	114 2	111 8	109 5	107 2
3800	140 4	134 2	131 3	128 5	125 8	123 2	120 5	118 0	115 5	113 2
4000	147.8	141 3	138 2	135 3	132 4	129 6	126 9	124 2	121 6	119 2
4200	155 2	148 3	145 1	142 1	139 1	136 1	133 2	130 4	127 7	125 1
4400	162 6	155 4	152 0	148 8	145 7	142 6	139 6	136 6	133 8	131 1
4600	170 0	162 5	159 0	155 6	152 3	149 1	145 9	142 8	139 9	137 0
4800	177 3	169 5	165 9	162 3	158 9	155 6	152 2	149 0	145 9	143 0
5000	184 7	176 6	172 8	169 1	165 6	162 0	158 6	155 2	152 0	148 9
5200	192 1	183 7	179 7	175 9	172 2	168 5	164 9	161 5	158 1	154 9
5400	199.5	190.7	186 6	182 6	178 8	175 0	171 3	167 7	164 2	160 8
5600	206 9	197 8	193 5	189 4	185 4	181 5	177 6	173 9	170 3	166 8
5800	214 3	204 8	200 4	196 2	192 0	188 0	184 0	180 1	176 3	172 8
6000	221 7	211 9	207 3	202 9	198 7	194 4	190 3	186 3	182 4	178 7
6200	229 1	219 0	214 2	209 7	205 3	200 9	196 6	192 5	188 5	184 7
6400	236 4	226 0	221 1	216 4	211 9	207 4	203 0	198 7	194 6	190 6
6600	243 8	233 1	228 0	223 2	218 5	213 9	209 3	204 9	200 7	196 6
6800	251 2	240 1	235 0	230 0	225 1	220 4	215 7	211 1	206 7	202 5
7000	258.6	247 2	241 9	236 7	231 8	226 8	222 0	217 3	212 8	208 5
7200	266 0	254 3	248 8	243 5	238 4	233 3	228 4	223 5	218 9	214 4
7400	273 4	261 3	255 7	250 2	245 0	239 8	234 7	229 7	225 0	220 4
7600	280 8	268 4	262 6	257 0	251 6	246 3	241 0	235 9	231 1	226 4
7800	288.1	275 4	269 5	263 8	258 2	252 8	247 4	242 2	237 1	232 3
8000	295 5	282 5	276 4	270 5	264 8	259 2	253 7	248 4	243 2	238 3
8200	302 9	289 6	283 3	277 3	271 5	265 7	260 1	254 6	249 3	244 2
8400	310 3	296 6	290 2	284 0	278 1	272 2	266 4	260 8	255 4	250 2
8600	317 7	303 7	297 1	290.8	284 7	278 7	272 7	267 0	261 4	256 1
8800	325 1	310 7	304 0	297 6	291 3	285 2	279 1	273 2	267 5	262 1
9000	332 5	317 8	310 9	304.3	297 9	291 6	285 4	279 4	273 6	268 0

REDUCTION OF BAROMETER TO SEA LEVEL (Continued)

ENGLISH UNITS—TABLE II

Value of Correction to be Added.

Temp alt. factor	Barometer reading 31	30	29	28	27	Temp alt. factor	Barometer reading 26	25	24	23	22
	in.	in.	in.	in.	in.		in.	in.	in.	in.	in.
1	0.04	0.03	0.03	...	...	165	5.44	5.23	5.02		
5	0.18	0.17	0.17	...	...	170	5.62	5.40	5.19		
10	0.36	0.35	0.34	0.32	...	175	...	5.58	5.36		
15	0.54	0.52	0.51	0.49	...	180	...	5.76	5.53	5.30	
20	0.72	0.70	0.68	0.65	...	185	...	5.93	5.70	5.46	
25	...	0.88	0.85	0.82	...	190	...	6.11	5.87	5.62	
30		1.05	1.02	0.98	...	195	...	6.29	6.04	5.79	
35		1.23	1.19	1.15	...	200	...	6.47	6.21	5.96	
40		1.41	1.37	1.32	1.27	205	...	...	6.39	6.12	
45		1.60	1.54	1.49	1.44	210	...		6.56	6.29	
50	...	...	1.72	1.66	1.60	215	...	...	6.74	6.46	
55		...	1.90	1.83	1.76	220	...	...	6.92	6.63	6.34
60	...	...	2.07	2.00	1.93	225	...		7.10	6.80	6.51
65	...	...	2.25	2.18	2.10	230	...	...	7.28	6.97	6.67
70		...	2.43	2.35	2.27	235	...		7.46	7.15	6.84
75		...	...	2.53	2.43	240	...	...		7.32	7.00
80	...	...	...	2.70	2.60	245	...	...	...	7.49	7.17
	28	27	26	25	24		23	22	21	20	
	in.	in.	in.	in.	in.		in.	in.	in.	in.	
75	2.53	2.43	2.34		...	250	7.67	7.34			
80	2.70	2.60	2.51	...	...	255	7.85	7.51			
85	2.88	2.78	2.67	...	...	260	8.03	7.68	7.33		
90	3.06	2.95	2.84		...	265	8.21	7.85	7.49		
95	3.24	3.12	3.01		...	270	8.39	8.02	7.66		
100	3.42	3.29	3.17		...	275	8.57	8.19	7.82		
105	3.60	3.47	3.34	3.21		280	...	8.37	7.99		
110		3.65	3.51	3.38		285		8.54	8.16		
115		3.82	3.68	3.54		290		8.72	8.32		
120		4.00	3.85	3.70		295		8.90	8.49	8.09	
125		4.18	4.02	3.87		300		9.08	8.66	8.25	
130		4.36	4.20	4.04		305		9.26	8.83	8.41	
135		4.54	4.37	4.20		310	...	9.44	9.01	8.58	
140		...	4.55	4.37	4.20	315		9.62	9.18	8.74	
145			4.72	4.54	4.36	320	...	9.80	9.35	8.91	
150			4.90	4.71	4.52	325	...		9.53	9.08	
155	...		5.08	4.88	4.69	330	...	...	9.71	9.24	
160		...	5.26	5.06	4.85						

REDUCTION OF BAROMETER TO GRAVITY AT SEA LEVEL

Metric Units

Correction to be subtracted given in millimeters

(From Smithsonian Physical Tables)

Height above sea level in meters	Observed Height of Barometer in Millimeters						
	500	550	600	650	700	750	800
100	.....	.....	.....	.....	.02	.02	.02
200	.....	.....	.....	.....	.04	.05	.05
300	.....	.....	.....	.....	.07	.07	.07
400	.....	.....	.....	.....	.09	.10	.10
500	.....	.....	.....	.....	.11	.12	.13
600	.....	.....	.....	.12	.13	.14	
700	.....	.....	.....	.14	.15	.16	
800	.....	.....	.....	.16	.18	.19	
900	.....	.....	.....	.18	.20	.22	
1000	.....	.18	.19	.20	.22	.24	
1100	.....	.19	.21	.22	.24		
1200	.....	.21	.23	.24	.26		
1300	.....	.22	.24	.26	.29		
1400	.....	.24	.26	.28	.31		
1500	.24	.26	.28	.30	.33		
1600	.25	.28	.30	.32			
1700	.27	.30	.32	.34			
1800	.28	.31	.34	.36			
1900	.30	.33	.36	.39			
2000	.31	.34	.38	.41			
2100	.33	.36	.40				
2200	.35	.38	.41				
2300	.36	.40	.43				
2400	.38	.42	.45				
2500	.39	43	.47				

English Units

Height above sea level in feet	Observed Height in Inches						
	18	20	22	24	26	28	30
1000	.....	....	.....	.....	.003	.003	.003
2000	.....	.....	.....	.004	.005	.005	.006
3000	.....	.....	.007	.007	.008	.008	
4000	.....	.....	.009	.009	.010		
4500	.....	.....	.010	.010	.011		
5000	.....	.010	.011	.011	.012		
5500	.....	.011	.012	.013			
6000	.....	.011	.013	.014			
6500	.011	.012	.014	.015			
7000	.012	.013	.015	.016			
7500	.013	.014	.016	.017			
8000	.014	.015	017				
8500	.015	.016	.018				
9000	.016	.017	.019				
9500	.016	.018	.020				

REDUCTION OF BAROMETER TO LATITUDE 45°

Metric Scale

For latitudes below 45°, subtract the correction; for latitudes greater than 45° it is to be added. Corrections in cm.

(From Smithsonian Meteorological Tables.)

Latitude		Observed Height of Barometer in Centimeters					
		68	70	72	74	76	78
25°	65°	0 116	0.120	0.123	0.127	0.130	0.133
26	64	.111	115	.118	121	.125	.128
27	63	.106	110	.113	116	.119	.122
28	62	.101	104	.107	.110	.113	.116
29	61	.096	.099	.102	.104	.107	.110
30	60	0 091	0 094	0 096	0.098	0.101	0.104
31	59	085	087	.090	.092	095	.097
32	58	.079	.082	.084	086	.089	.091
33	57	.074	.076	.078	.080	.082	.084
34	56	.068	070	.072	.074	.076	.078
35	55	0 062	0 064	0.066	0.067	0.069	0.071
36	54	.056	058	059	.061	.063	.064
37	53	.050	051	053	054	056	.057
38	52	.044	.045	046	048	.049	.050
39	51	.038	.039	.040	.041	.042	.043
40	50	0 031	0 032	0.033	0.034	0 035	0.036
41	49	025	026	.027	027	.028	029
42	48	.019	019	.020	021	.021	.022
43	47	013	013	013	014	.014	.014
44	46	006	007	.007	007	007	.007

English Scale

Corrections in inches.

Latitude		Observed Height in Inches					
		25	26	27	28	29	30
25°	65°	0 043	0 044	0 046	0 048	0.050	0.051
26	64	.041	043	044	.046	.048	.049
27	63	039	041	042	044	.045	.047
28	62	.037	039	040	.042	.043	.045
29	61	.035	037	.038	.039	.041	.042
30	60	0 033	0 035	0 036	0 037	0 039	0.040
31	59	.031	032	034	.035	.036	.037
32	58	.029	030	032	033	.034	.035
33	57	.027	.028	.029	.030	031	.032
34	56	.025	.026	.027	.028	.029	.030
35	55	0 023	0 024	0 025	0.025	0.026	0.027
36	54	021	021	.022	.023	.024	.025
37	53	.018	019	.020	.021	.021	.022
38	52	.016	017	.017	.018	.019	.019
39	51	.014	.014	.015	.015	.016	.017
40	50	0.012	0 012	0 012	0.013	0.013	0.014
41	49	.009	.010	.010	.010	.011	.011
42	48	.007	.007	.008	.008	.008	.008
43	47	.005	.005	.005	.005	.005	.006
44	46	.002	.002	.003	.003	003	.003

RELATIVE HUMIDITY—DEW-POINT

The table gives the relative humidity of the air for temperature *t* and dew-point *d*.

(From Smithsonian Meteorological Tables.)

Depression of dew-point $t-d$ °C.	Dew-point (*d*).				
	−10	0	+10	+20	+30
0.0	100%	100%	100%	100%	100%
0.2	98	99	99	99	99
0.4	97	97	97	98	98
0.6	95	96	96	96	97
0.8	94	94	95	95	96
1.0	92	93	94	94	94
1.2	91	92	92	93	93
1.4	90	90	91	92	92
1.6	88	89	90	91	91
1.8	87	88	89	90	90
2.0	86	87	88	88	89
2.2	84	85	86	87	88
2.4	83	84	85	86	87
2.6	82	83	84	85	86
2.8	80	82	83	84	85
3.0	79	81	82	83	84
3.2	78	80	81	82	83
3.4	77	79	80	81	82
3.6	76	77	79	80	82
3.8	75	76	78	79	81
4.0	73	75	77	78	80
4.2	72	74	76	77	79
4.4	71	73	75	77	78
4.6	70	72	74	76	77
4.8	69	71	73	75	76
5.0	68	70	72	74	75
5.2	67	69	71	73	75
5.4	66	68	70	72	74
5.6	65	67	69	71	73
5.8	64	66	69	70	72
6.0	63	66	68	70	71
6.2	62	65	67	69	71
6.4	61	64	66	68	70
6.6	60	63	65	67	69
6.8	60	62	64	66	68
7.0	59	61	63	66	68
7.2	58	60	63	65	67
7.4	57	60	62	64	66
7.6	56	59	61	63	65
7.8	55	58	60	63	65

RELATIVE HUMIDITY—DEW-POINT (Continued)

Depression of dew-point $t-d$ °C.	Dew-point (d).				
	−10	0	+10	+20	+30
8.0	54	57	60	62	64
8.2	54	56	59	61	63
8.4	53	56	58	60	63
8.6	52	55	57	60	62
8.8	51	54	57	59	61
9.0	51	53	56	58	61
9.2	50	53	55	58	60
9.4	49	52	55	57	59
9.6	48	51	54	56	59
9.8	48	51	53	56	58
10.0	47	50	53	55	57
10.5	45	48	51	54	
11.0	44	47	49	52	
11.5	42	45	48	51	
12.0	41	44	47	49	
12 5	39	42	45	48	
13.0	38	41	44	46	
13.5	37	40	43	45	
14.0	35	38	41	44	
14 5	34	37	40	43	
15.0	33	36	39	42	
15 5	32	35	38	40	
16.0	31	34	37	39	
16 5	30	33	36	38	
17.0	29	32	35	37	
17.5	28	31	34	36	
18.0	27	30	33	35	
18.5	26	29	32	34	
19.0	25	28	31	33	
19.5	24	27	30	33	
20.0	24	26	29	32	
21.0	22	25	27		
22.0	21	23	26		
23.0	19	22	24		
24.0	18	21	23		
25.0	17	19	22		
26.0	16	18	21		
27.0	15	17	20		
28.0	14	16	19		
29.0	13	15	18		
30.0	12	14	17		

RELATIVE HUMIDITY FROM WET AND DRY

This table gives the approximate relative humidity directly from the reading of the air pressure of 74.27 cm Hg. Errors resulting from the use of this table for air temperatures

Condensed from Bulletin of the

t \ $t - t'$	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6
−10	93	87	80	74	67	61	54	48	41	35	28	22	16	9		.		.
−9	94	88	81	75	69	63	57	51	45	39	33	27	21	15	9	.		.
−8	94	88	83	77	71	65	60	54	48	43	37	32	26	20	15	10		
−7	95	89	84	78	73	67	62	57	52	46	41	36	31	25	20	15	10	5
−6	95	90	85	79	74	69	64	59	54	49	45	40	35	30	25	20	15	11
−5	95	90	86	81	76	71	66	62	57	52	48	43	39	34	29	25	20	16
−4	95	91	86	82	77	73	68	64	59	55	51	46	42	38	33	29	25	21
−3	96	91	87	82	78	74	70	66	62	57	53	49	45	41	37	33	29	25
−2	96	92	88	84	79	75	71	68	64	60	56	52	48	44	40	37	33	29
−1	96	92	88	84	81	77	73	69	66	62	58	54	51	47	43	40	36	33
0	96	93	89	85	81	78	74	71	67	64	60	57	53	50	46	43	40	36
1	97	93	90	86	83	80	76	73	70	66	63	59	56	53	49	46	43	40
2	97	93	90	87	84	81	78	74	71	68	65	62	59	55	52	49	46	43
3	97	94	91	88	84	82	78	76	72	70	67	64	61	58	55	52	49	46
4	97	94	91	88	85	82	79	77	74	71	68	65	62	60	57	54	51	48
5	97	94	91	88	86	83	80	77	75	72	69	67	64	61	58	56	53	51
6	97	94	92	89	86	84	81	78	76	73	70	68	65	63	60	58	55	53
7	97	95	92	89	87	84	82	79	77	74	72	69	67	64	62	59	57	54
8	97	95	92	90	87	85	82	80	77	75	73	70	68	65	63	61	58	56
9	98	95	93	90	88	85	83	81	78	76	74	71	69	67	64	62	60	58
10	98	95	93	90	88	86	83	81	79	77	74	72	70	68	66	63	61	59
11	98	95	93	91	89	86	84	82	80	78	75	73	71	69	67	65	62	60
12	98	96	93	91	89	87	85	82	80	78	76	74	72	70	68	66	64	62
13	98	96	93	91	89	87	85	83	81	79	77	75	73	71	69	67	65	63
14	98	96	94	92	90	88	86	84	82	79	78	76	74	72	70	68	66	64
15	98	96	94	92	90	88	86	84	82	80	78	76	74	73	71	69	67	65

t \ $t - t'$	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5
16	95	90	85	81	76	71	67	63	58	54	50	46	42	38	34	30	26	23	19
17	95	90	86	81	76	72	68	64	60	55	51	47	43	40	36	32	28	25	21
18	95	91	86	82	77	73	69	65	61	57	53	49	45	41	38	34	30	27	23
19	95	91	87	82	78	74	70	65	62	58	54	50	46	43	39	36	32	29	26
20	96	91	87	83	78	74	70	66	63	59	55	51	48	44	41	37	34	31	28
21	96	91	87	83	79	75	71	67	64	60	56	53	49	46	42	39	36	32	29
22	96	92	87	83	80	76	72	68	64	61	57	54	50	47	44	40	37	34	31
23	96	92	88	84	80	76	72	69	65	62	58	55	52	48	45	42	39	36	33
24	96	92	88	84	80	77	73	69	66	62	59	56	53	49	46	43	40	37	34
25	96	92	88	84	81	77	74	70	67	63	60	57	54	50	47	44	41	39	36
26	96	92	88	85	81	78	74	71	67	64	61	58	54	51	49	46	43	40	37
27	96	92	89	85	82	78	75	71	68	65	62	58	56	52	50	47	44	41	38
28	96	93	89	85	82	78	75	72	69	65	62	59	56	53	51	48	45	42	40
29	96	93	89	86	82	79	76	72	69	66	63	60	57	54	52	49	46	43	41
30	96	93	89	86	83	79	76	73	70	67	64	61	58	55	52	50	47	44	42
31	96	93	90	86	83	80	77	73	70	67	64	61	59	56	53	51	48	45	43
32	96	93	90	86	83	80	77	74	71	68	65	62	60	57	54	51	49	46	44
33	97	93	90	87	83	80	77	74	71	68	66	63	60	57	55	52	50	47	45
34	97	93	90	87	84	81	78	75	72	69	66	63	61	58	56	53	51	48	46
35	97	94	90	87	84	81	78	75	72	69	67	64	61	59	56	54	51	49	47
36	97	94	90	87	84	81	78	75	73	70	67	64	62	59	57	54	52	50	48
37	97	94	91	87	84	82	79	76	73	70	68	65	63	60	58	55	53	51	48
38	97	94	91	88	84	82	79	76	74	71	68	66	63	61	58	56	54	51	49
39	97	94	91	88	85	82	79	77	74	71	69	66	64	61	59	57	54	52	50
40	97	94	91	88	85	82	80	77	74	72	69	67	64	62	59	57	54	53	51

BULB THERMOMETER (CENT. SCALE)

temperature (dry bulb) (t°C) and the wet bulb (t'°C). It is computed for a barometric above −10°C and between 77.5 and 71 cm Hg will usually be within the errors of observation.

U. S. Weather Bureau No. 1071

t \ $t - t'$	3.8	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0
−10																
−9																
−8																
−7																
−6	6															
−5	11	7														
−4	17	12														
−3	21	17	8													
−2	25	22	12													
−1	29	26	17	8												
0	33	29	21	13	5											
1	36	33	25	17	10											
2	40	37	29	22	14	7										
3	43	40	33	26	19	12	5									
4	46	43	36	29	22	16	9									
5	48	45	39	33	26	20	13	7								
6	50	48	41	35	29	24	17	11	5							
7	52	50	44	38	32	26	21	15	10							
8	54	51	46	40	35	29	24	19	14	8						
9	55	53	48	42	37	32	27	22	17	12	7					
10	57	55	50	44	39	34	29	24	20	15	10	6				
11	58	56	51	46	41	36	32	27	22	18	13	9	5			
12	60	58	53	48	43	39	34	29	25	21	16	12	8			
13	61	59	54	50	45	41	36	32	28	23	19	15	11	7		
14	62	60	56	51	47	42	38	34	30	26	22	18	14	10	6	
15	63	61	57	53	48	44	40	36	32	27	24	20	16	13	9	6
	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	16.0	17.0	18.0	19.0	20.0
16	15	12	8	5												
17	18	14	11	8												
18	20	17	14	10	7											
19	22	19	16	13	10	7										
20	24	21	18	15	12	9	6									
21	26	23	20	17	14	12	9	6								
22	28	25	22	19	17	14	11	8	6							
23	30	27	24	21	19	16	13	11	8	6						
24	31	29	26	23	20	18	15	13	10	8	5					
25	33	30	28	25	22	20	17	15	12	10	8					
26	34	32	29	26	24	21	19	17	14	12	10	5				
27	36	33	31	28	26	23	21	18	16	14	12	7				
28	37	34	32	29	27	25	22	20	18	16	13	9	5			
29	38	36	33	31	28	26	24	22	19	17	15	11	7			
30	39	37	35	32	30	28	25	23	21	19	17	13	9	5		
31	40	38	36	33	31	29	27	25	22	20	18	14	11	7		
32	41	39	37	35	32	30	28	26	24	22	20	16	12	9	5	
33	42	40	38	36	33	31	29	27	25	23	21	17	14	10	7	
34	43	41	39	37	35	32	30	28	26	24	23	19	15	12	8	5
35	44	42	40	38	36	34	32	30	28	26	24	20	17	13	10	7
36	45	43	41	39	37	35	33	31	29	27	25	21	18	15	11	8
37	46	44	42	40	38	36	34	32	30	28	26	23	19	16	13	10
38	47	45	43	41	39	37	35	33	31	29	27	24	20	17	14	11
39	48	46	43	42	39	38	36	34	32	30	28	25	22	18	15	12
40	48	46	44	42	40	38	36	35	33	31	29	26	23	20	16	14

REDUCTION OF PSYCHROMETRIC OBSERVATION

For the reduction of observations with the wet and dry bulb thermometer. Assuming the relative velocity of the air to the thermometer bulbs is at least three meters per second; if t is the temperature of the air as indicated by the dry bulb, t_w, the temperature of the wet bulb, B, the barometric pressure, and E_w, the vapor tension of water corresponding to t_w, then the actual vapor tension is

$$E = E_w - 0.00066B(t - t_w)[1 + 0.00115(t - t_w)].$$

The value of the term

$$0.00066B(t - t_w)[1 + 0.00115(t - t_w)]$$

is given in the following table.

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

$t - t_w$	Barometric Pressure B in Centimeters							
	70 0	71 0	72 0	73 0	74 0	75 0	76 0	77 0
°C	cm	cm	cm	cm	cm	cm	cm	cm
1	0 047	0 048	0 048	0 049	0 050	0 050	0 051	0 052
2	093	094	096	.097	.098	100	101	103
3	139	141	143	145	147	149	152	154
4	186	189	.191	.194	.197	199	202	204
5	0 232	0 236	0 239	0 243	0 246	0 249	0 252	0.256
6	279	283	.287	.291	295	299	303	.307
7	.326	331	336	340	345	.350	.354	359
8	.373	.379	384	.389	395	400	.405	411
9	.421	427	432	438	.444	450	456	462
10	0 468	0 474	0 481	0 488	0 494	0 501	0 508	0 515
11	515	522	530	537	.544	551	559	566
12	562	570	578	586	594	602	611	.619
13	610	618	627	636	645	653	662	.671
14	658	.667	676	686	695	.705	714	.723
15	0 706	0 716	0 726	0 736	0 746	0 756	0 766	0.776
16	754	764	.775	.786	.796	.807	.818	.829
17	802	813	.824	836	.847	859	.870	.882
18	850	862	874	886	.898	910	.922	.935
19	898	911	923	.936	.949	962	975	987
20	0 946	0 960	0 973	0 987	1 000	1 014	1 027	1 041

CONSTANT HUMIDITY

The following table shows the % humidity and the aqueous tension at the given temperature within a closed space when an excess of the substance indicated is in contact with a saturated aqueous solution of the given solid phase.

Solid phase	t°C.	% humidity	Aq. tension
$H_3PO_4.\frac{1}{2}H_2O$	24	9	1.99
$ZnCl_2.1\frac{1}{2}H_2O$*	20	10	1.74
$KC_2H_3O_2$	168	13	738
$LiCl.H_2O$	20	15	2.60
$KC_2H_3O_2$	20	20	3.47
KF	100	22.9	174
NaBr	100	22.9	174
NaCl, KNO_3 and $NaNC_3$	16.39	30.49	4.23
$CaCl_2.6H_2O$	24.5	31	7.08
$CaCl_2.6H_2O$	20	32.3	5.61
$CaCl_2.6H_2O$	18.5	35	5.54
CrO_3	20	35	6.08
$CaCl_2.6H_2O$	10	38	3.47
$CaCl_2.6H_2O$	5	39.8	2.59
$Zn(NO_3)_2.6H_2O$	20	42	7.29
$K_2CO_3.2H_2O$	24.5	43	9.82
$K_2CO_3.2H_2O$	18.5	44	6.96
KNO_2	20	45	7.81
KCNS	20	47	8.16
NaI	100	50.4	383
$Ca(NO_3)_2.4H_2O$	24.5	51	11.6
$NaHSO_4.H_2O$	20	52	9.03
$Na_2Cr_2O_7.2H_2O$	20	52	9.03
$Mg(NO_3)_2.6H_2O$	24.5	52	11.9
$NaClO_3$	100	54	410
$Ca(NO_3)_2.4H_2O$	18.5	56	8.86
$Mg(NO_3)_2.6H_2O$	18.5	56	8.86
KI	100	56.2	427
$NaBr.2H_2O$	20	58	10.1
$Mg(C_2H_3O_2)_2.4H_2O$	20	65	11.3
$NaNO_2$	20	66	11.5
NH_4Cl and KNO_3	30	68.6	21.6
KBr	100	69.2	526
NH_4Cl and KNO_3	25	71.2	16.7
NH_4Cl and KNO_3	20	72.6	12.6
$NaClO_3$	20	75	13.0
$(NH_4)_2SO_4$	108.	75	754
$NaC_2H_3O_2.3H_2O$	20	76	13.2
$H_2C_2O_4.2H_2O$	20	76	13.2
$Na_2S_2O_3.5H_2O$	20	78	13.5
NH_4Cl	20	79.5	13.8

* Unstable form.

CONSTANT HUMIDITY (Continued)

Solid phase	t°C.	% humidity	Aq. tension
NH_4Cl	25	79.3	18.6
NH_4Cl	30	77.5	24.4
$(NH_4)_2SO_4$	20	81	14.1
$(NH_4)_2SO_4$	25	81.1	19.1
$(NH_4)_2SO_4$	30	81.1	25.6
KBr	20	84	14.6
Tl_2SO_4	104.7	84.8	768
$KHSO_4$	20	86	14.9
$Na_2CO_3.10H_2O$	24.5	87	20.9
$BaCl_2.2H_2O$	24.5	88	20.1
K_2CrO_4	20	88	15.3
$Pb(NO_3)_2$	103.5	88.4	760
$ZnSO_4.7H_2O$	20	90	15.6
$Na_2CO_3.10H_2O$	18.5	92	14.6
$NaBrO_3$	20	92	16.0
K_2HPO_4	20	92	16.0
$NH_4H_2PO_4$	30	92.9	29.3
$NH_4H_2PO_4$	25	93	21.9
$Na_2SO_4.10H_2O$	20	93	16.1
$NH_4H_2PO_4$	20	93.1	16.2
$ZnSO_4.7H_2O$	5	94.7	6.10
$Na_2SO_3.7H_2O$	20	95	16.5
$Na_2HPO_4.12H_2O$	20	95	16.5
NaF	100	96.6	734
$Pb(NO_3)_2$	20	98	17.0
$CaSO_4.5H_2O$	20	98	17.0
$TlNO_3$	100.3	98.7	759
$TlCl$	100.1	99.7	761

CONSTANT HUMIDITY WITH SULFURIC ACID SOLUTIONS

The relative humidity and pressure of aqueous vapor of air in equilibrium conditions above aqueous solutions of sulfuric acid are given below

Density of acid solution	Relative humidity	Vapor pressure at 20°C	Density of acid solution	Relative humidity	Vapor pressure at 20°C
1.00	100.0	17.4	1.30	58.3	10.1
1.05	97.5	17.0	1.35	47.2	8.3
1.10	93.9	16.3	1.40	37.1	6.5
1.15	88.8	15.4	1.50	18.8	3.3
1.20	80.5	14.0	1.60	8.5	1.5
1.25	70.4	12.2	1.70	3.2	0.6

SOUND

VELOCITY OF SOUND

Solids

Approximate values.
(From Smithsonian Tables.)

Substance	Temp. °C	Veloc., meters per sec.	Veloc., feet per sec.	Observer
Metals:				
Aluminum	..	5104	16740	Masson
Brass	..	3500	11480	Various
Cadmium	..	2307	7570	Masson
Cobalt	....	4724	15500	Masson
Copper	20	3560	11670	Wertheim
Copper	100	3290	10800	Wertheim
Copper	200	2950	9690	Wertheim
Gold, soft	20	1743	5717	Wertheim
Gold, hard	....	2100	6890	Various
Iron and soft steel	...	5000	16410	Various
Iron	20	5130	16820	Wertheim
Iron	100	5300	17390	Wertheim
Iron	200	4720	15480	Wertheim
Iron cast steel	20	4990	16360	Wertheim
Iron cast steel	200	4790	15710	Wertheim
Lead	20	1227	4026	Wertheim
Magnesium	....	4602	15100	Melde
Nickel	....	4973	16320	Masson
Palladium	....	3150	10340	Various
Platinum	20	2690	8815	Wertheim
Platinum	100	2570	8437	Wertheim
Platinum	200	2460	8079	Wertheim
Silver	20	2610	8553	Wertheim
Silver	100	2640	8658	Wertheim
Tin	....	2500	8200	Various
Zinc	....	3700	12140	Various
Various:				
Brick	...	3652	11980	Chladni
Clay rock	..	3480	11420	Gray and Milne
Cork	.	500	1640	Stefan
Granite	..	6000	19685	
Marble	...	3810	12500	Gray and Milne
Paraffin	15	1304	4280	Warburg
Slate	....	4510	14800	Gray and Milne
Tallow	16	390	1280	Warburg
Glass, from	....	5000	16410	Various
Glass, to	....	6000	19690	Various
Ivory	....	3013	9886	Ciccone & Campanile
Vulcanized rubber	0	54	177	Exner
Wax	17	880	2890	Stefan
Woods:				
Ash, along the fiber	...	4670	15310	Wertheim
Ash, across the rings	...	1390	4570	Wertheim
Ash, along the rings	....	1260	4140	Wertheim
Beech, along the fiber	...	3340	10960	Wertheim
Elm, along the fiber	...	4120	13516	Wertheim
Fir, along the fiber	...	4640	15220	Wertheim
Maple, along the fiber		4110	13470	Wertheim
Oak, along the fiber		3850	12620	Wertheim
Pine, along the fiber	..	3320	10900	Wertheim
Poplar, along the fiber	..	4280	14050	Wertheim
Sycamore, along fiber	...	4460	14640	Wertheim

VELOCITY OF SOUND (Continued)

LIQUIDS AND GASES

(From Smithsonian Tables.)

Substance	Temp. °C	Veloc., meters per sec.	Veloc., feet per sec.	Observer
Liquids:				
Alcohol, 95 %	12.5	1241.	4072.	Dorsing, 1908
Alcohol . . .	20.5	1213.	3890.	Dorsing, 1908
Ammonia, conc	16.	1663.	5456.	Dorsing, 1908
Benzine . .	17.	1166.	3826.	Dorsing, 1908
Carbon bisulfide.	15.	1161.	3809.	Dorsing, 1908
Chloroform. .	15.	983.	3225.	Dorsing, 1908
Ether	15.	1032.	3386.	Dorsing, 1908
NaCl, 10 % sol	15.	1470.	4823	Dorsing, 1908
NaCl, 15 % sol.	15	1530.	5020	Dorsing, 1908
NaCl, 20 % sol. . .	15.	1650	5414	Dorsing, 1908
Turpentine oil .	15	1326.	4351.	Dorsing, 1908
Water, air-free	13.	1441.	4728.	Dorsing, 1908
Water, air-free.	19.	1461.	4794	Dorsing, 1908
Water, air-free.	31.	1505.	4938	Dorsing, 1908
Water, Lake Geneva	9.	1435.	4708.	Colladon-Sturm
Water, Seine River	15	1437.	4714	Wertheim
Water, Seine River	30	1528	5013	Wertheim
Water, Seine River .	60	1724	5657.	Wertheim
Gases:				
Air, dry, CO_2-free .	0.	331.78	1088.5	Rowland
Air, dry	0.	331.36	1087.1	Violle, 1900
Air, dry, CO_2-free	0.	331.92	1089.0	Thiesen, 1908
Air 1 atmosphere.	0.	331.7	1088	Mean
Air 25 atmospheres	0	332.0	1089	Mean (Witkowski)
Air 50 atmospheres	0	334.7	1098	Mean (Witkowski)
Air 100 atmospheres	0	350.6	1150	Mean (Witkowski)
Air	20	344	1129	
Air	100.	386	1266	Stevens
Air . . .	500.	553	1814	Stevens
Air	1000	700	2297	Stevens
Ammonia .	0.	415	1361.	Masson
Carbon monoxide	0.	337.1	1106	Wullner
Carbon dioxide	0.	258.0	846	Bückendahl, 1906
Carbon disulfide	0	189	606	Masson
Chlorine .	0	205.3	674	Strecker
Ethylene ..	0	314	1030	Dulong
Hydrogen	0	1269.5	4165	Dulong
Illuminating gas	0	490.4	1609	Zoch
Methane	0.	432	1417.	Masson
Nitric oxide	0	325	1066.	Masson
Nitrous oxide	0.	261.8	859	Dulong
Oxygen . .	0.	317.2	1041.	Dulong
Vapors:				
Alcohol	0	230.6	756	Masson
Ether	0	179.2	588	Masson
Water	0.	401	1315	Masson
Water .	100.	404.8	1328	Treitz, 1903
Water	130.	424.4	1392	Treitz, 1903

MUSICAL SCALES

Equal Tempered Chromatic Scale

$A_4 = 440$

American Standard pitch. Adopted by the American Standards Association in 1936

Note	Frequency	Note	Frequency	Note	Frequency	Note	Frequency
C_0	16.35	C_2	65.41	C_4	261.63	C_6	1046.50
$C\#_0$	17.32	$C\#_2$	69.30	$C\#_4$	277.18	$C\#_6$	1108.73
D_0	18 35	D_2	73.42	D_4	293.66	D_6	1174 66
$D\#_0$	19.45	$D\#_2$	77.78	$D\#_4$	311.13	$D\#_6$	1244.51
E_0	20.60	E_2	82.41	E_4	329.63	E_6	1318 51
F_0	21.83	F_2	87.31	F_4	349.23	F_6	1396.91
$F\#_0$	23.12	$F\#_2$	92.50	$F\#_4$	369.99	$F\#_6$	1479.98
G_0	24.50	G_2	98.00	G_4	392 00	G_6	1567.98
$G\#_0$	25.96	$G\#_2$	103.83	$G\#_4$	415 30	$G\#_6$	1661.22
A_0	27 50	A_2	110.00	$\mathbf{A_4}$	**440.00**	A_6	1760 00
$A\#_0$	29 14	$A\#_2$	116 54	$A\#_4$	466.16	$A\#_6$	1864.66
B_0	30.87	B_2	123.47	B_4	493 88	B_6	1975 53
C_1	32.70	C_3	130 81	C_5	523.25	C_7	2093 00
$C\#_1$	34.65	$C\#_3$	138 59	$C\#_5$	554.37	$C\#_7$	2217.46
D_1	36.71	D_3	146.83	D_5	587 33	D_7	2349 32
$D\#_1$	38.89	$D\#_3$	155 56	$D\#_5$	622.25	$D\#_7$	2489 02
E_1	41.20	E_3	164 81	E_5	659.26	E_7	2637 02
F_1	43 65	F_3	174 61	F_5	698.46	F_7	2793 83
$F\#_1$	46 25	$F\#_3$	185 00	$F\#_5$	739.99	$F\#_7$	2959 96
G_1	49 00	G_3	196 00	G_5	783.99	G_7	3135 96
$G\#_1$	51 91	$G\#_3$	207 65	$G\#_5$	830.61	$G\#_7$	3322 44
A_1	55.00	A_3	220.00	A_5	880 00	A_7	3520 00
$A\#_1$	58 27	$A\#_3$	233.08	$A\#_5$	932.33	$A\#_7$	3729 31
B_1	61 74	B_3	246 94	B_5	987.77	B_7	3951 07
						C_8	4186.01

Equal Tempered Chromatic Scale

$A_4 = 435$

International Pitch, adopted 1891

Note	Frequency	Note	Frequency	Note	Frequency	Note	Frequency
C_0	16 17	C_2	64 66	C_4	258 65	C_6	1034.61
$C\#_0$	17.13	$C\#_2$	68 51	$C\#_4$	274 03	$C\#_6$	1096 13
D_0	18 15	D_2	72 58	D_4	290.33	D_6	1161 31
$D\#_0$	19 22	$D\#_2$	76.90	$D\#_4$	307.59	$D\#_6$	1230 37
E_0	20 37	E_2	81 47	E_4	325 88	E_6	1303 53
F_0	21.58	F_2	86.31	F_4	345.26	F_6	1381 04
$F\#_0$	22 86	$F\#_2$	91 45	$F\#_4$	365.79	$F\#_6$	1463.16
G_0	24 22	G_2	96 89	G_4	387.54	G_6	1550 16
$G\#_0$	25 66	$G\#_2$	102 65	$G\#_4$	410.59	$G\#_6$	1642.34
A_0	27.19	A_2	108 75	$\mathbf{A_4}$	**435.00**	A_6	1740.00
$A\#_0$	28.80	$A\#_2$	115 22	$A\#_4$	460.87	$A\#_6$	1843.47
B_0	30.52	B_2	122 07	B_4	488.27	B_6	1953.08
C_1	32.33	C_3	129 33	C_5	517.31	C_7	2069.22
$C\#_1$	34 25	$C\#_3$	137.02	$C\#_5$	548.07	$C\#_7$	2192 26
D_1	36 29	D_3	145 16	D_5	580.66	D_7	2322 62
$D\#_1$	38 45	$D\#_3$	153 80	$D\#_5$	615.18	$D\#_7$	2460.73
E_1	40 74	E_3	162 94	E_5	651.76	E_7	2607.05
F_1	43 16	F_3	172 63	F_5	690 52	F_7	2762.08
$F\#_1$	45 72	$F\#_3$	182 89	$F\#_5$	731 58	$F\#_7$	2926.32
G_1	48.44	G_3	193.77	G_5	775.08	G_7	3100.33
$G\#_1$	51.32	$G\#_3$	205 29	$G\#_5$	821.17	$G\#_7$	3284 68
A_1	54.38	A_3	217.50	A_5	870.00	A_7	3480.00
$A\#_1$	57.61	$A\#_3$	230.43	$A\#_5$	921.73	$A\#_7$	3686.93
B_1	61.03	B_3	244 14	B_5	976.54	B_7	3906.17
						C_8	4138 44

MUSICAL SCALES (Continued)

SCIENTIFIC OR JUST SCALE

$C_4 = 256$

Note	Frequency	Note	Frequency	Note	Frequency	Note	Frequency
C_0	16	C_2	64	**C_4**	**256**	C_6	1024
D_0	18	D_2	72	D_4	288	D_6	1152
E_0	20	E_2	80	E_4	320	E_6	1280
F_0	21.33	F_2	85.33	F_4	341.33	F_6	1365.33
G_0	24	G_2	96	G_4	384	G_6	1536
A_0	26.67	A_2	106.67	A_4	426.67	A_6	1706.67
B_0	30	B_2	120	B_4	480	B_6	1920
C_1	32	C_3	128	C_5	512	C_7	2048
D_1	36	D_3	144	D_5	576	D_7	2304
E_1	40	E_3	160	E_5	640	E_7	2560
F_1	42.67	F_3	170.67	F_5	682.67	F_7	2730.67
G_1	48	G_3	192	G_5	768	G_7	3072
A_1	53.33	A_3	213.33	A_5	853.33	A_7	3413.33
B_1	60	B_3	240	B_5	960	B_7	3840
						C_8	4096

SOUND ABSORPTION

Table I.—General Building Materials

The following table gives the absorption coefficients of various materials. The reverberation time is usually defined as the time required for the reverberant sound to sink to one millionth its initial intensity. This time is given in seconds by the relation, $T_0 = .05\left(\frac{V}{a}\right)$, where V is the volume of the room in cubic feet and a is the absorption. The absorption a is computed by multiplying the area in square feet of each surface by its absorption coefficient and taking the sum of these products plus the absorbing power of objects, such as seats and furnishings.

Data in the following tables have been selected largely from the Official Bulletin of the Acoustical Materials Association.

Material	Coefficients		
	128	512	2048
Floor Coverings:			
Carpet unlined	.09	.20	27
Carpet felt lined	.11	.37	.27
Carpet, pile, on concrete, $\frac{3}{8}''$	09	.21	.27
Carpet, pile, on $\frac{1}{8}''$ felt, $\frac{3}{8}''$	11	.37	.27
Carpet, rubber, on concrete, $\frac{2}{16}''$	04	.08	.03
Cocoa matting	08	.17	.30
Cork flooring slabs, glued down, $\frac{3}{4}''$	.08	.08	.21
Cork flooring, like above, waxed and polished, $\frac{3}{4}''$	04	.05	.07
Cork Tile, $\frac{1}{2}''$	.04	06	.7
Linoleum	.02	03	.04
Linoleum, asphalt, rubber or cork tile on concrete		.03–.08	
Rug, Axminster	.11	20	.52
Rug, Oriental	.10	.29	.40
Hair felt:			
1″ Hair felt on 2″ × 1½″ battens 3′ c/c	.09	.43	.33
1″ Hair felt close against wall	.12	.41	.30
Hangings:			
Fabrics, hung straight:			
Light, 10 ozs. per sq. yd	04	.11	.30
Medium, 14 ozs. per sq. yd	06	13	.40
Heavy, draped, 18 ozs. per sq. yd	10	.50	82
Hard Plasters, Masonry, Wood:			
Brick wall, painted	.012	.017	.023
Brick wall, unpainted	.024	.03	.049
Clay tile, burned, 1″	.015	.028	.035
Cement		.025	

TABLE I.—GENERAL BUILDING MATERIALS (Continued)

Material	Coefficients 128	512	2048
Hard Plasters, Masonry, Wood:			
Concrete or terrazzo	.01	015	.02
Glass	035	.027	.02
Interior Stucco, smooth finish, ½″	03	.04	04
Marble or glazed tile	.01	.01	.015
Plaster, gypsum or lime, smooth finish on tile or brick	.013	.025	.04
Plaster, gypsum or lime, smooth finish on lath	.02	.03	.04
Plaster, gypsum or lime, rough finish on lath	.039	.06	.054
Wood blocks, pitch pine, laid in mastic, ¾″	.05	.06	.10
Wood flooring	05	.03	.03
Wood paneling	08	06	06
Combination of Accoustical Materials:			
Fibreglas Semi-rigid Panels and Boards			
Type TW-PF-2.5D 1″ thick, .23 lbs. per sq. ft	.24	.65	.73
Type TW-PF- 4D 2″ thick, .71 lbs. per sq. ft	.41	.99	.84
Type TW-PF- 12D 1″ thick, 1.04 lbs. per sq. ft	.09	.79	.87
Fibreglas Metal Mesh Blankets (style HO)·			
Type TW-G-2D 1″ thick, .42 lbs. per sq. ft	.24	.57	.70
Type TW-G-4D 2″ thick, .97 lbs. per sq. ft	.54	99	.88
Type TW-G-6D 2″ thick, 1.31 lbs. per sq. ft	.55	.99	.91
Fibreglas Sewn Blankets—Muslin Faced (Styles PM 2 or FM 2)			
Type TW-G-4D 2″ thick, .69 lbs. per sq. ft	.62	.99	.86
Openings:			
Stage, depending on furnishings		25–.75	
Deep balcony, upholstered seats		.50–1 00	
Grills, ventilating		.15–.50	
Ventilators, 50% open	.30	.50	.50
Audience, Individual Persons, Chairs, etc.:			
Audience, seated, units per person, depending on character of seats, etc	1.0–2.0	3.0–4 3	3.5–6.0
Chairs, metal or wood	.15	.17	.20
Pew Cushions	.75–1.1	1 45–1 90	1.4–1.7
Theater and Auditorium Chairs			
Wood veneer seats and back		.25	
Upholstered in leatherette		1.6	
Heavily upholstered in plush or mohair		2 6–3 0	
Wood Pews		.40	

TABLE II.—SPECIAL ACOUSTICAL MATERIALS

The type of material and method of mounting are indicated by symbols as follows:

TYPES OF MATERIALS

1. Cast units composed of small uniform mineral particles held together with Portland cement.
2. Cast units having a surface composed of or resembling small uniform granules. The binder may be gypsum or any other suitable mineral binder.
3. Cast units having a surface composed of or resembling irregular, rough granules. The binder may be gypsum or any other suitable mineral binder.
4. Units having a mechanically perforated surface, which acts as a covering for the sound absorbent material.
5. Units which are mechanically perforated, the perforations extending into the sound absorbent material.
6. Units having a fissured surface.
7. Compressed units composed of long wood fibers held together with a mineral binder. This type shall not have a mechanically perforated surface.
8. Felted fiber or wood pulp units which have a surface that is not mechanically perforated.

TYPES OF MOUNTINGS

1. Cemented to plaster board. Considered equivalent to cementing to plaster or concrete ceiling.
2. Nailed to 1″ × 2″ wood furring 12″ o.c., unless otherwise indicated.
3. Attached to metal supports applied to 1″ × 2″ wood furring.
4. Laid directly on laboratory floor.
5. Nailed to 1″ × 3″ wood furring 24″ o.c. and filled in between furring with 1″ mineral wool, .35 lbs./sq. ft.
6. Laid on 24 ga. sheet iron, nailed to 1″ × 2″ wood furring 24″ c.c.
7. Attached to special metal supports mounted on 2″ × 2″ wood furring.
8. Nailed to 2″ × 2″ wood furring 18″ or 20″ c.c. 2″ mineral wool between furring.

Material, trade name	†Thickness	Types: Material	Types: Mounting	‡Mfgr. of product	Coefficients: 128	Coefficients: 512	Coefficients: 2048	*Noise red. coef.	Surface
Absorbatone A.	1″	7	2	L-S	.15	.82	.87	.75	Unpainted
Absorbatone A. . .	1″	7	2	L-S	11	.80	.80	.70	Painted by mfgr.
Absorbatone A. .	1″	7	5	L-S	25	.99	.85	.85	Painted by mfgr.
Absorbex Type A	1″	7	1	C.C.	13	70	.79	.70	Painted by mfgr.
Absorbex Type A . . .	1″	7	2 (18″ o.c.)	C.C.	.17	.85	.84	.75	Painted by mfgr.
Absorbex Type A	1″	7	8 (18″ o.c.)	C.C.	.41	96	.85	.85	Painted by mfgr.
Absorbex Type F	1″	7	1	C.C.	15	.59	61	60	Painted by mfgr.
Absorbex Type F	2″	7	1	C.C.	20	99	90	75	Painted by mfgr.

TABLE II.—SPECIAL ACOUSTICAL MATERIALS (Continued)

Material, trade name	†Thickness	Types: Material	Types: Mounting	‡Mfgr. of product	Coefficients: 128	Coefficients: 512	Coefficients: 2048	*Noise red. coef.	Surface
Acousteel-B, pad plus metal facing and supports.. plus furring	$1\frac{1}{4}''$ $1\frac{5}{8}''$ $2\frac{1}{2}''$	4	3	C.C.	29	98	85	.85	Perforated enameled metal .068″ diameter perforations, 4608 per sq. ft.
Acousteel-B, pad plus metal facing and supports....... plus furring	$1\frac{1}{4}''$ $1\frac{5}{8}''$ $2\frac{1}{2}''$	4	3	C.C.	25	71	55	65	50/50 Pattern, $\frac{1}{2}$ perforated enameled metal, backed with pads, same as above; $\frac{1}{2}$ enameled metal unperforated, without pads.
Acoustex 30R..	$\frac{5}{8}''$	7	2	N.G.	09	45	77	.55	Painted by mfgr.
Acoustex 30R backed by 1″ rock wool.	$\frac{5}{8}''$	7	2	N.G.	17	98	.85	.80	Painted by mfgr.
Acoustex 40R....	$\frac{3}{4}''$	7	2	N G.	09	.59	.75	.60	Painted by mfgr.
Acoustex 50R...............	$\frac{7}{8}''$	7	2	N.G.	.09	.67	.78	.65	Painted by mfgr.
Acoustex 60R..............	1″	7	2	N G.	.14	81	.83	.70	Painted by mfgr.
Acousti-Celotex, Type C-1....	$\frac{1}{2}''$	5	1	C.C.	.07	57	.64	.50	Painted by mfgr. Perforated 441 holes per sq. ft. $\frac{3}{16}''$ diameter, $\frac{3}{4}''$ deep.
Acousti-Celotex, Type C-2 ..	$\frac{5}{8}''$	5	1	C.C.	.16	.67	.69	.60	Painted by mfgr. Perforated same as above. $\frac{1}{2}''$ deep.
Acousti-Celotex, Type C-3 .	$\frac{13}{16}''$	5	1	C.C.	.15	.82	.63	.65	Same as above $1\frac{1}{8}''$ deep.
Acousti-Celotex, Type C-3	$\frac{13}{16}''$	5	2	C.C.	.22	76	.66	.70	Same as above.
Acousti-Celotex, Type C-3	$\frac{13}{16}''$	5	7	C.C.	.22	76	.60	.70	Same as above.
Acousti-Celotex, Type C-4	$1\frac{1}{4}''$	5	1	C.C.	.13	99	.60	.70	Painted by mfgr. Perforated same as above, $1\frac{1}{8}''$ deep.
Acousti-Celotex, Type C-5	$\frac{13}{16}''$	5	1	C.C.	.12	.78	.83	70	Painted by mfgr. Perforated 441 holes per sq. ft. $\frac{1}{4}''$ diameter, $1\frac{1}{8}''$ deep.
Acousti-Celotex, Type C-6	$1\frac{1}{4}''$	5	2	C.C.	.30	.94	.69	80	Painted by mfgr. Perforated same as above, $1\frac{1}{8}''$ deep.

TABLE II.—SPECIAL ACOUSTICAL MATERIALS (Continued)

Material, trade name	†Thickness	Types		‡Mfgr. of product	Coefficients			*Noise red. coef.	Surface
		Material	Mounting		128	512	2048		
Acousti-Celotex, Type C-8	1″	5	2	C.C.	31	.58	.73	.65	Painted by mfgr. Perforated 441 holes per sq. ft. $\frac{3}{16}$″ diameter, $\frac{7}{8}$″ deep.
Acousti-Celotex, Type M-1.	$\frac{5}{8}$″	5	1	C.C.	10	.55	.89	.60	Painted by mfgr. Perforated 676 holes per sq. ft. $\frac{5}{32}$″ diameter, $\frac{1}{2}$″ deep.
Acousti-Celotex, Type M-2.	1″	5	1	C.C.	.12	82	.80	.70	Painted by mfgr. Perforated same as above, $\frac{7}{8}$″ deep.
Acoustimetal, Type P pad plus metalfacing and pad supports plus furring.	$1\frac{1}{4}$′ $1\frac{5}{8}$″ $2\frac{1}{2}$″	4	3	N.G.	.23	.99	.78	85	Perforated enameled metal .068″ diameter perforations, 4608 per sq. ft.
Acoustone D	$\frac{9}{16}$″	6	1	USG	.06	.61	.82	.60	Unpainted
Acoustone D	$\frac{11}{16}$″	6	1	USG	.08	.73	.81	.65	Unpainted
Acoustone D..	$\frac{11}{16}$″	6	1	USG	13	.79	.76	.65	Painted by mfgr.
Acoustone D.	$\frac{13}{16}$″	6	1	USG	15	.79	.85	.70	Unpainted
Acoustone D.	$\frac{15}{16}$″	6	1	USG	20	.84	.85	.75	Unpainted
Acoustone F ..	$\frac{9}{16}$″	6	1	USG	.11	.44	.90	.60	Unpainted
Acoustone F ..	$\frac{11}{16}$″	6	1	USG	.14	.65	.85	.65	Unpainted
Acoustone F	$\frac{13}{16}$″	6	1	USG	14	.81	.85	.70	Unpainted
Acoustone F.. ..	$\frac{15}{16}$″	6	1	USG	.16	87	.83	.75	Unpainted
Airacoustic......	$\frac{1}{2}$″	8	6	J-M	22	.48	.86	.60	Unpainted
Airacoustic	$1\frac{1}{2}$″	8	6	J-M	.50	.67	.86	.70	Unpainted
Calicel, Standard.	$\frac{3}{4}$″	2	1	C C.	.12	.47	.78	.60	Painted by mfgr.
Calicel, Standard	1″	2	1	C C.	11	.66	.74	.65	Painted by mfgr.
Calistone, SW..	1″	1	4	C.C.	.08	.40	.66	.50	Unpainted
Corkoustic B5..	$1\frac{1}{2}$″	6	1	A.C.	.06	.73	.56	.55	Painted by mfgr.
Corkoustic B5.....	$1\frac{1}{2}$″	6	2	A.C.	.18	.70	.58	.55	Painted by mfgr.
Corkhoustic B6..	$1\frac{3}{4}$″	6	1	A.C.	.15	.82	.58	.55	Painted by mfgr.
Corkoustic B6.	$1\frac{3}{4}$″	6	2	A.C.	.22	.61	.51	.55	Painted by mfgr.
Cushiontone A1.	$\frac{1}{2}$″	5	1	A.C.	.05	.58	.71	.55	Painted by mfgr. Perforated 484 holes per sq. ft. $\frac{3}{16}$″ diam. $\frac{3}{8}$″ deep

TABLE II.—SPECIAL ACOUSTICAL MATERIALS (Continued)

Material, trade name	†Thickness	Types: Material	Types: Mounting	‡Mfgr. of product	Coefficients: 128	Coefficients: 512	Coefficients: 2048	*Noise red. coef.	Surface
Cushiontone A2	⅝″	5	1	A.C.	.13	.59	.73	.60	Same as above, ½″ deep
Cushiontone A2	⅝″	5	2	A.C.	.11	.53	.70	.60	Same as above.
Cushiontone A3	⅞″	5	1	A C.	.13	.75	.81	.70	Same as above, ¼″ deep.
Econacoustic	½″	8	1	N G.	.05	.54	.76	.60	Painted by mfgr.
Econacoustic	½″	8	2	N G.	.09	.73	.78	.65	Painted by mfgr.
Econacoustic	1″	8	1	N.G.	.25	.78	.79	.70	Painted by mfgr.
Fiberglas Acoustical Tile Type TW-PF 9D	½″	.	2	O-C	.08	.67	.71	.65	Painted by mfgr.
Fiberglas Acoustical Tile Type TW-PF 9D	1″	..	2	O-C.	.22	.97	.68	.75	Painted by mfgr.
Fibracoustic	1″	8	1	J-M.	.17	.79	.79	.75	Painted by mfgr.
Fibracoustic	1″	8	2	J-M	18	82	85	.80	Painted by mfgr.
Fibretex	⅝″	7	2	J-M	.09	.45	77	.55	Painted by mfgr.
Fibretex	1″	7	2	J-M	14	81	.83	.70	Painted by mfgr.
Kencoustic	1½″	6	1	DEK	05	61	56	.50	Painted by mfgr.
Koustex	1″	7	1	DEK	.10	.64	.77	.65	Unpainted
Koustex	1″	7	2	DEK	.15	.75	.80	.70	Painted by mfgr.
Macoustic Plaster, Type 55V Trowel finish	½″			NG	.32	53	.68	.55	Finished with steel trowel
Muffletone (Std.)	¾″	2	1	C.C.	.17	63	.74	.60	Unpainted
Muffletone (Std.)	1″	2	1	C.C.	18	72	.79	.70	Painted by mfgr.
Perfatone, pad plus metal facing and pad supports plus furring	1¼″ 1⅝″ 2½″	4	3	USG	.23	98	87	.85	Perforated enameled metal, 4608 holes per sq. ft., .073″ diameter
Permacoustic	¾″	6	1	J-M	19	.74	.75	.65	Unpainted
Permacoustic	1″	6	1	J-M	23	.71	.70	.65	Painted by mfgr.
Q-T Ductliner	½″	8	6	C.C.	14	43	75	60	Unpainted
Q-T Ductliner	1″	8	6	C.C.	29	78	88	75	Unpainted
Reverbolite Acoustical Plaster brush finish	½″	..		C.C.	29	40	54	45	Stippled with rice brush

TABLE II.—SPECIAL ACOUSTICAL MATERIALS (Continued)

Material, trade name	†Thickness	Types: Material	Types: Mounting	‡Mfgr. of product	Coefficients: 128	Coefficients: 512	Coefficients: 2048	*Noise red. coef.	Surface
Reverbolite Acoustical Plaster trowel finish	$\frac{1}{4}$″	.	.	C.C.	.26	.47	.65	.50	Finished with steel trowel.
Sabinite Acoustical Plaster	$\frac{1}{2}$″		..	USG	.26	.32	.73	.50	Floated with cork float.
Sanacoustic, pad plus metal facing and pad supports plus furring	$1\frac{1}{8}$″ $1\frac{9}{16}$″ $2\frac{1}{2}$″	4	3	J-M	.25	.99	.91	.85	Perforated enameled metal .068″ diam. perforations, 4608 per sq. ft.
Sanacoustic, pad plus metal facing and pad supports plus furring	$1\frac{1}{8}$″ $1\frac{9}{16}$″ $2\frac{1}{4}$″	4	3	J-M	.22	.63	.52	.65	50/50 pattern, $\frac{1}{2}$ perforated enameled metal backed with pad, .068″ diam., 4608 holes/sq. ft.; $\frac{1}{2}$ enameled metal unperforated, unbacked.
Sound Isolation Blanket MK	$\frac{1}{2}$″	..	4	J-M	.05	.48	.86	.55	Muslin covered, unpainted.
Sound Isolation Blanket MK	1″	.	4	J-M	.15	.89	.89	.80	Muslin covered, unpainted.
Sound Isolation Blanket MK	2″	..	4	J-M	.43	.97	.87	.85	Muslin covered, unpainted.
Transite Acoustical Unit, Pad plus Transite facing	1″ $1\frac{1}{8}$″	4	2	J-M	.28	.83	.76	.75	Painted by mfgr. 576 holes per sq. ft., $\frac{5}{32}$″ diameter.
Travacoustic	1″	6	1	NG	.14	.80	.85	.75	Unpainted

* The noise reduction coefficient is the average of the coefficients at frequencies from 256 to 2048 cycles inclusive, given to the nearest 5%. This average coefficient is recommended for use in comparing materials for noise quieting purposes as in offices, hospitals, banks, corridors, etc.

For auditorium treatment, attention should be directed to the coefficients at 512 cycles and other frequencies as explained elsewhere.

† Unless otherwise noted, the thickness given is the thickness of the sound-absorbing element forming the face of the construction. The thickness of other sound-absorbing elements in the construction, if used, is indicated by the type of mounting.

‡ Key to Manufacturer of Product

A.C.—Armstrong Cork Company
C.C.—The Celotex Corporation
DEK—David E. Kennedy, Inc.
J-M—Johns-Manville Sales Corp.
L-S—Luse-Stevenson Co.
N.G.—National Gypsum Co.
O-C—Owens-Corning Fiberglas Corp.
USG—United States Gypsum Company

SPARK-GAP VOLTAGES

Based on results of the American Institute of Electric Engineers
Air at 760 mm, 25° C.

Peak voltage, kilovolts	Diameter of spherical electrodes, cm				Needle points
	2.5	5	10	25	
	Length of spark gap cm				
5	0.13	0.15	0.15	0.16	0.42
10	0.27	0.29	0.30	0.32	0.85
15	0.42	0.44	0.46	0.48	1.30
20	0.58	0.60	0.62	0.64	1.75
25	0.76	0.77	0.78	0.81	2.20
30	0.95	0.94	0.95	0.98	2.69
35	1.17	1.12	1.12	1.15	3.20
40	1.41	1.30	1.29	1.32	3.81
45	1.68	1.50	1.47	1.49	4.49
50	2.00	1.71	1.65	1.66	5.20
60	2.82	2.17	2.02	2.01	6.81
70	4.05	2.68	2.42	2.37	8.81
80	...	3.26	2.84	2.74	11.1
90		3.94	3.28	3.11	13.3
100	...	4.77	3.75	3.49	15.5
110	...	5.79	4.25	3.88	17.7
120	...	7.07	4.78	4.28	19.8
130	...	...	5.35	4.69	22.0
140	...	...	5.97	5.10	24.1
150	...		6.64	5.52	26.1
160	...	...	7.37	5.95	28.1
170	...		8.16	6.39	30.1
180	...		9.03	6.84	32.0
190	...		10.0	7.30	33.9
200			11.1	7.76	35.7
210	...		12.3	8.24	37.6
220			13.7	8.73	39.5
230	...		15.3	9.24	41.4
240				9.76	43.3
250	...			10.3	45.2
300	...	...	...	13.3	54.7

CORRECTIONS FOR TEMPERATURE AND PRESSURE

Values found in the above table may be corrected for temperature and pressure by multiplying the values given by the appropriate correction factor found below:

Temp. °C.	Pressure mm			
	720	740	760	780
0	1.04	1.06	1.09	1.12
10	1.00	1.02	1.05	1.08
20	0.96	0.99	1.02	1.04
30	0.93	0.96	0.98	1.01

SPECIFIC INDUCTIVE CAPACITY

Solids

Atmospheric temperatures except where noted.

(From Smithsonian Tables.)

Substance.	Wave length.	Specific inductive capacity.	Observer.
Asphalt	∞	2.68	v. Pirani, 1903
Caoutchouc	∞	2.22	Gordon, 1879
Calcspar:			
⊥ to axis	∞	8.49	Fallinger, 1902
‖ to axis	∞	7.56	Fallinger, 1902
Diamond	∞	16.5	v. Pirani, 1903
Ebonite	∞	2.72	Winklemann, 1889
Glass flint, extra heavy	∞	9.90	Hopkinson, 1891
hard crown	∞	6.96	Hopkinson, 1891
lead (Powell)	∞	5.4–8.0	Gray-Dobbie, 1898
Jena, barium	∞	7.8–8.5	Löwe, 1898
Gutta percha	.....	3.3–4.9	(submarine-data)
Ice −5° C	1200	2.85	Thwing, 1894
−18°	5000	3.16	Abegg, 1897
−190°	75	1.76–1.88	Behn-Kiebitz, 1904
Iodine, cryst	75	4.00	Schmidt, 1903
Marble, Carrara	75	8.3	Schmidt, 1903
Mica	∞	5.66–5.97	Elsas, 1891
Mica, Canadian amber	∞	3.0	E. Wilson
Paraffin	∞	2.10	Zietkowski, 1900
Phosphorus, yellow	75	3.60	Schmidt, 1903
Porcelain, hard (Royal Berlin)	∞	5.73	Starke, 1897
Quartz:			
⊥ to axis	∞	4.69	Fallinger, 1902
‖ to axis	∞	5.06	Fallinger, 1902
Selenium	∞	6.13	Vonwiller-Mason, 1907
Shellac	∞	3.10	Winkelmann, 1889
Sulphur, amorphous	∞	3.98	v. Pirani, 1903
Sulphur, cast, fresh	∞	4.22	v. Pirani, 1903
Wood, dry:			
red beech	∞	4.83–2.51	
red beech	∞	7.73–3.63	
oak	∞	4.22–2.46	
oak	∞	6.84–3.64	

Gases

The specific inductive capacity of a vacuum is taken as unity. Wave-lengths of the measuring current greater than 10,000 cm.

(Dielectric constant.)

Gas.	Temp. ° C.	Pressure in atmospheres.	Specific inductive capacity.	Observer.
Air	0	1	1.000590	Boltzmann, 1875
Air	19	20	1.0108	Tangl, 1907
Air	....	40	1.0218	Tangl, 1907
Air	....	60	1.0330	Tangl, 1907
Air	....	80	1.0439	Tangl, 1907
Air	....	100	1.0548	Tangl, 1907
Ammonia	20	1	1.00718	Bädeker, 1901
Carbon bisulphide	0	1	1.00290	Klemenčič
Carbon bisulphide	100	1	1.00239	Bädeker
Carbon dioxide	0	1	1.000985	Klemenčič
Carbon dioxide	15	10	1.008	Linde, 1895
Carbon dioxide	....	20	1.020	Linde, 1895
Carbon dioxide	....	40	1.060	Linde, 1895
Carbon monoxide	0	1	1.000690	Boltzmann
Ethylene	0	1	1.00131	Boltzmann
Hydrochloric acid	100	1	1.00258	Bädeker
Hydrogen	0	1	1.000264	Boltzmann
Methane	0	1	1.000944	Boltzmann
Nitrous oxide (N_2O)	0	1	1.00116	Boltzmann
Nitrous oxide (N_2O)	15	10	1.010	Linde, 1895
Nitrous oxide (N_2O)	....	20	1.025	Linde, 1895
Nitrous oxide (N_2O)	....	40	1.070	Linde, 1895
Sulphur dioxide	0	1	1.00993	Bädeker
Sulphur dioxide	0	1	1.00905	Klemenčič
Water vapor	145	1	1.00705	Bädeker

Liquids

Where the wave-length is not specified it is greater than 10,000 cm.

Liquid.	Temp. ° C.	Wave length, cm.	Specific inductive capacity.	Observer.
Acetic acid	18	∞	9.7	Francke, 1893
Acetone	0	∞	26.6	Abegg, 1897
Air	−191	∞	1.43	v. Pirani, 1903
Alcohol:				
amyl	0	∞	17.4	Abegg-Seitz, 1899
amyl	+20	∞	16.0	Abegg-Seitz, 1899
ethyl	frozen	∞	2.7	Abegg-Seitz, 1899
ethyl	−120	∞	54.6	Abegg-Seitz, 1899

SPECIFIC INDUCTIVE CAPACITY (Continued)

Liquids (Continued)

Liquid.	Temp. °C.	Wave length, cm.	Specific inductive capacity.	Observer.
Alcohol:				
ethyl	−80	∞	44.3	Abegg-Seitz, 1899
ethyl	−40	∞	35.3	Abegg-Seitz, 1899
ethyl	0	∞	28.4	Abegg-Seitz, 1899
ethyl	+20	∞	25.8	Abegg-Seitz, 1899
ethyl	17	200	24.4	Drude, 1896
ethyl	17	75	23.0	Drude, 1896
ethyl	17	53	20.6	Marx, 1898
ethyl	17	4	8.8	Marx, 1898
ethyl	17	0.4	5.0	Lampa, 1896
methyl	0	∞	35.0	Abegg-Seitz, 1899
methyl	+20	∞	31.2	Abegg-Seitz, 1899
propyl	0	∞	24.8	Abegg-Seitz, 1899
propyl	+20	∞	22.2	Abegg-Seitz, 1899
Ammonia	−34	75	21–23	Goodwin-Thompson, 1899
Amyl acetate	19	∞	4.81	Löwe, 1898
Anilin	18	∞	7.316	Turner, 1900
Benzol (Benzene)	18	∞	2.288	Turner, 1900
Bromine	23	84	3.18	Schlundt
Carbon bisulphide	20	∞	2.626	Tangl, 1903
Carbon dioxide	−5	∞	1.60	Linde, 1895
Chlorine	−60	∞	2.15	Linde, 1895
Chloroform	18	∞	5.2	Turner, 1900
Ethyl ether	0	∞	4.68	Abegg, 1897
Ethyl ether	20	∞	4.30	Tangl, 1903
Glycerine	15	1200	56.2	Thwing, 1894
Hydrogen peroxide 46% in H_2O	18	75	84.7	Calvert, 1900
Hydrogen sulphide	10	∞	5.93	Eversheim, 1904
Nitrous oxide, N_2O	−88	∞	1.93	Hasenhörl, 1900
Oils:				
castor	11	∞	4.67	Arons-Rubens, 1892
cottonseed	14	∞	3.10	Salvioni, 1888
linseed	13	∞	3.35	Salvioni, 1888
olive	20	∞	3.11	Heinke, 1896
petroleum	....	2000	2.13	Marx
sperm	20	∞	3.17	Hopkinson, 1881
turpentine	20	∞	2.23	Hopkinson, 1881
Oxygen	−182	∞	1.49	Fleming-Dewar, 1896
Phenol	48	73	9.68	Drude, 1896
Sulphur dioxide	20	∞	14.0	Eversheim, 1904
Water	18	∞	81.07	Turner, 1900

SPARKING POTENTIAL OR DIELECTRIC STRENGTH

Various Insulators.

Potential to puncture in kilovolts per centimeter. 1 kilovolt = 1000 volts.

Substance.	Thickness used mm.	Kilovolts per cm.
Air, liquid	....	40–90
Ebonite	....	300–1100
Fiber	....	20
Glass	....	300–1500
Guttapercha	....	80–200
Kerosene	1.0	164
Linen, varnished	....	100–200
Mica	0.1	1500–2200
Mica	1.0	300–700
Oils:		
castor	0.2	190
castor	1.0	130
cottonseed	....	70
lard	0.2	140
lard	1.0	40
linseed, raw	0.2	185
raw	1.0	90
boiled	0.2	190
boiled	1.0	80
lubricating	....	50
olive	0.2	170
olive	1.0	75
paraffin	0.2	215
paraffin	1.0	160
sperm, mineral	0.2	180
mineral	1.0	85
natural	0 2	195
natural	1 0	90
turpentine	0.2	160
turpentine	1.0	110
Papers:		
beeswaxed	....	770
blotting	....	150
Manilla	....	25
paraffined	....	500
varnished	....	100–250
Paraffin:		
melted	....	75
solid, melt. point 43°	....	350
solid, melt. point 70°	....	450
Rubber	....	160–500
Vaseline	....	90–130
Xylol	0.2	140
Xylol	1.0	80

ELECTROMOTIVE FORCE AND COMPOSITION OF VOLTAIC CELLS

STANDARD CELLS

(From Smithsonian Tables.)

Name of cell.	Negative pole.	Solution.	Positive pole.	Depolarizer.	E.M.F. in volts.
Weston normal..	Cadmium amalgam. .	Saturated solution of $CdSO_4$.....	Mercury.	Paste of Hg_2SO_4 and $CdSO_4$	1.0183 at 20° C.
Clark standard.	Zinc amalgam.....	Saturated solution of $ZnSO_4$.....	Mercury. .	Paste of Hg_2SO_4 and $ZnSO_4$	1.4328 at 15° C.

Temperature equations:

Clark cell: $E_t = 1.4328[1 - 0.00119(t - 15) - 0.000007(t - 15)^2]$ volt

Weston cell: $E_t = 1.0183[1 - 0.0000406(t - 20) - 0.00000095(t - 20)^2 + 0.00000001(t - 20)^3]$ volt

DOUBLE FLUID CELLS

Name of cell.	Negative pole.	Solution.	Positive pole.	Solution.	E.M.F. in volts.
Bunsen.........	Amal. zinc........	1 part H_2SO_4 to 12 parts H_2O....	Carbon..	Fuming nitric acid........	1.94
Bunsen.........	Amal. zinc.........	1 part H_2SO_4 to 12 parts H_2O....	Carbon...	HNO_3, density, 1.38.......	1.86
Bichromate.....	Amal. zinc..........	12 parts $K_2Cr_2O_7$ to 25 parts H_2SO_4 and 100 parts H_2O.	Carbon...	1 part H_2SO_4 to 12 parts H_2O	2.00
Bichromate.....	Amal. zinc..........	1 part H_2SO_4 to 12 parts H_2O....	Carbon...	12 parts $K_2Cr_2O_7$ to 100 parts H_2O..............	2.03
Daniell.........	Amal. zinc..........	1 part H_2SO_4 to 4 parts H_2O.....	Copper...	Saturated solution of $CuSO_4 + 5H_2O$...........	1.06
Daniell.........	Amal. zinc..........	5% solution of $ZnSO_4 + 6H_2O$....	Copper...	Saturated solution of $CuSO_4 + 5H_2O$...........	1.08
Daniell	Amal. zinc..........	1 part NaCl to 4 parts H_2O.....	Copper...	Saturated solution of $CuSO_4 + 5H_2O$...........	1.05
Grove..........	Amal. zinc..........	1 part H_2SO_4 to 12 parts H_2O....	Platinum .	Fuming nitric acid........	1.93
Grove.........	Amal. zinc..........	Solution of $ZnSO_4$.............	Platinum	HNO_3 density 1.33.........	1.66

ELECTROMOTIVE FORCE AND COMPOSITION OF VOLTAIC CELLS (Continued)

Double Fluid Cells (Continued)

Name of cell.	Negative pole.	Solution.	Positive pole.	Solution.	E.M.F. in volts.
Grove	Amal. zinc	H_2SO_4 solution, density 1.136	Platinum	HNO_3 density 1.33	1.79
Grove	Amal. zinc	H_2SO_4 solution, density 1.14	Platinum	HNO_3 density 1.19	1.66
Grove	Amal. zinc	NaCl solution	Platinum	HNO_3 density, 1.33	1.88

Single Fluid Cells

Name of cell.	Negative pole.	Solution.	Positive pole.	E.M.F.
Dry cell	Zinc	Ammonium Chloride	Carbon with MnO_2	1.53
Leclanché	Amal. zinc	Solution of sal-ammoniac	Carbon, depolarizer: manganese peroxide with powd. carbon	1.46
Edison-Lalande	Amal. zinc	Solution of caustic potash	Copper, depolarizer, CuO	0.70
Chloride of silver	Zinc	23% sol. of sal-ammoniac	Silver, depolarizer: silver chloride	1.02

Storage Cells

Name of cell.	Negative pole.	Solution.	Positive pole.	E.M.F.
Lead accumulator	Lead	H_2SO_4 solution of density 1.1	PbO_2	2.2
Regnier (1)	Copper	$CuSO_4+H_2SO_4$	PbO_2	1.68 to 0.85, average, 1.3
Regnier (2)	Amal. zinc	$ZnSO_4$ solution	PbO_2 in H_2SO_4	2.36
Main	Amal. zinc	H_2SO_4, density about 1.1	PbO_2	2.50
Edison	Iron	KOH, 20% solution	A nickel oxide	1.1, mean of full discharge

CONTACT POTENTIALS

Potential of metal at left minus potential of metal at top in volts. The values are given for room temperature and for pressures, indicated by the superscript. Figures indicate pressure in mm of Hg, ^{vac}, vacuum, ^{atm}., atmospheric pressure. The figures are for fresh surfaces.

	Brass	Platinum	Other metals
Aluminum	$+1.04^{vac}$ $+0.19^{atm}$	+1.20	Fe, +0.87 Zn, +0.29
Antimony	$+0.15^{atm.}$	.....	....
Bismuth	$+0.07^{atm.}$	+0.35	...
Cadmium	....	....	Hg, $-0.22^{.05}$
C* + NH_3	....	.....	Cu, + 079
C + H_2	.....	....	Cu, +.096
C + N_2	.....	...	Cu, +.129
C + CO_2	.....	.....	Cu, +.130
C + NO	......		Cu, +.136
C + O_2	.....	...	Cu, +.142
C + O_3	.....	..	Cu, +.155
Copper	$+0.10^{vac}$ $-0.04^{atm.}$	+0.13 ...	....
CuO	....	..	Li, −1.52

	Brass	Platinum	Other metals
CuO	....	....	Na, −2.52
Gold	-0.23^{atm}	.	.....
Iron	$+0.24^{vac}$	..	Zn, $-0.06^{vac.}$
Lead	$+0.41^{atm.}$	.	......
Magnesium	$+1.47^{vac}$	+1.05	.
Mercury	....	.....	Sb, $-0.26^{.05}$
Nickel	$+0.16^{atm}$	.....	Zn, $+0.17^{.05}$
Platinum	$-0.32^{atm.}$	.	......
Potassium	....	+2.8	.....
Silver	$+0.05^{vac.}$ $-0.35^{atm.}$	... ..	.. ....
Sodium	....	+2.40	....
Tin	....	+0.62	...
Zinc	......	+0.90	...

* Coconut charcoal saturated with the gas named.

DIFFERENCE OF POTENTIAL BETWEEN METALS IN SOLUTIONS OF SALTS

The table gives the difference in potential in hundredths of a volt between zinc in a normal solution of sulphuric acid and the metal named at the head of the columns in the solution named at the side. The signs given refer to the external difference of potential.

(Magnanini.)

Strength of the solution in gramme molecules per liter.	Difference of potential in centivolts.					
	Zinc·	Cadmium.	Lead.	Tin.	Copper.	Silver.
0.5 Sulphuric acid	0.0	36.6	51.3	51.3	100.7	121.3
1.0 Sodium hydroxide	−32.1	19.5	31.8	0.2	80.2	95.8
1.0 Potassium hydroxide	−42.5	15.5	32.0	−1.2	77.0	104.0
0.5 Sodium sulphate	1.4	35.6	50.8	51.4	101.3	120.9
1.0 Potassium nitrate	11.8	31.9	42.6	31.1	81.2	105.7
1.0 Sodium nitrate	11.5	32.3	51.0	40.9	95.7	114.8
0.5 Potassium bichromate	72.8	61.1	78.4	68.1	123.6	132.4
0.5 Potassium sulphate	1.8	34.7	51.0	40.9	95.7	114.8
0.2 Potassium chlorate	15.−10.	39.9	53.8	57.7	105.3	120.9
1.0 Ammonium chloride.	2.9	32.4	51.3	50.9	81.2	101.7
1.0 Sodium chloride	......	31.9	51.2	50.3	80.9	101.3
1.0 Potassium chloride	......	32.1	51.6	52.6	81.6	107.6

ELECTROCHEMICAL EQUIVALENTS OF THE ELEMENTS

By G. A. Roush

Element	Valence	Mg per coulomb	Coulombs per mg	Grams per amp.-hr.	Amp.-hr. per gram	Lb./1000 amp.-hr.	Amp.-hr. per lb.
A	n	0.41393	2.41588	1.49014	0.67108	3.28519	304.396
Ab	7	0.32717	3.05656	1.17779	0.84904	2.59656	385.120
Ac	3	0.78411	1 27533	2.82280	0.35426	6 22320	160 689
Ag	1	1.11793[1]	0.89451	4.02454	0.24848	8.87259	112.707
Al	3	0.09316	10.73415	0.33538	2.98171	0.73938	1352.480
As	5	0.15254	6.44106	0.55891	1.78918	1.23219	811.560
	3	0.25876	3.86464	0.93152	1.07351	2.05366	486.936
Au	3	0.68117	1.46805	2.45223	0.40779	5.40624	184.972
	1	2.04352	0.48935	7.35668	0.13593	16.21871	61.657
B	3	0.03737	26.75602	0.13455	7.43223	0.29662	3371.201
Ba	2	0.71171	1.40507	2.56216	0.39030	5.64858	177.035
Be	2	0.04674	21.39688	0.16825	5.94358	0.37092	2695.963
Bi	5	0.43316	2.30861	1.55938	0.64128	3.43784	290.880
	3	0.72193	1.38517	2.59896	0.38477	5 72973	174 528
Br	1	0.82815	1.20752	2.98132	0.33542	6.57269	152.145
C	4	0.03111	32.13989	0.11201	8.92775	0.24694	4049.558
	2	0.06223	16.06994	0.22402	4.46387	0.49388	2024.779
Ca	2	0.20767	4.81537	0.74761	1.33760	1.64819	606.726
Cb	5	0.19256	5.19320	0.69321	1.44255	1.52828	654.332
Cd	2	0.58244	1.71693	2.09677	0.47692	4.62258	216.329
Ce	3	0.48404	2.06594	1.74255	0.57387	3.84166	260.304
Cl	1	0.36743	2.72161	1.32275	0.75600	2.91616	342.917
Co	2	0.30539	3.27452	1.09931	0.90966	2.42356	412.617
Cr	6	0.08983	10.13247	0.32338	3.09235	0.71293	1402.668
	3	0.17965	5.56624	0.64676	1.54618	1.42585	701.334
Cs	1	1.37731	0.72606	4.95830	0.20168	10.93118	91 481
Cu	2	0.32938	3.03602	1.18576	0.84334	2.61416	382 532
	1	0.65876	1.51801	2.37152	0.42167	5.22831	191.266
D[2]	1	0.020878	47.89771	0.075160	13.30492	0.16570	6035.011
Dy	3	0.56069	1.78351	2.01849	0.49542	4.44901	224.886
Er	3	0.57907	1.72691	2.08464	0.47970	4.59585	217.588
Eu	3	0.52504	1.90461	1.89016	0.52906	4.16708	241 911
F	1	0.19689	5.07895	0.70881	1 41082	1.56265	639.937
Fe	3	0.19291	5.18363	0.69451	1 43987	1.53113	653 114
	2	0.28938	3.45568	1.04176	0 95991	2.29669	435.409
Ga	3	0.24083	4.15232	0.86698	1.15342	1.91137	523.184
Gd	3	0.54179	1.84572	1.95046	0.51270	4.30002	232.737
Ge	4	0.18808	5.31680	0.67710	1 47689	1.49275	669.906
H	1	0.010446	95.73321	0.037605	26.59256	0.082904	12062.183
He	n	0.04147	24.11294	0.14930	6.69804	0.32914	3038.180
Hf	4	0.46269	2.16125	1.66570	0.60035	3.67223	272.313
Hg	2	1.03943	0.96207	3.74195	0.26724	8.24958	121.218
	1	2.07886	0.48103	7.48390	0.13362	16 49917	60.609
Ho	3	0.56974	1.75518	2.05107	0 48755	4.5218	221 149
I	1	1.31523	0.76032	4.73484	0.21120	10.43853	95.799
Il	3	0.50432	1.98288	2.72332	0.55080	3.90256	272.539
In	3	0.39641	2.52266	1.42707	0.70074	3.14614	317 849
Ir	4	0.50026	1.99896	1.80095	0.55546	3.97038	251.865
K	1	0.40514	2.46828	1.45850	0.68563	2.21545	310.998
Kr	n	0.86736	1.15293	3.12249	0.32026	6.88390	145.266

ELECTROCHEMICAL EQUIVALENTS OF THE ELEMENTS (Continued)

Element	Valence	Mg per coulomb	Coulombs per mg	Grams per amp.-hr.	Amp.-hr. per gram	Lb./1000 amp.-hr.	Amp.-hr. per lb.
La	3	0.47986	2.08393	1.72750	0.57887	3.80849	262.571
Li	1	0.07192	13.90490	0.25890	3.86247	0.57078	1751.988
Lu	3	0.60446	1.65438	2.17604	0.45955	4.79734	208.448
Ma	7	0.14478	6.90695	0.52121	1.91860	1.14908	870.262
Mg	2	0.12601	7.93586	0.45364	2.20440	1.00010	999.901
Mn	4	0.14230	7.02727	0.51229	1.95202	1.12941	885.421
	2	0.28461	3.51363	1.02458	0.97601	2.25881	442.711
Mo	6	0.16580	6.03125	0.59689	1.67535	1.31592	759.925
N	5	0.029032	34.44446	0.10452	9.56795	0.23042	438.995
	3	0.048387	20.66676	0.17419	5.74077	0.38403	260.397
Na	1	0.23831	4.19620	0.85792	1.16561	1.89139	528.712
Nd	3	0.49834	2.00665	1.79403	0.55740	3.95516	252.834
Ne	*n*	0.20915	4.78125	0.75294	1.32813	1.65995	602.428
Ni	2	0.30409	3.28846	1.09474	0.91346	2.41348	414.340
O	2	0.082902	12.06250	0.29845	3.35069	0.65796	1519.850
Os	4	0.49611	2.01567	1.78601	0.55991	3.93748	253.970
P	5	0.06421	15.57456	0.23115	4.32627	0.50959	1962.362
Pa	5	0.59845	2.08874	1.72352	0.58021	3.79972	263.177
Pb	4	0.53681	1.86284	1.93253	0.51746	4.26050	234.716
	2	1.07363	0.93142	3.86506	0.25873	8.52099	117.357
Pd	4	0.27642	3.61762	0.99513	1.00489	2.19388	455.812
Po	6	0.36269	2.75714	1.30570	0.76587	2.87857	347.394
Pr	3	0.48677	2.05436	1.75237	0.57065	3.86332	258.845
Pt	4	0.50578	1.97716	1.82080	0.54921	4.01417	249.117
Ra	2	1.17124	0.85379	4.21648	0.23716	9.29574	107.576
Rb	1	0.88580	1.12892	3.18889	0.31359	7.03030	142.241
Re	7	0.27581	3.62568	0.99292	1.00713	2.18901	456.828
Rh	4	0.26661	3.75085	0.95978	1.04190	2.11596	472.599
Rn	*n*	2.30052	0.43468	8.28187	0.12075	18.25839	54.769
Ru	4	0.26347	3.79548	0.94850	1.05430	2.09108	478.222
S	6	0.05537	18.05989	0.19934	5.01664	0.43946	2275.508
	4	0.08306	12.03993	0.29901	3.34442	0.65919	1517.005
	2	0.16611	6.01996	0.59801	1.67221	1.31839	758.503
Sb	5	0.25235	3.96272	0.90847	1.10075	2.00283	499.294
	3	0.42059	2.37763	1.51411	0.66045	3.33805	299.576
Sc	3	0.15579	6.41907	0.56083	1.78307	1.23642	808.789
Se	6	0.13637	7.33283	0.49094	2.03690	1.08234	923.921
Si	4	0.07269	13.75624	0.26170	3.82118	0.57695	1733.257
Sm	3	0.51962	1.92448	1.87063	0.53458	4.12404	242.481
Sn	4	0.30751	3.25190	1.10705	0.90330	2.44062	409.732
Sn	2	0.61503	1.62595	2.21409	0.45165	4.88124	204.866
Sr	2	0.45404	2.20244	1.63455	0.61179	3.60356	277.503
Ta	5	0.37488	2.66751	1.34957	0.74098	2.97529	336.101
Tb	3	0.54991	1.181847	1.97969	0.50513	4.36447	229.113
Te	6	0.22040	4.53726	0.79343	1.26037	1.74921	571.686
Th	4	0.60135	1.66293	2.16485	0.46193	4.77268	209.526
Ti	4	0.12409	8.05846	0.44674	2.23846	0.98488	1015.348
Tl	3	0.70601	1.41641	2.54164	0.39345	5.59002	178.571
Tm	3	0.58515	1.70897	2.10653	0.47471	4.64410	215.327
U	6	0.41117	2.43206	1.48023	0.67557	3.26168	306.591

ELECTROCHEMICAL EQUIVALENTS OF THE ELEMENTS (Continued)

Element	Valence	Mg per coulomb	Coulombs per mg	Grams per amp.-hr.	Amp.-hr. per gram	Lb./1000 amp.-hr.	Amp.-hr. per lb.
V	5	0.10560	9.47007	0 38015	2.63057	0.83808	1193 209
Vi	1	2.32124	0.43080	8.35648	0.11967	18.42288	54.280
W	6	0.31779	3.14674	1.14404	0.87409	2.52218	396.483
Xe	*n*	1.36062	0.73496	4.89824	0.20416	10.79877	92.603
Y	3	0.30715	3.25574	1.10574	0.90437	2 43774	410.216
Yb	3	0.59772	1.67302	2.15179	0 46473	4 74389	210.797
Zn	2	0.33876	2.95197	1.21952	0 81999	2 68859	371 942
Zr	4	0.23632	4.23153	0.85076	1.17542	1 87560	533 164

The above compilation is abridged from a complete table published in Volume 73 of the Transactions of the Electrochemical Society, but has been corrected to correspond to the 1942 atomic weights as published by the American Chemical Society and the best values obtainable for the few elements not listed in the official table; in most cases the only valence covered is that which determines the placing of the element in the periodic table, though in a few cases the most important valence from an electrochemical standpoint is given precedence, and for a few of the more important elements two or more valences are given; values for elements in the O group of the periodic system are calculated on the basis of unit valence, listed as *n*, to distinguish them from elements with a true unit valence. For uses where a more complete table is required, the reader is referred to the original publication.

Digits printed in italics may, if desired, be dropped from the values, rounding them off to the nearest preceding digit; such digits have been carried as a matter of convenience and uniformity in calculating and tabulating, but are in excess of the number of significant figures in the primary data, and hence do not add to the true accuracy of the results.

[1] This value varies from the basic figure of 1.1180 mg because of the rounding off of the value of the Faraday to 96,500 coulombs; other values also differ in the same proportion.

[2] This is the second isotope of hydrogen, and is the only isotope included in the table, as no others have as yet been isolated to a sufficient degree to have their atomic weights determined.

INTERNAL RESISTANCE OF VARIOUS VOLTAIC CELLS

The internal resistance is subject to large variations; the values given can be considered only approximate.

Cell	Resistance, ohms	Cell	Resistance, ohms
Edison-Lalande	0 03	Grove	0 1–0.2
Daniell	0 85	Bunsen	0 1–0.2
Gravity	1–5	Bichromate	0.08–0 40
Silver chloride	4.	Storage	0.004–0.02
Dry cell	0.05–0.10	Clark standard	20–50
Leclanché	0.4–0.2	Weston standard	20–50

IONIZATION POTENTIALS

The Elements

The following table gives the ionization potentials in volts for the elements in the atomic state. The degree of ionization is indicated by the numerals I, II, etc. Doubtful values are indicated by parentheses.

El.	At. No.	Ionization potential, volts					
		I	II	III	IV	V	VI
A	18	15.68	27.76	40.75	(61)	(78)	...
Ac	89	...	...	...	...	...	...
Ag	47	7.542	21.4	35.9	...	...	...
Al	13	5.96	18.74	28.31	119.37	153.4	...
As	33	10.5	20.1	28.0	49.9	62.5	...
Au	79	9.18	19.95	...	...	...	...
B	5	8.257	25.00	37.75	258.1	338.5	...
Ba	56	5.19	9.95	...	...	...	...
Be	4	9.28	18.12	153.1	216.6	...	...
Bi	83	8.0	16.6	25.42	45.1	55.7	...
Br	35	11.80	19.1	25.7	(50)	...	...
C	6	11.217	24.27	47.65	64.22	390.1	...
Ca	20	6.09	11.82	50.96	69.7	...	...
Cb	41	...	...	24.2	...	49.3	...
Cd	48	8.96	16.84	38.0	...	...	...
Ce	58	6.54	14.8	...	(36.5)	...	...
Cl	17	12.952	23.67	39.69	53.16	67.4	...
Co	27	7.81	17.3	...	...	...	...
Cr	24	6.74	16.6		...	(73)	...
Cs	55	3.87	23.4	(35)	(51)	(58)	...
Cu	29	7.68	20.34	29.5	...	...	...
Dy	66	6.8	...	...		...	...
Er	68	...				...	...
Eu	63	5.64	11.4	...	...	...	...
F	9	17.34	34.81	62.35	86.72	113.67	156.37*
Fe	26	7.83	16.16	...	...	...	...
Ga	31	5.97	20.43	30.6	63.8	...	...
Gd	64	6.7	...	...	...	...	...
Ge	32	8.09	15.86	34.07	45.5	93.0	...
H	1	13.527	...	...	...	...	...
He	2	24.46	54.14				...
Hf	72	...	(14.8)				...
Hg	80	10.39	18.65	34.3	(72)	(82)	...
Ho	67	...	...				...
I	53	10.6	19.4				...
Il	61	...	...	...		...	...
In	49	5.76	18.79	27.9	57.8	...	...
Ir	77	...	...	...	...	...	...
K	19	4.318	31.66	46.5	...	...	...
Kr	36	13.93	26.4	36.8	(68)	...	...
La	57	5.6	11.4	(20.4)	...	...	...
Li	3	5.363	75.26	121.8			...
Lu	71	...	...	...			...
Ma	43	...		...	...	...	...
Mg	12	7.61	14.96	79.72	108.9	...	...
Mn	25	7.41	15.70	...	...	(76)	...
Mo	42	7.35	...	...		60.8	...
N	7	14.48	29.47	47.40	77.0	97.4	...
Na	11	5.12	47.06	70.72	...	...	...
Nd	60	6.3	...	...		...	...
Ne	10	21.47	40.9	63.2	...	...	...

* Seventh ionization potential of fluorine, 184.26 volts.

IONIZATION POTENTIALS (Continued)

The Elements (Continued)

El.	At. No.	Ionization potential, volts					
		I	II	III	IV	V	VI
Ni	28	7 61	18 2	...	...	...	...
O	8	13 550	34.93	54.87	76 99	113.	137 5
Os	76	(8 7)	...	...	...	...	...
P	15	10 9	19 56	30 012	51.106	64 698	...
Pa	91	...	...		...	...	...
Pb	82	7 38	14.96	(31.9)	42 11	69 4	...
Pd	46	8.3	19.8	...	...	...	...
Po	84	...	...	...		...	...
Pr	59	5 8	...	...	...	...	...
Pt	78	8 88	...	...	...	...	...
Ra	88	5 252	10 099	...		...	...
Rb	37	4.159	27.36	(47)	(80)	...	...
Re	75	...	...	...			...
Rh	45	7 7	...	...	...	...	...
Rn	86	10 698	...	...			...
Ru	44	7 7	...	...			...
S	16	10 30	23 3	34 9	47 08	63	87 65
Sb	51	8 5	(18)	24 7	44 0	55 5	...
Sc	21	6 7	12 8	24.61	(73 9)	(97.0)	...
Se	34	9.70	21 3	33 9	42.72	72 8	
Si	14	8 12	16 27	33 35	44.93	165 6	
Sm	62	6 6	11 4	...			
Sn	50	7 30	14 5	30 5	39 4	80.7	...
Sr	38	5 667	10.98	...		...	...
Ta	73	...		...	...	...	...
Tb	65	6 7	...		...		...
Te	52	8 96	...	30 5	37 7	60 0	(72)
Th	90	...	...	29 4			...
Ti	22	6 81	13 6	27 6	42 98	(99.6)	...
Tl	81	6 07	20 32	29 7	50 5		
Tm	69	...	...		...		...
U	92	...	...		...		...
V	23	6 71	14 1	(26 4)	(48)	(65)	...
W	74	8 1			...		...
Xe	54	12 08	(21 1)	32 0	(46)	(76)	...
Y	39	6 5	12 3	20 4	...	...	...
Yb	70	7 1	...			...	...
Zn	30	9 36	17 89	40 0	...	...	...
Zr	40	6 92	13 97	24 00	33 8	...	...

Compounds

The first ionization potential of the molecules indicated is given in volts.

Compound	Ionization potential I volts	Compound	Ionization potential I volts
Br_2 .	12 8	CH_3Cl, methyl chloride	10 7
BrCl	12 9 (calc.)	CH_3I, methyl iodide . .	9 1
C_2	12	CH_4, methane ..	14 5
CH_2O, formaldehyde	11 3	CN .	14
CH_3Br, methyl bromide .	10.0	CO.......	14.1

IONIZATION POTENTIALS (Continued)

COMPOUNDS (Continued)

Compound	Ionization potential I volts	Compound	Ionization potential I volts
CO_2	14 4	HI	12 8
CS	10.6	H_2O	12.56
CS_2	10 4	H_2S	10.42
C_2H_2, acetylene	11.6	I_2	9.7
C_2H_4, ethylene	12.2	IBr	11 6 (calc.)
C_2H_6, ethane	12.8	ICl	11.9 (calc.)
C_6H_6, benzene	9 6	N_2	15.51
C_7H_8, toluene	8 5	NH_3	11.2
Cl_2	13.2	NO	9.5
F_2	17.8 (calc.)	NO_2	11.0
H_2	15 6	N_2O	12.9
HBr	13 2	O_2	12.5
HCN	14 8	S_2	10.7
HCl	13.8	SO_2	13.1
HF	17 7 (calc.)		

PROPERTIES OF METALS AS CONDUCTORS

Metal.	Resistivity microhm-centimeters 20° C.	Temp. coefficient 20° C.	Specific gravity.	Tensile strength, lbs./in.	Melting point ° C.
Advance. See *constantan*					
Aluminum..........	2.824	0.0039	2.70	30,000	659
Antimony..........	41.7	.0036	6.6	....	630
Arsenic............	33.3	.0042	5.73	....	....
Bismuth....	120	.004	9.8	....	271
Brass.............	7	.002	8.6	70,000	900
Cadmium...........	7.6	.0038	8.6	....	321
Calido. See *nichrome*					
Climax............	87	.0007	8.1	150,000	1250
Cobalt............	9.8	.0033	8.71	....	1480
Constantan..	49	.00001	8.9	120,000	1190
Copper: annealed...	1.7241	.00393	8.89	30,000	1083
hard-drawn.......	1.771	.00382	8.89	60,000	....
Eureka. See *constantan*					
Excello............	92	.00016	8.9	95,000	1500
Gas Carbon...... ...	5000	—.0005	......	....	3500
German silver, 18%Ni	33	.0004	8.4	150,000	1100
Gold..............	2.44	.0034	19.3	20,000	1063
Ideal. See *constantan*					
Iron, 99.98% pure..	10	.005	7.8	....	1530
Lead	22	.0039	11.4	3,000	327
Magnesium..........	4.6	.004	1.74	33,000	651
Manganin	44	.00001	8.4	150,000	910
Mercury..........	95.783	.00089	13.546	0	—38.9
Molybdenum, drawn	5.7	.004	9.0	....	2500
Monel metal........	42	.0020	8.9	160,000	1300
Nichrome...........	100	.0004	8.2	150,000	1500
Nickel.......	7.8	.006	8.9	120,000	1452
Palladium.	11	.0033	12.2	39,000	1550
Phosphor bronze....	7.8	.0018	8.9	25,000	750
Platinum...	10	.003	21.4	50,000	1755
Silver....	1.59	.0038	10.5	42,000	960
Steel, E. B. B.......	10.4	.005	7.7	53,000	1510
Steel, B. B.	11.9	.004	7.7	58,000	1510
Steel, Siemens-Martin	18	.003	7.7	100,000	1510
Steel, manganese....	70	.001	7.5	230,000	1260
Tantalum..........	15.5	.0031	16.6	....	2850
Therlo......	47	.00001	8.2	....	....
Tin...	11.5	.0042	7.3	4,000	232
Tungsten, drawn....	5.6	.0045	19	500,000	3400
Zinc	5.8	.0037	7.1	10,000	419

RESISTIVITY

Giving the resistivity ρ for metals, including alloys and carbon. Temperature coefficients of resistance are given in a succeeding table.

Material	Temp. °C.	Resistivity ohm-cm	Authority
Advance,	0	47.—49.	
Aluminum,			
commercial	20	2.828×10^{-6}	Bureau of Standards
Al 99.57, Si 0.29, Fe 0.14			
pure	−189	.64	Niccolai, 1907
	−100	1.53	"
	0	2.63	"
	+100	3.86	"
	400	8.0	"
Aluminum bronze	0	12.—13.	Various
Cu 97, Al 3	0	8.26	Pecheux, 1909
Cu 90, Al 10	0	12.6	"
Cu 6, Al 94	0	3.1	"
Antimony	20	41.7	Bureau of Standards
	−190	10.5	Eucken, Gelhoff
liquid	+860	120.	de la Rive
Argentan			
Cu 56, Ni 26	15	42.	Matthiessen
Arsenic	0	35.	"
Bismuth	18	119.0	Jäger, Diesselhorst
	100	160.2	" "
	−200	34.8	Various
	−100	75.6	"
	+100	156.5	Northrup, 1914
	200	214.5	"
liquid	300	128.9	"
"	500	139.9	"
"	700	150.8	"
Brass			
various	0	6.4—8.4	Various
hard drawn Cu 70.2, Zn 29.8	0	8.2	Siemens
annealed	0	7.0	"
Bronze			
Cu 88, Sn 12	20	18	
Cu 89, Sn 6, Zn 4	15	13.5	
Cadmium, drawn	18	7.54	Jäger, Diesselhorst
	100	9.82	" "
	−252.9	0.17	Euchen, Gehlhoff, 1912
	−200	1.66	" "
	−100	4.80	" "
	+300	16.50	Northrup, 1913
liquid	400	33.70	"
	500	35.12	"
	700	35.78	"
Caesium	0	19	Various
	−187	5.25	Guntz, Broniewski
	27	22.2	Hackspill
liquid	30	36.6	"
Calcium, Ca 99.57%	20	4.6	Swisher, 1917
Calido,	0	110	
Carboloy	20	19.6	
Carbon	0	3500	
	500	2700	
	1000	2100	
	2000	1100	
	2500	900	

Material	Temp. °C.	Resistivity ohm-cm	Authority
Chromium	0	2.6×10^{-6}	Shukow
Climax,	20	87	Bureau of Standards
Cobalt, Co 99.8%	20	9.7	Reichardt, 1901
Constantan, Cu 60, Ni 40	20	49	Bureau of Standards
	−200	42.4	Niccolai
	−150	43.0	"
	−100	43.5	"
	−50	43.9	"
	0	44.1	"
	+100	44.6	"
	400	44.8	"
Copper, commercial			
annealed	20	1.7241*	Bureau of Standards
hard drawn	20	1.77	"
pure, annealed	20	1.692	Wolff, Dellinger 1910
	−258.6	.014	Niccolai
	−206.6	.163	"
	−150	.567	"
	−100	904	"
	+100	2.28	Northrup, 1914
	200	2 96	"
	500	5.08	"
	1000	9 42	"
liquid	1500	24.62	"
Copper-manganese			
Mn 0.98	0	4.83	Munker, 1912
Mn 1.49	0	6.66	" "
Mn 4 2	20	17 9	Sebast & Gray, 1916
Mn 7 4	20	19 7	" " " "
Mn 15	20	50	Klein, 1924
Copper-manganese-iron			
Cu 91, Mn 7.1, Fe 1.9	0	20	Blood
Cu 70.6, Mn 23.2, Fe 6.2	0	77	"
Copper-manganese-nickel			
Cu 73, Mn 24, Ni 3	0	48	Feussner, Lindeck
Eureka	0	47	Drysdale, 1907
Excello	20	92	Bureau of Standards
Gallium	0	53	Guntz, Broniewski
German silver, Ni 18%	20	33	Bureau of Standards
Cu 60.16, Zn 25.37, Ni 14.03, Fe 0.3, Co and Mn trace	−200	27.9	Dewar, Fleming
	−100	29.3	
	+100	33.1	
Gold, pure, drawn	20	2.44	Jäger, Diesselhorst
	−252 8	.018	Niccolai
	−200	.601	"
99.9 pure	−183	.68	Dewar, Fleming
	−150	.997	Niccolai, 1907
	−100	1.400	"
	+100	2.97	Northrup, 1914

*Int. Ann. Cu. Std.

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Gold, 99.9 pure	200	3.83×10^{-6}	Northrop, 1914
	500	6.62	"
	1000	12.52	"
	1500	3.70	"
Gold-copper-silver			
Au 58.3, Cu 26.5, Ag 15.2	0	13.2	Matthiessen
Au 66.5, Cu 15.4, Ag 18.1	0	14.6	"
Au 7.4, Cu 78.3, Ag 14.3	0	3.6	"
Gold-silver			
Au 90, Ag 10	0	6.3	
Au 67, Ag 33	0	10.8	
Graphite	0	800	
	500	830	
	1000	870	
	2000	1000	
	2500	1100	
Ia — Ia			
Cu 60, Ni 40	0	50	Drysdale, 1907
Ideal, (*See constantan*)			
Illium		91.61	Knipp, Hall 1922
Indium	0	8 37	Erhardt, 1881
Invar (*See steel*)			
Iridium	−186	1.92	Broniewski, Hackspill
	0	6.10	" "
	100	8.30	" "
Iron 99.98% pure	20	10	Bureau of Standards
	−252.7	0.011	Niccolai
	−205 3	.652	Dewar, Fleming
	−200.	2.27	Niccolai
	−192 5	.844	"
	−100	5.92	"
	+100	16.61	"
	200	24.50	"
	400	43.29	"
(*See also under steel*)			
Lead	20	22.	Bureau of Standards
	−252.9	.59	Schimank, Nernst
	−203	4.42	" "
	−192.8	5.22	" "
	−103	11.8	
	+100	27.8	Northrup
	200	38	"
	319	50	"
liquid	333	95.0	"
"	400	98.3	"
"	600	107.2	"
"	800	116.2	"
cold pressed	−183	6.02	Dewar, Fleming
" "	−78	14.1	
" "	0	20.4	
" "	90.4	28.0	
" "	196.1	36.9	
Lithium	−187	1.34	Guntz, Broniewski
	0	8.55	" "
	99.3	12.7	" "

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Lithium liquid	230	45.2×10^{-6}	Bernini, 1905
Magnesium	20	4.6	Bureau of Standards
Zn free	−183	1.00	Dewar, Fleming
" "	−78	2.97	" "
" "	0	4.35	" "
" "	98.5	5.99	" "
pure	400	11.9	Niccolai, 1907
Manganese		5.0	Shukow
Manganese-copper Mn 30, Cu 70	0	100	Feussner, Lindeck
Manganin, Cu 84,	20	44	Bureau of Standards
Mn 12, Ni 4	22.5	45	Kimura, Sakamaki
	−200	37.8	Niccolai
	−100	38.5	"
	−50	38.7	"
	0	38.8	"
	100	38.9	"
	400	38.3	"
Mercury	20	95.783	Bureau of Standards
solid	−183.5	6.97	Dewar, Fleming
"	−102.9	15.04	" "
"	−50.3	12.3	" "
"	−39.2	25.5	" "
liquid	−36.1	80.6	" "
"	0	94.07	" "
"	50	98.50	Grimaldi
"	100	103.25	Vincentini, Omodei
"	200	114.27	" "
"	350	135.5	" "
"	100	103.1	Northrup
"	200	114.0	"
"	300	127.0	"
Molybdenum, drawn	20	5.7	Bureau of Standards
Monel metal	20	42	Bureau of Standards
Nichrome	20	100	Bureau of Standards
Nickel	20	7.8	Bureau of Standards
pure	−182.5	1.44	Fleming, 1900
"	−78.2	4.31	"
"	0	6.93	"
"	94.9	11.1	"
"	400	60.2	Niccolai, 1907
Nickel-copper-zinc Ni 12.84, Cu 30.59 Zn 6.57 by vol.	0	20.3	Matthiessen
Nickelin Ni 18.46, Cu 61.63 Zn 19.67, Fe 0.24 Co 0.19, Mn 0.18	0	33	Feussner, Lindeck
Osmium	20	60.2	Niccolai
Palladium	20	11	Bureau of Standards
	−183	2.78	Dewar, Fleming
	−78	7.17	" "
	0	10.21	" "
	98.5	13.79	" "
Patent nickel Ni 25.1, Cu 74.41 Fe 0.42, Zn 0.23 Mn 0.13, Co trace	0	34	Feussner, Lindeck
Phosphor bronze Sn 5.08, P 0.01		10.5	
Sn 2	0	5-6	

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Platinoid, Cu 62,	−160	32.5×10^{-6}	Lees, 1908
Ni 15, Zn 22	18	34.4	"
Platinum	20	10	Bureau of Standards
	−203.1	2.44	Dewar, Fleming
	−97.5	6.87	" "
	0	10.96	" "
	+100	14.85	" "
	400	26	Niccolai
	−265	.10	Nernst
	−253	.15	"
	−233	.54	"
	−153	4.18	"
	−73	7.82	"
	0	11.05	"
	+100	14.1	Pirrani
	200	17.9	"
	400	25.4	"
	800	40.3	"
	1000	47.0	"
	1200	52.7	"
	1400	58.0	"
	1600	63.0	"
Platinum-iridium			
P 90, Ir 10	0	24	Barnes, 1888
P 80, Ir 20	0	31	"
Platinum-rhodium	−200	14.49	Dewar, Fleming
Pt 90, Rh 10	−100	18.05	" "
	0	21.14	" "
	+100	24.20	" "
Platinum-silver	0	24.2	
Pt 67, Ag 33			
Platinite, nickel steel	0	45	
Ni 46–48%			
Potassium	−200	1 72	Guntz, Broniewski
	−100	3.72	" "
	−75	4 0	Hackspill
	0	6.1	"
	+55	8.4	"
liquid	100	15.31	Northrup
Rheotan	0	53	Feussner, Lindeck
Cu 53.28, Ni 25.31			
Zn 16.80, Fe 4.46			
Mn 0.37			
Rhodium	−186	0.7	Broniewski, Hackspill
	−78 3	3.09	" "
	0	4.69	" "
	+100	6.60	" "
Rose metal	0	64	
Bi 49, Pb 28,			
Sm 23			
Rubidium	−190	2.5	Hackspill
	0	11.6	
	+35	13.4	
liquid	40	19.6	
Silicium (silicon)	20	58.	
Silicium bronze	0	2.4	
Silver 99.98%	18	1.629	Jäger, Diesselhorst
electrolytic	−183	0.390	Dewar, Fleming
"	−78	1.021	" "

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Silver, 99.98 %	0	1.468 × 10^{-6}	Dewar, Fleming
electrolytic	+98.15	2.062	" "
"	192.1	2.608	" "
	−258.6	.009	Nicoolai
	−200	.357	"
	−100	.916	"
	0	1.506	"
	+100	2.15	Northrup
	200	2.80	"
	400	3.46	"
	750	6.65	"
liquid	1000	11.3	"
"	1500	15.3	"
Sodium	−180	1.0	Hackspill
	−75	2.8	"
	0	4.3	"
	55	5.4	"
liquid	116	10.2	"
"	−200	0.605	Various
	140	10.34	Northrup
Sodium-amalgam	0	95	
Hg 98, Na 2			
Steel			
aluminum	20	64	Portevin, 1909
Al 5, C 0 2			
Al 15, C 09	20	88	"
chromium	20	60	"
Cr 13, C oz			
Cr 40, C 08	20	71	
invar			
35% Ni	20	81	Bureau of Standards
manganese	20	70	" "
nickel			
Ni 10, C 0.1	20	29	
Ni 25, C 0 1	20	39	
Ni 80, C 0.1	20	82	Portevin, 1909
piano wire	0	11.8	Stronhal, Barnes
Siemens-martin	20	18	Bureau of Standards
silicon, Si 25%	20	45	
Si 4%	20	62	
tempered glass			
hard		45.7	Stronhal, Barnes
tempered yellow		27	" "
" blue		20.5	" "
" soft		15.9	" "
titanium			
Ti 2.5, C 0.15,	20	16	Portevin, 1909
tungsten			
W 5, C 0.2	20	20	"
W 20, C 0.2	20	24	"
vanadium			
V 5, C 1.1	20	121	"
Strontium	20	24.8	Matthiessen
Tantalium	20	15.5	Bureau of Standards
Tellurium	19.6	200,000.	Matthiessen
Thallium, pure	−183	4.08	Dewar, Fleming
	−78	11.8	" "
	0	17.60	" "
	+98.5	24.7	" "

Material	Temp. °C.	Resistivity ohm-cm	Authority
Therlo	20	47×10^{-6}	Bolton, 1909
Thorium	15	40.1	Rentschler, Marden, 1925
	20	18	Bureau of Standards
Tin	20	11.5	Bureau of Standards
	−184	3.40	Dewar, Fleming
	−78	8.8	" "
	0	13.0	" "
	+91.45	18.2	" "
	200	20.30	Northrup
	225	22.00	"
liquid	235	47.60	"
	750	61.22	"
Tin-bismuth			
Sn 90.5, Bi 9.5,	12	16	
Sn 2., Bi 98	0	244	
Tin-lead			
Sn 90, Pb 10	15	13.5	
Sn 33.3, Pb 66.7	15	16	Laport, 1897
Titanium		3.2	Shukow
Tungsten	20	5.51	Langmuir, 1916
	727	25.3	"
	1227	41 4	"
	1727	59 4	"
	2727	98.9	"
	3237	118	
Wood's metal			
Bi 56, Pb 14, Sn 14	0	52	
Zinc	−183	1.62	Dewar, Fleming
	−78	3.34	" "
	0	5.75	" "
	+92.5	8.00	
	191.5	10.37	
liquid	440	37.2	de la Rive
	100	7.95	Northrup
	300	13.25	"
	415	17.00	"
liquid	427	37.30	"
"	500	36.60	"
"	600	35 90	"
"	700	35.60	"
"	800	35.60	"
"	850	35.74	"

Material	Temp. °C.	Resistivity ohm-cm	Temperature coefficient
Alloy 193	0	$87\text{–}96 \times 10^{-6}$	0.000014–.0008
Alumel	0	33.3	0.0012
Chromel	0	70–110	0 00011–.000054
Copel	0	49.5	0.00000
Dowmetal	0	13–17	....
Duralumin	0	3.35	....
Nichrome II	0	109–111	0.00015
" III	0	90–97	0.00005–.00019
" IV	0	98–108	0.00018

TEMPERATURE COEFFICIENT OF RESISTIVITY

Giving the temperature coefficient of resistivity for degrees centigrade for various metals including alloys.

Material	T °C.	α	Authority
Advance (*See constantan*)			
Aluminum	18	0.0039	Jäger, Diesselhorst, 1900
	25	.0034	Somerville, 1910
	100	.0040	"
	500	.0050	"
annealed, highest purity	0–100	.00445	Holborn, 1921
Aluminum-bronze			
Cu 97, Al 3		.00102	
Cu 90, Al 10		.00320	
Cu 6, Al 94		.00380	
Antimony	20	.0036	
Arsenic		.0042	
Bismuth	20	.004	Bureau of Standards
	0–100	.00446	Holborn, 1921
Brass	20	.002	Bureau of Standards
Cu 66, Zn 34	15	.0020	
Cu 60, Zn 40	15	.0010	
Bronze			
Cu 88, Sn 12	20	.0005	
Cadmium	20	.0038	Bureau of Standards
drawn			
annealed, pure	0–100	.00424	Holborn, 1921
	0	.0042	
Carbon		−.0005	
Climax	20	+.0007	Bureau of Standards
Cobalt	0	.0033	
	0–100	.00658	Holborn, 1921
Constantan	12	.000008	Somerville, 1911
	25	.000002	"
	100	.000033	"
	200	.000020	"
	500	.000027	"
Copper, annealed	20	.00393	Bureau of Standards
hard drawn	20	.00382	" "
	100	.0038	Somerville, 1911
	400	.0042	"
	1000	.0062	"
electrolytic	0	.0041	
pure, annealed	0–100	.00433	Holborn, 1921
Copper-manganese			
Cu 96.5, Mn 3.5		.00022	Feussner, Lindeck
Cu 95, Mn 8		.000026	" "
Cu 70, Mn 30		.00004	" "
Copper-manganese-iron			
Cu 91, Mn 7.1, Fe 1.9	0	.000120	Blood
Cu 70.6, Mn 23.2, Fe 6.2	0	.000022	"
Copper-manganese-nickel			
Cu 73, Mn 24, Ni 3	0	−.00003	Feussner, Lindeck
Eureka	0	+.00005	Drysdale, 1907
Excello	20	.00016	Bureau of Standards
German-silver			
Ni 18%	20	.0004	Bureau of Standards
Cu 60, Zn 25, Ni 15	0	.00036	Feussner, Lindeck
Gold	20	.0034	Bureau of Standards
	100	.0025	Somerville, 1910
	500	.0035	"
	1000	.0049	"
	0–100	.00400	Holborn, 1921

TEMPERATURE COEFFICIENT OF RESISTIVITY
(Continued)

Material	T °C.	α	Authority
Gold-copper-silver			
Au 58.3, Cu 26.5, Ag 15.2	0	.000574	Matthiessen
Au 66.5, Cu 15.4, Ag 18.1	0	.000529	"
Au 7.4, Cu 78.3, Ag 14.3	0	.001830	"
Gold-silver			
Au 90, Ag 10	0	.0012	
Au 67, Ag 33	0	.00065	
Ia Ia			
Cu 60, Ni 40	0	−.00003	Drysdale, 1907
Illium		+.000479	Knipp-Hall, 1922
Indium	0	.0047	
Iridium	0–100	.00411	Holborn, 1921
Iron	20	.0050	Bureau of Standards
	0	.0062	Dewar, Fleming
	25	.0052	Somerville, 1910
	100	.0068	"
	500	.0147	"
	1000	.0050	"
	0–100	.00657	Holborn, 1912
Lead	18	.0043	Jäger, Diesselhorst
pure	0–100	.00422	Holborn, 1921
Lithium	0	.0047	
	230	.0027	
Magnesium	20	.004	Bureau of Standards
	0	.0038	Vincentini, Omodei
	25	.0050	Somerville, 1910
	100	.0045	"
	500	.0036	"
	600	.0100	"
Manganese-copper	0	.000040	Feussner-Lindeck
Mn 30, Cu 70			
Manganin			
Cu 84, Mn 12, Ni 4	12	.000006	Somerville, 1910
	25	.000000	"
	100	−.000042	"
	250	−.000052	"
	475	.000000	"
	500	+.00011	"
Mercury	20	.00089	Bureau of Standards
	0	.00088	Glazebrook
Molybdenum	25	.0033	Somerville
	100	.0034	"
	1000	.0048	"
	0–100	.00435	Holborn, 1921
Monel-metal	20	.0020	Bureau of Standards
Nichrome	20	.0004	Bureau of Standards
Nickel	20	.006	Bureau of Standards
	0	.006	Vincentini
	25	.0043	Somerville
	100	.0043	"
	500	.0030	"
	1000	.0037	"
pure, annealed	0–100	.00675	Holborn, 1912
Palladium	20	.0033	Bureau of Standards
pure	0–100	.00377	Holborn
"	0	.0035	Dewar, Fleming
Phosphor-bronze	0	.0040 – .0030	

TEMPERATURE COEFFICIENT OF RESISTIVITY
(Concluded)

Material	T °C.	α	Authority
Platinite, nickel steel, Ni 46–48%	0	.003	
Platinum	20	.003	Bureau of Standards
	0	.0037	Dewar, Fleming
	0–100	.00392	Holborn, 1921
Platinum-iridium			
Pt 90, Ir 18	0	.0012	Barnes, 1888
Pt 80, Ir 20	0	.0008	"
Platinum-rhodium			
Pt 90, Rh 10	0	.0013	Le Chatelier, 1900
Platinum-silver			
Pt 33, Ag 67	0	.00024	
Potassium	0	.0055	
liquid	100	.0042	
Rheotan	0	.0004	
Rhodium	0–100	.00443	Holborn
Rose metal	0	.0020	
Rubidium	0	.0060	
Silicium bronze	0	.0038–.0023	
Silver	20	.0038	Bureau of Standards
	25	.0030	Somerville, 1910
	100	.0036	"
	500	.0044	"
pure, annealed	0–100	.00410	Holborn, 1921
Sodium	0	.0044	
liquid	120	.0033	
Steel			
invar Ni 36, C 0.2	0	.0020	
piano wire	0	.0032	Strouhal, Barnes
Siemens-Martin	20	.003	Bureau of Standards
Silicon			
Si 4%	20	.0008	
tempered glass hard	0	.0016	Strouhal, Barnes
tempered blue	0	.0033	" "
Tantalum	20	.0031	Bureau of Standards
	0–100	.00347	Holborn, 1921
Thallium	0	.0040	
liquid	295	.00035	
Therlo	20	.00001	Bureau of Standards
Thorium	20–1800	.0021	Rentschler, Marden, 1925
Tin	20	.0042	Bureau of Standards
Tungsten	18	.0045	Jager, Diesselhorst
	500	.0057	Somerville
	1000	.0089	"
pure, annealed	0–100	.00465	Holborn, 1921
Wood's metal	0	.0020	
Zinc	20	.0037	Bureau of Standards
	0	.0040	
	0–100	.00415	Holborn, 1921

RATIO TABLES FOR BRIDGE CALCULATIONS

The Leeds & Northrup Co.

$$\frac{A}{1000 - A}$$

The first table gives values of the ratio, $A/(1000 - A)$, the value of A being measured from the zero at one end of the scale. If the balance point is at 500, A = 500 and the ratio is unity.

UNITS

A	0	1	2	3	4	5	6	7	8	9
0	.0 0000	1001	2004	3010	4016	5025	6036	7049	8064	9082
10	.0 1010	1112	1214	1317	1420	1523	1626	1730	1833	1937
20	.0 2041	2145	2250	2354	2459	2564	2670	2775	2881	2987
30	.0 3093	3199	3306	3413	3520	3627	3735	3843	3950	4058
40	.0 4167	4275	4384	4493	4602	4712	4820	4931	5042	5152
50	.0 5263	5374	5485	5596	5708	5820	5932	6044	6156	6269
60	.0 6383	6496	6610	6724	6838	6952	7066	7180	7296	7412
70	0 7527	7643	7759	7875	7992	8109	8225	8342	8460	8578
80	.0 8696	8814	8933	9051	9170	9290	9408	9528	9649	9770
90	.0989	.1001	.1013	.1025	.1037	.1050	.1062	.1074	.1086	.1099
100	.1111	.1123	.1136	.1148	.1160	.1173	.1186	.1198	.1211	.1223
110	.1236	.1248	.1261	.1274	.1287	.1300	.1312	.1325	.1338	.1351
120	.1364	.1377	.1390	.1403	.1416	.1429	.1442	.1455	.1468	.1481
130	.1494	.1507	.1521	.1534	.1547	.1561	.1574	.1587	.1601	.1615
140	.1628	.1641	.1655	.1669	.1682	.1695	.1710	.1723	.1737	.1751
150	.1765	.1778	.1792	.1806	.1821	.1834	.1848	.1862	.1876	.1890
160	.1905	.1919	.1933	.1947	.1962	.1976	.1990	.2005	.2019	.2034
170	.2048	.2063	.2077	.2092	.2106	.2121	.2136	.2151	.2165	.2180
180	.2195	.2210	.2225	.2240	.2255	.2270	.2285	.2300	.2315	.2331
190	.2346	.2361	.2376	.2392	.2407	.2423	.2438	.2454	.2469	.2485
200	.2500	.2516	.2532	.2547	.2563	.2579	.2595	.2610	.2625	.2642
210	.2658	.2674	.2690	.2706	.2722	2739	.2755	.2772	.2788	.2804
220	.2820	.2837	.2853	.2870	.2887	.2903	.2920	.2937	.2954	.2971
230	.2987	.3004	.3020	.3038	.3055	.3072	.3089	.3106	.3123	.3140
240	.3157	.3175	.3192	.3210	.3228	.3245	.3262	.3280	.3298	.3316
250	.3333	.3351	.3369	.3387	.3405	.3423	.3440	.3459	.3477	.3495
260	.3513	.3532	.3550	.3568	.3587	.3606	.3624	.3643	.3662	3681
270	.3699	.3717	.3736	.3755	.3774	.3793	3812	.3831	.3850	3869
280	.3889	.3908	.3928	.3947	.3966	.3986	.4005	.4024	.4044	.4064
290	.4084	.4104	.4124	.4144	.4164	.4185	.4205	.4225	.4245	.4265
300	.4285	.4306	.4326	.4347	.4368	.4389	.4409	.4430	.4450	.4471
310	.4493	.4514	.4535	.4556	.4577	.4598	.4619	.4640	.4661	.4683
320	.4705	.4727	.4749	.4771	.4793	.4814	.4836	.4858	.4881	.4903
330	.4925	.4947	.4969	.4992	.5015	.5038	.5060	.5083	.5106	.5129
340	.5152	.5174	.5197	.5220	.5244	.5267	.5290	.5313	.5336	.5360
350	.5384	.5407	.5431	.5455	.5480	.5504	.5528	.5553	.5576	.5600
360	.5625	.5650	.5674	.5698	.5723	.5748	.5773	.5798	.5823	.5848
370	.5873	.5899	.5924	.5949	.5974	.6000	.6025	.6051	.6077	.6103
380	.6129	.6155	.6181	.6207	.6233	.6260	.6286	.6313	.6340	.6367
390	.6394	.6420	.6447	.6474	.6502	.6529	.6557	.6584	.6611	.6638
400	.6666	.6694	.6722	.6750	.6778	.6806	.6834	.6862	.6891	.6920
410	.6949	.6978	.7007	.7036	.7065	.7094	.7123	.7152	.7181	.7211
420	.7241	.7271	.7301	.7331	.7361	.7391	.7421	.7451	.7482	.7512
430	.7543	.7574	.7605	.7636	.7667	.7698	7729	.7760	.7792	.7824
440	.7857	.7889	.7921	.7953	.7986	.8018	.8050	.8084	.8117	.8150
450	.8182	.8215	.8248	.8282	.8316	.8349	.8382	.8416	.8450	.8484
460	.8518	.8552	.8586	.8620	.8655	.8691	.8727	.8762	.8798	.8834
470	8868	.8904	.8939	.8975	.9011	.9048	.9084	.9120	.9157	.9194
480	.9231	.9267	.9304	.9341	.9379	.9417	.9454	.9493	.9531	.9570
490	.9609	.9649	9687	.9725	.9764	.9803	.9842	.9881	.9920	.9960

RATIO TABLES FOR BRIDGE CALCULATIONS (Continued)

Units

A	0	1	2	3	4	5	6	7	8	9
500	1.000	1 004	1.008	1.012	1.016	1.020	1.024	1.028	1.032	1 036
510	1.041	1.045	1.049	1.053	1.058	1.062	1.066	1.071	1.075	1.079
520	1.083	1.088	1.092	1.097	1 101	1.105	1.110	1.114	1.119	1 123
530	1.128	1.132	1.137	1.141	1.146	1.151	1.155	1.160	1.165	1 169
540	1.174	1.179	1.183	1.188	1.193	1.198	1.203	1.208	1.212	1.217
550	1.222	1 227	1.232	1.237	1.242	1.247	1.252	1.257	1.262	1.267
560	1.273	1.278	1.283	1.288	1.294	1.299	1.304	1.309	1.314	1 320
570	1.326	1.331	1.336	1.342	1.347	1.353	1.359	1.364	1.370	1.375
580	1.381	1.386	1.392	1.398	1.404	1.410	1.415	1.421	1.427	1 433
590	1.439	1.445	1.451	1.457	1.463	1.469	1.475	1.481	1.487	1 494
600	1.500	1.506	1.513	1.519	1.525	1.531	1.538	1.544	1.551	1.557
610	1.564	1.571	1.577	1.584	1.591	1.597	1.604	1.611	1.618	1.625
620	1.632	1.639	1.645	1.652	1.659	1.667	1.674	1.681	1.688	1.695
630	1.703	1.710	1.717	1.724	1.732	1.740	1.747	1.755	1.763	1.770
640	1.778	1.786	1.793	1.801	1.809	1.817	1.825	1.833	1 841	1.849
650	1.857	1.865	1.873	1.882	1.890	1.899	1.907	1.916	1 924	1.933
660	1.941	1.950	1.958	1.967	1.976	1.985	1.994	2.003	2.012	2 021
670	2.030	2.039	2.048	2.058	2.068	2.078	2.087	2.096	2.106	2 115
680	2.125	2.135	2.145	2 155	2.165	2.175	2.185	2.195	2.205	2.215
690	2.225	2.236	2.247	2 257	2.268	2.278	2.289	2.300	2.311	2.322
700	2 333	2 344	2.355	2.367	2.378	2.389	2.401	2.413	2.425	2.436
710	2.448	2.460	2.472	2.485	2.497	2.509	2.521	2.534	2.546	2.559
720	2.571	2.584	2.597	2.610	2.623	2.636	2.650	2.663	2.676	2.690
730	2.703	2.716	2.731	2.745	2.759	2.774	2 788	2.802	2.817	2 831
740	2.846	2.861	2.876	2.891	2.907	2.922	2.937	2 953	2.968	2 984
750	3.000	3.016	3.032	3.049	3.065	3.081	3.098	3.115	3.132	3 150
760	3 168	3.185	3.202	3.220	3.237	3.255	3.273	3.291	3.310	3 329
770	3.348	3 367	3 386	3.405	3.425	3.445	3.464	3.484	3.505	3.525
780	3.546	3.566	3.587	3.608	3.630	3.652	3.674	3.695	3.717	3.740
790	3.762	3.785	3.808	3.831	3.854	3.878	3.902	3.926	3.950	3.975
800	4 000	4.025	4.050	4 075	4.102	4.127	4.154	4.181	4.209	4.236
810	4.263	4.290	4.319	4.348	4.376	4.405	4.435	4.464	4.494	4.525
820	4 556	4.587	4.618	4 650	4.682	4.715	4.748	4.781	4.814	4.848
830	4 882	4.917	4.953	4 988	5.025	5.061	5.097	5.135	5.173	5 211
840	5.250	5.290	5.330	5 370	5.411	5.451	5.493	5.536	5.580	5.623
850	5.666	5.711	5.757	5 803	5.850	5.898	5.945	5.994	6.043	6.093
860	6.143	6.194	6.247	6.300	6 353	6.407	6.463	6.519	6.576	6 634
870	6.693	6.752	6.812	6.873	6 937	7.000	7.064	7.129	7.196	7.264
880	7.334	7.403	7.474	7.546	7.620	7.696	7.772	7.849	7.928	8.009
890	8.091	8.175	8.259	8.346	8.434	8.524	8.616	8.709	8.804	8.901
900	9.000	9.101	9.204	9.309	9.416	9.526	9.638	9.753	9.870	9.989
910	10.11	10.23	10.36	10.49	10.63	10.76	10.90	11.05	11.19	11.34
920	11.50	11.66	11.82	11.99	12.16	12.33	12.51	12.70	12.89	13 08
930	13 28	13.49	13.71	13.93	14.15	14.38	14.62	14.87	15.13	15.40
940	15 66	15.95	16.24	16.54	16.86	17.18	17.52	17.87	18.23	18.61
950	19.00	19.41	19.83	20.28	20.75	21.22	21.73	22.26	22.81	23 38
960	24.00	24.64	25.32	26.03	26.77	27.57	28.41	29.30	30.25	31 26
970	32.33	33.49	34.70	36.04	37.46	39.00	40.67	42.48	44.44	46 62
980	49 00	51 63	54.55	57.83	61.50	65 67	70.43	75 93	82 33	89 91
990	99 .00	110.1	124.0	141.9	165.7	199.0	249.0	332.3	499 0	999 0

RATIO TABLES FOR BRIDGE CALCULATIONS (Continued)

$$\frac{4500 + A}{5500 - A}$$

The second table gives values of the ratio $(4500 + A)/(5500 - A)$, the value of A being measured from the 4500 division on a total scale of 10,000. If the balance point is at 5000, $A = 500$ and the ratio is unity.

Units

A	0	1	2	3	4	5	6	7	8	9
0	.8182	8185	8188	8192	8195	8198	8202	8205	8208	8212
10	.8215	8218	8221	.8225	8228	8232	8235	8238	8241	8245
20	8248	8251	.8254	.8258	8262	.8265	8268	8272	.8275	8278
30	8281	8285	8288	.8292	.8295	.8298	8302	.8305	.8308	.8312
40	8315	.8318	8322	.8325	.8328	8332	8335	.8338	.8341	8345
50	.8349	8353	8356	.8360	.8363	8366	8370	.8373	.8376	8379
60	.8382	.8385	.8389	.8392	.8396	.8399	8403	.8406	.8409	8413
70	.8416	8419	.8423	.8426	8424	.8433	.8436	8440	.8443	.8447
80	.8450	8453	.8457	.8460	.8464	.8467	8470	.8474	.8477	8481
90	.8484	.8487	.8491	.8495	.8498	.8501	8505	.8509	.8513	8517
100	.8519	8522	.8525	.8529	.8532	.8536	.8539	8543	.8546	8549
110	.8553	.8556	8560	.8563	.8567	.8570	8574	8577	8581	8584
120	.8587	8591	.8594	.8598	.8601	8605	8608	8612	8615	8619
130	.8622	.8626	.8629	.8633	.8636	8640	.8643	.8646	.8650	8653
140	.8657	.8660	.8664	.8667	.8671	.8674	.8678	.8681	.8685	8688
150	.8692	.8695	.8699	.8702	.8706	.8709	.8713	.8716	8720	8723
160	.8727	.8730	8734	8737	.8741	.8744	.8748	8751	.8755	8758
170	8762	.8765	.8769	8772	.8776	.8779	.8783	.8786	8790	8793
180	.8797	.8800	8804	.8808	.8811	.8815	.8818	.8822	.8825	8829
190	.8832	.8836	.8839	8843	.8847	.8850	.8854	.8857	.8861	8864
200	.8868	.8871	8875	.8879	.8882	.8885	.8889	.8893	.8896	8900
210	.8903	.8907	8910	.8914	.8917	.8921	.8925	8929	.8932	8936
220	8939	.8942	.8946	.8950	.8953	.8957	.8960	.8964	8968	8972
230	8975	.8979	8982	.8986	.8990	.8993	.8997	.9001	.9004	9008
240	9011	9015	.9018	.9022	.9025	.9029	.9032	.9037	.9040	.9044
250	9048	9051	.9055	.9059	.9063	.9066	9070	.9073	.9077	9080
260	9084	9088	9091	.9095	.9098	.9101	.9105	.9108	.9112	9116
270	9120	9123	.9127	.9131	.9135	.9139	9142	9146	.9150	9153
280	9157	.9161	9165	.9168	.9172	.9175	9179	9183	.9186	.9190
290	9194	.9198	9202	.9205	.9209	.9212	9215	9220	.9223	.9227
300	9231	.9234	9238	.9242	.9245	.9249	9253	9257	.9260	9264
310	9268	.9272	9276	.9279	.9282	9286	.9290	9294	.9298	.9301
320	9305	.9309	9312	.9316	.9320	.9324	.9327	.9331	.9335	9339
330	9342	.9346	9350	.9354	.9357	.9361	9365	.9369	9372	9376
340	9380	.9384	9388	.9391	.9395	.9399	9403	9406	.9410	9414
350	9417	.9421	.9425	.9429	.9432	9436	.9440	9444	.9448	9451
360	9455	9459	.9463	.9467	.9470	.9474	9478	.9482	.9486	.9489
370	9493	9497	.9500	.9504	.9508	.9512	.9516	.9520	.9523	.9527
380	9531	.9535	.9539	.9543	.9547	.9550	9554	.9558	.9562	9566
390	9570	9573	9577	.9581	.9585	.9589	9592	.9596	.9600	9604
400	.9608	9611	9615	.9619	.9623	.9627	.9631	.9635	.9639	.9643
410	9646	9650	9654	.9658	.9661	.9665	.9669	.9673	.9677	.9681
420	.9685	9689	9693	.9697	.9700	9704	.9708	.9712	.9716	.9720
430	.9724	.9728	.9732	.9736	9740	9744	9748	.9751	.9755	.9759
440	.9763	.9767	.9771	.9774	.9778	,9782	.9786	.9790	.9795	.9798
450	.9802	9806	9810	.9814	.9818	.9822	.9826	.9830	.9834	.9837
460	9841	9846	9849	.9853	.9857	.9861	9865	.9869	.9873	.9877
470	9881	9885	9889	.9893	.9897	.9900	9904	.9908	.9912	.9916
480	9920	.9924	.9928	.9932	9936	9940	9944	9948	.9952	9956
490	.9960	9964	.9968	9972	.9976	.9980	9984	9988	.9992	9996

RATIO TABLES FOR BRIDGE CALCULATIONS (Continued)

UNITS

A	0	1	2	3	4	5	6	7	8	9
500	1 0000	1 0004	1 0008	1.0012	1.0016	1.0020	1 0024	1 0028	1 0032	1 0036
510	1.0040	1.0044	1 0048	1 0052	1 0056	1 0061	1 0065	1 0069	1 0073	1 0077
520	1 0081	1 0085	1 0089	1.0093	1 0097	1.0101	1.0105	1 0109	1 0113	1.0117
530	1.0121	1 0125	1 0129	1.0133	1 0137	1.0142	1.0146	1 0150	1 0154	1.0158
540	1 0162	1 0166	1 0170	1 0174	1 0178	1 0183	1 0187	1 0192	1 0196	1 0200
550	1 0203	1 0207	1 0211	1.0215	1 0219	1.0224	1 0228	1 0232	1 0236	1.0240
560	1 0244	1 0248	1 0252	1.0256	1.0260	1.0264	1.0269	1 0273	1 0277	1 0281
570	1 0285	1 0289	1 0293	1.0297	1.0301	1.0305	1 0309	1 0313	1 0317	1 0321
580	1 0325	1 0329	1 0333	1.0337	1.0341	1.0345	1.0350	1 0354	1 0358	1 0362
590	1 0366	1 0370	1 0375	1.0379	1.0383	1.0388	1 0392	1 0396	1 0400	1 0405
600	1 0409	1 0413	1 0417	1.0421	1.0425	1.0429	1 0434	1 0438	1 0442	1.0446
610	1 0450	1 0454	1 0458	1.0463	1.0467	1.0471	1 0475	1 0479	1 0484	1 0488
620	1 0492	1 0496	1 0500	1 0505	1 0509	1.0513	1 0517	1 0521	1 0526	1 0530
630	1 0534	1 0538	1 0542	1.0547	1.0551	1.0555	1 0559	1.0563	1.0568	1 0572
640	1 0576	1 0580	1 0585	1 0589	1.0593	1.0598	1 0602	1 0606	1 0610	1 0615
650	1 0619	1 0623	1 0628	1 0632	1.0636	1.0641	1 0645	1 0649	1 0653	1 0658
660	1 0662	1 0666	1 0670	1 0675	1.0679	1.0683	1.0687	1 0691	1 0696	1 0700
670	1 0704	1 0708	1 0713	1 0717	1 0721	1.0726	1 0730	1 0734	1 0738	1 0743
680	1 0747	1 0751	1 0755	1.0760	1.0764	1.0768	1 0772	1 0776	1 0781	1 0785
690	1 0789	1 0794	1 0798	1 0803	1.0807	1.0811	1.0816	1 0821	1 0825	1 0830
700	1 0834	1 0838	1 0843	1 0847	1 0851	1.0856	1 0860	1 0864	1 0868	1 0873
710	1 0877	1.0881	1 0886	1.0890	1.0895	1.0899	1 0903	1 0908	1 0912	1 0917
720	1 0921	1 0925	1 0930	1 0934	1.0939	1.0943	1 0947	1 0952	1 0956	1 0961
730	1 0965	1 0969	1 0974	1 0978	1 0982	1 0987	1 0991	1 0995	1 0999	1 1004
740	1 1008	1.1013	1 1017	1 1022	1 1026	1.1031	1 1035	1 1040	1 1044	1 1049
750	1 1053	1 1057	1 1062	1 1066	1.1071	1 1075	1 1079	1 1084	1 1088	1 1093
760	1 1097	1 1102	1 1106	1 1111	1.1115	1 1120	1.1124	1 1129	1 1133	1 1138
770	1 1142	1 1147	1 1151	1 1156	1 1160	1.1165	1 1169	1 1174	1.1178	1 1183
780	1 1187	1 1192	1 1196	1 1201	1 1205	1 1210	1 1214	1 1219	1 1223	1 1228
790	1 1232	1 1236	1 1241	1 1245	1 1250	1.1254	1 1258	1 1263	1 1267	1 1272
800	1 1276	1 1281	1 1285	1 1290	1 1294	1.1299	1 1304	1 1308	1 1313	1 1317
810	1 1322	1 1327	1 1331	1 1336	1 1340	1 1345	1 1349	1 1354	1 1358	1 1363
820	1 1367	1 1372	1 1376	1.1381	1 1385	1.1390	1.1395	1 1400	1 1404	1 1408
830	1 1413	1 1418	1 1422	1 1427	1.1431	1 1436	1 1441	1 1445	1 1450	1 1454
840	1 1459	1 1464	1 1468	1 1473	1 1477	1 1482	1 1487	1 1491	1 1496	1 1500
850	1 1505	1 1510	1 1514	1 1519	1 1523	1.1528	1 1533	1 1537	1 1542	1.1546
860	1 1551	1 1556	1 1560	1 1565	1 1570	1.1575	1 1579	1 1584	1.1589	1 1593
870	1 1598	1 1603	1 1608	1.1612	1.1617	1.1622	1 1627	1 1632	1 1636	1 1641
880	1 1646	1 1651	1 1655	1.1660	1.1664	1.1669	1 1674	1 1678	1.1683	1 1687
890	1 1692	1 1697	1 1701	1 1706	1 1710	1.1715	1 1720	1 1724	1 1729	1 1733
900	1 1738	1 1743	1 1748	1 1752	1.1757	1 1762	1 1767	1 1772	1 1776	1 1781
910	1 1786	1 1791	1 1796	1.1800	1 1805	1 1810	1 1815	1 1820	1 1824	1 1829
920	1 1834	1 1839	1 1844	1 1848	1 1853	1 1858	1 1863	1 1868	1 1872	1.1877
930	1 1882	1 1887	1 1892	1.1896	1.1901	1 1906	1 1911	1 1916	1 1920	1 1925
940	1 1930	1 1935	1 1939	1.1944	1.1949	1.1954	1 1958	1 1963	1 1968	1 1972
950	1 1977	1 1982	1.1987	1 1992	1 1997	1.2002	1 2006	1 2011	1 2016	1 2021
960	1 2026	1 2031	1 2036	1 2041	1.2046	1.2051	1 2055	1 2060	1 2065	1 2070
970	1 2075	1 2080	1 2085	1 2090	1 2095	1 2100	1 2104	1 2109	1 2114	1 2119
980	1 2124	1 2129	1 2134	1 2139	1 2144	1 2149	1 2153	1 2158	1 2163	1.2168
990	1 2173	1.2178	1 2183	1.2188	1.2193	1 2198	1 2202	1.2207	1 2212	1 2217

RESISTANCE OF ELECTROLYTES

Resistance of aqueous solutions of various salts and acids in ohms per centimeter cube for a temperature of 18° C.

(From observations by Kohlrausch.)

Salt.	Number of grams of salt in 100 grams solution.							
	5	10	15	20	25	30	40	50
Acetic acid		654.	616.	622 5	658.	714	925.	1351.
Ammonium chloride....	10 89	5.63	3 86	2.97	2 48			
Copper nitrate.........	27 4	15.7	11 7	9.82	9 17			
sulphate.............	52 9	31 2	23 7					
Hydrochloric acid.....	2 54	1 59	1 34	1 31	1.38	1 51	1 94	
Potassium iodide	29 5	14 7	...	6 88	....	4 34	3 16	2.55
Silver nitrate.	39 0	21 0	14.64	11.46	9 45	8 07	6.39	5.39
Sodium carbonate....	22 2	14 2	12 0					
chloride	14 94	8.33	6 10	5.11	4 69			
hydroxide.	5 08	3 20	2 89	3.06	3 68	4 95	8 61	
Sulphuric acid.........	4 79	2 55	1.84	1 53	1 39	1.35	1 47	1.85
Zinc chloride...........	20 70	13.75	.	10 96	.	10.80	11.83	15.87
sulphate.............	52 3	31 2	24.1	21 4	20 8	22 5		
(Concentration)	6 2	12.4	18 6	24 8	31	37 2	43 4	
Nitric acid.........	3.2	1.84	1.45	1 30	1 28	1.32	1.43	
(Concentration) ..	8 4	12 6	16 8	21.	25 2	29 4	33 6	
Potassium hydroxide .	3 67	2 66	2.19	1 96	1 85	1.84	1.91	

SAFE CARRYING CAPACITY OF COPPER WIRE

(From Collins' Design and Construction of Induction Coils, by permission.)

Brown & Sharpe gauge.	Diameter in mils.	Area in circular mils.	Number of amperes, exposed work	Number of amperes, confined spaces.
18	40	1.624	5	3
17	45	2.048	6	4
16	51	2.583	8	6
15	57	3.257	10	8
14	64	4.106	16	12
13	72	5.178	19	14
12	81	6.530	23	17
11	91	8.234	27	21
10	102	10.380	32	25
9	114	13 090	39	29
8	128	16.510	46	33
7	144	20.820	56	39
6	162	26.250	65	45
5	182	33.100	77	53
4	204	41.740	92	63
3	229	52.630	110	75
2	258	66.370	131	88
1	289	83.690	156	105
0	325	105.500	185	125
00	365	133.100	220	150

CONDUCTIVITY OF STANDARD SOLUTIONS

Giving the conductivity in reciprocal ohms (mho) per cm. for NaCl, KCl, H_2SO_4 and $MgSO_4$ for various temperatures. Solutions are as follows: —

H_2SO_4, — maximum conductivity (18° C.); dissolve 378 g. of 97% acid in pure water and dilute to 1 liter. Density at 18° C., 1.223.

$MgSO_4$, — maximum conductivity (18° C.); dissolve in 1 liter of distilled water 552 g. of $MgSO_4 7H_2O$. Density at 18° C., 1.190.

NaCl, — solution saturated at all temperatures given. An excess of NaCl in distilled water, about 450 g. per liter. D = 1.2014 (18° C.).

KCl, — normal solution, 74.59 grams per liter of solution at 18° C. Dissolve 74.555 grams (weighed in air) of KCl and dilute to 1 liter. Density, 1.04492.

Solution.	0° C.	5°	10°	15°
H_2SO_4	0.5184	0.5792	0.6408	0.7028
$MgSO_4$	0.02877	0.03402	0.03963	0.04555
NaCl	0.1345	0.1555	0.1779	0.2014
KCl, normal	0.06541	0.07414	0.08319	0.09252
KCl, 1/10 normal	0.00715	0.00822	0.00933	0.01048
KCl, 1/100 normal	0.000776	0.000896	0.001020	0.001147

	16°	17°	18°	19°	20°
H_2SO_4	0.7151	0.7275	0.7398	0.7522	0.7645
$MgSO_4$	0.04676	0.04799	0.04922	0.05046	0.05171
NaCl	0.2062	0.2111	0.2160	0.2209	0.2259
KCl, n.	0.09441	0.09631	0.09822	0.10014	0.10207
KCl, 1/10 n.	0.01072	0.01095	0.01119	0.01143	0.01167
KCl, 1/100 n.	0.001173	0.001199	0.001225	0.001251	0.001278

	21°	22°	23°	24°	25°
H_2SO_4	0.7768	0.7890	0.8013	0.8135	0.8257
$MgSO_4$	0.05297	0.05424	0.05551	0.05679	0.05808
NaCl	0.2309	0.2360	0.2411	0.2462	0.2513
KCl, n.	0.10400	0.10594	0.10789	0.10984	0.11180
KCl, 1/10, n.	0.01191	0.01215	0.01239	0.01264	0.01288
KCl, 1/100 n.	0.001305	0.001332	0.001359	0.001386	0.001413

	26°	27°	28°	29°	30°
H_2SO_4	0.8378	0.8499	0.8620	0.8740	0.8860
$MgSO_4$	0.05937	0.06067	0.06197	0.06328	0.06459
NaCl	0.2565	0.2616	0.2669	0.2721	0.2774
KCl, n.	0.11377	0.11574	....	....	....
KCl, 1/10 n.	0.01313	0.01337	0.01362	0.01387	0.01412
KCl, 1/50 n.	0.002819	0.002873	0.002927	0.002981	0.003036

EQUIVALENT CONDUCTANCE OF AQUEOUS SOLUTIONS

The equivalent conductance is given in reciprocal ohms. Concentration is given in milli-equivalents of solute per liter of solution. Corrected for conductance of water except in case of the strong acids.

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Acetic acid	0.	347.	773.
	10.	14.50	25.1
	30.	8.50	14.7
	80.	5.22	9.05
	100.	4.67	8.10
*Ammonium acetate	0.	99.8	338.
	10.	91.7	300.
	25.	88.2	286.
*Ammonium chloride	0.	131.1	415.
	2.	126.5	399.
	10.	122.5	382.
	30.	118.1	......
Ammonium hydroxide	0.	238.	647.
	10.	9.66	23.2
	30.	5.66	13.6
	100.	3.10	7.47
Barium ferrocyanide	0.	91.	521.
	2.	46.9	202.3
	12.5	30.4	129.8
Barium hydroxide	0.	222.	645.
	2.	215.	591.
	10.	207.	548.
	50.	191.1	478.
	100.	180.1	443.
Barium nitrate	0.	116.9	385.
	2.	109.7	352
	10.	101.	322.
	40.	88.7	280.
	80.	81.6	258.
	100.	79.1	249.
Calcium ferrocyanide	0.	88.	512.
	100.	21.9	84.3
	200.	20.6	77.5
	400.	202.	76.2
Calcium nitrate	0.	70.4	369.
	2.	66.5	346.5
	50.	55.6	276.8
	100.	51.9	255.5
	200.	48.3	234.4

* Values have been corrected for hydrolysis.

EQUIVALENT CONDUCTANCE OF AQUEOUS SOLUTIONS (Continued)

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Hydrochloric acid	0.	379.	850.
	2.	373.6	826.
	10.	368.1	807.
	80.	353.	762.
	100.	350.6	754.
Lanthanum nitrate	0.	75.4	413.
	2.	68.9	363.5
	12.5	61.4	311.2
	50.	54.	261.4
	100.	49.9	236.7
	200.	46.	210.8
Magnesium sulphate	0.	114.1	426.
	2.	94.3	302.
	10.	76.1	234.
	20.	67.5	190.
	40.	59.3	160.
	80.	52.	136.
	100.	49.8	130.
	200.	43.1	110.
Nitric acid	0.	377.	826.
	2.	371.2	806.
	10.	365.	786.
	50.	353.7	750.
	100.	346.4	728.
Phosphoric acid	0.	338.3	730.
	2.	283.1	498.
	10.	203.	308.
	50.	122.7	168.
	100.	95.7	128.
Potassium chloride	0.	130.1	414.
	2.	126.3	393.
	10.	122.4	377.
	80.	113.5	342.
	100.	112.	336.
Potassium citrate	0.	76.4	420.
	2.	71.	381.2
	5.	67.6	357.2
	50.	54.4	273.
	100.	50.2	247.5
	300.	43.5	209.5
Potassium nitrate	0.	80.8	384.
	2.	78.6	370.3
	12.5	75.3	351.5

EQUIVALENT CONDUCTANCE OF AQUEOUS SOLUTIONS (Continued)

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C
Potassium nitrate	50.	70.7	326.1
	100.	67.2	308.5
Potassium ferrocyanide	0.	98.4	527.
	2.	84.8	427.6
	50.	58.2	272.4
	100.	53.	245.
	206.	48.8	222.3
	400.	45.4	203.1
Potassium oxalate	0.	79.4	419.
	2.	74.9	389.3
	50.	63.	312.2
	100.	59.3	288.9
	200.	55.8	265.1
Potassium sulphate	0.	132.8	455.
	2.	124.8	402.
	10.	115.7	365.
	40	104.2	320.
	80	97.2	294
	100	95.	286.
Silver nitrate	0.	115.8	367.
	2.	112.2	353.
	10.	108.	337.
	20.	105.1	326.
	40.	101.3	312.
	80.	96.5	294.
	100.	94.6	289.
Sodium acetate	0.	78.1	285.
	2.	74.5	268.
	10.	71.2	253.
	80.	63.4	221.
Sodium chloride	0.	109.	362.
	2.	105.6	349.
	10.	102.	336.
	80.	93.5	301.
	100.	92.0	296.
Sodium hydroxide	0.	216.5	594.
	2.	212.1	582.
	20.	205.8	559.
	50.	200.6	540.
Sulphuric acid	0.	383.	891.
	2.	353.9	571.
	10.	309.	446.
	50.	253.5	384.
	100.	233.3	369.

THE EQUIVALENT CONDUCTANCE OF THE SEPARATE IONS

(From Smithsonian Physical Tables)

Ion.	0°	18°	25°	50°	75°	100°	128°	156°
K	40.4	64.6	74.5	115	159	206	263	317
Na	26.	43.5	50.9	82	116	155	203	249
NH_4	40.2	64.5	74.5	115	159	207	264	319
Ag	32 9	54.3	63.5	101	143	188	245	299
$\frac{1}{2}$Ba	33.	55.	65.	104	149	200	262	322
$\frac{1}{2}$Ca	30.	51.	60.	98	142	191	252	312
$\frac{1}{3}$La	35.	61.	72.	119	173	235	312	388
Cl	41 1	65.5	75 5	116	160	207	264	318
NO_3	40 4	61.7	70.6	104	140	178	222	263
$C_2H_3O_2$	20.3	34.6	40.8	67	96	130	171	211
$\frac{1}{2}SO_4$	41	68.	79.	125	177	234	303	370
$\frac{1}{2}C_2O_4$	39.	63.	73.	115	163	213	275	336
$\frac{1}{3}C_6H_5O_7$	36.	60.	70.	113	161	214		
$\frac{1}{4}Fe(CN)_6$	58.	95.	111.	173	244	321		
H	240	314.	350.	465	565	644	722	777
OH	105	172.	192.	284	360	439	525	592

RESISTIVITY OF DIELECTRICS

Giving the volume resistivity ρ, the variation of the volume resistivity with temperature, given as the ratio of the value at 20° C. to that at 30° C., and the surface resistivity for various dielectrics. The surface resistivity is the resistance between the opposite edges of a centimeter square. A large part of the data are from Curtis, Bulletin of the Bureau of Standards 1915. Temperatures, unless otherwise stated, are 22° C. The numbers in parentheses refer to the source of information.

Material	Volume resistivity			Surface resistivity, ohm-cm	
	Temp °C.*	ρ ohm-cm	ρ^{20}/ρ^{30}	Humidity 50%	Humidity 90%
Amberite	22	5×10^{16}		2×10^{15}	3×10^{12}
Amber............		5×10^{16}		6×10^{14}	1×10^{11}
Bakelite†					
No. 1..........		2×10^{11}		3×10^{11}	2×10^{8}
140......... ..		2×10^{7}	2.4	3×10^{9}	2×10^{5}
150...........		4×10^{12}	3.6	3×10^{12}	4×10^{9}
190.		1×10^{11}	3.6	1×10^{11}	5×10^{8}
L 558......... ..		2×10^{16}	2.6	8×10^{15}	8×10^{14}
G5074..		4×10^{10}		3×10^{11}	5×10^{5}
5199RGRB.....		5×10^{12}		6×10^{12}	1×10^{10}
5200.....		4×10^{11}	5.3	1×10^{12}	5×10^{9}
Bakelite micarta ...		5×10^{10}	2.4	2×10^{10}	1×10^{8}
Beeswax					
yellow, unrefined.		20×10^{14}	16.0	$**6\times10^{14}$	$**5\times10^{14}$
	20	8×10^{14}(1)			
white......... ..		6×10^{14}			
	22	5×10^{14} (1)			
Celluloid.........		2×10^{10}	1.8	5×10^{10}	2×10^{9}
	16	4×10^{10}(2)			
Ceresin...........		$>5\times10^{18}$		$>**1\times10^{17}$	$>**1\times10^{17}$
Condensite					
black..........		4×10^{10}	2 9	6×10^{10}	8×10^{8}
yellow.		4×10^{10}	2 9	3×10^{11}	6×10^{9}
Dielectrite.......		5×10^{12}	3 0	5×10^{11}	4×10^{7}
Duranoid		3×10^{15}		6×10^{12}	3×10^{8}
Electrose, No. 8.. .		2×10^{16}		1×10^{15}	2×10^{12}
black..		1×10^{14}	2 0	1×10^{12}	6×10^{9}
yellow.........		5×10^{15}	2 3	3×10^{14}	5×10^{8}
Fibre, hard		2×10^{10}	3 2	5×10^{9}	3×10^{7}
red........		5×10^{9}	2.6	2×10^{10}	2×10^{8}
	20	1×10^{8}(3)			
Galalith,					
black...........		2×10^{10}		8×10^{10}	3×10^{9}
white...		1×10^{10}		4×10^{10}	6×10^{8}
Glass, German		5×10^{13}	2.5	4×10^{11}	6×10^{8}
	18	5×10^{11} (4)			
Kavalier.......		8×10^{15}	4.5	4×10^{12}	1×10^{9}
	17	1×10^{16} (5)			
opal........		1×10^{12}	2 8		
plate, commercial		2×10^{13}	3 2	5×10^{10}	2×10^{8}
ordinary........	20	9×10^{13}			
Bohemian..	20	6×10^{12}			
Glyptal		1×10^{16}	3 0		
Gummon ..		3×10^{12}	1 4	2×10^{12}	3×10^{8}
Halowax 1001.....		2×10^{13}	2.5	$*6\times10^{15}$	$*5\times10^{11}$
5055 B...		2×10^{16}			

* Temperature is 22°C. except where otherwise stated.
† For composition of bakelite samples see table following.
** Leakage resistivity.

RESISTIVITY OF DIELECTRICS (Continued)

Material	Volume resistivity			Surface resistivity, ohm-cm	
	Temp. °C.	ρ ohm-cm	ρ^{20}/ρ^{30}	Humidity 50%	Humidity 90%
Hard Rubber		1×10^{18}		3×10^{15}	2×10^{9}
		2×10^{15} (6)			
		3×10^{16} (?)			
Hemit		1×10^{10}	1.2	1×10^{10}	3×10^{8}
Insulate		8×10^{15}	1.0	3×10^{14}	3×10^{11}
Ivory		2×10^{8}	1.5	5×10^{9}	1×10^{9}
Khotinsky Cement		2×10^{15}	11.0	*7×10^{14}	*5×10^{11}
Lavite		2×10^{10}		1×10^{11}	1×10^{8}
Marble					
Italian		1×10^{11}		3×10^{9}	2×10^{7}
		1×10^{10} (?)			
Pink Tennessee		5×10^{9}		5×10^{9}	3×10^{7}
Blue Vermont		1×10^{9}		8×10^{9}	1×10^{7}
Mica	20	9×10^{15} (6)			
black African		4×10^{13}		3×10^{12}	3×10^{9}
brown African		2×10^{15}	1 2	3×10^{11}	1×10^{9}
colorless		2×10^{17}	2 0	2×10^{13}	8×10^{9}
India ruby		5×10^{13}	2 7	1×10^{10}	9×10^{7}
stained		2×10^{13} (7)			
Indian ruby		5×10^{16}	1 0		
slightly stained		4×10^{13} (7)			
Moulded mica		1×10^{15}	1.2	5×10^{13}	3×10^{9}
Paraffin (special)		$>5\times10^{18}$		*9×10^{15}	*6×10^{13}
parowax		1×10^{16}	2 0		
		3×10^{18} (8)			
	17	5×10^{16} (5)			
Porcelain, unglazed		3×10^{14}	1 6	6×10^{11}	5×10^{8}
glazed				2×10^{13}	5×10^{8}
Quartz crystal					
‖ to axis	17	2×10^{14} (5)			
	20	1×10^{14} (6)			
⊥ to axis	17	2×10^{16} (5)			
	20	3×10^{16} (6)			
fused		$>5\times10^{18}$		3×10^{12}	2×10^{8}
cleaned with chromic acid				3×10^{14}	2×10^{12}
Redmonite		2×10^{14}	2 0	5×10^{13}	3×10^{10}
Rosin		5×10^{16}	3 6	5×10^{14}	2×10^{14}
	17	7×10^{15} (5)			
Sealing wax		8×10^{15}	0 9	2×10^{15}	9×10^{13}
	19	1×10^{15} (1)			
Shellac		1×10^{16}	1 5	5×10^{13}	6×10^{9}
		9×10^{15} (?)			
Slate		1×10^{8}		9×10^{6}	1×10^{6}
		2×10^{8} (?)			
Stabalite		3×10^{13}	1 6	2×10^{13}	4×10^{7}
Sulfur		1×10^{17}	4.9	7×10^{15}	1×10^{14}
	17	8×10^{15} (5)			
Tegit		2×10^{12}	1.4		
Tetrachlornaphthalene		5×10^{13}	2.9	*1×10^{14}	*1×10^{14}
Wood, paraffined					
mahogany		4×10^{13}		3×10^{12}	5×10^{9}
maple		3×10^{10}	3 6	8×10^{11}	2×10^{9}
poplar		5×10^{11}	3.6	1×10^{12}	1×10^{9}

* Leakage resistivity

RESISTIVITY OF DIELECTRICS (Continued)

Description of Materials

Amberite is made by compressing scrap amber.

Bakelite. A phenol condensation product, with various fillers. The various samples were made as follows:

Number	Percent pure Bakelite	Filler	Phenolic Body	Condensing Agent
1		Paper	Cresols	Ammonia
140	50	Vegetable	Phenol	Caustic soda
150	50	Fiber	"	Ammonia
190	50	"	Cresols	"
5199	50	"	Phenol	"
5200	50	Fiber & clay	"	"
5074	35	Talc	"	Caustic soda
588	100	None	"	
1 Regular	100	None	Cresols	Ammonia

Ceresin is a waxy material refined from the mineral ozokerite, m.p. below 100° C. sp. gr. 0.91–0.97. Condensite is a phenol condensation product.

Hard fiber, soft cotton paper, treated with zinc chloride, dried and pressed.

Galalith is made from the casein of milk.

Kavalier glass is hard combustion tubing having a large potassium and calcium content.

Glyptal is an artificial resin resembling amber

Gummon, hemit, and tegit are coal tar products

Halowax, chlorinated naphthalenes.

Moulded mica is ground mica and asbestos with shellac.

Stabalite is a rubber compound.

References

1. Dietrich, 1909
2. Addenbrooke, 1911
3. Rayner, 1905
4. Campbell, 1913
5. Thornton, 1910
6. Curie, 1889
7. Wilson-Mitchell, 1905
8. Braum, 1887

Liquids

Resistance in ohms per centimeter cube.

Substance.	Temp. °C	Resistance, ohms
Alcohol, ethyl	15	3×10^{8}
methyl		$.14 \times 10^{6}$
Oils, olive		5×10^{12}
paraffin		1×10^{18}
Petroleum		2×10^{16}
Water distilled	18	0.5×10^{6}

Fused Salts

(Poincaré)

Substance	Temp. °C.	Resistance, ohms.
Calcium chloride	750	.862
Potassium bromide	750	714
chlorate fused	355	2 20
Silver nitrate	350	.820
Sodium chloride fused	750	.294

STANDARD CALIBRATION TABLES FOR THERMOCOUPLES

The following tables which represent the Temperature-E. M. F. functions of various thermocouples should be used with appropriate correction curves if precise results are desired. These curves must be determined for each individual couple by plotting ΔE, the difference between the observed and the standard E. M. F., against the standard E. M. F. at three or more fixed temperature points. The value ΔE as shown by such a correction curve is then subtracted algebraically from the observed E. M. F. to give the true E. M. F. reading.

In the following tables the fixed or "cold junction" is at 0° C.; when the cold junction is not maintained at 0° C. the readings of the E. M. F. must be corrected as follows: $Et = E_{(t-tc)} + Etc$ where $E_{(t-tc)}$ is the observed reading, Etc is the E. M. F. for the temperature corresponding to the cold junction temperature as read from the standard table and Et is the E. M. F. produced by the hot junction corrected to the value which would be obtained with the cold junction at 0° C. The temperature corresponding to Et is then obtained by reference to the standard table.

Since the E. M. F.-temperature function is not linear the cold junction should be maintained at a temperature very close to that at which the thermocouple was calibrated. Otherwise considerable error will result despite the above correction.

TEMPERATURE-E. M. F. VALUES FOR PLATINUM-PLATINUM (90%), RHODIUM (10%) THERMO-ELEMENTS

E. M. F. values are in millivolts; temperatures are in degrees Centigrade
(Computed from values in the International Critical Tables)

Degree C.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0	0.06	0.11	0.17	0.24	0 30	0.36	0 43	0 50	0 57
100°	0.64	0.72	0.79	0.87	0.95	1 02	1.10	1.18	1 26	1 35
200°	1.43	1.52	1.60	1 69	1.78	1.86	1.95	2.04	2 13	2 22
300°	2.31	2.40	2.50	2.59	2 68	2.77	2.87	2.96	3.05	3 15
400°	3.24	3.34	3.44	3 53	3.63	3.73	3.82	3.92	4.02	4 12
500°	4.22	4.31	4.41	4 51	4 61	4.71	4.82	4.92	5 02	5 12
600°	5.22	5.32	5 43	5 53	5.63	5.74	5.84	5.94	6.05	6 16
700°	6.26	6.37	6.47	6 58	6.68	6.79	6.89	7.01	7.11	7 22
800°	7.33	7.44	7.55	7.66	7.77	7.88	7 99	8.10	8 21	8 32
900°	8.43	8.54	8 66	8 77	8.89	9.00	9 11	9 22	9 34	9 46
1000°	9.57	9 68	9.80	9 92	10 03	10.15	10.27	10.38	10.50	10 62
1100°	10.74	10 86	10 98	11 10	11 21	11.33	11 45	11 57	11 69	11.81
1200°	11.93	12 05	12 17	12.29	12.41	12 53	12.65	12.77	12 89	13 01
1300°	13 13	13 25	13.37	13.49	13 61	13 73	13 85	13.97	14 09	14.21
1400°	14.33	14 45	14 58	14 70	14 82	14.94	15 06	15.19	15.31	15 43
1500°	15.55	15 67	15 79	15 91	16 03	16 15	16 27	16.39	16 51	16 63
1600°	16.75	16 87	16 99	17 11	17 23	17.35	17.47	17.59	17 71	17.83
1700°	17.95	18 07	18 19	18 31	18 43	18.55	.....	....	.....	.....

CALIBRATION TABLES FOR THERMOCOUPLES (Continued)

TEMPERATURE-E. M. F. VALUES FOR PLATINUM-PLATINUM (87%) RHODIUM (13%) THERMO-ELEMENTS

E. M. F. values are in millivolts; temperatures are in degrees Centigrade
(From values given in Bulletin No. 325, Charles Engelhard, Inc., New York)

Degree C	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0	0.06	0.12	0.18	0.25	0.31	0.38	0.45	0.52	0.60
100°	0.67	0.75	0.83	0.90	0.99	1.07	1.15	1.23	1.32	1.40
200°	1.49	1.58	1.67	1.76	1.85	1.94	2.03	2.12	2.21	2.30
300°	2.40	2.49	2.59	2.68	2.77	2.87	2.98	3.08	3.19	3.29
400°	3.40	3.51	3.61	3.72	3.82	3.93	4.04	4.15	4.25	4.36
500°	4.47	4.58	4.69	4.81	4.92	5.03	5.14	5.26	5.37	5.49
600°	5.60	5.72	5.83	5.95	6.06	6.18	6.30	6.42	6.53	6.65
700°	6.77	6.89	7.01	7.13	7.25	7.37	7.49	7.62	7.74	7.87
800°	7.99	8.12	8.24	8.37	8.49	8.62	8.75	8.88	9.00	9.13
900°	9.26	9.39	9.52	9.66	9.79	9.92	10.05	10.18	10.32	10.45
1000°	10.58	10.72	10.85	10.99	11.12	11.26	11.40	11.54	11.67	11.81
1100°	11.95	12.09	12.23	12.38	12.52	12.66	12.80	12.94	13.09	13.23
1200°	13.37	13.52	13.66	13.81	13.95	14.10	14.25	14.40	14.54	14.69
1300°	14.84	14.99	15.14	15.30	15.45	15.60	15.75	15.90	16.06	16.21
1400°	16.36	16.52	16.67	16.83	16.98	17.14	17.30	17.46	17.61	17.77
1500°	17.93	18.09	18.25	18.42	18.58	18.74	18.90	19.06	19.23	19.39
1600°	19.55	19.71	19.88	20.04	20.21	20.37	.	.		

THERMAL E. M. F. FOR CHROMEL P-ALUMEL THERMOCOUPLE

FAHRENHEIT

E. M. F values are in millivolts; temperatures are in degrees Fahrenheit
Roeser, Dahl and Gowens, Bur. Stds. Jour. Res. **14**, 239 (1935)

Temp. °F.	0	10	20	30	40	50	60	70	80	90
−300	−5.51	−5.60					.			.....
−200	−4.29	−4.43	−4.57	−4.71	−4.84	−4.96	−5.08	−5.19	−5.30	−5.41
−100	−2.65	−2.83	−3.01	−3.19	−3.36	−3.52	−3.68	−3.84	−4.00	−4.15
0	−0.68	−0.89	−1.10	−1.30	−1.50	−1.70	−1.90	−2.09	−2.28	−2.47
0	−0.68	−0.47	−0.26	−0.04	+0.18	0.40	0.62	0.84	1.06	1.29
100	1.52	1.74	1.97	2.20	2.43	2.66	2.89	3.12	3.36	3.59
200	3.82	4.05	4.28	4.51	4.74	4.97	5.19	5.42	5.64	5.87
300	6.09	6.31	6.53	6.75	6.98	7.20	7.42	7.64	7.87	8.09
400	8.31	8.53	8.76	8.98	9.20	9.43	9.66	9.88	10.11	10.33
500	10.56	10.79	11.02	11.25	11.47	11.70	11.93	12.16	12.39	12.62
600	12.85	13.08	13.31	13.55	13.78	14.01	14.24	14.48	14.71	14.94
700	15.18	15.41	15.64	15.88	16.11	16.35	16.58	16.82	17.05	17.29
800	17.52	17.75	17.99	18.22	18.46	18.70	18.93	19.17	19.41	19.64
900	19.88	20.12	20.36	20.59	20.83	21.07	21.30	21.54	21.78	22.01
1000	22.25	22.49	22.72	22.96	23.20	23.43	23.67	23.91	24.14	24.38
1100	24.62	24.85	25.09	25.33	25.57	25.80	26.04	26.27	26.51	26.74
1200	26.98	27.21	27.45	27.68	27.92	28.15	28.39	28.62	28.86	29.09
1300	29.33	29.56	29.79	30.02	30.26	30.49	30.72	30.96	31.19	31.42
1400	31.65	31.88	32.11	32.34	32.57	32.80	33.03	33.26	33.49	33.71
1500	33.94	34.17	34.40	34.62	34.85	35.08	35.30	35.53	35.75	35.98
1600	36.20	36.42	36.65	36.87	37.10	37.32	37.54	37.76	37.99	38.21
1700	38.43	38.65	38.87	39.09	39.31	39.53	39.75	39.96	40.18	40.40
1800	40.62	40.83	41.05	41.27	41.48	41.70	41.91	42.13	42.34	42.56
1900	42.77	42.98	43.20	43.41	43.62	43.83	44.04	44.26	44.47	44.68
2000	44.89	45.10	45.31	45.52	45.73	45.93	46.14	46.35	46.56	46.76
2100	46.97	47.18	47.38	47.59	47.79	47.99	48.20	48.40	48.61	48.81
2200	49.01	49.21	49.41	49.61	49.81	50.01	50.21	50.41	50.61	50.80
2300	51.00	51.20	51.39	51.59	51.78	51.98	52.17	52.37	52.56	52.75
2400	52.95	53.14	53.33	53.52	53.71	53.90	54.09	54.28	54.47	54.66
2500	54.85	. .	.	.	...	.	. .		. . .	.

CALIBRATION TABLES FOR THERMOCOUPLES (Continued)

THERMAL E. M. F. FOR CHROMEL P-ALUMEL THERMOCOUPLE

Centigrade

E. M. F. values are in millivolts; temperatures are in degrees Centigrade
Roeser, Dahl and Gowens, Bur. Stds. Jour. Res. **14**, 239 (1935)

Temp. °C.	0	10	20	30	40	50	60	70	80	90
−200	−5.75					..			..	...
−100	−3.49	−3.78	−4.05	−4.32	−4.57	−4.81	−5.03	−5.24	−5.43	−5.60
0	0.00	−0.39	−0.77	−1.14	−1.50	−1.86	−2.21	−2.55	−2.87	−3.19
0	0.00	0.40	0.80	1.20	1.61	2.02	2.43	2.85	3.26	3.68
100	4.10	4.51	4.92	5.33	5.73	6.13	6.53	6.93	7.33	7.73
200	8.13	8.53	8.93	9.34	9.74	10.15	10.56	10.97	11.38	11.80
300	12.21	12.62	13.04	13.45	13.87	14.29	14.71	15.13	15.55	15.97
400	16.39	16.82	17.24	17.66	18.08	18.50	18.93	19.36	19.78	20.21
500	20.64	21.07	21.49	21.92	22.34	22.77	23.20	23.62	24.05	24.48
600	24.90	25.33	25.75	26.18	26.60	27.03	27.45	27.87	28.29	28.72
700	29.14	29.56	29.98	30.40	30.82	31.23	31.65	32.07	32.48	32.90
800	33.31	33.71	34.12	34.53	34.94	35.35	35.75	36.16	36.56	36.96
900	37.36	37.76	38.16	38.56	38.96	39.35	39.75	40.14	40.53	40.92
1000	41.31	41.70	42.08	42.47	42.86	43.24	43.62	44.00	44.38	44.76
1100	45.14	45.52	45.89	46.27	46.64	47.01	47.38	47.75	48.12	48.48
1200	48.85	49.21	49.57	49.94	50.29	50.65	51.00	51.36	51.71	52.06
1300	52.41	52.75	53.10	53.45	53.79	54.13	54.47	54.81	55.15	55.48
1400	55.81			...	..	..	....	.....	..	....

TEMPERATURE-E. M. F. VALUES FOR COPPER-CONSTANTAN

E. M. F. values are in millivolts; reference junctions at 0°C., temperatures are in degrees Centigrade
Roeser and Wensel, National Bureau of Standards

Degree C	0°	10°	20°	30°	40	50°	60	70°	80°	90
−200°	−5.54									
−100°	−3.35	−3.62	−3.89	−4.14	−4.38	−4.60	−4.82	−5.02	−5.20	−5.38
0°	0	−0.38	−0.75	−1.11	−1.47	−1.81	−2.14	−2.46	−2.77	−3.06
0	0	0.39	0.79	1.19	1.61	2.03	2.47	2.91	3.36	3.81
100	4.28	4.75	5.23	5.71	6.20	6.70	7.21	7.72	8.23	8.76
200°	9.29	9.82	10.36	10.91	11.46	12.01	12.57	13.14	13.71	14.28
300°	14.86	15.44	16.03	16.62	17.22	17.82	18.42	19.03	19.64	20.25
400°	20.87									

TEMPERATURE-E. M. F. VALUES FOR COPPER-CONSTANTAN

E. M. F. values are in millivolts, reference junctions at 32 F., temperatures are in degrees Fahrenheit
Roeser and Wensel, National Bureau of Standards

Degree F	0°	10°	20°	30°	40°	50°	60°	70°	80°	90
−300°	−5.28									
−200	−4.11	−4.25	−4.38	−4.50	−4.63	−4.75	−4.86	−4.97	−5.08	−5.18
−100°	−2.56	−2.73	−2.90	−3.06	−3.22	−3.38	−3.53	−3.68	−3.83	−3.97
0°	−0.67	−0.87	−1.07	−1.27	−1.47	−1.66	−1.84	−2.03	−2.21	−2.39
0°	−0.67	−0.46	−0.26	−0.04	+0.17	0.39	0.61	0.83	1.06	1.29
100°	1.52	1.75	1.99	2.23	2.47	2.71	2.96	3.21	3.46	3.71
200°	3.97	4.22	4.48	4.75	5.01	5.28	5.55	5.82	6.09	6.37
300°	6.64	6.92	7.21	7.49	7.77	8.06	8.35	8.64	8.93	9.23
400°	9.52	9.82	10.12	10.42	10.72	11.03	11.33	11.64	11.95	12.26
500°	12.57	12.89	13.20	13.52	13.83	14.15	14.47	14.79	15.12	15.44
600°	15.77	16.10	16.42	16.75	17.08	17.42	17.75	18.08	18.42	18.75
700°	19.09	19.43	19.77	20.11	20.45	20.80				

CALIBRATION TABLES FOR THERMOCOUPLES (Continued)

TEMPERATURE-E. M. F. VALUES FOR IRON-CONSTANTAN THERMOCOUPLES

E. M. F. values are in millivolts, reference junctions at 32°F.; temperatures are in degrees Fahrenheit

Roeser and Wensel, National Bureau of Standards

Degrees F	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
−300°	−7.87									
−200°	−6.01	−6.22	−6.43	−6.63	−6.83	−7.02	−7.20	−7.38	−7.55	−7.72
−100°	−3.63	−3.88	−4.13	−4.38	−4.63	−4.87	−5.11	−5.34	−5.57	−5.79
0°	−0.92	−1.20	−1.48	−1.76	−2.04	−2.31	−2.58	−2.85	−3.11	−3.37
0°	−0.92	−0.63	−0.35	−0.06	+0.23	0.52	0.82	1.11	1.41	1.70
100°	2.00	2.30	2.60	2.90	3.20	3.50	3.81	4.11	4.42	4.72
200°	5.03	5.34	5.64	5.95	6.26	6.57	6.88	7.19	7.50	7.81
300°	8.12	8.43	8.75	9.06	9.37	9.68	10.00	10.31	10.62	10.93
400°	11.24	11.56	11.87	12.18	12.49	12.80	13.11	13.42	13.73	14.04
500°	14.35	14.65	14.96	15.27	15.58	15.89	16.20	16.50	16.81	17.12
600°	17.43	17.73	18.04	18.34	18.65	18.95	19.26	19.56	19.87	20.18
700°	20.48	20.79	21.09	21.40	21.70	22.01	22.31	22.62	22.92	23.23
800°	23.53	23.84	24.14	24.45	24.75	25.06	25.37	25.67	25.98	26.29
900°	26.59	26.90	27.21	27.52	27.83	28.14	28.45	28.76	29.07	29.39
1000°	29.70	30.01	30.33	30.64	30.96	31.28	31.60	31.92	32.24	32.56
1100°	32.88	33.20	33.53	33.86	34.18	34.51	34.84	35.17	35.50	35.84
1200°	36.17	36.50	36.84	37.18	37.52	37.86	38.20	38.54	38.88	39.23
1300°	39.58	39.93	40.28	40.63	40.98	41.34	41.69	42.05	42.40	42.76
1400°	43.12	43.48	43.84	44.20	44.56	44.92	45.28	45.65	46.01	46.37
1500°	46.74	47.10	47.47	47.83	48.20	48.56	48.93	49.29	49.66	50.02
1600°	50.39	50.75	51.12	51.49	51.85	52.22	52.55	52.88	53.21	53.54
1700°	53.87	54.20	54.52	54.85	55.18	55.51	55.84	56.17	56.50	56.83
1800°	57.16									

TEMPERATURE-E. M. F. VALUES FOR IRON-CONSTANTAN THERMOCOUPLES

E. M. F. values are in millivolts, reference junctions at 0°C., temperatures are in degrees Centigrade

Roeser and Wensel, National Bureau of Standards

Degree C	0°	10°	20	30°	40°	50°	60°	70°	80°	90
−200°	−8.27									
−100°	−4.82	−5.25	−5.66	−6.06	−6.44	−6.80	−7.14	−7.46	−7.75	−8.02
0°	0.00	−0.52	−1.03	−1.53	−2.03	−2.52	−3.00	−3.47	−3.93	−4.38
0°	0.00	0.52	1.05	1.58	2.12	2.66	3.20	3.75	4.30	4.85
100°	5.40	5.95	6.51	7.07	7.63	8.19	8.75	9.31	9.87	10.43
200°	10.99	11.56	12.12	12.68	13.23	13.79	14.35	14.90	15.46	16.01
300°	16.56	17.12	17.67	18.22	18.77	19.32	19.87	20.42	20.97	21.52
400°	22.07	22.62	23.17	23.72	24.27	24.82	25.37	25.92	26.47	27.03
500°	27.58	28.14	28.70	29.26	29.82	30.39	30.96	31.53	32.11	32.69
600°	33.27	33.86	34.45	35.04	35.64	36.24	36.84	37.45	38.06	38.68
700°	39.30	39.93	40.56	41.19	41.83	42.48	43.12	43.77	44.42	45.07
800°	45.72	46.37	47.03	47.69	48.34	49.00	49.66	50.32	50.97	51.63
900°	52.29	52.88	53.47	54.06	54.65	55.25	55.84	56.43	57.03	57.63
1000°	58.22									

REFERENCE TABLE FOR Pt TO Pt - 10 PER CENT Rh THERMOCOUPLE

Emfs are expressed in microvolts and temperatures in °C. Cold junctions at 0°C.
ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

E(μv)	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	E(μv)
0	0	146.9	265.0	373.7	477.7	578.1	675.3	769.5	861.0	0
	17.7	12.5	11.2	10.5	10.2	9.9	9.5	9.3	9.0	
100	17.7	159.4	276.2	384.2	487.9	588.0	684.8	778.8	870.0	100
	16.7	12.3	11.1	10.5	10.2	9.8	9.5	9.2	9.0	
200	34.4	171.7	287.3	394.7	498.1	597.8	694.3	788.0	879.0	200
	15.8	12.1	11.0	10.5	10.1	9.8	9.5	9.2	9.0	
300	50.2	183.8	298.3	405.2	508.2	607.6	703.8	797.2	888.0	300
	15.2	12.0	11.0	10.5	10.1	9.8	9.5	9.2	9.0	
400	65.4	195.8	309.3	415.7	518.3	617.4	713.3	806.4	897.0	400
	14.6	11.8	10.9	10.4	10.1	9.7	9.4	9.2	8.9	
500	80.0	207.6	320.2	426.1	528.4	627.1	722.7	815.6	905.9	500
	14.1	11.7	10.8	10.4	10.0	9.7	9.4	9.1	8.9	
600	94.1	219.3	331.0	436.5	538.4	636.8	732.1	824.7	914.8	600
	13.7	11.6	10.7	10.3	10.0	9.7	9.4	9.1	8.9	
700	107.8	230.9	341.7	446.8	548.4	646.5	741.5	833.8	923.7	700
	13.3	11.5	10.7	10.3	9.9	9.6	9.4	9.1	8.9	
800	121.1	242.4	352.4	457.1	558.3	656.1	750.9	842.9	932.6	800
	13.0	11.3	10.7	10.3	9.9	9.6	9.3	9.1	8.8	
900	134.1	253.7	363.1	467.4	568.2	665.7	760.2	852.0	941.4	900
	12.8	11.3	10.6	10.3	9.9	9.6	9.3	9.0	8.8	
1,000	146.9	265.0	373.7	477.7	578.1	675.3	769.5	861.0	950.2	1,000

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE (Continued)

Emfs are expressed in microvolts and temperatures in °C. Cold junctions at 0°C.

E(μv)	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	E(μv)
0	950.2	1,037.2	1,122.3	1,206.4	1,290.0	1,373.8	1,458.0	1,542.6	1,627.8	0
	8.8	8.6	8.5	8.3	8.3	8.4	8.4	8.5	8.6	
100	959.0	1,045.8	1,130.8	1,214.7	1,298.3	1,382.2	1,466.4	1,551.1	1,636.4	100
	8.8	8.6	8.4	8.4	8.4	8.4	8.4	8.5	8.5	
200	967.8	1,054.4	1,139.2	1,223.1	1,306.7	1,390.6	1,474.8	1,559.6	1,644.9	200
	8.7	8.5	8.4	8.3	8.4	8.4	8.5	8.5	8.6	
300	976.5	1,062.9	1,147.6	1,231.4	1,315.1	1,399.0	1,483.3	1,568.1	1,653.5	300
	8.8	8.6	8.4	8.4	8.4	8.4	8.5	8.5	8.6	
400	985.3	1,071.5	1,156.0	1,239.8	1,323.5	1,407.4	1,491.8	1,576.6	1,662.1	400
	8.7	8.5	8.4	8.4	8.3	8.4	8.4	8.5	8.6	
500	994.0	1,080.0	1,164.4	1,248.2	1,331.8	1,415.8	1,500.2	1,585.1	1,670.7	500
	8.7	8.5	8.4	8.3	8.4	8.4	8.5	8.6	8.6	
600	1,002.7	1,088.5	1,172.8	1,256.5	1,340.2	1,424.2	1,508.7	1,593.7	1,679.3	600
	8.6	8.5	8.4	8.4	8.4	8.5	8.5	8.5	8.6	
700	1,011.3	1,097.0	1,181.2	1,264.9	1,348.6	1,432.7	1,517.2	1,602.2	1,687.9	700
	8.7	8.4	8.4	8.3	8.4	8.4	8.4	8.5	8.6	
800	1,020.0	1,105.4	1,189.6	1,273.2	1,357.0	1,441.1	1,525.6	1,610.7	1,696.5	800
	8.6	8.5	8.4	8.4	8.4	8.4	8.5	8.6	8.6	
900	1,028.6	1,113.9	1,198.0	1,281.6	1,365.4	1,449.5	1,534.1	1,619.3	1,705.1	900
	8.6	8.4	8.4	8.4	8.4	8.5	8.5	8.5	8.6	
1,000	1,037.2	1,122.3	1,206.4	1,290.0	1,373.8	1,458.0	1,542.6	1,627.8	1,713.7	1,000

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE

Emfs are expressed in microvolts and temperatures in °F. Cold junctions at 32°F.
ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

E(μv)	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	E(μv)
0	32.0	296.4	509.0	704.7	891.9	1,072.6	1,247.5	1,417.1	1,581.8	0
	31.9	22.5	20.1	19.0	18.4	17.7	17.1	16.7	16.2	
100	63.9	318.9	529.1	723.7	910.3	1,090.3	1,264.6	1,433.8	1,598.0	100
	30.0	22.1	20.0	18.9	18.3	17.7	17.1	16.6	16.2	
200	93.9	341.0	549.1	742.6	928.6	1,108.0	1,281.7	1,450.4	1,614.2	200
	28.5	21.8	19.9	18.8	18.2	17.7	17.1	16.6	16.2	
300	122.4	362.8	569.0	761.4	946.8	1,125.7	1,298.8	1,467.0	1,630.4	300
	27.3	21.6	19.8	18.8	18.1	17.6	17.1	16.5	16.1	
400	149.7	384.4	588.8	780.2	964.9	1,143.3	1,315.9	1,483.5	1,646.5	400
	26.3	21.3	19.6	18.8	18.1	17.5	17.0	16.5	16.1	
500	176.0	405.7	608.4	799.0	983.0	1,160.8	1,332.9	1,500.0	1,662.6	500
	25.4	21.0	19.4	18.7	18.1	17.5	16.9	16.5	16.0	
600	201.4	426.7	627.8	817.7	1,001.1	1,178.3	1,349.8	1,516.5	1,678.6	600
	24.6	20.9	19.3	18.6	18.0	17.4	16.9	16.4	16.0	
700	226.0	447.6	647.1	836.3	1,019.1	1,195.7	1,366.7	1,532.9	1,694.6	700
	24.0	20.7	19.3	18.5	17.9	17.3	16.9	16.3	16.0	
800	250.0	468.3	666.4	854.8	1,037.0	1,213.0	1,383.6	1,549.2	1,710.6	800
	23.4	20.4	19.2	18.6	17.8	17.3	16.8	16.3	15.9	
900	273.4	488.7	685.6	873.4	1,054.8	1,230.3	1,400.4	1,565.5	1,726.5	900
	23.0	20.3	19.1	18.5	17.8	17.2	16.7	16.3	15.9	
1,000	296.4	509.0	704.7	891.9	1,072.6	1,247.5	1,417.1	1,581.8	1,742.4	1,000

REFERENCE TABLE FOR Pt TO Pt—10 PER CENT Rh THERMOCOUPLE (Continued)

Emfs are expressed in microvolts and temperatures in °F. Cold junctions at 32°F.

E(μv)	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	E(μv)
0	1,742.4	1,899.0	2,052.1	2,203.5	2,354.0	2,504.8	2,656.4	2,808.7	2,962.0	0
	15.8	15.5	15.2	15.0	15.0	15.2	15.1	15.3	15.4	
100	1,758.2	1,914.5	2,067.3	2,218.5	2,369.0	2,520.0	2,671.5	2,824.0	2,977.4	100
	15.8	15.4	15.2	15.0	15.1	15.1	15.2	15.3	15.4	
200	1,774.0	1,929.9	2,082.5	2,233.5	2,384.1	2,535.1	2,686.7	2,839.3	2,992.8	200
	15.7	15.4	15.2	15.0	15.1	15.1	15.2	15.3	15.5	
300	1,789.7	1,945.3	2,097.7	2,248.5	2,399.2	2,550.2	2,701.9	2,854.6	3,008.3	300
	15.8	15.4	15.1	15.1	15.1	15.1	15.3	15.3	15.5	
400	1,805.5	1,960.7	2,112.8	2,263.6	2,414.3	2,565.3	2,717.2	2,869.9	3,023.8	400
	15.7	15.3	15.1	15.1	15.0	15.1	15.2	15.3	15.5	
500	1,821.2	1,976.0	2,127.9	2,278.7	2,429.3	2,580.4	2,732.4	2,885.2	3,039.3	500
	15.6	15.3	15.1	15.0	15.1	15.2	15.3	15.4	15.4	
600	1,836.8	1,991.3	2,143.0	2,293.7	2,444.4	2,595.6	2,747.7	2,900.6	3,054.7	600
	15.6	15.2	15.2	15.1	15.1	15.2	15.3	15.4	15.5	
700	1,852.4	2,006.5	2,158.2	2,308.8	2,459.5	2,610.8	2,763.0	2,916.0	3,070.2	700
	15.6	15.2	15.1	15.0	15.1	15.2	15.2	15.3	15.5	
800	1,868.0	2,021.7	2,173.3	2,323.8	2,474.6	2,626.0	2,778.2	2,931.3	3,085.7	800
	15.5	15.2	15.1	15.1	15.1	15.2	15.2	15.4	15.5	
900	1,883.5	2,036.9	2,188.4	2,338.9	2,489.7	2,641.2	2,793.4	2,946.7	3,101.2	900
	15.5	15.2	15.1	15.1	15.1	15.2	15.3	15.3	15.5	
1,000	1,899.0	2,052.1	2,203.5	2,354.0	2,504.8	2,656.4	2,808.7	2,962.0	3,116.7	1,000

REFERENCE TABLE FOR Pt TO Pt—13 PER CENT Rh THERMOCOUPLE

Emfs are expressed in microvolts and temperatures in °C. Cold junctions at 0°C.
ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

E(μv)	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	E(μv)
0	0	145.3	258.8	361.0	457.4	549.8	638.3	723.5	806.0	886.1	0
	17.9	12.2	10.6	9.9	9.5	9.0	8.7	8.4	8.1	7.9	
100	17.9	157.5	269.4	370.9	466.9	558.8	647.0	731.9	814.1	894.0	100
	16.7	12.0	10.5	9.8	9.4	9.0	8.6	8.4	8.1	7.8	
200	34.6	169.5	279.9	380.7	476.3	567.8	655.6	740.3	822.2	901.8	200
	15.8	11.7	10.4	9.8	9.4	9.0	8.6	8.3	8.1	7.9	
300	50.4	181.2	290.3	390.5	485.7	576.8	644.2	748.6	830.3	909.7	300
	15.1	11.5	10.3	9.7	9.3	8.9	8.6	8.3	8.0	7.8	
400	65.5	192.7	300.6	400.2	495.0	585.7	672.8	756.9	838.3	917.5	400
	14.5	11.4	10.2	9.7	9.3	8.9	8.5	8.2	8.0	7.8	
500	80.0	204.1	310.8	409.9	504.3	594.6	681.3	765.1	846.3	925.3	500
	13.9	11.2	10.2	9.6	9.2	8.8	8.5	8.2	8.0	7.8	
600	93.9	215.3	321.0	419.5	513.5	603.4	689.8	773.3	854.3	933.1	600
	13.4	11.1	10.1	9.5	9.1	8.8	8.5	8.2	8.0	7.8	
700	107.3	226.4	331.1	429.0	522.6	612.2	698.3	781.5	862.3	940.9	700
	13.0	10.9	10.0	9.5	9.1	8.7	8.4	8.2	8.0	7.8	
800	120.3	237.3	341.1	438.5	531.7	620.9	706.7	789.7	870.3	948.7	800
	12.6	10.8	10.0	9.5	9.1	8.7	8.4	8.1	7.9	7.7	
900	132.9	248.1	351.1	448.0	540.8	629.6	715.1	797.8	878.2	956.4	900
	12.4	10.7	9.9	9.4	9.0	8.7	8.4	8.2	7.9	7.7	
1,000	145.3	258.8	361.0	457.4	549.8	638.3	723.5	806.0	886.1	964.1	1,000

REFERENCE TABLE FOR Pt TO Pt 13 PER CENT Rh THERMOCOUPLE (Continued)

Emfs are expressed in microvolts and temperatures in °C. Cold junctions at 0°C.

E(μv)	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	18,000	19,000	E(μv)
0	964.1	1,040.0	1,113.9	1,186.9	1,259.3	1,331.8	1,404.3	1,476.9	1,550.0	1,623.6	0
	7.6	7.4	7.3	7.2	7.3	7.2	7.3	7.3	7.4	7.4	
100	971.7	1,047.4	1,121.2	1,194.1	1,266.6	1,339.0	1,411.6	1,484.2	1,557.4	1,631.0	100
	7.7	7.5	7.4	7.3	7.2	7.2	7.3	7.3	7.4	7.4	
200	979.4	1,054.9	1,128.6	1,201.4	1,273.8	1,346.2	1,418.9	1,491.5	1,564.8	1,638.4	200
	7.6	7.4	7.3	7.3	7.3	7.3	7.2	7.3	7.3	7.4	
300	987.0	1,062.3	1,135.9	1,208.7	1,281.1	1,353.5	1,426.1	1,498.8	1,572.1	1,645.8	300
	7.7	7.4	7.3	7.2	7.2	7.3	7.2	7.3	7.4	7.4	
400	994.7	1,069.7	1,143.2	1,215.9	1,288.3	1,360.8	1,433.3	1,506.1	1,579.5	1,653.2	400
	7.6	7.4	7.3	7.3	7.2	7.2	7.2	7.3	7.3	7.4	
500	1,002.3	1,077.1	1,150.5	1,223.2	1,295.5	1,368.0	1,440.5	1,513.4	1,586.8	1,660.6	500
	7.6	7.3	7.3	7.2	7.2	7.3	7.3	7.3	7.4	7.4	
600	1,009.9	1,084.4	1,157.8	1,230.4	1,302.7	1,375.3	1,447.8	1,520.7	1,594.2	1,668.0	600
	7.6	7.4	7.3	7.2	7.2	7.3	7.2	7.3	7.3	7.4	
700	1,017.5	1,091.8	1,165.1	1,237.6	1,309.9	1,382.6	1,455.0	1,528.0	1,601.5	1,675.4	700
	7.5	7.4	7.2	7.2	7.3	7.2	7.3	7.3	7.4	7.4	
800	1,025.0	1,099.2	1,172.3	1,244.8	1,317.2	1,389.8	1,462.3	1,535.3	1,608.9	1,682.8	800
	7.5	7.3	7.3	7.3	7.3	7.3	7.3	7.4	7.3	7.4	
900	1,032.5	1,106.5	1,179.6	1,252.1	1,324.5	1,397.1	1,469.6	1,542.7	1,616.2	1,690.2	900
	7.5	7.4	7.3	7.2	7.3	7.2	7.3	7.3	7.4	7.4	
1,000	1,040.0	1,113.9	1,186.9	1,259.3	1,331.8	1,404.3	1,476.9	1,550.0	1,623.6	1,697.6	1,000

REFERENCE TABLE FOR Pt TO Pt—13 PER CENT Rh THERMOCOUPLE

Emfs are expressed in microvolts and temperatures in °F. Cold junctions at 32°F.
ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

E(μv)	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	E(μv)
0	32.0	293.5	497.8	681.8	855.3	1,021.6	1,180.9	1,334.3	1,482.8	1,627.0	0
	32.2	22.0	19.1	17.8	17.0	16.2	15.6	15.1	14.6	14.2	
100	64.2	315.5	516.9	699.6	872.3	1,037.8	1,196.5	1,349.4	1,497.4	1,641.2	100
	30.1	21.6	18.9	17.7	17.0	16.2	15.6	15.1	14.6	14.1	
200	94.3	337.1	535.8	717.3	889.3	1,054.0	1,212.1	1,364.5	1,512.0	1,655.3	200
	28.4	21.1	18.7	17.6	16.9	16.2	15.5	15.0	14.5	14.1	
300	122.7	358.2	554.5	734.9	906.2	1,070.2	1,227.6	1,379.5	1,526.5	1,669.4	300
	27.2	20.7	18.6	17.5	16.8	16.1	15.4	14.9	14.4	14.1	
400	149.9	378.9	573.1	752.4	923.0	1,086.3	1,243.0	1,394.4	1,540.9	1,683.5	400
	26.1	20.4	18.4	17.4	16.7	16.0	15.3	14.8	14.4	14.0	
500	176.0	399.3	591.5	769.8	939.7	1,102.3	1,258.3	1,409.2	1,555.3	1,697.5	500
	25.0	20.2	18.3	17.3	16.6	15.9	15.3	14.8	14.4	14.1	
600	201.0	419.5	609.8	787.1	956.3	1,118.2	1,273.6	1,424.0	1,569.7	1,711.6	600
	24.1	20.0	18.2	17.2	16.4	15.8	15.3	14.8	14.4	14.0	
700	225.1	439.5	628.0	804.3	972.7	1,134.0	1,288.9	1,438.8	1,584.1	1,725.6	700
	23.4	19.7	18.0	17.1	16.4	15.7	15.2	14.7	14.4	14.0	
800	248.5	459.2	646.0	821.4	989.1	1,149.7	1,304.1	1,453.5	1,598.5	1,739.6	800
	22.7	19.4	18.0	17.0	16.3	15.6	15.1	14.6	14.3	13.9	
900	271.2	478.6	664.0	838.4	1,005.4	1,165.3	1,319.2	1,468.1	1,612.8	1,753.5	900
	22.3	19.2	17.8	16.9	16.2	15.6	15.1	14.7	14.2	13.9	
1 000	293.5	497.8	681.8	855.3	1,021.6	1,180.9	1,334.3	1,482.8	1,627.0	1,767.4	1 000

REFERENCE TABLE FOR Pt TO Pt—13 PER CENT Rh THERMOCOUPLE (Continued)

Emfs are expressed in microvolts and temperatures in °F. Cold junctions at 32°F.

E(μv)	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	18,000	19,000	E(μv)
0	1,767.4	1,904.0	2,037.0	2,168.4	2,298.7	2,429.2	2,559.7	2,690.4	2,822.0	2,954.5	0
	13.8	13.4	13.2	13.0	13.1	13.0	13.1	13.2	13.3	13.3	
100	1,781.2	1,917.4	2,050.2	2,181.4	2,311.8	2,442.2	2,572.8	2,703.6	2,835.3	2,967.8	100
	13.7	13.4	13.2	13.1	13.0	13.0	13.1	13.1	13.3	13.3	
200	1,794.9	1,930.8	2,063.4	2,194.5	2,324.8	2,455.2	2,585.9	2,716.7	2,848.6	2,981.1	200
	13.7	13.3	13.2	13.1	13.1	13.1	13.0	13.1	13.2	13.3	
300	1,808.6	1,944.1	2,076.6	2,207.6	2,337.9	2,468.3	2,598.9	2,729.8	2,861.8	2,994.4	300
	13.8	13.3	13.2	13.0	13.0	13.1	13.0	13.2	13.3	13.4	
400	1,822.4	1,957.4	2,089.8	2,220.6	2,350.9	2,481.4	2,611.9	2,743.0	2,875.1	3,007.8	400
	13.7	13.3	13.1	13.1	13.0	13.0	13.0	13.1	13.2	13.3	
500	1,836.1	1,970.7	2,102.9	2,233.7	2,363.9	2,494.4	2,624.9	2,756.1	2,888.3	3,021.1	500
	13.7	13.3	13.1	13.0	13.0	13.1	13.1	13.2	13.3	13.3	
600	1,849.8	1,984.0	2,116.0	2,246.7	2,376.9	2,507.5	2,638.0	2,769.3	2,901.6	3,034.4	600
	13.6	13.3	13.1	13.0	13.0	13.1	13.0	13.1	13.2	13.3	
700	1,863.4	1,997.3	2,129.1	2,259.7	2,389.9	2,520.6	2,651.0	2,782.4	2,914.8	3,047.7	700
	13.6	13.3	13.1	13.0	13.1	13.0	13.1	13.2	13.2	13.3	
800	1,877.0	2,010.6	2,142.2	2,272.7	2,403.0	2,533.6	2,664.1	2,795.6	2,928.0	3,061.0	800
	13.5	13.2	13.1	13.0	13.1	13.1	13.1	13.2	13.2	13.4	
900	1,890.5	2,023.8	2,155.3	2,285.7	2,416.1	2,546.7	2,677.2	2,808.8	2,941.2	3,074.4	900
	13.5	13.2	13.1	13.0	13.1	13.0	13.2	13.2	13.3	13.3	
1,000	1,904.0	2,037.0	2,168.4	2,298.7	2,429.2	2,559.7	2,690.4	2,822.0	2,954.5	3,087.7	1,000

THERMOELECTRIC POWER

The table gives the thermoelectric power in microvolts per degree Centigrade difference in temperature when the cold junction is at 0°C.

The values given are with respect to lead except where noted. A is the thermoelectric power at 0°C, B is the coefficient of t in the equation for the thermoelectric power at any temperature t,—

$$Q = A + Bt.$$

The values are regarded as positive if the current flows from the metal listed to the reference metal (usually lead) at the cold junction.

Metal	Microvolts per °C		Temp. range °C
	A	*B*	
		$\times 10^{-2}$	
Aluminum, 99% pure	−0 4717	+0 2718	−200–+100
commercial	−0 38	−0 01	0–100
	−0 53	+0 21	
Antimony, used in cast form, solid rods soldered end to end	+35 58	+14 50	0 100
Bismuth, commercial	−43 688	−46 47	−200 +100
electrolytic	−74 42	+3 2	0–100
Brass, 85.8 Cu, 14.22 Zn	+0 710	+0.56	−78 +100
66.3 Cu, 33.72 Zn	+0 699	+0 69	−78 +100
Cadmium	+3 059	+2 856	−200–+100
cold drawn	+2 85	+3 89	0 100
Calcium, 99.57% pure	−8 20	−2 9	0 400
Caesium	+0 66	−0 10	−183 0
	+7 735	−3 34	28 100
Carbon, filament	+11 056	+3 578	−200 +100
Cerium, 97.7% Ce, 1.2% Fe, remainder cerium oxide and cerium carbide	+4 39	1 26	0 200
Cobalt	−10 7	−5 70	0 1200
Constantan, 60 Cu, 40 Ni	−38 105	−8 88	0 400
Copper, electrolytic	+2 705	+0 7866	−270–+200
pure, hard drawn	+2 76	+1 22	0 100
German silver, commercial	−10 861	−3 29	−200–+100
Germanium	+302 5	+72 5	−200–+125
Gold	+2 90	+0 68	−260 0
	+2 90	+0 934	0–200
Indium	+2 40	+0 190	0–100
Iridium, Heraeus made	+2 44	−0 28	−80–+100
Iron	−51 34	−20 4	−260 – 200
transformer iron	+16 65	−2 966	−230–+100
Lithium	+14 37	+8 76	−200–+50
Magnesium	0 2010	+0 2572	−200–+100
Heraeus made	0 120	+0 193	0 200
Manganin, 84 Cu, 12 Mn, 4 Ni	+1 366	+0 083	0 100
Mercury	−8 8103	−3 333	0–200
Molybdenum	+5 892	+4 334	0 100
Nichrome, 58.5 Ni, 22.5 Fe 16 Cr, 3. Mn (Against Pt)	+25 0	. ..	0 420
Nickel	−19 067	−3 022	0–200
	−17 633	−5 016	−260 0
Nickel-chromium, 84 Ni, 16 Cr (Against Pt)	+30 22	...	600–1200
90 Ni, 10 Cr (Against Pt)	+30 3	0 0	0–1200
Palladium	−7 409	−3 922	−200–+100
Platinoid	−10 620	−2 77	−200 +100
Platinum	−3 038	−3 248	−200–+300
	−6 677	+0 1528	−260 0

THERMOELECTRIC POWER—(Continued)

Metal	Microvolts per °C A	Microvolts per °C B	Temp. range °C
Platinum		× 10^{-2}	
Baker's platinum	− 1 788	− 3 460	0–100
Platinum-iridium, 85 Pt, 15 Ir	+ 14 083	+ 1 06	0–1200
90 Pt, 10 Ir	+ 13 208	+ 0 75	0–1200
Platinum-rhodium, 90 Pt, 10 Rh (Against Pt)	+ 7 013	+ 0 64	0–1600
85 Pt, 15 Rh (Against Pt)	+ 6 69	+ 1.07	0–1600
Potassium	− 11 33	− 3 76	−183-0
Rubidium	− 8 26	− 3 02	−183–0
	− 0 28	− 6 00	38–100
Silicon	−408 2	−46 96	−200–+350
Silver, annealed	+ 2 50	+ 1 15	0–100
electrolytic	+ 2 947	+ 0 6782	−200–+100
Sodium	− 4 16	− 1 44	−183–0
Steel (piano wire)	+ 10 763	− 1 56	−200–+100
Thallium	+ 1 659	− 0 268	0–100
Tin	+ 0 0684	+ 0 0038	−200–+100
	+ 0 230	− 0 134	0–100
Tungsten	+ 1 594	+ 3 41	0–100
Zinc	+ 3 096	+ 3 191	−260–0
	+ 3 047	− 0 99	0–100

HYSTERESIS

The dissipation of energy due to hysteresis in metals is expressed by Steinmetz by the following equation:

$$E = \eta B^{1.6}$$

Values of η as found by Steinmetz appear below. C. G. S. units.

Material	
Iron	
Norway iron	.00227
Wrought bar	.00326
Commercial ferrotype plate	.00548
Annealed " "	.00458
Thin tin plate	.00286
Medium thickness tin plate	.00425
Steel	
Soft galvanized wire	.00349
Annealed cast steel	.00848
Soft annealed cast steel	.00457
Very soft annealed cast steel	.00318
Same above tempered in cold water	.02792
Tool steel glass hard tempered in water	.07470
" " tempered in oil	.02670
" " annealed	.01899
Cast iron	
Gray cast iron	.01300
" " " "⅛% aluminum	.01365
" " " "½% "	.01459
Nickel	
Soft wire	.0122
Annealed wire	.0156
Hardened	.0385
Cobalt	
2% of iron	.0210
Iron Filings	
180 cycles per second	.0457
114 " " "	.0396
79-91 " " "	.0373

MAGNETIC CONSTANTS OF IRON

Permeability of Transformer Iron

Giving M, the total magneto motive force applied. M/l, the magneto motive force per unit length of iron circuit. B the total induction, B/a the induction per unit cross-section of iron, M/B, the magnetic reluctance of the iron circuit and Bl/Ma, the permeability; showing the typical relations of the magnetic constants for varying field.

(From Smithsonian Tables.)

M.	M/l.	B.	B/a.	Reluctance $M/B=K$.	Permeability $Bl/Ma = \mu$.
20	0.597	218×10^3	1406	0.917×10^{-4}	2360
40	1.194	587	3790	0.681	3120
60	1.791	878	5660	0.683	3180
80	2.338	1091	7040	0.734	2960
100	2.985	1219	7860	0.819	2640
120	3.582	1330	8580	0.903	2410
140	4.179	1405	9060	0.994	2186
160	4.776	1475	9510	1.090	2000
180	5.373	1532	9880	1.180	1850
200	5.970	1581	10200	1.270	1720
220	6.567	1618	10430	1.360	1590
260	7.761	1692	10910	1.540	1410

MAGNETIC PROPERTIES OF IRON AND STEEL

(From Gumlich, 1909.)

Sample.	Coercive force.	Residual B.	Maximum permeability.	B for H = 150	$4\pi I$ for saturation.
Electrolytic iron	2.83	11400	1850	19200	21620
The same annealed	0.36	10800	14400	18900	21630
Cast steel	1.51	10600	3550	18800	21420
The same annealed	0.37	11000	14800	19100	21420
Steel hardened	52.4	7500	110	11700	18000
Cast iron	11.4	5100	240	10400	16400
The same annealed	4 6	5350	600	11000	16800
Electrical iron in sheets annealed	1 30	9400	3270	18200	20500

SATURATION CONSTANTS FOR MAGNETIC SUBSTANCES

Substance.	Field intensity. (For saturation)	Induced magnetization	Substance.	Field intensity. (For saturation)	Induced magnetization.)
Cobalt	9000	1300	Nickel, hard	8000	400
Iron, wrought	2000	1700	annealed	7000	515
cast	4000	1200	Vicker's steel	15000	1600
Manganese steel	7000	200			

MAGNETIC SUSCEPTIBILITY

The following tables give the specific susceptibility χ for various substances. The relation to volume susceptibility κ is shown by the equation $\chi = \kappa/d$, where d is the density of the substance. Unit of χ, 1×10^{-6} cgs electromagnetic units. Room temperature is to be understood where no other is stated. The values are positive for paramagnetic bodies, negative for diamagnetic.

Elements and Inorganic Compounds

Substance	Formula	Temp. °C	Susceptibility 10^{-6} cgs	Observer
Aluminum	Al	−170 sol.	0.60	31
		18	0.65	16
		230	0.64	16
		500	0.57	16
		1000 liq.	0.57	16
Aluminum bromide	$AlBr_3$	19	−0.32	27
Aluminum chloride	$AlCl_3$	19	−0.60	27
Aluminum oxide	Al_2O_3	.	−0.098	45
Aluminum sulfate	$Al_2(SO_4)_3$	18	−0.48	27
Alum, ammonium, iron	$Fe_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$	−258.4	598.	29
		−196	114.7	29
		17	30.4	29
Ammonia	NH_3	16 gas	−1.1	33
Ammonium chloroplatinate	$(NH_4)_2PtCl_6$	. .	−0.42	11
Ammonium metavanadate	NH_4VO_3	15	−0.12	27
Antimony	Sb	18 sol.	−0.87	1
		800 liq.	−0.49	16
Antimony bromide	$SbBr_3$		−0.275	33
Antimony pentachloride	$SbCl_5$		−0.371	31
Antimony trichloride	$SbCl_3$		−0.364	33
Antimony trioxide	Sb_2O_3	14	−0.19	27
Argon	A	20 gas	−0.45	15
Arsenic	As	18	−0.31	1
Arsenous oxide	As_2O_3	18	−0.27	27
Arsenous sulfide	As_2S_3	18	−0.03	27
Barium	Ba	18	0.9	31
Barium bromide	$BaBr_2$	.	−0.39	27
	$BaBr_2 \cdot 2H_2O$		−0.371	8
Barium carbonate	$BaCO_3$		−0.298	33
Barium chloride	$BaCl_2$		−0.41	27
	$BaCl_2 \cdot 2H_2O$		−0.368	8
Barium hydroxide	$Ba(OH)_2$	18	−0.32	27
	$Ba(OH)_2 \cdot 8H_2O$		−0.497	33
Barium iodide	BaI_2	22	−0.39	24
	$BaI_2 \cdot 2H_2O$	19	−0.38	27
Barium nitrate	$Ba(NO_3)_2$		−0.254	33
Barium oxide	BaO	20	−0.13	27
Barium sulfate	$BaSO_4$		−0.306	33
Barium sulfide	BaS	18	−0.32	27
Beryllium	Be	20	−1.0	31
Beryllium chloride	$BeCl_2$	17	−0.60	27
Beryllium hydroxide	$Be(OH)_2$		−0.537	33
Beryllium oxide	BeO	16	0.0	27
Beryllium sulfate	$BeSO_4$	18	−0.46	27
	$BeSO_4 \cdot 4H_2O$	17	−0.51	27
Bismuth	Bi	−259	−1.55	30
		−100	−1.52	31
		18	−1.35	1
		150	−1.19	16
		260	−1.02	16
Bismuth bromide	$BiBr_3$	. .	−0.328	12

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Susceptibility 10^{-6} cgs	Observer
Bismuth iodide	BiI_3	20	−0.49	27
Bismuth nitrate	$Bi(NO_3)_3\,5H_2O$		−0.365	12
Bismuth sulfide	Bi_2S_3		−0.385	12
Bismuth trichloride	$BiCl_3$		−0.322	12
Bismuth trioxide	Bi_2O_3		−0.170	8
Boron	B	18	−0.69	1
Boric acid	H_3BO_3		−0.52	26
Boron oxide	B_2O_3	14	−0.55	27
Bromine	Br	−170 sol.	−0.40	31
		−8	−0.40	31
		18 liq.	−0.39	1
Cadmium	Cd	18	−0.18	1
		400	−0.16	16
Cadmium bromide	$CdBr_2$	18	−0.38	27
Cadmium chloride	$CdCl_2$	18	−0.32	27
Cadmium iodide	CdI_2	18	−0.32	27
Cadmium oxide	CdO	15	−0.30	27
Caesium	Cs	18	−0.10	31
Caesium carbonate	Cs_2CO_3		−0.320	33
Caesium chloride	CsCl		−0.363	33
Caesium nitrate	$CsNO_3$		−0.412	33
Caesium sulfate	Cs_2SO_4		−0.322	33
Calcium	Ca	18	1.10	31
Calcium carbonate	$CaCO_3$		−0.382	33
Calcium chloride	$CaCl_2$	17	−0.49	27
	$CaCl_2{\cdot}6H_2O$	17	−0.54	27
Calcium hydroxide	$Ca(OH)_2$	16	−0.39	27
Calcium oxide	CaO	16	−0.27	27
Calcium sulfate	$CaSO_4$		−0.364	33
	$CaSO_4{\cdot}H_2O$		−0.384	33
Carbon (diamond)	C	−170	−0.49	31
		20	−0.49	16
		200	−0.50	16
		400	−0.51	16
		900	−0.54	16
		1200	−0.56	16
Carbon (gas carbon)	C	20	−2.0	16
		100	−2.0	16
		500	−1.8	16
		850	−1.6	16
		1150	−1.5	16
Carbon (graphite)	C	−170	−6.0	31
		20	−3.5	31
		300	−2.7	31
		600	−2.0	31
		900	−1.4	31
		1000	−1.3	31
Carbon dioxide	CO_2	20 gas	−0.423	35
Carbon disulfide	CS_2		−0.54	26
Cerium	Ce	−170	38.	31
		−150	35	31
		−100	26.	31
		18	15.	31
		100	12.	31
		200	11	31
Ceric oxide	CeO_2		0.39	26
Cerous bromide	$CeBr_3$	18	6.0	5
Cerous chloride	$CeCl_3$	19	6.1	27
Cerous sulfate	$Ce_2(SO_4)_3$		7.8	39
Chlorine	Cl	−60 liq.	−0.57	33
Chromium	Cr	18	3.6	1
		500	3.8	16
		1100	4.2	16

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Suscepti-bility 10^{-6} cgs	Ob-server
Chromic chloride	$CrCl_3$	19	44.3	17
Chromic oxide	Cr_2O_3	18	25.5	18
Chromic sulfate	$Cr_2(SO_4)_3$	21	29.5	19
Chromium trioxide	CrO_3	17	0.51	18
Chromous chloride	$CrCl_2$	......	84.	38
Chromous hydroxide	$Cr(OH)_2$	......	48.5	34
Chromous sulfate	$CrSO_4$	...	66.	2
Chromous sulfide	CrS	20	28.4	41
Cobaltic oxide	Co_2O_3	..	34.3	45
Cobalto cobaltic oxide	Co_3O_4	..	39 to 43.6	45
Cobaltous bromide	$CoBr_2$	..	46.8	9
Cobaltous chloride	$CoCl_2$	25	90.5	19
Cobaltous iodide	CoI_2	18	32.	25
Cobaltous nitrate	$Co(NO_3)_2 \cdot 6H_2O$	.....	33.1	8
Cobaltous oxide	CoO	.....	74.5	45
Cobaltous sulfate	$CoSO_4$	22	59.6	19
	$CoSO_4 \cdot H_2O$	.	53.6	11
	$CoSO_4 \cdot 7H_2O$	19.9	37.0	21
Columbium	Cb	18	1.5	1
Copper	Cu	18	−0.086	1
		500	−0.075	16
		1050	−0.070	16
Cupric bromide	$CuBr_2$	31	3.10	19
Cupric chloride	$CuCl_2$	19	9.10	19
	$CuCl_2 \cdot 2H_2O$	17	8.35	11
Cupric nitrate	$Cu(NO_3)_2 \cdot 6H_2O$	.	5.50	8
Cupric oxide	CuO	..	3.8	45
Cupric sulfate	$CuSO_4$	.	8.6	11
	$CuSO_4 \cdot 5H_2O$	.	5.9	11
Cupric sulfide	CuS	17	−0.20	27
Cuprous oxide	Cu_2O	.	1.2	45
Cuprous sulfide	Cu_2S	18	−0.18	27
Dysprosium oxide	Dy_2O_3	16	229.	29
Erbium	Er	18	22.	18
Erbium chloride	$ErCl_3$	18	114.	5
Erbium oxide	Er_2O_3	20	189.1	43
Erbium sulfate	$Er_2(SO_4)_3$	.	118.	40
Ferric bromide	$FeBr_3$	18	48	25
Ferric chloride	$FeCl_3$	20	86.2	19
Ferric hydroxide	$Fe(OH)_3$	.....	157.	27
Ferric nitrate	$Fe(NO_3)_3 \cdot 6H_2O$	.....	31.3	8
Ferric oxide	Fe_2O_3	18	20.6	18
Ferric sulfate	$Fe_2(SO_4)_3$	23	57.3	19
Ferrous ammonium sulfate	$FeSO_4 \cdot (NH_4)_2$-$SO_4 \cdot 6H_2O$	−258.6	547	21
		17.2	32.6	21
Ferrous chloride	$FeCl_2$	17	101.2	19
	$FeCl_2 \cdot 4H_2O$	19	60.1	19
Ferrous iodide	FeI_2	18	40.	25
Ferrous sulfate	$FeSO_4$	19	74.2	19
	$FeSO_4 \cdot 7H_2O$	16.5	41.5	21
Gadolinium chloride	$GdCl_3$	18	91.	5
Gadolinium oxide	Gd_2O_3	20	130.1	43
Gadolinium sulfate	$Gd_2(SO_4)_3$	.....	92.6	11
Gallium	Ga	−170 sol.	−0.26	31
		18	−0.24	31
		30	−0.23	31
		100 liq.	−0.04	31
Germanium	Ge	−170 sol.	−0.30	31
		18	−0.12	31
		900 liq.	−0.30	31

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Suscepti-bility 10^{-6} cgs	Ob-server
Gold	Au	18	−0.15	1
Gold chloride	$AuCl_3$	21	0.43	27
Hafnium oxide	HfO_2	...	−0.110	27
Helium	He	20 gas	−0.47	15
Holmium chloride	$HoCl_3$	...	172	46
Holmium nitrate	$Ho(NO_3)_3$	...	123.6	46
Holmium oxide	Ho_2O_3	...	243	46
Hydrochloric acid	HCl	22	−0.661	8
Hydrogen	H	20 gas	−1.97	1
Indium	In	20	−0.11	16
Indium trichloride	$InCl_3$	18	−0.39	27
Iodine	I	−100 sol	−0.32	31
		−60	−0.33	31
		0	−0.35	31
		18	−0.36	1
		50	−0.37	16
		113 liq	−0.39	16
		160	−0.33	16
Iridium	Ir	18	0.14	1
		200	0.17	16
		450	0.20	16
		850	0.26	16
		1150	0.31	16
Iron carbonyl	$Fe(CO)_5$	19	−0.40	32
Lanthanum	La	18	1.04	31
Lanthanum chloride	$LaCl_3$	15	5.6	27
Lanthanum sesquioxide	La_2O_3	24	−0.40	43
Lanthanum sulfate	$La_2(SO_4)_3$	...	−0.30	39
Lead	Pb	−170 sol	−0.14	31
		−18	−0.12	1
		330 liq	−0.08	16
Lead bromide	$PbBr_2$	20	−0.28	27
Lead chloride	$PbCl_2$	15	−0.32	27
Lead iodide	PbI_2	19	−0.33	27
Lead monoxide	PbO	18	−0.13	27
Lead nitrate	$Pb(NO_3)_2$	.	−0.248	37
Lead oxide (red)	Pb_3O_4	18	−0.24	27
Lithium	Li	16	0.50	31
Lithium carbonate	Li_2CO_3		−0.413	33
Lithium chloride	LiCl	.	−0.573	33
Lithium nitrate	$LiNO_3$	19	−0.48	27
Lithium oxide	Li_2O	20	−0.57	27
Lithium sulfate	Li_2SO_4	15	−0.38	27
Magnesium	Mg	18 sol	0.55	16
		700 liq	0.55	16
Magnesium bromide	$MgBr_2$	20	−0.57	27
Magnesium carbonate	$MgCO_3$		−0.51	27
	$MgCO_3 \cdot 3H_2O$		−0.525	33
Magnesium chloride	$MgCl_2$	18	−0.58	27
	$MgCl_2 \cdot 6H_2O$	18	−0.57	27
Magnesium oxide	MgO	17	−0.25	27
Magnesium sulfate	$MgSO_4$	.	−0.45	36
	$MgSO_4 \cdot 7H_2O$		−0.551	33
Manganese	Mn	18	9.9	1
Manganese bromide	$MnBr_2$	18	68	25
Manganese chloride	$MnCl_2$	24	107.0	19
Manganese dioxide	MnO_2	21	38.4	18
Manganese hydroxide (ous)	$Mn(OH)_2$		49	34
Manganese iodide	MnI_2	18	47	25
Manganese nitrate	$Mn(NO_3)_2 \cdot 6H_2O$		45.5	8
Manganese oxide (ous)	MnO	21	75.9	18

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Susceptibility 10^{-6} cgs	Observer
Manganese oxide (ic) ...	Mn_2O_3	21	69 0	18
Manganese oxide (ous-ic)	Mn_3O_4	20	55 8	18
Manganese phosphate. ..	$MnPO_4$	......	69.	38
Manganese sulfate (ous)	$MnSO_4$	24	88 5	18
Manganese sulfide (ous)	MnS	10	44 32	41
Mercury . . .	Hg	− 80 sol.	−0.15	31
		18 liq.	−0 19	1
		310	−0 193	16
Mercuric bromide .	$HgBr_2$	15	−0 30	27
Mercuric chloride . .	$HgCl_2$	17	−0 19	27
Mercuric iodide .	HgI_2	17	−0 33	27
Mercuric oxide ...	HgO	16	−0 24	27
Mercuric sulfide	HgS	16	−0 23	27
Mercurous chloride.	HgCl	19	−0 23	27
Molybdenum . .	Mo	18	0 04	16
Molybdenum dioxide .	MoO_2	20	0 33	41
Molybdenum trioxide	MoO_3	20	0 88	41
Molybdenum sesquioxide	Mo_2O_3	16	−0.35	27
Neodymium . ..	Nd	18	36	31
Neodymium oxide	Nd_2O_3	....	30.3	39
Neodymium sulfate .	$Nd_2(SO_4)_3$	.	18 3	39
Neon	Ne	20 gas	−0 33	15
Nickel bromide .	$NiBr_2$	18	19	25
Nickel carbonyl. .	$Ni(CO)_4$	19	−0 481	32
Nickel chloride	$NiCl_2$	24	44 7	19
Nickel hydroxide (ous)	$Ni(OH)_2$	.. .	48 3	45
Nickel monoxide	NiO	. .	53 7	45
Nickel nitrate....	$Ni(NO_3)_2{\cdot}6H_2O$	. .	13 6	8
Nickel sulfate	$NiSO_4$	15 9	26 7	21
	$NiSO_4{\cdot}6H_2O$		15 6	11
	$NiSO_4{\cdot}7H_2O$	19 1	16 0	21
Nitric acid	HNO_3	22	−0 467	8
Nitrogen .	N	20 gas	−0 342	1
Nitrogen dioxide .	NO	22 gas	48 66	35
Nitrogen monoxide	N_2O	12 liq.	−0 429	35
Nitrogen pentoxide ..	N_2O_5	16 sol.	−0 332	35
Nitrogen peroxide .	N_2O_4	− 16 sol.	−0 276	35
	NO_2	135 gas	3 26	35
Nitrogen trioxide	N_2O_3	18 liq.	−0 206	35
Osmium .. .	Os	18	0 05	1
Oxygen (1st modification) ..	O	−259 sol.	54.	30
		−240	60.	30
(2nd modification)		−240	118.	30
		−219	113	30
(liquid)		−219 liq.	310.	30
		−203	273.	30
		−196	260	30
		20 gas	106 2	1
Palladium . .	Pd	−258	10 9	29
		−196	8 1	29
		−103	6 9	29
		0	5 4	31
		18	5 4	1
		200	4 6	16
		750	2 6	16
		1230	1 7	16
Phosphorus (white).. .	P	20 sol.	−0 90	1
Phosphorus (red)	P	20	−0 67	3
		45 liq.	−0 90	16
Phosphorus pentoxide .	P_2O_5	18	−0 46	27
Platinum	Pt	−170	1 31	31

Substance	Formula	Temp. °C	Suscepti-bility 10^{-6} cgs	Ob-server
Platinum (continued)	Pt	−100	1.20	31
		18	1.10	1
		250	0.66	16
		700	0.45	16
		1220	0.30	16
Platinum tetrachloride	$PtCl_4$	22	0.0	24
Potassium	K	18	0.52	1
Potassium acid fluoride	KHF_2		−0.428	8
Potassium bromide	KBr		−0.377	8
Potassium carbonate	K_2CO_3		−0.488	8
Potassium chlorate	$KClO_3$		−0.30	26
Potassium chloride	KCl		−0.516	33
Potassium chloroplatinate	K_2PtCl_6		−0.393	11
Potassium chloroplatinite	K_2PtCl_4		−0.356	11
Potassium cyanate	KCNO		−0.465	33
Potassium dichromate	$K_2Cr_2O_7$		0.129	8
Potassium ferricyanide	$K_3Fe(CN)_6$	21	7.08	19
Potassium ferrocyanide	$K_4Fe(CN)_6 \cdot 3H_2O$		−0.420	32
Potassium hydroxide	KOH	22	−0.33	24
Potassium iodide	KI		−0.422	8
Potassium nitrate	KNO_3		−0.326	33
Potassium permanganate	$KMnO_4$	21	0.175	19
Potassium sulfate	K_2SO_4		−0.403	33
Potassium tetrathionate	$K_2S_4O_6$		−0.412	33
Praseodymium	Pr	−170 sol.	90	31
		−100	53	31
		20	25	31
		200	14	31
		600	8	31
		900 liq	7	31
Praseodymium chloride	PrCl	19	17	27
Praseodymium sulfate	$Pr_2(SO_4)_3$		13.7	28
Praseodymium trioxide	Pr_2O_3		15.6	28
Quartz (*see Silicon dioxide*)	SiO_2			
Rhodium	Rh	−180	0.90	31
		−40	1.05	31
		18	1.11	1
		280	1.31	16
		730	1.52	16
		1140	1.86	16
Rubidium	Rb	18	0.09	1
Rubidium carbonate	Rb_2CO_3		−0.321	33
Rubidium chloride	RbCl		−0.327	33
Rubidium nitrate	$RbNO_3$		−0.281	33
Rubidium sulfate	Rb_2SO_4		−0.331	33
Ruthenium	Ru	−170	0.55	31
		18	0.50	1
		750	0.65	16
		1100	0.75	16
Samarium oxide	Sa_2O_3	22	6.02	43
Scandium nitrate	$Sc(NO_3)_3$	21	0.0	27
Scandium oxide	Sc_2O_3		−0.018	26
Scandium sulfate	$Sc_2(SO_4)_3$		−0.33	39
Selenium	Se	18	−0.32	1
Selenious acid	H_2SeO_3	18	−0.36	27
Silicon	Si	18	−0.13	1
Silicochloroform	$SiHCl_3$		−0.515	33
Silicon dioxide	SiO_2		−0.493	33
Silicon tetrabromide	$SiBr_4$		−0.360	33
Silicon tetrachloride	$SiCl_4$		−0.537	33
Silver	Ag	−170 sol.	−0.16	31

Substance	Formula	Temp. °C	Susceptibility 10^{-6} cgs	Observer
Silver (continued)	Ag	−80	−0.18	31
		−40	−0.19	31
		18	−0.20	31
		270	−0.23	16
		945	−0.26	16
		1000 liq.	−0.28	16
Silver bromide	$AgBr$	19	−0.33	27
Silver chloride	$AgCl$	17	−0.35	27
Silver iodide	AgI	19	−0.37	27
Sodium	Na	18	0.51	1
Sodium acetate	$NaC_2H_3O_2 \cdot 3H_2O$	. .	−0.50	26
Sodium acid carbonate	$NaHCO_3$	. . .	−0.21	26
Sodium bromide	$NaBr$	18	−0.47	27
Sodium carbonate	Na_2CO_3	17	−0.24	27
	$Na_2CO_3 \cdot 10H_2O$	17	−0.58	27
Sodium chloride	$NaCl$	18	−0.499	19
Sodium fluoride	NaF	21	−0.51	27
Sodium hydroxide	$NaOH$	17	−0.59	27
Sodium iodide	$NaI \cdot 2H_2O$	.	−0.402	8
Sodium nitrate	$NaNO_3$		−0.28	26
di-Sodium phosphate	Na_2HPO_4	. .	−0.399	33
di-Sodium phosphite	Na_2HPO_3	. .	−0.451	33
Sodium sulfate	$Na_2SO_4 \cdot 10H_2O$		−0.86	26
Sodium sulfite	$Na_2SO_3 \cdot 7H_2O$	.	−0.462	33
Sodium tetraborate	$Na_2B_4O_7 \cdot 10H_2O$		−0.59	26
Sodium thiosulfate (hypo)	$Na_2S_2O_3$	. .	−0.391	33
Stannic bromide	$SnBr_4$		−0.354	33
Stannic chloride	$SnCl_4$	.	−0.442	33
Stannic hydroxide	$Sn(OH)_4$	. . .	−0.321	33
Stannic oxide	SnO_2	15	−0.050	27
Stannous chloride	$SnCl_2$	18	−0.37	27
Stannous oxide	SnO	17	−0.11	27
Stannous sulfate	$SnSO_4$	18	−0.29	27
Strontium	Sr	18	−0.2	31
Strontium bromide	$SrBr_2$	19	−0.39	27
Strontium carbonate	$SrCO_3$	. .	−0.316	33
Strontium chloride	$SrCl_2$	20	−0.56	27
Strontium iodide	SrI_2	19	−0.44	27
Strontium oxide	SrO	20	−0.060	27
Strontium sulfate	$SrSO_4$	. . . . . .	−0.315	33
Sulfur (rhombic)	S	−170 sol.	−0.49	16, 31
		18	−0.49	1
		112	−0.49	16, 31
		113 liq	−0.49	16, 31
		220	−0.49	16, 31
Sulfur dioxide	SO_2	liq.	−0.285	33
Sulfur trioxide	SO_3	16	−0.289	33
Sulfuric acid	H_2SO_4	22	−0.441	8
Tantalum	Ta	−170	0.83	31
		18	0.87	1
		420	0.88	16
		820	0.77	16
Tellurium	Te	−160 sol.	−0.46	31
		−60	−0.36	31
		0	−0.32	31
		18	−0.31	1
		130	−0.32	16
		436	−0.31	16
		470 liq.	−0.071	16
Tellurium dioxide	TeO_2	18	−0.14	27
Thallium	Tl	18	−0.24	1

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Temp. °C	Susceptibility 10^{-6} cgs	Observer
Thallium monochloride	$TlCl$	20	−0.19	27
Thallium sulfate (ous)	Tl_2SO_4	20	−0.25	27
Thallium trichloride	$TlCl_3$	20	−0.23	27
Thorium	Th	−170	0.05	31
		18	0.13	1
		150	0.23	16
		390	0.29	16
Thorium nitrate	$Th(NO_3)_4$		−0.14	27
Tin	Sn	18 sol.	0.025	1
(gray)		18	−0.35	16
		400 liq	−0.036	16
Tin tetraethyl	$Sn(C_2H_5)_4$		−0.138	33
Tin tetramethyl	$Sn(CH_3)_4$		−0.218	33
Titanium	Ti	−170	1.6	31
		20	1.25	31
Titanium dioxide	TiO_2		0.066	40
Titanium sulfide	TiS_2		0.56	40
Tungsten	W	18	0.28	1
Tungsten trioxide	WO_3	15	0.81	41
Tungstic acid	H_2WO_4	18	−1.1	27
Uranium	U	18	2.6	31
Uranium dioxide	UO_2	17	7.5	41
Uranium oxide (ous-ic)	U_3O_8	15	0.95	41
Uranium tetrachloride	UCl_4	19	−0.40	27
Uranium trioxide	UO_3	16	1.08	41
Uranyl nitrate	$UO_2(NO_3)_2$	15	−0.44	27
Vanadium	V	18	1.4	1
Vanadium oxide	VO_2	13	3.73	41
Vanadium pentoxide	V_2O_5	15	0.85	41
Vanadium trioxide	V_2O_3	15	13.9	41
Water	H_2O	−120 to 0 sol.	−0.699	19
Ytterbium	Yb	−160	16.8	31
		20	5.3	31
Ytterbium chloride	$YbCl_3$		25	5
Ytterbium oxide	Yb_2O_3		38	27
Yttrium chloride	YCl_3	17	20	27
Yttrium oxide	Y_2O_3	22	0.53	43
Yttrium sulfate	$Y_2(SO_4)_3$		−0.24	39
Zinc	Zn	18 sol	−0.157	1
		450 liq	−0.09	16
Zinc bromide	$ZnBr_2$	19	−0.40	27
Zinc chloride	$ZnCl_2$	22	−0.47	24
Zinc hydroxide	$Zn(OH)_2$		−0.487	45
Zinc oxide	ZnO		−0.362	8
Zinc sulfate	$ZnSO_4 \cdot 7H_2O$		−0.48	26
Zirconium	Zr	18	0.45	1
Zirconium dioxide	ZrO_2	15	0.112	27

Organic Compounds

Room temperature is to be understood where no other is stated

Substance	Formula	Susceptibility 10^{-6} cgs	Observer
Acetaldehyde	C_2H_4O	−0.502	33
Acetamide	C_2H_5NO	0.577	
Acetic acid	$C_2H_4O_2$	−0.526	
Acetic anhydride	$C_4H_6O_3$	−0.517	

MAGNETIC SUSCEPTIBILITY (Continued)

Substance	Formula	Susceptibility 10^{-6} cgs	Observer
Acetone	C_3H_6O	−0.581	
Acridine	$C_{13}H_9N$	−0.688	
n-Amyl alcohol	$C_5H_{12}O$	−0.766	26
iso-Amyl alcohol	$C_5H_{12}O$	−0.799	33
tert.-Amyl alcohol	$C_5H_{12}O$	−0.804	
iso-Amyl ether	$C_{10}H_{22}O$	−0.813	
Amyl nitrate	$C_5H_{11}NO_3$	−0.574	
Aniline	C_6H_7N	−0.692 (10°)	32
Anisole	C_7H_8O	−0.672	33
Anthracene	$C_{14}H_{10}$	−0.726	
Anthraquinone	$C_{14}H_8O_2$	−0.575	
Benzaldehyde	C_7H_6O	−0.573	
Benzene	C_6H_6	−0.712 (16.8°)	19, 20
Benzoic acid	$C_7H_6O_2$	−0.556	13, 14
Benzophenone	$C_{13}H_{10}O$	−0.594	33
Benzoyl chloride	C_7H_5ClO	−0.539 (20°)	
Benzyl alcohol	C_7H_8O	−0.705	
Bromobenzene	C_6H_5Br	−0.540 (−20°)	32
Bromoform	$CHBr_3$	−0.316	33
n-Butyl alcohol	$C_4H_{10}O$	−0.743	26
iso-Butyl alcohol	$C_4H_{10}O$	−0.798	33
iso-Butylamine	$C_4H_{11}N$	−0.843	
n-Butyric acid	$C_4H_8O_2$	−0.632	
iso-Butyric acid	$C_4H_8O_2$	−0.646	
Cacodylic acid	$C_2H_7AsO_2$	−0.579	
Camphor	$C_{10}H_{16}O$	−0.68	10
Camphoric acid	$C_{10}H_{16}O_4$	−0.746	13, 14
Carbon tetrabromide	CBr_4	−0.293	33
Carbon tetrachloride	CCl_4	−0.429	
Carbon tetraiodide	CI_4	−0.261	
Chloral	C_2HCl_3O	−0.459	
Chloroacetone	C_3H_5ClO	−0.550	
Chlorobenzene	C_6H_5Cl	−0.664 (−30°)	32
Chloroform	$CHCl_3$	−0.488	33
Chrysene	$C_{18}H_{12}$	−0.648	
Cinnamic aldehyde	C_9H_8O	−0.566	
Cyanogen	C_2N_2	−0.415	
Cyanuric acid	$C_3H_3N_3O_3$	−0.490	
Cyclohexane	C_6H_{12}	−0.810	
Cyclohexene	C_6H_{10}	−0.711	
Cymene	$C_{10}H_{14}$	−0.769	
Decane	$C_{10}H_{22}$	−0.876	
Diethylamine	$C_4H_{11}N$	−0.835	
m-Dinitrobenzene	$C_6H_4N_2O_4$	−0.398	
Diphenyl	$C_{12}H_{10}$	−0.677	
Diphenylamine	$C_{12}H_{11}N$	−0.634	
Ethyl acetate	$C_4H_8O_2$	−0.607 (−6°)	19, 20
Ethyl acetoacetate (fresh)	$C_6H_{10}O_3$	−0.576	33
Ethyl alcohol	C_2H_6O	−0.744	
Ethyl benzoate	$C_9H_{10}O_2$	−0.628	
Ethyl bromide	C_2H_5Br	−0.489	
Ethyl cinnamate	$C_{11}H_{12}O_2$	−0.610	
Ethyl ether	$C_4H_{10}O$	−0.766	26
Ethyl formate	$C_3H_6O_2$	−0.581	33
Ethyl iodide	C_2H_5I	−0.679	26
Ethylene	C_2H_4	−1.6	6, 7
Ethylene bromide	$C_2H_4Br_2$	−0.422	33
Ethylene chloride	$C_2H_4Cl_2$	−0.602	
Ethylene iodide	$C_2H_4I_2$	−0.381	
Ethylidene chloride	$C_2H_4Cl_2$	−0.580	
Eucalyptol	$C_{10}H_{18}O$	−0.754	
Eugenol and iso-eugenol	$C_{10}H_{12}O_2$	−0.622	
Fluorobenzene	C_6H_5F	−0.608	

Substance	Formula	Susceptibility 10^{-6} cgs	Observer
Formaldehyde	CH_2O	−0.62	26
Formamide	CH_3NO	−0.486	33
Formic acid	CH_2O_2	−0.432	
Fumaric acid	$C_4H_4O_4$	−0.426	13, 14
Furfural	$C_5H_4O_2$	−0.492	33
Glycerol	$C_3H_8O_3$	−0.538	26
Glycol	$C_2H_6O_2$	−0.624	33
Hexachlorobenzene	C_6Cl_6	−0.518	
Hexane	C_6H_{14}	−0.888	
Iodobenzene	C_6H_5I	−0.471	
Maleic acid	$C_4H_4O_4$	−0.427	13, 14
Methane	CH_4	−2.5	6, 7
Methyl acetate	$C_3H_6O_2$	−0.590	33
Methyl alcohol	CH_4O	−0.65 (−3°)	19, 20
Methylamine	CH_5N	−0.870	33
Methyl benzoate	$C_8H_8O_2$	−0.602	
Methyl bromide	CH_3Br	−0.603	
Methyl chloride	CH_3Cl	−0.633	
Methyl ether	C_2H_6O	−0.716	22
Methyl formate	$C_2H_4O_2$	−0.518	33
Methyl iodide	CH_3I	−0.403	
Methyl propionate	$C_4H_8O_2$	−0.628	
Methyl salicylate	$C_8H_8O_3$	−0.580	
Methylene bromide	CH_2Br_2	−0.379	33
Methylene chloride	CH_2Cl_2	−0.549	
Methylene iodide	CH_2I_2	−0.349	
Naphthalene	$C_{10}H_8$	−0.717	
Naphthol	$C_{10}H_8O$	−0.673	
Nitrobenzene	$C_6H_5NO_2$	−0.499 (20°)	32
Nitroethane	$C_2H_5NO_2$	−0.472	33
Nitrosobenzene	C_6H_5NO	−0.514	
Octane	C_8H_{18}	−0.872	
Oleic acid	$C_{18}H_{34}O_2$	−0.742	
Paraldehyde	$C_6H_{12}O_3$	−0.652	
Phenetole	$C_8H_{10}O$	−0.692	
Phenol	C_6H_6O	−0.648	
Phenyl cyanide	C_7H_5N	−0.651	
Phthalic acid	$C_8H_6O_4$	−0.446	13, 14
Piperidine	$C_5H_{11}N$	−0.755	33
Propionic acid	$C_3H_6O_2$	−0.587	
Propyl alcohol	C_3H_8O	−0.766	
Pyridine	C_5H_5N	−0.623	
Quinoline	C_9H_7N	−0.662	
Quinone	$C_6H_4O_2$	−0.382	
Resorcinol	$C_6H_6O_2$	−0.617	
Stilbene	$C_{14}H_{12}$	−0.666	
Succinic acid	$C_4H_6O_4$	−0.461	13, 14
Terpineol	$C_{10}H_{18}O$	−0.725	33
Tetrabromethylene	C_2Br_4	−0.334	
Tetrachloroethylene	C_2Cl_4	−0.508	
Toluene	C_7H_8	−0.729	
o-Toluidine	C_7H_9N	−0.701	33
Trichlorobenzene	$C_6H_3Cl_3$	−0.587	
Trichloronitromethane	CCl_3NO_2	−0.458	
Triethylphosphine	$C_6H_{15}P$	−0.762	
Trinitrobenzene-1, 3, 5	$C_6H_3N_3O_6$	−0.352	
Urea	CH_4N_2O	−0.560	
o-Xylene	C_8H_{10}	−0.662 (−10°)	32
m-Xylene	C_8H_{10}	−0.743	33

MAGNETIC SUSCEPTIBILITY (Continued)

MISCELLANEOUS

Substance	Susceptibility	Observer
Air, 20°C, 1 atm.	24 16 gas	1
Celluloid	−0 13	23, 24
Ebonite	0 6	44
Glass (crown)	−0 90	23, 24
Glass (heavy flint)	−1.2	23, 24
Linseed oil	−0 74	10
Marble ($CaCO_3$)	−0 8	44
Paraffin	−0 6	44
Petroleum	−0 83	26
Shellac	−0 30	26
Wax (white)	−0 6	44
Wood	−0 3 to 0.7	44

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MAGNETIC INCLINATION OR DIP AND HORIZONTAL INTENSITY

The mean or limiting values are given for the territory covered by the State named. The horizontal intensity is given in gausses. The table is compiled from the results of the U. S. Coast and Geodetic Survey for 1911 and 1912.

State.	Dip, degrees.		Horizontal intensity.	
Alabama	62. to	66.	.23 to	.26
Alaska	67.	74.	.16	.21
Arizona	59.		.27	
Arkansas	63.	65.	.24	.25
California	58.	62.	.25	.27
Colorado	67.	68.	.22	.23
Connecticut	72.	73.	17	.18
Delaware	70.	71.5	19	.20
Florida	57.	58.	27	.29
Georgia	62.	66.	.23	.26
Hawaii	39.		.29	
Idaho	69.		.21	
Indiana	69.	72.	.18	.21
Iowa	71.	73.	.18	.20
Kansas	67.	69.	.21	.23
Kentucky	68.	70.	.20	.22
Maine	74.	76.	.14	.16
Maryland	70		.20	
Massachusetts	73.		.17	
Michigan	73.	76.	.15	.18
Mississippi	61.	66.	.24	.26
Missouri	67.	71.	.20	.22
Montana	70.	72.	.18	.20
Nebraska	70.	71.	.20	
New Hampshire	73.	74.	.16	.17
New Jersey	71.		.19	
New Mexico	63.	65.	.24	.25
New York	74.		.16	.17
North Carolina	66.	68.	.21	.23
North Dakota	74.	77.	.15	.16
Ohio	71.	73.	.18	.20
Oklahoma	63.	67.	.23	.25
Oregon	68.	69.	.21	
Pennsylvania	71.	72.	.18	.19
Philippines	0.	23.	.37	.39
Porto Rico	49.	50.	.29	.30
South Carolina	66.	67.	.23	
South Dakota	71.	74.	.17	.19
Tennessee	66.	68.	.22	.23
Texas	57.	63.	.25	.29
Utah	66.	67.	.22	.23
Vermont	73.	75.	.16	.17
Virginia	68.	70.	.20	.21
Washington	71.		.19	
West Virginia	70.5		.20	
Wisconsin	74.	76.	.15	.17
Wyoming	68.	72.	.19	.22

MAGNETIC DECLINATION

(Selected from tables of the U. S. Coast and Geodetic Survey)

State.	Station.	Magnetic declination in degrees and tenths					
		1870 °	1880 °	1890 °	1900 °	1910 °	1920 °
Ala.	Ashland	4.7 E	4.1 E	3.4 E	3.0 E	2.9 E	3.0 E
	Tuscaloosa	6.1 E	5.5 E	4.8 E	4.4 E	4.4 E	4.6 E
Alas.	Sitka	29.0 E	29.3 E	29.5 E	29.7 E	30.2 E	30.4 E
	Kodiak	25.7 E	25.2 E	24.8 E	24.5 E	24.2 E	24.2 E
	Unalaska	20.1 E	19.6 E	19.0 E	18.3 E	17.5 E	17.2 E
	St. Michael	......	24.7 E	23.1 E	22.1 E	21.5 E	21.0 E
Ariz.	Holbrook	13.8 E	13.6 E	13.4 E	13.5 E	14.1 E	14.5 E
	Prescott	13.7 E	13.7 E	13.6 E	13.7 E	14.4 E	14.9 E
Ark.	Augusta	7.1 E	6.5 E	5.9 E	5.5 E	5.6 E	5.8 E
	Danville	8.6 E	8.1 E	7.6 E	7.2 E	7.4 E	7.7 E
Calif.	Bagdad	14.3 E	14.4 E	14.4 E	14.6 E	15.3 E	15.7 E
	Mojave	14.6 E	14.9 E	14.9 E	15.1 E	15.8 E	16.3 E
	Modesto	16.1 E	16.1 E	16.2 E	16.6 E	17.3 E	17.7 E
	Redding	18.1 E	18.2 E	18.3 E	18.7 E	19.4 E	19.7 E
Colo.	Pueblo	13.7 E	13.5 E	13.0 E	12.8 E	13.3 E	13.7 E
	Ouray	15.2 E	15.0 E	14.6 E	14.6 E	15.1 E	15.5 E
Conn.	Hartford	8.7 W	9.4 W	9.8 W	10.4 W	11.2 W	12.1 W
Del.	Dover	4.7 W	5.3 W	5.9 W	6.5 W	7.2 W	8.0 W
D. C.	Washington	2.4 W	3.0 W	3.6 W	4.2 W	4.9 W	5.6 W
Fla.	Miami	3.3 E	2.7 E	2.2 E	1.7 E	1.5 E	1.5 E
	Bartow	3.2 E	2.6 E	2.1 E	1.6 E	1.4 E	1.3 E
	Jacksonville	3.0 E	2.4 E	1.8 E	1.3 E	1.1 E	0.9 E
	Tallahassee	4.2 E	3.6 E	3.0 E	2.5 E	2.4 E	2.4 E
Ga.	Millen	2.7 E	2.1 E	1.5 E	0.9 E	0.7 E	0.5 E
	Americus	4.1 E	3.5 E	2.9 E	2.4 E	2.2 E	2.2 E
Haw.	Honolulu	9.5 E	9.8 E	10.1 E	10.4 E	10.7 E	11.1 E
Idaho.	Pocatello	18.0 E	17.9 E	17.8 E	17.9 E	18.5 E	18.8 E
	Boise	18.8 E	18.8 E	18.6 E	18.8 E	19.5 E	19.8 E
	Pierce	21.2 E	21.1 E	21.2 E	21.4 E	22.0 E	22.2 E
Ill.	Kankakee	5.3 E	4.8 E	4.1 E	3.5 E	3.3 E	3.1 E
	Rushville	7.0 E	6.4 E	5.7 E	5.2 E	5.1 E	5.1 E
Ind.	Indianapolis	3.3 E	2.7 E	2.1 E	1.5 E	1.1 E	0.9 E
Iowa	Walker	8.2 E	7.5 E	6.8 E	6.2 E	6.2 E	6.2 E
	Sac City	10.2 E	9.6 E	8.8 E	8.4 E	8.6 E	8.6 E
Kans.	Emporia	11.2 E	10.8 E	10.2 E	9.9 E	10.1 E	10.3 E
	Ness City	12.2 E	11.9 E	11.3 E	11.2 E	11.4 E	11.7 E
Ky.	Manchester	1.6 E	1.0 E	0.3 E	0.3 W	0.6 W	0.8 W
	Louisville	3.2 E	2.5 E	1.9 E	1.5 E	1.3 E	1.2 E
	Princeton	5.5 E	4.8 E	4.2 E	3.9 E	3.7 E	3.8 E
La.	Winfield	8.2 E	7.6 E	7.1 E	6.8 E	7.0 E	7.4 E
Me.	Eastport	18.5 W	18.8 W	19.0 W	19.3 W	20.0 W	21.0 W
	Bangor	15.9 W	16.4 W	16.7 W	17.1 W	17.8 W	18.8 W
	Portland	13.1 W	13.6 W	14.1 W	14.5 W	15.3 W	16.3 W
Md.	Baltimore	3.8 W	4.4 W	5.0 W	5.6 W	6.3 W	7.0 W
Mass.	Boston	11.0 W	11.5 W	12.0 W	12.6 W	13.4 W	14.4 W
	Pittsfield	9.3 W	10.0 W	10.4 W	11.0 W	11.8 W	12.7 W
Mich.	Marquette	4.7 E	3.8 E	3.0 E	2.4 E	2.1 E	1.7 E
	Lapeer	0.3 E	0.5 W	1.2 W	1.8 W	2.3 W	2.8 W
	Grand Haven	3.1 E	2.4 E	1.6 E	1.1 E	0.7 E	0.3 E
Minn.	St. Paul	10.9 E	10.3 E	9.5 E	8.9 E	8.8 E	8.7 E
	Marshall	11.0 E	10.5 E	9.8 E	9.3 E	9.4 E	9.4 E
	Hibbing	9.7 E	9.0 E	8.2 E	7.6 E	7.7 E	7.5 E
	Bagley	12.3 E	11.7 E	11.0 E	10.4 E	10.6 E	10.5 E
Miss.	Meridian	6.5 E	5.9 E	5.2 E	4.8 E	4.9 E	5.1 E
	Vicksburg	7.6 E	7.1 E	6.4 E	6.0 E	6.1 E	6.4 E
Mo.	Hermann	8.3 E	7.7 E	7.0 E	6.5 E	6.5 E	6.6 E

MAGNETIC DECLINATION (Continued)

(Selected from tables of the U. S. Coast and Geodetic Survey)

State.	Station.	Magnetic declination in degrees and tenths.					
		1870 °	1880 °	1890 °	1900 °	1910 °	1920 °
Mo	Sedalia	9.3 E	8.7 E	8.0 E	7.6 E	7.8 E	8.0 E
Mont	Miles City	17.7 E	17.4 E	16.9 E	16.9 E	17.3 E	17.6 E
	Lewistown	20.1 E	19.9 E	19.6 E	19.6 E	20.1 E	20.4 E
	Ovando	21.2 E	21.1 E	20.9 E	21.1 E	21.6 E	22.0 E
Nebr	Albion	12.5 E	12.0 E	11.4 E	11.0 E	11.2 E	11.5 E
	Valentine	13.9 E	13.4 E	12.8 E	12.6 E	12.8 E	13.1 E
	Alliance	15.3 E	14.8 E	14.3 E	14.2 E	14.5 E	14 8 E
Nev	Elko	17.7 E	17.7 E	17.6 E	17.8 E	18.4 E	18.9 E
	Hawthorne	16.8 E	17.0 E	17.0 E	17.3 E	18.0 E	18.4 E
N. H	Hanover	11.1 W	11.6 W	12.0 W	12.6 W	13.2 W	14.2 W
N. J	Trenton	6 0 W	6.7 W	7.2 W	7.8 W	8.6 W	9.4 W
N. Mex	Santa Rosa	12.7 E	12.4 E	12.0 E	11.9 E	12.5 E	12.9 E
	Laguna	13.6 E	13.4 E	13.0 E	13.0 E	13.6 E	14.1 E
N. Y	Albany	9.2 W	10.0 W	10.3 W	10.9 W	11.6 W	12.5 W
	Elmira	5.4 W	6.3 W	7.0 W	7.5 W	8.2 W	9.0 W
	Buffalo	3.8 W	4.7 W	5.4 W	5.9 W	6.5 W	7.2 W
N. C	Newbern	1 0 W	1.7 W	2.3 W	2.9 W	3.4 W	4.0 W
	Greensboro	1.0 E	0.3 E	0.3 W	0.8 W	1.3 W	1.8 W
	Asheville	2.0 E	1.3 E	0.7 E	0.2 E	3.2 W	0.5 W
N. D	Jamestown	13.7 E	13.2 E	12.5 E	12.2 E	12.4 E	12.5 E
	Bismarck	16.1 E	15.6 E	15.0 E	14.7 E	15 0 E	15.2 E
	Dickinson	17.5 E	17.1 E	16.5 E	16.3 E	16.7 E	16.9 E
Ohio	Canton	0 0	0.7 W	1.3 W	1.9 W	2.5 W	3.1 W
	Urbana	2 4 E	1.8 E	1.1 E	0.5 E	0.1 E	0 3 W
Okla	Okmulgee	9.8 E	9.5 E	9.1 E	8.7 E	8.9 E	9.2 E
	Enid	11.0 E	10.6 E	10.2 E	9.8 E	10.1 E	10.5 E
Ore	Sumpter	20 0 E	20.2 E	20.2 E	20.4 E	21.1 E	21.4 E
	Detroit	20.1 E	20.3 E	20.5 E	20.8 F	21.6 E	21.9 E
Pa	Wilkes-Barre	5.3 W	6.0 W	6.6 W	7.2 W	8.0 W	8.8 W
	LockHaven	4.3 W	5.0 W	5.6 W	6.3 W	7.0 W	7.7 W
	Indiana	2.0 W	2.6 W	3.3 W	3.9 W	4.6 W	5.2 W
P. R	San Juan	......	......	......	1.0 W	2.0 W	3.4 W
R. I	Newport	10.3 W	10.8 W	11.3 W	11.9 W	12 7 W	13.7 W
S. C	Marion	0 9 E	0 3 E	0.4 W	1.0 W	1 4 W	1.8 W
	Aiken	2.5 E	1.9 E	1.3 E	0 7 E	0.4 E	0.1 E
S. D	Huron	12 7 E	12.3 E	11.7 E	11.2 E	11 5 E	11.7 E
	Murdo	14 7 E	14.3 E	13.7 E	13 4 E	13 7 E	13.9 E
	Rapid City	16.3 E	15 8 E	15.3 E	15.1 E	15 4 E	15 7 E
Tenn	Knoxville	1 8 E	1.1 E	0.5 E	0.0	0.3 W	0 5 W
	Shelbyville	4 9 E	4.3 E	3 7 E	3.2 E	3.0 E	2.9 E
	Huntingdon	6.1 E	5 5 E	4.9 E	4.4 E	4 3 E	4 4 E
Tex	Houston	8.9 E	8 4 E	7.9 E	7.7 E	8 1 E	8 6 E
	San Antonio	9.5 E	9.2 E	8.7 E	8.7 E	9 2 E	9.7 E
	Pecos	11.0 E	10.8 E	10.4 E	10.3 E	10 8 E	11 3 E
	Wytheville	0.8 E	0.1 E	0.5 W	1.1 W	1.5 W	1.9 W
Utah	Manti	16.8 E	16.7 E	16.4 E	16.5 E	17.1 E	17 5 E
Vt	Rutland	10.5 W	11.2 W	11.6 W	12.1 W	12.8 W	13.8 W
Va	Richmond	1.8 W	2 5 W	3 1 W	3.7 W	4 2 W	4.9 W
	Lynchburg	0.7 W	1.4 W	2.0 W	2.6 W	3 1 W	3.7 W
	Stanley	7.8 E	7.1 E	6.3 E	5 8 E	5.6 E	5.4 E
Wash	Wilson Creek	21.8 E	21.9 E	22 1 E	22 4 E	23 0 E	23 3 E
	Seattle	22.0 E	22 2 E	22 4 E	22.8 E	23.5 E	23.8 E
W. Va	Sutton	0.4 W	1.1 W	1.8 W	2.4 W	2.9 W	3.4 W
Wis	Shawano	5.9 E	5.0 E	4 3 E	3.7 E	3 4 E	3.1 E
	Floydada	11.2 E	10.9 E	10.4 E	10.3 E	10 7 E	11.1 E
Wyo	Douglas	16.0 E	15.8 E	15.3 E	15.2 E	15.7 E	16.0 E
	Green River	17.0 E	16.8 E	16 5 E	16 6 E	17.2 E	17.5 E

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS

Radiation traversing a layer of substance is reduced in intensity by a constant fraction μ per centimeter. After penetrating to a depth x the intensity is $I = I_0 e^{-\mu x}$ where I_0 is the intensity at the surface. μ/ρ is the mass absorption coefficient where ρ is the density of the material.

Values of μ/ρ for $\lambda = .005$ Å to $\lambda = 44.6$ Å. Where two values of μ/ρ for one value of λ occur they represent the maximum and minimum values at an absorption discontinuity.

Compiled by S. J. M. Allen

$\lambda = 44.6 - 2.74$ Å

λ, Å	He	C	N	O	Ne	Al	S	Cl	A
44.6	3600	2170	3850	5765	13100	.			45700
11.88		. . .	. .	.	6850	850			....
9.87	.	1063	1796	2540	4310	500	1320	1570	1860
8.32	..	656	1109	1585	2750	330	794	962	1160
7.94		. .	. . . .	. . .	. . .	280	..		.....
						3700			
6.97	...	390	645	976	1727	2800	500	610	748
5.39	.	185	312	476	865	1450	249	310	360
5.17		160	273	413	763	1350	221	277	324
5.01		.	.....	.....	....	. . .	210		.. ..
							2260		
4.38		..	...	....	....		.	178	
								1830	
4.36		97.8	166	258	478	815	1570	1800	202
4.15		84.6	144	222	416	720	1350	1476	174
3.93		71.0	121	189	356	635	1175	1256	153
3.87			. .				. .		148
									1460
3.69		.	.	.	.	.	.	...	
3.59	. .	55.2	96	150	279	500	928	966	1215
3.51	....	.....	....	.....	...	..	.	.	
3.38	....	46.0	79.5	117	231	425	795	880	1025
3.35	...	43.0	...	....	....	417	780	870	1015
3.24		.....	...	..	.	.	.		.
3.03	.	35.0	....	84.0	175	323	595	670	760
2.74		25.0	.....	60.0	135	250	454	520	600

λ, Å	Fe	Ni	Cu	Zn	Kr	Ag	Sn	Xe	Pt	Au
44.6	.	..	...	.	31800	.	. .	6740		12500
11.88		6900	7550	.			.	....		
9.87	. .	4540	5030	.		2700	. .	.	2440	
8.32	..	3140	3450	.	.	1800	.	.	1560	.
7.94	..	..	....	. .	. .	.	..	. . .		
6.97	.	2000	2130	..	..	1300	...	...	1190	.
5.39	...	1250	1290	..	. . .	845	..	...	1645	. . .
5.17	.	1150	1190	.	..	790	. .	....	.	. .
5.01	. .	....	....	...	.		...	....		. .
4.38	...	....	....					....	. .	.
4.36	610	715	760	910	....	535	640	....	....	
4.15	540	630	690	820	..	461	550	....	1290	
3.93	470	555	610	715	.	408	490	.. .		
3.87	.	..	....		.		..	....		.
3.69	. .	...	....	..	..	354	..	....	..	.
						1410				
3.59	375	450	495	575	. . .	1360	...	....	1370	
3.51		...	...	...		1300	...	....	..	. .
						1510				
3.38	320	380	....	495	.....	. .	...	...	....	..
3.35	312	375	404	480	.. .	1310		. .	1120	. .
3.24	..	....	...	...	....	1230	.	.	. . .	. .
						1440				
3.03	245	290	315	375	....	1290	...	..	939	. ...
2.74	185	239	262	283	....	925	.		756	.....

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

λ = 2.50 – .900 Å

λ, Å	H	Li	Be	B	C	N	O	Ne	Na
2.50	.52	4 0	6.1	9 1	17 8	...	44.5	100	128
2 29	...	...	...	...	15 0	...	36 4	75.5	...
1.93	.50	2.10	3 05	4.7	8.75	14.0	21 7	49.0	61.3
1.74	...	...	...	...	...	...	...	...	...
1.656	...	...	...	...	...	...	...	...	...
1.539	.48	1.10	1.60	2.45	4 52	7.45	11.1	24.0	32.1
1.484	...	...	...	...	...	...	...	...	...
1.432	...	...	...	...	...	...	...	...	...
1.389	.47	.86	1.25	1.87	3 35	5 50	8.1	17.0	23.4
1.377	...	...	...	...	...	...	...	...	...
1.293	...	...	...	...	...	...	...	...	...
1.280	...	...	...	...	...	...	...	...	...
1.235	.46	.67	.95	1.35	2.42	3.95	5.7	12 4	17 1
1.104	...	...	...	...	...	...	...	...	...
1.071	...	...	...	...	...	...	...	...	...
1.038	...	...	...	...	...	...	...	...	...
1.000	.45	.43	.55	.76	1 36	2.10	3 13	6.5	8 8
.980	...	...	...	...	...	...	...	...	...
.949	...	...	...	...	1.20	...	...	...	...
.932	...	...	...	...	...	...	...	...	...
.900	...	...	...	...	1 05	...	...		...

λ, Å	Mg	Al	S	Cl	A	Ca	Fe	Ni	Cu
2 50	161	193	355	400	475	620	147	180	197
2 29	...	150	285	315	355	480	115	137	153
1.93	77.2	93.5	173	198	235	306	71.2	89.5	96.2
1.74	...	83.0	...	...	...	...	54 465	...	...
1.656	...	60.7	110	126	143	195	410	59.2	63 5
1.539	40 8	49.0	91	103	114	163	325	48.0	50 9
1.484	...	...	...	...	...	...	...	40 5 338	...
1.432	...	40 0	75	85	93	130	285	325	42
1.389	31 5	36.8	68.5	76 7	85.7	125	252	275	38.5
1.377	...	...	...	...	...	...	...	...	37.0 307
1.293	...	29.8	55 3	60	72	102	212	233	260
1 280	...	28.8	...	...	...	...	...	225	252
1.235	21.4	26.3	49.5	55 5	62 5	90	181	208	230
1.104	...	18.6	38.0	44	50	67	135	155	175
1 071	...	...	...	...	...	...	...	...	...
1.038	...	...	...	...	...	...	...	...	...
1.000	11 8	14.12	26.7	29 7	34 5	49	100	121	130
.980	...	...	...	...	...	...	...	...	...
.949	...	12.0	22 0	24 5	...	42	86	99	114
.932	...	...	...	...	...		...	...	...
.900	...	10.4	...		...		74 5	86 5	98.5

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

$\lambda = 2.50 - .900$ Å

λ, Å	Zn	Br	Mo	Ag	Sn	I	W	Pt	Au	Pb
2 50	228	..	..	710	850	...	...	596	.....	...
2.29	180	..	..	550	670	...	...	480	...	...
1.93	110	...	..	405	470	...	300	358	385	428
1.74	...	...	.	.....	.....	...	...	.....	.....	...
1.656	72.5	...	..	285	.....	...	...	228	.....	...
1 539	58.6	89	..	217	247	290	176	202	213	230
1.484	....	...	.	.....	.....	...	...	.....	.....	...
1.432	49 3	...	..	192	220	...	130	172	179	202
1.389	45.2	..	..	174	209	...	...	155	166	185
1 377	...	...	..	.....	.....	..	...	.....	.....	...
1 293	39	...	..	146	176	.	...	132	138	154
1.280	36	...	..	127	146	...	...	.....	.....	...
	287									
1 235	250	...	..	125	140	...	95	115	122	137
1.104	208	...	..	96.5	115	...	...	99	107	120
1.071	.....	...	..	.....	.....	...	...	77 5	.....	...
								198		
1 038	.....	...	..	....	.....	...	...	.....	76.5	...
									194	
1 000	145		52	73 0	86 0	...	...	165	174	75
980	.	.	..		.	...	...	155	168	73
949	129	.	..	63 0	75 5	. .	...	146	156	68
										168
.932	.....		.	.	.	...	...	136	148	159
								184		
.900	112	150	.	54 2	65.0	...	...	168	134	145
									182	

$\lambda = .892 - .184$ Å

λ, Å	H	Li	Be	B	C	N	O	Ne	Na	Mg	Al
.892	.	...	...	.		.	. .	....	....	....	. .
.880	440	.350	425	.580	.990	1 50	2 20	4.55	6.10	8 34	9 75
.862	.. .	..	....	....		....	.. .	.. .	....	... .	....
.850	. ..	.. .	....	....	.907	.....	....	.....	....	....	8.85
814	..	...	....	....	.814	..	...	...	....	.....	7.85
.780	.	.	....	....	.750	.	....	....	....	...	6.86
.710	.435	260	315	.365	.598	870	1 22	2 50	3 30	4 30	5.22
680	..	.	....	....	.550	.	. .	. .	. .	.....	4 52
.631	.435	.225	.255	.305	.467	.610	.900	1 80	2 30	3 0	3.73
618	....	....	....	....	....	....	.....	.....	....	....	.....
560	...	.	...	....	.370	.. .	. .	...	...	....	2.60
497	.435	.198	.210	.220	.315	400	.520	930	1.18	1.52	1.90
.485	....	....	....	....	.308	.....	....	.....	.....	.....	1.77
.476	.430	...	....	.215	.304	... .	.485	.....	.....	.....	1.74
424	...	....	....	....	....	.....	.....	.....	.....	.....	1.23
.417	.390	.180	.185	.198	.256	.310	.372	.580	.750	.940	1.170
380	....	....	....	....	.230	.....	....	.....	.....	.....	.950
331	...	...	...	...	...	.....	.....	.....	.....	.....	.. .
.260	.385	.156	.166	.175	.185	.200	.210	.270	.305	.343	.402
.220	....	...	....	....	.178	.....	.....	.....	.....	. .	.300
.200	.375	.151	.160	.165	.175	.180	.183	.210	.225	.250	.270
.184	....	...	....	....	.166	....	....	. ...	.....	. ...	.246

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

λ = .892 – .184 A

λ, Å	S	Cl	A	Ca	Fe	Ni	Cu	Zn	Br	Sr	Mo
.892											
.880	18 2	20.7	24 0	34.8	69.5	82	91 2	103			36.0
.862											
.850					63.5	74	84 5	96.5			
814					57	66	75 7	86			28
780					50 5	59 5	67 5	77			
.710	9.90	11.6	13.0	18.6	38.5	48 1	51 0	59 0	80	106.	19.9
.680					32 7	41	45 3	52 7			
.631	6 90	8 40	9.80	13.3	27.0	34	36 2	41 0	56 8	72 5	15.0
.618											12 5
											88 0
.560					18.2	24	25 5	30 7			
.497	3 50	4.20	5 0	6 60	13 9	17 9	18 4	21 0	32 0	40 5	50 2
.485					12 4	15 4	16 9	19 5			
.476							16 6				42
.424											
.417	2 10	2.47	2 95	3 97	8 45	10 5	11 45	12 3	19 0	24 0	30 0
.380					6 32	7.70	8 42	9 95			22
.331											
.260	650	750	.850	1.10	2.28	2.89	3 16	3 58	5 30	6 50	8 20
.220					1 42	1.80	2 00	2 32			
.200	400	445	.500	.630	1.10	1 45	1 55	1 78	2 4	3 32	4.30
.184						1 24					

λ, Å	Ag	Sn	I	Ba	Ta	W	Pt	Au	Pb	Bi	U
.892							165	178	142		
							201				
.880	50	60					195	170	135		
.862							185	163	130		
								193			
.850	46	56					179	186	124		
.814	41	49 5					160	167	111		
									150		
.780	36	44 5					144	150	136		
									166		
.710	27.5	34 0	38 5	42 0	100	104	115	120	136		
.680	23 5	28 4					102	108	120		
.631	19 6	23.0	26.4	31.1	72	75	84 5	87	98		
.618											
.560	13 3	16.2					62	66	75		
.497	10 5	11.8	15.6	17.8	36	38	47	48 5	52 8		
.485	9 8	11.1									
	62.5										
.476	60						42		47 5		
.424	43.5	8 0									
		46.6									
.417	41	45	9.2	10.5	21.5	22 5	27 4	28 4	32 0		
.380	31 2	34				17.3	21 1	22	26 4	27 8	
.331	21.7	24.5		5 4					18.1	19 5	
				28.0							
.260	11 4	12 8	14 2	16.1	6.7	6 85	8 0	8 3	10 0	11 0	
.220	7 05	7 80				4 25	5 25	5 50	5.92	6 4	
.200	5.48	6 20	7.0	8.0	3 4	3 50	4.25	4 40	4 90	5 1	5.40
184	4 45				2.8		3 45	3 60	4.05	4.2	
					11.8						

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

λ = .178 − .005 A

λ, Å	H	Li	Be	B	C	N	O	Ne	Na	Mg	Al
.178					164						235
.175	.360	144	150	.155	163	.166	169	185	195	.205	228
.158					160						208
.155											
146	340				155		162		.170	.176	195
142	.330				153						.191
130	.320	.132		149	152		.157		.160	.168	.186
120					150		154			.163	.172
113	.310				147		.153		.155	.160	.166
107											
098	.280	.125		138	142		.144		.150	.152	.156
.080	.255				137						.146
072	.250	118		132	136		137		.139	.140	.143
.064	245	110		126	130		.130		.130	.130	.130
.050						.120					115
.040	.205				110						.106
.030	.180				095						093
024	.165				080						.079
.010	117				059						.058
.005	078				0385						.0380

λ, Å	S	Cl	A	Ca	Fe	Ni	Cu	Zn	Br	Sr	Mo
.178							1.15				
.175	335	.341	400	.460	800	1.05	1 12	1 26	1.90	2 24	2 95
.158					640	815	862	990			
155											
146	249	280		345	520		680				
142					515	630	.670	780			1 55
130	220	230		290	424		.551				
.120	200				368	.430	455	537			
.113	189	195		.230	337		.422				
.107											
098	.166	.176		200	.265		.325				.790
.080		164			.235	.264	.268	.308			
.072	150	.158		180	.202		.232				
.064	.139	.142		155	.178		.198				.413
.050					140		155				
.040					.118		.126				
.030					.095		.100				
.024					.080		.081				
.010					.058		057				
.005							.0380				

MASS ABSORPTION COEFFICIENTS FOR X AND γ RAYS (Continued)

λ = .178 – .005 A

λ, Å	Ag	Sn	I	Ba	Ta	W	Pt	Au	Pb	U
.178	.....	..			..	2 7	3.16	3.30	3.55	...
						11 3				
175	3 96	4 50	5 10	5 70	10.0	10 5	2 97	3 13	3.48	3.95
.158	3.00	3.40		.	.	8 6	2.45	2 43	2.60	.....
							9 40			
.155	.. .	. .			..	.	.	2 30	......	....
								8 80		
.146	2.48	2 66	. .		6.75	. .	7 60	7.85	2.35	2.70
.142	2 31	2 64			..	6 75	7.20	7 33	2.10	....
									7.75	
130	1 97	2.12		.	5.10	....	6.30	6.40	6.55	2.20
120	1 61	1 77		2 20		4 60	4 92	4 98	5.20	1.90
113	1 47	1 60			3.80	.	4 40	4 50	4.75	...
.107	..	.			......	.	..	....	......	1.62
										4.65
.098	1 05	1.17			2 80	.	3 15	3 21	3.50	3.90
.080	73	.79		.	. .	2.30	2 40	2 42	2.50	2.70
.072	584	.614			1.75	.	2 00	2.05	2.10	2.25
.064	465	.490	.		1 35		1 52	1 55	1.64	1.80
.050	. .	320					86	88	1 00	. . .
.040	.	.21							62	. .
.030		.13							38	.
.024		10							21	
.010	.	060							071	082
.005	... .	0385	.						0425	044

ATOMIC ABSORPTION COEFFICIENTS

$$\frac{\mu}{\nu} = \frac{\mu}{\rho} \times \frac{W}{N}$$

The values are multiplied by 10^{23}

A.U.	H 1	Li 3	C 6	N 7	O 8	Al 13	Fe 26	Cu 29	Mo 42	Ag 47	Pb 82	H_2O (H)
.025	..	....	.....	...	.....	.317	.625	....	....	.. .	2 60	.....
.100	.	. ..	.285	....	.....	.724	....	3.3	.. .	.	. ..	.....
.125	.04	...	.305	....	.385	.792	3.67	4.8	21.3	.. .	103.	.478
.150	.05	....	.323	.376	.430	.889	5.38	8.3	31.0		53.6	.534
.175	.06	..	.329	.395	.459	1.04	7.55	11.8	44.7	66.5	86.1	.578
.20	.05	..	.343	.409	.482	1.19	9.75	16.4	63.5	107.	157.	.591
.25	.05	....	.370	.446	.546	1.62	17.3	29.0	117.	203.	290.	.650
.30	.04	.197	.400	.518	.641	2.34	28.4	47.2	201	323.	485.	.730
.35	.04	.215	.433	.580	.763	3.31	43.9	72.9	302.	483.	772.	.840
.40	.05	.238	.475	....	.886	4.56	64.5	106.	422.	686.	1150.	.992
.50	.08	.280	.602	...	1.29	8.44	127.	197.	769.	204.	2070.	1.458
.60	.09	.350	.780	....	1.92	14.0	208.	332.	1277.	348.	......	2.11
.70	.10	.462	1.052	..	2.85	22.1	325.	512.	297	..	.....	3.04
.80	.17	....	1.40	....	4.03	32.4	466.	.....	430.	......	....	4.38
1.00	..	....	2.51	....	.....	61.6	830.	....	838.	2000.	......	8.01

X-RAY SPECTRA

Compiled by J. M. Cork

Emission Wave-Lengths in the K and L Series, $\lambda \times 10^{-8}$ cm.

For calcite d = 3.02904×10^{-8} cm.

At. No.	Element	K Series α_2	K Series α_1	K Series β_1	K Series β_2	L Series l	L Series α_2	L Series α_1	L Series η	L Series β_1	L Series β_4	L Series β_3	L Series β_2	L Series γ_1
11	Sodium	11.885		11.594										
12	Magnesium	9.869		9 539										
13	Aluminum	8.320		7.965										
14	Silicon	7.111		6.7545										
15	Phosphorus	6.142		5.7921										
16	Sulphur	5.3637	5.3613	5.0211										
17	Chlorine	4.7212	4.7182	4.3942										
18	Argon	......	......	......										
19	Potassium	3.7371	3.7337	3.4468										
20	Calcium	3.3549	3.3517	3.0834										
21	Scandium	3.0284	3.0250	2.7739										
22	Titanium	2.7468	2.7432	2.5090										
23	Vanadium	2.5021	2.4984	2.2797	......	......	24.3		......					
24	Chromium	2.2889	2.2850	2.0806	......	......	21.52		......	21.19				
25	Manganese	2.1015	2.0975	1.9062	......	......	19.39		......	19.04				
26	Iron	1.9360	1.9321	1.7530	......	20.12	17.58		19.65	17.22	15.61			
27	Cobalt	1.7892	1.7853	1.6174	......	18.20	15.94		17.77	15.62	.....			
28	Nickel	1.6584	1.6545	1.4970	1.4856	16.55	14.53		16.17	14.24	13.14			
29	Copper	1.5412	1.5374	1.3894	1.3782	15.19	13.306		14.83	13.03	12.10			
30	Zinc	1.4360	1.4322	1.2926	1.2811	13.95	12.23		13.61	11.95	11.16			
31	Gallium	1.3409	1.3372	1.2052	1.1938	12.89	11.27		12.56	11.01	..			
32	Germanium	1.2552	1.2513	1.1267	1.1146	11.922	10.415		11.587	10.153				

X-RAY SPECTRA (Continued)

EMISSION WAVE-LENGTHS IN THE K AND L SERIES, $\lambda \times 10^{-8}$ cm.

At. No	Element	K Series α_2	K Series α_1	K Series β_1	K Series β_2	L Series l	L Series α_2	L Series α_1	L Series η	L Series β_1	L Series β_4	L Series β_3	L Series β_2	L Series γ_1
33	Arsenic	1.1774	1.1734	1.0551	1.0428	11.048	9.652		10 711	....				
34	Selenium	1.1065	1.1025	.99013	.97791	10.272	8 972		9 939	8 718				
35	Bromine	1.0417	1.0376	.93087	.91853	9 564	8 358		9.235	8 109				
37	Rubidium	.9278	.9236	.82696	.81476	....	......		......	....	6 801	6 769		
38	Strontium	.8776	.8734	.78130	.76921	7 822	6 849		7.506	6 610	6 392	6.358		
39	Yttrium	.8313	.8271	.73919	.72713	.....	6 436		7.031	6 204	6 008	5.974	.....	......
40	Zirconium	.7885	.7843	.70028	.68850	6 899	6 057		6.594	5.824	5.652	5 619	5.574	5.374
41	Columbium	.7489	.7446	.66438	.65280	6.510	5 718	5 712	6.196	5.480	5.330	5.297	5.226	5.024
42	Molybdenum	.71210	.70783	.63098	.61970	......	5 401	5.395	5.836	5.166	5.041	5.005	4 910	....
44	Ruthenium	64606	.64174	.57131	.56051	5 486	4 843	4 836	....	4.611	4.513	4.476	4.362	4.173
45	Rhodium	.61637	.61202	.54449	.53396	5 2070	4 5956	4.5878	4.9112	4.3640	4.2802	4.2447	4 1221	3.9357
46	Palladium	.58860	.58422	.51961	.50928	4.9396	4 3666	4.3585	4.6502	4.1373	4.0623	4.0257	3 9007	3.7164
47	Silver	.56265	.55824	.49622	.48607	4.6976	4 1538	4 1456	4.4101	3.9266	3.8611	3.8245	3.6938	3 5149
48	Cadmium	.53831	.53388	.47413	.46429	4.4713	3.9564	3.9478	4.1875	3.7301	3.6743	3.6364	3.5064	3.3280
49	Indium	.51547	.51104	.45365	.44408	4.2593	3.7724	3 7637	3.9761	3.5478	3.4990	3.4619	3.3312	3 1513
50	Tin	.49404	.48961	.43430	.42507	4.0633	3.6011	3.5922	3.7818	3.3779	3.3363	3.2989	3.1679	2.9949
51	Antimony	.47394	.46943	.41630	.40715	3 8803	3 4408	3 4318	3.5996	3.2184	3.1843	3.1451	3.0166	2.8451
52	Tellurium	.45496	.45045	.39928	.39043	3.7101	3.2910	3.2820	.....	3.0700	3.0400	3.0013	2.8761	2.7065
53	Iodine	.43698	.43246	.38315	.37466	3.5497	3 1509	3 1417	...	2.9309	2.9059	2.8682	2.7461	2.5775
54	Xenon	......	......	......	......	......	......	......	......	......	......	......	......	......
55	Caesium	.40404	.39953	.35362	.34516	3.2596	2.8956	2.8861	2 9833	2 6778	2.6605	2.6299	2.5064	2.3425
56	Barium	.38891	.38438	.34022	.33222	3.1287	2 7790	2.7696	2.8571	2.5622	2.5498	2.5110	2.3993	2.2366
57	Lanthanum	.37463	37000	.32726	.31966	3.0000	2 6688	2 6597	2 7340	2 4533	2.4438	2.4053	2.2980	2.1372
58	Cerium	.36103	35642	31501	.30770	2.8857	2.5651	2.5560	2 6147	2 3510	2 3442	2.3059	2.2041	2.0443
59	Praesodymium	.34805	.34340	.30360	29625	2.7781	2.4676	2.4577	2.5070	2.2539	2 2501	2 2124	2 1148	1.9568

X-RAY SPECTRA (Continued)

EMISSION WAVE-LENGTHS IN THE K AND L SERIES, $\lambda \times 10^{-8}$ cm.

At. No.	Element	K Series α_2	K Series α_1	K Series β_1	K Series β_2	L Series l	L Series α_2	L Series α_1	L Series η	L Series β_1	L Series β_4	L Series β_3	L Series β_2	L Series γ_1
60	Neodymium	33596	.33128	.29275	.28573	2.6703	2 3756	2 3653	2 4042	2 1622	2.1622	2.1222	2.0314	1.8738
62	Samarium	31311	.30844	.27250	26575	2.4770	2 2057	2.1950	2.2140	1 9936	1.9964	1.9580	1 8781	1.7231
63	Europium	30267	29795	.26307	25645	2.3903	2.1273	2.1163	. . . .	1.9163	1.9221	1.8827	1.8082	1.6543
64	Gadolinium	.29251	.28778	.25394	.24762	2.3071	2 0526	2 0419	. . .	1 8425	1.8493	1.8109	1.7419	1.5886
65	Terbium ..	.28294	.27820	.24551	23912	2.2290	1 9823	1.9715		1 7727	1.7814	1.7425	1.6790	1.5266
66	Dysprosium	.27369	.26895	.23710	.23128	2.1540	1.9156	1.9046	1.8922	1 7066	1.7167	1.6777	1.6198	1.4697
67	Holmium .	.26499	.26030	......	......	2.0821	1.8521	1.8410	1.8220	1.6435	1.6553	1.6160	1.5637	1.4142
68	Erbium	25669	.25198	.22215	.21671	2.0151	1.7914	1.7804	1.7548	1.5834	1.5964	1.5579	1.5106	1.3623
69	Thulium .	24861	.24387	.21487	......	1.9511	1.7339	1.7228	1.6923	1.5268	1.5412	1.5023	1.4602	1.3127
70	Ytterbium	.24099	.23625	.20834	20322	1.8900	1.6789	1.6678	1.6310	1.4725	1.4882	1.4494	1.4128	1.2648
71	Lutecium	.23358	.22882	.20171	.19649	1.8318	1.6264	1.6155	1.5738	1.4207	1.4372	1.3982	1.3672	1.2203
72	Hafnium..	.22653	.22173	.19515	.19042	1 7774	1 5770	1.5661	1.5197	1 3711	1.3893	1.3497	1.3235	1.1765
73	Tantalum .	21973	.21488	.18911	.18451	1.7249	1.5298	1.5188	1.4679	1.3242	1.3431	1.3041	1.2819	1.1356
74	Tungsten.	21345	.20862	.18422	.17898	1.6750	1.4844	1.4734	1.4181	1.2792	1.2988	1.2599	1.2420	1.0963
76	Osmium .	20131	.19645	.17361	.16875	......	1.3987	1.3886	.....	1.1949	......	......	1.1688	1.0229
77	Iridium.. .	19550	.19065	.16850	.16376	......	1.3598	1.3485	1.2817	1.1554	1.1771	1.1385	1.1329	.98876
78	Platinum	19004	.18523	.16370	.15887	1.4964	1.3215	1.3103	1.2403	1.1176	1.1398	1.1016	1.0997	.95599
79	Gold... ..	18483	.17996	.15902	.15426	1.4569	1.2850	1.2737	1.2003	1.0813	1.1042	1.0655	1.0680	.9246
80	Mercury .. .	......	......	......	......	1.4184	1.2495	1.2386	1.1616	1 0465	1 0692	1.0305	1.0377	.8946
81	Thalium.. ...	17466	.16980	.15011	.14539	1.3819	1.2163	1.2049	1.1254	1.0130	1.0370	.9985	1.0082	.8657
82	Lead. .. .	.17004	.16516	14606	14125	1.3474	1.1841	1.1726	1.0900	.9808	1.0056	.9672	.9808	8380
83	Bismuth... .	16525	.16041	14025	......	1.3137	1.1530	1.1415	1.0565	.9500	.9750	.9367	.9532	.8114
90	Thorium	.1368	.1323	1169	.1134	1.1128	.9658	.9540	.8528	.7636	.7919	.7532	.7919	.6517
92	Uranium. . .	.1309	.1264	.1119	.1084	1.0649	.9206	.9087	.8035	.7185	.7464	.7088	.7531	.6136

Wave-lengths in Ångstrom units as determined by Crystal.

X-RAY SPECTRA (Continued)

EMISSION WAVE-LENGTHS IN THE M SERIES, $\lambda \times 10^{-8}$ cm.

Atomic Number	Element	α_2	α_1	β	γ
58	Cerium	.....	14.030	13.755	11.511
59	Praesodymium	.....	.....	.....	10.975
60	Neodymium	.....	12.650	12.375	10.483
62	Samarium	11.475	11.406	11.238	9 580
63	Europium	11.003	10.932	10.723	9.192
64	Gadolinium	10.428	10.394	10.233	8.826
65	Terbium	9.946	9.917	9.772	8.468
66	Dysprosium	9.555	9.524	9.345	8 127
67	Holmium	9.165	9.143	8.947	7.849
68	Erbium	8.794	8.783	8 576	7.530
70	Ytterbium	8.138	8.122	7.893	7.009
71	Lutecium	.....	7.824	7.585	6.748
72	Hafnium	.....	7.524	7.289	6.530
73	Tantalum	.....	7.237	7.008	6.299
74	Tungsten	.....	6.969	6.743	6.076
75	Rhenium	.....	6.715	6.491	5.875
76	Osmium	.....	6.477	6.254	5.670
77	Iridium	6.262	6.249	6.025	5 490
78	Platinum	6.045	6.034	5.816	5 309
79	Gold	5.842	5.828	5.612	5.135
81	Thalium	5.461	5.450	5.239	4.815
82	Lead	5.288	5.274	5.065	4.665
83	Bismuth	5.119	5.108	4.899	4.522
90	Thorium	4.143	4.130	3.934	3.672
92	Uranium	3.916	3.902	3.708	3 473

GRATING SPACE IN CRYSTALS

Calcite	3.02904×10^{-8}cm.	Millikan
Potassium ferrocyanide	8.408	Siegbahn
Rock salt, plane parallel to face	2.81	Bragg
Calcium fluoride	5.455 (Cu radiation)	Gerlach
	5.478 (Ni radiation)	"
Mica	9.845 (1st order)	Davis, Terrill
	9.958 (7th order)	" "
Silicon	5.415 (Cu radiation)	Gerlach
	5.410 (Ni radiation)	"
Zinc blende	5.90 (Cu radiation)	"

X-RAY CRYSTALLOGRAPHIC DATA*

Compiled with the collaboration of John G. Albright

The following table presents crystallographic data for about 1300 compounds. For convenience they have been separated into; elements, inorganic compounds, minerals, metal-organic compounds and organic compounds. Alloys will be found among the inorganic compounds under one or the other of the metal constituents.

The crystal system is given using abbreviations indicated below. The type of structure is indicated by reference to certain characteristic compounds. The space group is indicated by the symbols of the Shoenflies system. The dimensions of the unit cell *a*, *b*, and *c* in angstrom units are given in order followed in some cases by axial angles. The last column indicates the number of molecules per unit cell.

For an explanation of the space group symbols, structure types or other details of crystallographic data see Wyckoff: The Structure of Crystals and also Davey: Study of Crystal Structure and its Applications (p. 672).

Abbreviations: b.c., body centered; c.p. close packed; cub., cubic; dia., diamond; f.c., face centered; hex., hexagonal; monocl., monoclinic; rhbdr., rhombohedral; rhomb., rhombic; tetr., tetragonal; tricl., triclinic.

THE ELEMENTS

Substance	System. struct. type	Space group	Lattice constants *a*, *b*, *c*, Ax. ang	Atoms
A (−235°C)	cub., f.c., Cu	O_h^5	5.43	4
Ag	cub., f.c., Cu	O_h^5	4.0776	4
Al	cub., f.c., Cu	O_h^5	4.04145	4
As	hex., rhbdr.	D_{3d}^5	4.151, ω = 53° 49′	2
As	rhbdr., f.c.	.	5.599, ω = 84° 18′	8
Au	cub., f.c., Cu	O_h^5	4.0702	4
Ba	cub., b.c., W	O_h^9	5.015	2
Be	hex., c.p., Mg	D_{6h}^4	2.283, . . . 3.607 2.2679, . . . 3.5942 (Neuburger, 1933)	2
Bi	hex., rhbdr., As	D_{6h}^5	4.749, ω = 57° 16′	2
Bi	rhbdr., f.c.	....	6.578, ω = 87° 34′	8
Br (−150°C)	rhomb., I	V_h^{18}	4.48, 6.67, 8.72	8
C (diamond, 18°C)	cub., f.c.	O_h^7	3.5597	8
C (graphite)	hex.	D_{6h}^4	2.455, . . 6.69	4
Ca	cub., f.c., Cu	O_h^5	5.56	4
Cb (Nb)	cub., b.c., W	O_h^9	3.03	2
Cd	hex., c.p., Mg	D_{6h}^4	2.973, . 5.606	2
Ce (α)	hex., c.p., Mg	D_{6h}^4	3.65, ... 5.91	2
Ce (β)	cub., f.c., Cu	O_h^5	5.12	4
Cl (−185°C)	tetr.	D_{4h}^{16}	8.56, . . 6.12	8
Co (α)	hex., c.p., Mg	D_{6h}^4	2.514, . 4.105	2
Co (β)	cub., f.c., Cu	O_h^5	3.554	4
Cr (α)	cub., b.c., W	O_h^9	2.878	2
Cr (β)	hex., c.p., Mg	D_{6h}^4	2.717, ... 4.418	2

* See also Supplementary Table following.

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System. struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Atoms
Cr (γ)	cub., b.c.,	T_d^3	8.717	58
Cs (−173°C)	cub., b.c., W	O_h^9	6.05	2
Cu	cub., f.c.	O_h^5	3.608	4
Er	hex., c.p., Mg	D_{6h}^4	3.74, . . , 6.09	2
Fe (α)	cub., b.c., W	O_h^9	2.86106	2
Fe (β) (800°C)	cub., b.c.	.	2.90	2
Fe (γ) (1100°C)	cub., f.c.	O_h^5	3.63	4
Fe (δ) (1425°C)	cub., b.c.		2.93	2
Ga	rhomb.	V_h^{18}	4.5167, 4.5107, 7.6448	
Ga	tetr. (simple)	D_{4h}^{16}	4.51, , 7.51	8
Ge	cub., f.c., Dia.	O_h^7	5.647	8
H_2 (−271°C)	hex.		3.75 . , 6.11	4
Hg (−46°C)	rhbdr.	D_{3d}^5	2.997, $\omega = 70° 32'$	1
Hg (−46°C)	rhbdr., f.c.		4.578, $\omega = 98° 13'$	4
Hf	hex., c.p., Mg	D_{6h}^4	3.200, , 5.077	2
I_2	rhomb., $4I_2$ groups	V_h^{18}	4.795, 7.255, 9.780	8
In	tetr., f.c.	D_{4h}^{17}	4.583, , 4.936	4
Ir	cub., f.c., Cu	O_h^5	3.823	4
K	cub., b.c., W	O_h^9	5.333	2
Kr (−252.5°C)	cub., f.c., Cu	O_h^5	5.59	4
La	hex., c.p., Mg	D_{6h}^4	3.72, , 6.06	2
La (β)	cub., f.c.	.	5.296	
Li (−173°C)	cub., b.c., W	O_h^9	3.46	2
Mg	hex., c.p.	D_{6h}^4	3.203, , 5.196	2
Mn (α)	cub., b.c.	T_d^3	8.894	58
Mn (β)	cub.	O^6 or O^7	6.300	20
Mn (γ)	tetr., f.c., In	D_{4h}^{17}	3.774, , 3.526	4
Mo	cub., b.c., W	O_h^9	3.1401	2
N_2 (α) (−252°C)	cub.	T^4	5.66 ($4N_2$)	8
Na (−173°C)	cub., b.c., W	O_h^9	4.24	2
Ne (−268°C)	cub., f.c., Cu	O_h^5	4.52	4
Ni (α)	hex., c.p., Mg	D_{6h}^4	2.66, , 4.29	2
Ni (β)	cub., f.c., Cu	O_h^5	3.517	4
O_2 (−252°C)	rhomb., b.c.	. .	5.50, 3.82, 3.44	4
O_2 (β)	rhbdr.	. .	6.19, $\alpha = 99.1°$	6
O_2 (γ) (−223°C)	cub.	T_h^6	6.83	8

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Atoms
Os	hex., c.p., Mg	D_{6h}^4	2.724, . . , 4.314	2
P (metallic)	hex., rhbdr., As	D_{3d}^5	5.14, $\omega = 34° 7'$	2
P (metallic)	rhbdr., f.c.		5.96, $\omega = 60° 47'$	8
P (red and black)*	rhomb., f.c.	V_h^{18}	3.31, 4.38, 10.50	8
P (white, −35°C)	cub.		7.17 ($4P_4$)	16
Pb	cub., f.c., Cu	O_h^5	4.941	4
Pd	cub., f.c., Cu	O_h^5	3.879	4
Po	monocl.	C_2^3	7.42, 4.29, 14.10, β = 92° (?)	
Pt	cub., f.c., Cu	O_h^5	3.9142	4
Rb (−173°C)	cub., b.c., W	O_h^9	5.62	2
Re	hex., c.p., Mg	D_{6h}^4	2.765, ... , 4.470	2
Rh	cub., f.c., Cu	O_h^5	3.7944	4
Ru	hex., c.p., Mg	D_{6h}^4	2.695, , 4.273	2
S	rhomb., f.c.	V_h^{24}	10.48, 12.92, 24.55	128
Sb	hex., rhbdr., As	D_{3d}^5	4.501, $\omega = 57° 5'$	2
Sb	rhbdr., f.c.		6.226, $\omega = 87° 24'$	8
Se	hex.	D_3^4 or D_3^6	4.337, . . , 4.944	3
Se (α)	monocl.	C_{2h}^2	8.992, 8.973, 11.52, $\beta = 91° 34'$ ($4Se_8$)	32
Se (β)	monocl.	C_{2h}^5	12.74, 8.04, 9.25, β = 93° 4'	32
Si	cub., f.c., Dia.	O_h^7	5.4173	8
Sn (α, gray)	cub., f.c., Dia.	O_h^7	6.46	8
Sn (β, white)	tetr., double b.c.	D_{4h}^{19}	5.818, , 3.174	4
Sr	cub., f.c., Cu	O_h^5	6.075	4
Ta	cub., b.c., W	O_h^9	3.281	2
Te	hex., Se	D_3^4 or D_3^6	4.495, . , 5.912	3
Th	cub., f.c., Cu	O_h^5	5.074	4
Ti	hex., c.p., Mg	D_{6h}^4	2.951, , 4.692	2
Ti (β) (above 900°C)	cub., b.c.		3.32	2
Tl (α)	hex., c.p., Mg	D_{6h}^4	3.450, . . , 5.520	2
Tl (β) (above 230°C)	cub., f.c., Cu	O_h^5	4.841	4
U	cub., b.c., W	O_h^9	3.43	2
U	monocl.(Wilson,1933)	C_{2h}^3	2.829, 4.887, 3.308	2
V	cub., b.c., W	O_h^9	3.011	2

* Crystalline and "amorphous" black and red phosphorus all give similar x-ray patterns.

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Atoms
W (α)	cub., b.c.	O_h^9	3.1583	2
W (β)	cub.	O^3 or O_h^3	5.04	8
Xe (−173°C)	cub., f.c., Cu	O_h^5	6.18	4
Zn	hex., c.p., Mg	D_{6h}^4	2.6585, ... , 4.9342	2
Zr	hex., c.p., Mg	D_{6h}^4	3.223, ... , 5.123	2
Inorganic Compounds				
				Mol.
AgBr	cub., NaCl	O_h^5	5.755	4
$AgBrO_3$	tetr., $AgClO_3$	V_d^{11} or D_{4h}^{17}	8.59, . . , 8.01	8
AgCN	hex.	C_{3v}^5	4.60, α = 81° 14′	
AgCa	cub., f.c.	. .	9.07	
AgCd (β-phase)	cub., CsCl	O_h^1	3.33	1
AgCl	cub., NaCl	O_h^5	5.545	4
$AgClO_3$	tetr.	V_d^{11} or D_{4h}^{17}	8.47, ... , 7.90	8
$AgClO_4$ (200°C)	cub., $KClO_4$	T_d^2	6.92	4
$Ag[Co(NH_3)_2(NO_2)_4]$	tetr.	D_{4h}^4	6.97, , 10.43	2
AgF	cub., NaCl	O_h^5	4.92	4
AgI	cub., ZnS	T_d^2	6.47	4
AgI	hex, ZnO	C_{6v}^4	4.58, ... , 7.49	2
AgI (α) (145.8–550°C)	cub.	. .	5.034	2
$AgIO_4$	tetr.	C_{4h}^6	5.368, . . , 12.013	4
$AgK(CN)_2$	hex.	D_{3d}^2	7.384, . . . , 17.55	
AgMg	cub., CsCl	O_h^1	3.28	
$AgMnO_4$	monocl.	C_{2h}^5	5.66, 8.27, 7.12, β = 92° 29′	4
$AgNO_2$	rhomb.	C_v^{20} or D_{2h}^{13}	3.505, 6.14, 5.16	2
$AgNO_3$	rhomb.	$V^1 - V^4$	6.97, 7.34, 10.14	8
$[AgNO_3.CO(NH_2)_2]n$	monocl.	$C_{2h}^2 (C_2^2?)$	10.23, 16.84, 6.25	8
AgN_3	rhomb. (pseudotetr.)	V_h^{26}	5.89, 5.58, 5.96	4
$AgRhO_4$	tetr.	C_{4h}^6	5.349, ... , 11.916	4
Ag (Sb, Bi)S_2	tricl.	. . . .	5.67, 5.69, 5.62	2
AgZn	cub., CsCl	O_h^1	3.156	1
Ag_2F	hex., CdI_2	D_{3d}^3	3.0, ... , 5.74	1
Ag_2HgI_4	tetr.	V_d^1	6.340	

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Ag_2HgI_4 (α, >50°C)	cub.	T_d^2	6.383	1
Ag_2MoO_4 .	cub., $MgAl_2O_4$	O_h^7	9.26	8
Ag_2O...	cub., Cu_2O	O_h^4	4.72	2
Ag_2S (α)	cub., b.c.	. .	4.88	2
$Ag_2SO_4.4NH_3$	tetr.	V_4^d	8.44, . . ., 6.35	2
Ag_2Se (α)	cub., b.c.		4.983	2
Ag_2Te (α)	cub., f.c.		6.572	4
Ag_3Al . .	cub., β-Mn		6.920	5
Ag_3AsO_4 .	cub., Ag_3PO_4	T_d^4	6.12	2
Ag_3Hg_4	cub.	O_h^9	10.09	4
Ag_3PO_4	cub.	O_h^3	5.99	2
Ag_3SbS_3 . .	hex. (rhbdr.)		7.07, α = 104° 1′	2
Ag_5Cd_8.	cub., Cu_5Zn_8	T_d^3	9.96	4
Ag_5Zn_8	cub., Cu_5Zn_8	T_d^3	9.33	4
AlAs .	cub., ZnS	T_d^2	5.62	
AlB_2	hex.		3.00, . . . , 3.245	1
AlB_{12}	tetr.		12.55, , 10.18	16
$AlCl_3$	monocl.	C_2^3	5.91, 10.24, 6.16, β = 71° 21′	4
$AlCl_3$	pseudo-hex.	D_3^3 or D_3^5	5.91, , 17.52	6
$AlCl_3.6H_2O$	hex. (rhbdr.)	D_{3d}^6	7.85	2
AlCu	hex.		3.89, α = 94° 36′	4
$AlCu_2Mn$.	cub., $AlCu_3$		5.950	4
$AlCu_3$ . .	cub., f.c.		3.47	4
AlF_3....	hex.	D_3^7	4.914, , 12.46	6
AlF_3 .	rhbdr.	.	5.029, α = 58° 31′	2
$AlH(SiW_{12}O_{40}).28H_2O$.	rhbdr.	D_{3d}^5	16.45, α = 56° 18′	2
AlN . .	hex., ZnO	C_{6v}^4	3.104, ... , 4.965	2
$Al(OH)_3$	monocl.	C_{2h}^5	8.6236, 5.06021, 9.699, β = 85° 26′	8
AlP . . .	cub., ZnS	T_d^2	5.42	
$Al(PO_3)_3$	cub.	T_d^6	13.63	16
AlSb	cub., ZnS	T_d^2	6.13	4
$(Al, Sc)_2O_3$.	cub.	O_i^{10}	9.22	16
Al_2Cu	tetr., b.c.	D_{4h}^{18}	6.04, . . . , 4.86	4
Al_2O_3 (α, corundum)	hex. (rhbdr.), Fe_2O_3	D_{3d}^6	5.12, α = 55° 17′	2
Al_2O_3 (β)	hex.		5.56, . . , 22.55	
Al_2O_3 (γ).	cub., $MgAl_2O_4$	O_h^7	7.895	$10\frac{2}{3}$
$Al_2O_3.H_2O$ . .	rhomb.	.	4.38, 9.35, 2.82	
Al_2SiO_5 (cyanite). .	tricl.	O_i^1	7.09, 7.72, 5.56, β = 101° 2′	4

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Al_3Mg_4	cub.		4.80	1
Al_4C_3 .	rhbdr.	D_{3d}^5	8.53, α = 22° 28′	1
Al_4Cu_9.	cub., Cu_5Zn_8	T_d^3	8.70	4
Al_5C_3N	hex.	C_{6v}^4	3.280, . , 21.55	2
AsI_3 .	hex.	C_3^1	7.187, . , 21.39	6
AsI_3	rhbdr.	C_{3i}^2	8.25, α = 51° 20′	2
As_2O_3	cub.	O_h^7	11.06	16
$AuCu$.	tetr.		3.98, . . , 3.72	
$AuCu_3$	cub.		3.75	1
$AuSb_2$	cub., FeS_2	T_h^6	6.636	4
$AuSn$	hex., NiAs	C_{6v}^4 or D_{6h}^4	4.307, . , 5.494	2
$AuZn$	cub., CsCl	O_h^1	3.19	1
$AuZn_3$ (α)	cub.		7.88	8
Au_2Bi	cub.	O_h^7	7.942	8
Au_2Pb	cub.		7.91	8
Au_5Zn_8	cub., Cu_5Zn_8	T_d^3	9.27	4
$BAsO_4$.	tetr.	S_4^2	4.458, , 6.796	2
BN .	hex., graphite	D_{6h}^4, C_{3h}*	2.51, , 6.69	4, 2*
BPO_4. .	tetr.	S_4^2	4.332, , 6.64	2
B_2H_6	hex.	D_{6h}^4	4.54, , 8.69	2
$B_{10}H_{14}$	rhomb.	V_h^{21}	14.46, 20.85, 5.69	
BaC_2 .	tetr., f.c., CaC_2	D_{4h}^{17}	4.39, , 7.04	2
$BaCO_3$	rhomb., KNO_3	V_h^{16}	5.29, 8.88, 6.41	4
$Ba(ClO_4)_2.3H_2O$	hex.		7.28, , 9.64	2
BaF_2	cub., CaF_2	O_h^5	6.184	4
$BaMoO_4$	tetr., $CaWO_4$	C_{4h}^6	5.56, . . , 12.76	4
$Ba(NO_3)_2$	cub.	T_h^6	8.11	4
$Ba(N_3)_2$	monocl.	C_{2h}^1 or C_{2h}^2	6.22, 29.29, 7.02, β = 105° 14′	10
$BaNi(CN)_4.4H_2O$	monocl.		11.89, 14.08, 6.54, β = 103° 42′	4
BaO	cub., NaCl	O_h^5	5.50	4
BaO_2	tetr.	D_{4h}^{17}	5.34, , 6.77	
BaS. . .	cub., NaCl	O_h^5	6.35	4
$BaSO_4$	rhomb.	V_h^{16}	8.85, 5.44, 7.13	4
BaS_3.	rhomb.	. . .	8.32, 9.64, 4.82	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$Ba(SbO_3)_2.8H_2O$ . . .	monocl., b.c. (pseudo-rhomb.)		9.961, 12.506, 10.129, $\beta = 87° 17'$	
BaSe . . .	cub., NaCl	O_h^5	6.62	4
BaTe . . .	cub., NaCl	O_h^5	6.986	4
$BaTiO_3$.	cub., $CaTiO_3$		3.97	
$BaWO_4$	tetr., $CaWO_4$	C_{4h}^6	5.60, . . , 12.69	4
BeO	hex., ZnO	C_{6v}^4	2.70, , 4.39	2
BeS . . .	cub., ZnS	T_d^2	4.85	
$BeSO_4.4H_2O$	tetr.	D_{2d}^{10} or D_{4h}^{18}	8.03, ... , 10.75	
BeSe . .	cub., ZnS	T_d^2	5.07	
$BeSiO_3.AlO_2H$	monocl.	C_{2h}^2	4.63, 14.30, 4.71, $\beta = 100° 16'$	4
BeTe	cub., ZnS	T_d^2	5.54	
Be_2C . .	cub., CaF_2	O_h^5	4.33	
Be_2SiO_4 (phenacite)	rhbdr.	C_{3i}^2	7.68	6
$Be_2SiW_{12}O_{40}.31H_2O$	cub.	O_h^7	23.3	8
BiF_3	cub.		5.85	4
BiI_3	hex., AsI_3	C_3^1	7.498, ... , 20.67	6
CBr_4 (above 47°)	cub.	T_h^6	11.34	8
CBr_4	monocl.	C_{2h}^3 or C_{2h}^6	12.10, 3.41, 10.20, $\beta = 125° 3'$	8
CI_4 .	cub.	T_h^6	11.62	8
CO (temp. liq. H_2)	cub., $\alpha - N_2$	T^4	5.63	4
COS (temp. liq. air)	hex. (trig.)	C_3^4 or C_{3v}^6	4.08	1
CO_2 (−190° C)	cub.	T_h^6	5.575	4
CS_2 (−185° C)	tetr.		8.12, ... , 3.77	
CaB_2O_4	rhomb.	V_h^{14}	6.19, 11.60, 4.28	4
CaB_6	cub.		4.145	1
$CaCN_2$	hex., $CsCl_2I$	D_{3d}^5	5.11, $\alpha = 43° 50'$	1
$CaCO_3$ (aragonite)	rhomb., KNO_3	V_h^{16}	4.94, 7.94, 5.72	4
$CaCO_3$ (calcite)	rhbdr., $NaNO_3$	D_{3d}^6	6.361, $\alpha = 46° 6'$	2
$CaCO_3$ (vaterite)	hex.	.	4.120, . . , 8.556	2
CaC_2 .	tetr.	O_{4h}^{17}	3.87, . . , 6.37	2
$CaC_2O_4.3H_2O$	. . . .		12.375, , 7.377	8
$CaCl_2$ . . .	rhomb.	V_h^{12}	6.24, 6.43, 4.20	2
$CaCrO_4$ . .	tetr.	D_{4h}^{19}	7.25, . . , 6.34	
$CaCrO_4.H_2O$ . .	rhomb.	V_h^{15}	7.99, 12.77, 8.11	8
$CaCrO_4.2H_2O$	rhomb.	V_h^{11}	16.02, 11.39, 5.60	8

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
CaF_2 (fluorite)	cub.	O_h^5	5.451	4
CaI_2 ...	hex.	.	4.48, ..., 6.96	
$CaIn_2O_4$. . .	tetr., Mn_3O_4	D_{4h}^{19}	6.201, ..., 9.822	4
Ca (Mg, Fe) $(CO_3)_2$.	hex.	C_{3i}^2	6.02, $\alpha = 47° 7'$	1
$CaMoO_4$	tetr., $CaWO_4$	C_{4h}^6	5.23, . . . , 11.44	4
$Ca(NO_3)_2$	cub., $Ba(NO_3)_2$	T_h^6	7.60	4
CaO . .	cub., NaCl	O_h^5	4.797	4
$3CaO.Al_2O_3$	cub., b.c.	O_h^1	7.624	3
$5CaO.3Al_2O_3$	cub.	T_d^6	11.95	
$Ca(OH)_2$	hex., CdI_2	D_{3d}^3	3.582, , 4.902	1
$CaPb_3$	cub.		4.891	
CaS	cub., NaCl	O_h^5	5.68	4
$CaSO_4$ (anhydrite)	rhomb.	V_h^{17}	6.22, 6.96, 6.97	4
$CaSO_4.2H_2O$	monocl.	C_{2h}^3	10.47, 15.15, 6.51, β = 151° 33′	4
$CaSO_4.4CO(NH_2)_2$	tricl.	.	14.74, 14.95, 6.47, α = 91° 26′, γ = 86° 50′	4
CaSe . .	cub., NaCl	O_h^5	5.91	4
$CaSiO_3BO_2H$	monocl.	C_{2h}^5	9.64, 7.62, 4.82, β = 90° 9′	4
$CaSi_2$.	hex. (rhbdr.)	D_{3d}^5	10.4, α = 21° 30′	2
$CaSnO_3$	cub. (?), $CaTiO_3$	.	3.92	
$CaSn_3$	cub.		4.732	
CaTe	cub., NaCl	O_h^5	6.345	4
$CaTl_3$ . .	cub.	.	4.794	
$CaWO_4$ (scheelite)	tetr.	C_{4h}^6	5.24, .. 11.38	4
$CaZrO_3$	cub. (?), $CaTiO_3$		3.99	
$Ca_3Al_2Si_3O_{12}$.	cub., b.c.	O_h^{10}	11.840	8
$Ca_3Cr_2Si_3O_{12}$	cub., b.c.	O_h^{10}	11.950	8
$Ca_3Fe_2Si_3O_{12}$	cub., b.c.	O_h^{10}	12.026	8
CbC.	cub., NaCl	O_h^5	4.40	4
CbN	cub., NaCl	O_h^5	4.41	4
CbO_2 . . .	tetr., SnO_2	D_{4h}^{14}	4.77, ., 2.96	2
$CdBr_2$ ..	hex., $CdCl_2$	D_{3d}^5	6.63, α = 34° 42′	1
$CdCO_3$.	hex., $NaNO_3$	D_{3d}^6	6.112, α = 47° 24′	2
$CdCl_2$	hex. (rhbdr.)	D_{3d}^5	6.35, α = 36° 40′	1
$CdCr_2O_4$	cub., $MgAl_2O_4$	... . .	8.59	

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
CdF_2	cub., CaF_2	O_h^5	5.40	4
$CdFe_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.73	8
CdI_2	hex.	D_{3d}^3	4.24, ..., 6.84	4
$CdIn_2O_4$	tetr., Mn_3O_4	D_{4h}^{19}	6.117, .., 9.875	4
$Cd(NH_3)_4(ReO_4)_2$	cub.	T_d^2	10.53	4
CdO	cub., NaCl	O_h^5	4.689	4
$CdO.Fe_2O_3$	cub.	...	8.67	8
$Cd(OH)_2$	hex., CdI_2	D_{3d}^3	3.47, , 4.64	1
Cd(OH)Cl	hex.	C_{6v}^4	3.66, , 10.27	2
CdS (α)	hex., ZnO	C_{6v}^4	4.14, , 6.72	2
CdS (β)	cub., ZnS	T_d^2	5.82	4
$3CdSO_4.8H_2O$	monocl.	C_{2h}^6	9.44, 11.87, 16.49, β = 117° 16′	4
CdSb	rhomb.	V_h, V or C_{2v}	8.492, 8.320, 6.390	8
CdSe	hex., ZnO	C_{6v}^4	4.30, , 7.02	2
CdTe	cub., ZnS	T_d^2	6.41	
$CdTiO_3$	cub. (?)		3.75	
Cd_3As_2	cub., Zn_3As_2		6.29	2
Cd_3P_2	cub., Zn_3As_2		6.06	2
CeC_2	tetr., CaC_2	D_{4h}^{17}	3.87, , 6.48	2
CeF_3	hex.	D_6^6	7.114, ., 7.273	6
CeN	cub., f.c.		5.01	
CeO_2	cub., CaF_2	O_h^5	5.41	4
CeP	cub., f.c..	..	5.89	
$CePb_3$	cub.	..	4.864	
$CeSn_3$	cub.	..	4.711	
Ce_2O_3	hex., La_2O_3	D_{3d}^3	3.880, , 6.057	1
$Ce_2(WO_4)_3$	tetr.		5.336, .. , 11.620	
$CoAl_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.059	8
CoAs	rhomb.		5.96, 5.15, 3.51	
CoAsS	cub.	T^4	5.60	4
$CoBr_2$	hex., CdI_2	D_{3d}^3	3.685, , 6.120	1
$CoCO_3$	hex. (rhbdr.), $NaNO_3$	D_{3d}^6	5.67, α = 48° 14′ (5.91, α = 103° 22′)	2 (4)
$CoCl_2$	rhbdr.	C_{3v}^5 (?)	6.16, α = 33° 26′	1
$CoCr_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.319	8
CoF_2	tetr., SnO_2	D_{4h}^{14}	4.69, ..., 3.19	2
$CoFe_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.35	8
CoI_2	hex., CdI_2	D_{3d}^3	3.96, . , 6.65	1

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$[Co.4NH_3.2H_2O]Co(CN)_6$	hex., $NiSnCl_6.6H_2O$	C^2_{3i}	7.02, α = 95° 51′	1
$[Co.5NH_3.H_2O]ClO_3.SO_4$	cub., $(NH_4)_2PtCl_6$		10.73	
$[Co.5NH_3.H_2O](ClO_4)_3$	cub., $(NH_4)_3FeF_6$		11.32	
$[Co.5NH_3.H_2O]ClO_4.SO_4$	cub., $(NH_4)_2PtCl_6$		10.89	
$[Co.5NH_3.H_2O]Co(CN)_6$	hex., $NiSnCl_6.6H_2O$	C^2_{3i}	7.18, α = 96° 49′	1
$[Co.5NH_3.H_2O]Fe(CN)_6$	hex., $NiSnCl_6.6H_2O$	C^2_{3i}	7.18, α = 96° 53′	1
$[Co.5NH_3.H_2O]I_3$	cub., $(NH_4)_3FeF_6$		10 81	
$[Co.5NH_3.H_2O]SO_4Br$	cub., $(NH_4)_2PtCl_6$		10.45	
$[Co.5NH_3.H_2O]SO_4I$	cub., $(NH_4)_2PtCl_6$		10.62	
$[Co.5NH_3.H_2O]SeO_4Br$	cub., $(NH_4)_2PtCl_6$		10.63	
$[Co.6NH_3]ClO_3.SO_4$	cub., $(NH_4)_2PtCl_6$		10.80	
$[Co.6NH_3](ClO_4)_3$	cub., $(NH_4)_3FeF_6$		11.39	
$[Co.6NH_3]ClO_4.SO_4$	cub., $(NH_4)_2PtCl_6$		10.95	
$[Co.6NH_3]Co(CN)_6$	hex., $NiSnCl_6.6H_2O$	C^2_{3i}	7.24, α = 97° 28′	1
$[Co.6NH_3]Cr(CN)_6$	hex., $NiSnCl_6.6H_2O$	C^2_{3i}	7.40, α = 97° 48′	1
$[Co.6NH_3]I_3$	cub., $(NH_4)_3FeF_6$		10.88	
$[Co.6NH_3]SO_4Br$	cub., $(NH_4)_2PtCl_6$		10.51	
$[Co.6NH_3]SO_4I$	cub., $(NH_4)_2PtCl_6$		10.71	
$[Co.6NH_3]SeO_4I$	cub., $(NH_4)_2PtCl_6$		10.79	
CoO	cub., NaCl	O^5_h	4.24	4
$Co(OH)_2$	hex., CdI_2	D^3_{3d}	3.19, , 4.66	1
CoP	rhomb.		5.588, 5.066, 3.274	
CoS	hex., NiAs	C^4_{6v} or D^4_{6h}	3.37, , 5.14	2
$CoSO_3.6H_2O$	hemi. trig.	C^4_3	8.822, , 9.040, α = 96° 22′	
$CoSO_4$	rhomb.		4.65, 6.66, 8.46	
$CoSO_4.7H_2O$	monocl., $FeSO_4.7H_2O$	C^6_{2h}	15.45, 13.08, 20.04, β = 104° 40′	16
CoS_2	cub., FeS_2	T^6_h	5.64	4
CoSb	hex., NiAs	C^4_{6v}	3.866, , 5.188	2
CoSe	hex., NiAs	C^4_{6v} or D^4_{6h}	3.614, , 5.278	2
CoSi	cub.	T^4	4.438	
$CoSiF_6.6H_2O$	hex., $NiSnCl_6.6H_2O$	C^2_{3i}	6.26, α = 96° 1′	1
CoTe	hex., NiAs	C^4_{6v} or D^4_{6h}	3.886, , 5.360	2
Co_2Al_5	hex.	D^4_{6h}	7.656, , 7.593	4
$Co_2O_3.2Fe_2O_3$	cub.		8.35	
Co_2Si	rhomb.	V^{16}_h	7.095, 4.908, 3.730	4
Co_2SnO_4	cub., $MgAl_2O_4$	O^7_h	8.60	8
Co_3O_4	cub., $MgAl_2O_4$	O^7_h	8.110	8
Co_3S_4	cub., $MgAl_2O_4$	O^7_h	9.36	8

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$Cr(CO)_6$	rhomb.	C_{2v}^9	11.72, 6.27, 10.89	4
$CrCl_3$	hex. (rhbdr.)	D_3^3 or D_3^5	6.02, , 17.3	6
$CrCl_3.6H_2O$	hex. (rhbdr.)	D_{3d}^6	7.98	2
$CrH(SiW_{12}O_{40}).24H_2O$	.	.	15.98, $\alpha = 58° 32'$	
$CrH(SiW_{12}O_{40}).28H_2O$	hex. (rhbdr.)	D_{3d}^5	16.47, $\alpha = 56° 14'$	2
CrN	cub., NaCl	O_h^5	4.140	4
$[Cr.5NH_3.H_2O](ClO_4)_3$	cub., $(NH_4)_3FeF_6$	.	11.47	
$[Cr.5NH_3.H_2O]SO_4Br$	cub., $(NH_4)_2PtCl_6$		10.535	
$[Cr.6NH_3](ClO_4)_3$	cub., $(NH_4)_3FeF_6$		11.545	
CrS	hex., NiAs	C_{6v}^4 or D_{6h}^4	3.44, , 5.67	2
CrSb	hex., NiAs	C_{6v}^4 or D_{6h}^4	4.107, , 5.468	2
CrSe	hex., NiAs	C_{6v}^4 or D_{6h}^4	3.59, . , 5.80	2
CrSi	cub.	T^4	4.620	4
$CrSi_2$	hex.	D_6^4	4.422, . , 6.351	3
CrTe	hex., NiAs	C_{6v}^4 or D_{6h}^4	3.981, , 6.211	2
Cr_2O_3	hex., Fe_2O_3	D_{3d}^6	5.35, $\alpha = 54° 58'$	2
Cr_3C_2	rhomb.		2.82, 5.52, 11.46	4
Cr_3Si	cub.		4.555	2
Cr_4C	cub.		10.64	24
Cr_5Al_8	rhbdr. (pseudo-cub.)		7.7894, $\alpha = 109° 7.6'$	2
Cr_7C_3	hex.		13.98	80
$CsAl(SO_4)_2.12H_2O$	cub.	T_h^6	12.31	4
CsBr	cub., CsCl	O_h^1	4.287	1
$CsBr_2I$	rhomb.	V_h^{16}	6.57, 9.18, 10.66	4
$CsCdBr_3$	cub. (?), $CaTiO_3$		5.33	
$CsCdCl_3$	cub. (?), $CaTiO_3$		5.20	
CsCl	cub.	O_h^1	4.110	1
CsCl(>445°C)	cub., NaCl	O_h^5	7.02	
$CsClO_4$	rhomb., $BaSO_4$	V_h^{16}	9.82, 6.00, 7.79	4
$CsClO_4$ (250°C)	cub., $KClO_4$		7.96	1
$CsCl_2I$	hex.	D_{3d}^5	5.46, $\alpha = 70° 42'$	1
CsF	cub., NaCl	O_h^5	6.01	4
$CsHgBr_3$	cub. (?), $CaTiO_3$		5.77	
$CsHgCl_3$	cub. (?), $CaTiO_3$		5.44	
CsI	cub., CsCl	O_h^1	4.562	1
$CsIBr_2$	rhomb.	V_h^{16}	6.57, 9.18, 10.66	4
$CsICl_2$	rhbdr.	D_{3d}^5	. . . .	1
$CsIO_3$	cub. (?), $CaTiO_3$	. .	4.66	
CsI_3.	rhomb.	V_h^{16}	6.82, 9.94, 11.01	4

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
CsSH	cub., CsCl	O_h^1	4.29	
$Cs_2AgAuCl_6$	cub.		5.33	
$Cs_2AuAuCl_6$	cub.		5.33	
Cs_2CrO_4	rhomb.	V_h^{16}	6.226, 11.135, 8.363	4
Cs_2GeF_6	cub., $(NH_4)_2PtCl_6$	O_h^5	8.99	4
Cs_2PbCl_6	cub.	O_h^5	10.416	
Cs_2PtCl_6	cub.	O_h^5	10.192	4
Cs_2SO_4	rhomb., K_2SO_4	V_h^{16}	6.24, 10.92, 8.22	4
$Cs_2S_2O_6$	hex.		6.326, , 11.535	2
$Cs_2S_2O_6$	monocl.	C_{2h}^5	8.13, 8.33, 6.46, β = 95° 19′	2
Cs_2SeCl_6	cub.	O_h^5	10.260	
Cs_2SnCl_6	cub.	O_h^5	10.347	
Cs_2TeCl_6	cub.	O_h^5	10.445	
Cs_2TiCl_6	cub.	O_h^5	10.219	
Cs_2ZrCl_6	cub.	O_h^5	10.407	
$Cs_3As_2Cl_9$	hex.	D_3^2	7.37, , 8.91	1
Cs_3CoCl_5	tetr.	D_{4h}^{18}	9.18, , 14.47	4
$Cs_3Co(NO_2)_6$	cub.		11.15	4
$Cs_3Fe(CN)_6$	rhomb.		11.8, 10.1, 7.0	2
$Cs_3Tl_2Cl_9$	rhbdr.	D_{3d}^6	9.58, α = 83° 48′	2
$Cs_3W_2Cl_9$	hex.	C_{6h}^2	7.35, , 17.06	2
$CuAl_2$	tetr.	D_{4h}^{18}	6.052, , 4.878	4
$CuAl_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.070	8
CuBe	cub., CsCl	O_h^1	2.698	
$CuBe_2$	cub., Cu_2Mg	O_h^7	5.940	8
CuBr	cub., ZnS	T_d^2	5.681	4
$CuBr_2.2Br(NH_4).2H_2O$	tetr.	D_{4h}^{14}	7.98, , 8.41	2
CuCl	cub., ZnS	T_d^2	5.407	4
$CuCl_2.2Cl(NH_4).2H_2O$	tetr.	D_{4h}^{14}	7.63, , 7.97	2
$CuCo_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.039	8
$CuCo_2S_4$	cub., $MgAl_2O_4$	O_h^7	9.458	8
$CuFe_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.445	8
CuH	hex., ZnO	C_{6v}^4	2.893, , 4.614	2
CuI	cub., ZnS	T_d^2	6.047	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$CuMg_2$	hex.	.	5.281, . . ., 18.29	8
CuO	monocl.	. .	4.66, 3.40, 5.09, $\alpha =$ 99° 30′	
CuPd .	cub., CsCl	O_h^1	2.988	1
CuPt .	hex.	. . .	3.779, $\alpha =$ 90° 54′	1
CuS	hex.	D_{6h}^4	3.802, ..., 16.43	6
$CuSO_4$	rhomb.		4.88, 6.66, 8.32	
$CuSO_4.5H_2O$	tricl.		6.07, 10.78, 5.89, $\alpha =$ 82° 5′, $\beta =$ 107° 8′, $\gamma =$ 102° 41′	2
CuSn . .	hex., NiAs	C_{6v}^4 or D_{6h}^4	4.190, . ., 5.086	2
CuZn .	cub., CsCl	O_h^1	2.945	1
$Cu_{1.8}S$	cub., f.c.	.	5.564	4
Cu_2HgI_4	tetr.	.	6.08, , 6.135	
Cu_2HgI_4 (α) (>70°C)	cub.	T^2	6.103	1
Cu_2HgI_4 (β)			6.041, . 6.115	
Cu_2Mg.	cub.	O_h^7	7.029	8
Cu_2MnSn	cub., $AlCu_3$		6.167	4
Cu_2O (cuprite) .	cub.	O_h^4	4.26	2
Cu_2S	cub., CaF_2	O_h^5	5.59	4
Cu_2Sb	tetr.		3.99, . 6.17	2
Cu_2Se (α).	cub., f.c.	O_h^5	5.840	4
Cu_2Zn_3	cub.		4.01	
Cu_3Pd	cub., $AuCu_3$		3.69	4
Cu_3Pt	cub., $AuCu_3$		3.71	1
Cu_3Sb	. . .		2.78, . . 4.37	
Cu_3Sn	hex.		2.75, . . . 4.32	
Cu_5Zn_8	cub.	T_d^3	8.85	52
Cu_9Al_4	cub.	T_d^1	8.70	52
Cu_9Ga_4 (δ)	cub.		8.711	
$Cu_{31}Sn_8$	cub.		8.955	
Dy_2O_3	cub., Tl_2O_3	T_h^7	10.63	16
Er_2O_3	cub., Tl_2O_3	T_h^7	10.54	16
Eu_2O_3	cub., Tl_2O_3	T_h^7	10.84	16
$FeAl_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.12	8
$FeAl_3$	rhomb.	V_h^{23}	47.43, 15.46, 8.08	
FeAs (η)	rhomb.		3.366, 6.016, 5.428	4
$FeAs_2$	rhomb.	V_h^{12} or V_h^{13}	6.35, 4.86, 5.80	
FeB	rhomb.	V_h^{16}	5.495, 4.053, 2.946	4
$FeBe_2$	hex., $MgZn_2$	D_{6h}^4	4.212, . . , 6.834	4
$FeBe_5$	cub., Cu_2Mg	O_h^7	5.878	4
$FeBr_2$.	hex., CdI_2	D_{3d}^3	3.740, . 6.171	1
$[Fe(CN)_2]_3$	cub.	. . . . . .	15.9	16

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$FeCO_3$	hex., $NaNO_3$	D_{3d}^6	5.82, α = 47° 45′	2
$Fe(CO)_4$	monocl.	C_{2h}^6	13.00, 11.41, β = 85° 35′	
$FeCl_2$	hex, $CdCl_2$	D_{3d}^5	6.20, α = 33° 33′	1
$FeCl_3$	hex.	C_{3i}^2	5.92, , 17.26	6
(Fe, Co)S	hex.	C_{6v}^4	3.36, , 5.29	2
FeF_2	tetr., SnO_2	D_{4h}^{14}	4.670, , 3.297	2
$FeHSiW_{12}O_{40}.20H_2O$	tricl.	C_1	19.11, 22.50, 23.92, α = 87° 55′, β = 105° 57′, γ = 92° 25′	8
$FeHSiW_{12}O_{40}.28H_2O$	rhbdr.	D_{3d}^5	16.46, α = 56° 30′	2
$FeHSiW_{12}O_{40}.30H_2O$	cub.	O_h^7	23.10	8
FeI_2	hex., CdI_2	D_{3d}^3	4.04, , 6.75	1
FeO	cub., NaCl	O_h^5	4.294	4
FeOCl	rhomb.	V_h^{13}	3.75, 7.95, 3 4	2
$Fe(OH)_2$	hex., CdI_2	D_{3d}^3	3.24, , 4 47	1
FeP	rhomb.		5.782, 5.177, 3.089	
FeS	hex.	C_{6v}^4	3.43, , 5.79	2
$FeSO_4$	rhomb.		4.82, 6.84, 8.67	
$FeSO_4.7H_2O$	monocl.	C_{2h}^6	15.34, 12 98, 20.02, β = 104° 15′	16
$FeSO_4.(NH_4)_2SO_4.6H_2O$	monocl.	C_{2h}^5	9.28, 12.58, 6.22, β = 106° 50′	
FeS + S_x	hex.	C_{6v}^4	3.43, , 5.68	2
Fe (S, Se)	hex.	C_{6v}^4	3.54, , 5.91	2
FeS_2 (marcasite)	rhomb., $FeAs_2$	V_h^{12}	3.35, 4.40, 5.35	2
FeS_2 (pyrite)	cub.	T_h^6	5.404	4
FeSb	hex., NiAs	C_{6v}^4 or D_{6h}^4	4.06, , 5.13	2
$FeSb_2$ (ζ)	rhomb.	V_h^{12} or V_h^{13}	3.189, 5.819, 6.520	
FeSe	hex., NiAs	C_{6v}^4	3.61, , 5.87	2
FeSe + Se_x	hex.	C_{6v}^4	3.51, , 5.55	
FeSi	cub.	T^4	4.467	4
$FeSiF_6.6H_2O$	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.42, α = 96° 59′	1
$FeSi_2$	tetr.		2.69, , 5.08	1
$FeTa_2O_6$ (tapiolite)	tetr.	D_{4h}^{14}	4.74, , 9.21	2
FeTe	hex., NiAs	C_{6v}^4 or D_{6h}^4	3.800, , 5.651	2
Fe_2As (ϵ)	tetr.		3.627, , 5.973	2
Fe_2B	tetr.	V_d^{11}	5.078, , 4.233	4

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$Fe_2(CO)_9$	hex.	C_{6v}^4 or D_{6h}^4	6.45, . . . ,15.8	2
Fe_2O_3 (hematite) . .	hex.	D_{3d}^6	5.42, α = 55° 17′	2
Fe_2O_3 (magnetic).	cub.		8.30	
$Fe_2O_3.H_2O$. . . .	rhomb., $Al_2O_3.H_2O$		4.55, 9.90, 3.01	2
Fe_2P (ζ)	hex.	D_3^2	5.852, , 3.453	3
Fe_2W.	hex.	. . . .	4.727, , 7.704	4
$Fe_3Al_2Si_3O_{12}$	cub., b.c.	O_h^{10}	11.497	8
Fe_3C	rhomb.	V_h^{16}	4.518, 5.069, 6.736	4
Fe_3Mo_2	hex.	. .	4.743, . . ., 25.63	8
Fe_3N (ϵ')	hex.	D_6^6	2.695, . . , 4.362	
Fe_3O_4	cub., $MgAl_2O_4$	O_h^7	8.37	8
Fe_3P (ϵ)	tetr.	S_4^2	9.09, , 4.446	8
Fe_3W_2.	hex.	. . . . . .	4.731, , 25.76	8
Fe_3Zn_{10}	cub.	O_h^9	8.93	52
Fe_4N	cub.	. . . . .	3.789	1
GaAs	cub., ZnS	T_d^2	5.635	
$(Ga, In)_2O_3$	cub.	O_h^{10}	9.76	16
GaP	cub., ZnS	T_d^2	5.436	
GaSb	cub., ZnS	T_d^2	6.118	
Ga_2O_3	hex., Fe_2O_3	D_{3d}^6	5.281, α = 55° 35′	2
$GdPMo_{12}O_{40}.30H_2O$	cub.	O_h^7	23.1	8
Gd_2O_3	cub., Tl_2O_3	T_h^7	10.79	16
GeI_4	cub., SnI_4	T_h^6	11.89	8
GeO_2	hex., α SiO_2	D_3^4	4.98, . . . , 5.64	3
GeS	rhomb.	V_h^{16}	4.29, 10.42, 3.64	4
GeS_2	rhomb.	C_{2v}^{19}	11.66, 22.34, 6.86	24
HCl (−168°C)	cub.		5.50	4
HI	cub., HCl		6.18	4
HIO_3	rhomb.	$V^1 - V^4$	5.53, 5.92, 7.75	4
H_2O (ice)*	hex.	D_{6h}^4	4.535, . . . , 7.41	4
H_2O_2	tetr.	. . . .	4.02, . , 8.02	4
H_2S (α, β & γ)	cub., f.c.	O_h^5	5.77	4
H_2Se (−170°C)	cub.	O_h^5	6.020	4
H_3BO_3	tricl.	. .	7.04, 7.04, 6.56, α = 92° 30′, β = 101° 10′, γ = 120°	4
$H_3PMo_{12}O_{40}.30H_2O$	cub.	O_h^7	23.1	8

* See also *ice* under minerals.

Substance	System, struct. type	Space group	Lattice constants *a*, *b*, *c*, Ax. ang.	Mol.
$H_3PW_{12}O_{40}.5H_2O$	cub.	O_h^4	12.14	2
$H_3PW_{12}O_{40}.29H_2O$	cub.	..	23.28	8
$H_4N_4S_4$	rhomb.	V_h^1	12.08, 6.76, 7.86	4
HfF_4	monocl.	C_{2h}^6	9.45, 9.84, 7.62, β = 94° 29′	12
HfO_2	cub., CaF_2	O_h^5	5.115	4
HfP_2O_7	cub.	T_h^6	8.18	4
$HgBr_2$	rhomb.	C_{2v}^{12}	4.67, 6.85, 12.45	4
$Hg(CN)_2$	tetr.	V_d^{12}	9.67, , 8.92	8
$HgCl_2$	rhomb.	V_h^{16}	5.963, 12.735, 4.325	4
HgI_2	rhomb.	C_{2v}^{12}	4.676, 7.32, 13.76	4
HgO	rhomb.		3.296, 3.513, 5.504	4
HgS (cinnabar)	hex.	D_3^4 or D_3^6	4.14, , 9.49	3
HgS (metacinnabarite)	cub., ZnS	T_d^2	5.84	4
HgSe	cub., ZnS	T_d^2	6.07	
HgTe	cub., ZnS	T_d^2	6.36	
Hg_2Br_2	tetr., Hg_2Cl_2	D_{4h}^{17}	4.65, , 11.10	2
Hg_2Cl_2	tetr.	D_{4h}^{17}	4.47, , 10.89	2
Hg_2I_2	tetr., Hg_2Cl_2	D_{4h}^{17}	4.92, , 11.61	2
Ho_2O_3	cub., Tl_2O_3	T_h^7	10.58	16
InSb	cub., ZnS	T_d^2	6.45	
In_2O_3	cub., Tl_2O_3	T_h^7	10.12	16
IrO_2	tetr., SnO_2	D_{4h}^{14}	4.49, , 3.14	
$KAl(SO_4)_2$	hex.	D_3^2	4.706, , 7.960	1
$KAl(SO_4)_2.12H_2O$	cub.	T_h^6	12.11	4
$KAlSi_3O_8$	monocl.	C_{2h}^3	8.57, 13.01, 7.23, β = 116° 7′	4
KBr	cub., NaCl	O_h^5	6.578	4
$KBrO_3$	hex.	C_{3v}^5	4.403, α = 86° 0′	1
KCN	cub., NaCl	O_h^5	6.55	4
KCNO	tetr., KN_3	D_{4h}^{18}	6.070, , 7.030	4
KCNS	rhomb.	V_h^{11}	6.67, 6.65, 7.54	4
$KCbO_3$	cub. (?), $CaTiO_3$		4.01	
KCl	cub., NaCl	O_h^5	6.28	4
$KCl.MgCl_2.6H_2O$	rhomb.	V_h^6	9.53, 16.08, 22.25	12

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$KClO_3$	monocl.	C_{2h}^2	4.647, 5.585, 7.085, β = 109° 38′	2
$KClO_4$	rhomb., $BaSO_4$	V_h^{16}	8.834, 5.650, 7.240	
$KClO_4$ (340°C)	cub.	T_d^2 or T^2	7.47	
$KCr(SO_4)_2$	hex., $KAl(SO_4)_2$	D_3^2	4.737, , 8.030	1
$KCr(SO_4)_2.12H_2O$	cub.	T_h^6	12.14	4
KF	cub., NaCl	O_h^5	5.33	4
KHC_2	tetr., CaC_2		4.28, , 8.42	4
KHF_2	tetr., KN_3	D_{4h}^{18}	5.67, . , 6.81	4
KH_2PO_4	tetr.	V_h^{12}	7.43, . . , 6.97	4
KI	cub., NaCl	O_h^5	7.052	4
KIO_3	cub. (?), $CaTiO_3$	. .	4.46	
KIO_4	tetr., $CaWO_4$	C_{4h}^6	8.13, , 12.63	4
KI_3	monocl.	. .	9.36, $b = c = a$ approx., β = 90° ±	4
$KLiSO_4$	hex.	C_6^6	5.13, . , 8.60	2
$KMgF_3$	cub. (?), $CaTiO_3$	.	4.00	
$KMnO_4$	rhomb., $BaSO_4$	V_h^{16}	9.10, 5.69, 7.40	4
KNO_2	monocl., f.c.	C_s^3	4.45, 4.99, 7.31, β = 114° 50′	2
KNO_3	rhomb.	V_h^{16}	5.43, 9.17, 6.45	4
KN_3	tetr.	D_{4h}^{18}	6.094, , 7.056	4
$KNiF_3$	cub. (?), $CaTiO_3$	.	4.008	
$KOsNO_3$	tetr.	C_{4h}^6		4
$(KPbCl_3)_3.H_2O$	monocl.	C_i^1	14.35, 9.05, 14.50, β= 113°	4
KPb_2Br_5	tetr.	D_{4h}^{18}	8.14, , 14.1	4
$KReO_4$	tetr., $CaWO_4$	C_{4h}^6	5.615, , 12.50	4
KSH	rhbdr.	D_{3d}^5	4.37, α = 68° 51′	
$KZnF_3$	cub. (?), $CaTiO_3$		4.050	
$K_2Ba[Co(NO_2)_6]$	cub.		10.45	4
$K_2Ba[Ni(NO_2)_6]$	cub.		10.67	4
$K_2Ca[Co(NO_2)_6]$	cub.		10.17	4
$K_2Ca[Ni(NO_2)_6]$	cub.		10.29	4
$K_2Cd(CN)_4$	cub., $MgAl_2O_4$	O_h^7	12.84	8
K_2CrO_4	rhomb., K_2SO_4	V_h^{16}	5.92, 10.40, 7.61	4
$K_2Cr_2O_7$ (α)	tricl.	. . . .	7.50, 7.38, 13.40, α = 82° 0′, β = 96° 13′, γ = 90° 51′	4
$K_2Cr_2O_7$ (β)	monocl.	. . . .	7.47, 7.35, 12.97, β = 91° 55′	4
$K_2CuCl_4.2H_2O$.	tetr., $(NH_4)_2CuCl_4.2H_2O$	O_{4h}^{14}	7.45, . , 7.88	2

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants: a, b, c, Ax. ang.	Mol.
$K_2Hg(CN)_4$	cub., $MgAl_2O_4$	O_h^7	12.76	8
K_2OsBr_6	cub.		10.30	
K_2OsCl_6	cub.		9.729	
$K_2OsO_2Cl_4$	tetr., f.c.	D_{4h}^{17}	9.90, , 8.75	2
$K_2PbCo(NO_2)_6$	cub.		10.49	4
$K_2PbCu(NO_2)_6$	cub.		10.52	4
$K_2PbNi(NO_2)_6$	cub.		10.55	4
K_2PdCl_4	tetr., K_2PtCl_4	D_{4h}^1	7.04, , 4.10	1
K_2PtBr_6	cub., $(NH_4)_2PtCl_6$	O_h^5	10.35	4
K_2PtCl_4	tetr.	D_{4h}^1	6.99, , 4.13	1
K_2PtCl_6	cub., $(NH_4)_2PtCl_6$	O_h^5	9.725	
$K_2Pt(SCN)_6$	hex.	D_{3d}^1	6.77, , 10.45	1
K_2ReCl_6	cub., K_2PtCl_6	O_h^5	9.861	
K_2S	cub., CaF_2	O_h^5	7.35	
K_2SO_4	rhomb.	V_h^{16}	5.731, 10.008, 7.424	4
$K_2S_2O_5$	monocl.	C_{2h}^2	6.95, 6.19, 7.55	
$K_2S_2O_6$	hex.	D_3^2	9.756, , 6.274	3
$K_2S_2O_8$	tricl.	C_i^1	5.10, 6.83, 5.40, α = 106° 54′, β = 90° 10′, γ = 102° 35′	
$K_2S_3O_6$	rhomb.	V_h^{16}	9.77, 13.63, 5.76	4
K_2SeBr_6	cub.		10.363	
K_2SeO_4	rhomb.	V_h^{16}	6.02, 10.40, 7.60	4
K_2SnCl_6	cub., $(NH_4)_2PtCl_6$	O_h^5	9.983	4
$K_2Sn(OH)_6$	hex. (rhbdr.)	D_{3d}^5	5.67, α = 70° 1′	1
$K_2Sr[Co(NO_2)_6]$	cub.		10.23	4
$K_2Sr[Ni(NO_2)_6]$	cub.		10.49	4
K_2TeCl_6	monocl.	C_{2h}^5	7.17, 7.17, 10.14, β = 90° approx.	
$K_2Zn(CN)_4$	cub., $MgAl_2O_4$	O_h^7	12.54	8
$K_3Co(NO_2)_6$	cub.		10.44	4
$K_3Co(NO_2)_6.1\frac{1}{2}H_2O$	cub.		10.32	
$K_3Cr(CN)_6$	rhomb.	V_h^{14}	13.55, 10.60, 8.60	4
$K_3Fe(CN)_6$	monocl.	C_{2h}^5	13.42, 10.40, 8.38	4
$K_3Ir(CN)_6$	rhomb.	V_h^{14}	13.70, 10.53, 8.34	4
$K_3Mn(CN)_6$	rhomb.	V_h^{14}	13.58, 10.60, 8.50	4
$K_3Na(SO_4)_2$	hex.	D_{3d}^3	5.65, , 7.29	1
$K_3TlCl_6.2H_2O$	tetr.	D_{4h}^{17}	15.841, , 18.005	14
$K_3W_2Cl_9$	hex.	C_{6h}^2	7.16, , 16.17	2

Substance	System, struct. type	Space group	Lattice constants: a, b, c, Ax. ang.	Mol.
$K_3Co(NO_2)_6$	cub.		10.32	
$K_3Ni(NO_2)_6$	cub.		10.49	
$LaAlO_3$	cub. (?), $CaTiO_3$		3.78	
$LaAl_4$			13.2 (?), , 10.2 (?)	16
LaC_2	tetr., CaC_2	D_{4h}^{17}	3.92, , 6.55	2
LaF_3	hex., CeF_3	D_6^6	7.163, , 7.329	6
$LaGaO_3$	cub. (?), $CaTiO_3$		3.89	
LaN	cub., f.c.		5.275	
LaP	cub., f.c.		6.013	
La_2O_3	hex.	D_{3d}^3	3.945, , 6.151	1
LiAl	cub., b.c.		6.360	
$LiAl_5O_8$	cub.	O_h^7	7.903	
LiBr	cub., NaCl	O_h^5	5.49	4
$LiCbO_3$	hex., $MgTiO_3$	C_{3i}^2	5.47, α = 55° 43′	2
LiCd	cub.		3.32	
$LiCd_3$	cub.		8.62	8
LiCl	cub., NaCl	O_h^5	5.14	4
$LiCl.H_2O$	tetr.		3.81, , 3.88	1
$LiClO_4.3H_2O$	hex.	C_{6v}^4	7.71, , 5.42	2
LiF	cub., NaCl	O_h^5	4.01	4
LiH	cub., NaCl	O_h^5	4.085	4
LiD	....		4.065	
$LiHg_3$	hex.		6.240, , 4.794	2
LiI	cub., NaCl	O_h^5	6.00	4
$LiI.3H_2O$	hex.	C_{6v}^4	7.45, 5.45	2
$LiIO_3$	hex.	D_6^6	5.469, , 5.155	2
$LiKSO_4$	hex.	C_6^6	5.13, , 8.00	2
Li_3N	hex.		3.658, , 3.882	3
$LiNO_3$	hex., $NaNO_3$	D_{3d}^6	5.74, α = 48° 3′	2
$LiNaCO_3$	hex.	D_{3h}^1 or D_{3h}^3	8.22, , 3.27	3
LiOH	tetr.	D_{4h}^7	3.549, , 4.334	
$Li_2SO_4.H_2O$	monocl.	C_2^2	5.43, 4.83, 8.14, β = 107° 35′	2
LiZn (β')	hex.		2.782, , 4.385	
LiZn (γ')	hex., pseudo		4.362, , 2.510	
Li_2BeF_4	hex.		8.15, α = 107° 40′	
Li_2MoO_4	hex., Be_2SiO_4		8.77, α = 108° 10′	
Li_2O	cub., CaF_2	O_h^5	4.61	4
Li_2S	cub., CaF_2	O_h^5	5.70	4
Li_2SO_4	monocl.	C_{2h}^5	8.25, 4.95, 8.44, β = 107° 54′	4
Li_2Se	cub., CaF_2	O_h^5	5.94	

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Li_2Te	cub., CaF_2	O_h^5	6.47	
Li_2WO_4	hex., Be_2SiO_4	C_{3i}^2	8.77, α = 108° 10′	
Li_3Hg	cub., $AlCu_3$		6.584	
Li_3N	cub.		5.50	
Lu_2O_3	cub., Tl_2O_3	O_h^{10}	10.37	16
$MgAl_2O_4$	cub.	O_h^7	8.090	8
MgAu	cub., CsCl	O_h^1	3.259	1
$MgBr_2$	hex., CdI_2	D_{3d}^3	3.815, . . , 6.256	1
$MgBr_2.6H_2O$	monocl.	C_{2h}^3	10.25, 7.40, 6.30, β = 93° 30′	2
$MgCO_3$	hex., $NaNO_3$	D_{3d}^6	5.61, α = 48° 12′	2
$MgCl_2$	hex., $CdCl_2$	D_{3d}^5	6.22, α = 33° 36′	1
$MgCl_2.6H_2O$	monocl.	C_{2h}^3	9.90, 7.15, 6.10, β = 94°	2
$MgCo_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.107	8
$MgCrO_4.7H_2O$	rhomb., $MgSO_4.7H_2O$	V^4	11.89, 12.01, 6.89	4
$MgCr_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.290	8
MgF_2	tetr., SnO_2	D_{4h}^{14}	4.66, , 3.08	2
$MgFe_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.342	8
MgHg	cub., CsCl	O_h^1	3.442	1
MgI_2	hex.		4.14, , 6.88	
MgO	cub., NaCl	O_h^5	4.203	4
$MgO.Fe_2O_3$	cub.		8.36	8
$Mg(OH)_2$	hex., CdI_2	D_{3d}^3	3.11, , 4.74	1
MgPr	cub.		3.88	1
$MgPt(CN)_4.7H_2O$	tetr.	D_{4h}^{17}	14.6, , 6.26	2
MgS	cub., NaCl	O_h^5	5.190	4
$MgSO_3.6H_2O$	hemi. trig.	C_3^4	8.820, . . , 9.052, α = 96° 20′	
$MgSO_4$	rhomb.		4.82, 6.72, 8.33	
$MgSO_4.7H_2O$	rhomb.	V^4	11.91, 12.02, 6.87	4
$MgSO_4.(NH_4)_2SO_4.6H_2O$	monocl.	C_{2h}^5	9.28, 12.57, 6.20, β = 107° 6′	2
$Mg(SbO_3)_2.12H_2O$	hex.	D_{3d}^1	16.079, . . . , 9.84	2
MgSe	cub., NaCl	O_h^5	5.451	4
$MgSiF_6.6H_2O$	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.43, α = 96° 3′	1
$MgSnF_6.6H_2O$	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.56, α = 96° 20′	1
MgTe	hex., ZnO	C_{6v}^4	4.52, . . . , 7.33	2
$MgTiF_6.6H_2O$	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.52, α = 96° 57′	1

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$MgTiO_3$	hex.	C_{3i}^2	5.40, $\alpha = 55° 1'$	2
$MgWO_4$	monocl.	..	4.67, 5.66, 4.92, $\beta = 89° 35'$	2
MgZn	hex.	...	10.66, , 17.16	
$MgZn_2$	hex.	D_{6h}^4	5.17, , 8.50	2
$MgZn_5$	hex.	..	9.92, , 16.48	
$Mg_2Al_2O_4$	cub.	O_h^7	8.08	
Mg_2Pb	cub., CaF_2	O_h^5	6.75	4
Mg_2Si	cub., CaF_2	O_h^5	6.39	4
$Mg_2SiMo_{12}O_{40}.31H_2O$	cub.	O_h^7	23.04	8
Mg_2Sn	cub., CaF_2	O_h^5	6.78	4
Mg_2SnO_4	cub., $MgAl_2O_4$	O_h^7	8.58	8
Mg_2Zn_{11}	cub.	O_h	8.53	3
$Mg_3Al_2Si_3O_{12}$	cub., b.c.	O_h^{10}	11.510	8
Mg_3As_2	cub., Zn_3As_2		6.10	2
$Mg_3Cu_7Al_{10}$	cub.		8.29	
Mg_3N_2	cub., b.c.		9.93	12
Mg_3P_2	cub., Zn_3As_2		5.92	2
$MnAl_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.263	8
MnAs	rhomb.		6.38, 5.63, 3.62	
$MnBr_2$	hex., CdI_2	D_{3d}^3	3.82, , 6.19	1
$MnCO_3$	hex., $NaNO_3$	D_{3d}^6	5.84, $\alpha = 47° 45'$	2
$MnCl_2$	hex., $CdCl_2$	D_{3d}^5	6.20, $\alpha = 34° 35$	1
$(Mn, Co)(Co, Mn)_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.268	8
$MnCr_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.487	8
MnF_2	tetr., SnO_2	D_{4h}^{14}	4.865, , 3.284	2
$MnFe_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.572	8
MnI_2	hex., CdI_2	D_{3d}^3	4.16, , 6.82	1
$MnMn_2O_4$	tetr., Mn_3O_4	D_{4h}^{19}	5.75, , 9.42	4
MnO	cub., NaCl	O_h^5	4.435	4
MnO_2	tetr., SnO_2	D_{4h}^{14}	4.44, , 2.89	2
$Mn(OH)_2$	hex., CdI_2	D_{3d}^3	3.34, , 4.68	1
MnP	rhomb.		5.905, 5.249, 3.167	
MnS	cub., NaCl	O_h^5	5.21	4
$MnSO_4$	rhomb.		4.86, 6.84, 8.58	
MnS_2	cub., FeS_2	T_h^6	6.10	4
MnSb	hex., NiAs	D_{6h}^4	4.120, , 5.784	2

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax ang.	Mol.
$MnSe$	cub., NaCl	O_h^5	5.448	4
$MnSi$	cub., FeSi	T^4	4.548	
$MnSiF_6.6H_2O$	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.45, α = 96° 53′	1
$MnSi_2$	tetr.		5.513, 17.422	16
$MnTe$	hex., NiAs	D_{6h}^4	4.124, 6.698	2
$MnTe_2$	cub., FeS_2	T_h^6	6.943	4
Mn_2O_3	cub., Tl_2O_3	T_h^7	9.41	16
$Mn_2O_3.H_2O$	rhomb.		4.46, 5.28, 2.88	
Mn_2Sb	tetr.	D_{4h}^7	4.08, 5.56	
$Mn_3Al_2Si_3O_{12}$	cub., b.c.	O_h^{10}	11.603	8
Mn_3Si	hex.		6.898, 4.802	4
Mn_4N	cub.		3.860	1
$Mo(CO)_6$	rhomb.	C_{2v}^9	12.02, 6.48, 11.23	4
MoO_2	tetr., SnO_2	D_{4h}^{14}	4.86, 2.79	2
MoO_3	rhomb.	Q_h^{16}	3 92, 13.94, 3 66	4
MoS_2	hex.	D_{6h}^4	3.15, 12.30	2
$MoSi_2$	tetr.	D_{2h}^{17}	3.20, 7.86	2
NH_3 (−80°C)	cub.	T^4	5.15	4
$(NH_4)_3AlF_6$	cub., $(NH_4)_3FeF_6$	T_h^6	8.40	4
$NH_4Al(SO_4)_2$	hex., $KAl(SO_4)_2$	D_3^2	4.724, 8.225	1
$NH_4Al(SO_4)_2.12H_2O$	cub.	T_h^6	12.18	4
NH_4BF_4	rhomb.	V_h^{16}	9.06, 5.64, 7.23	4
$(NH_4)_2BeF_4$	rhomb., K_2SO_4	V_h^{16}	5.8, 10 2, 7 5	
NH_4Br	cub., CsCl	O_h^1	4.047	1
NH_4Br(250°C)	cub., NaCl	O_h^5	6.90	4
NH_4Cl	cub., CsCl	O_h^1	3.866	1
NH_4Cl(250°C)	cub., NaCl	O_h^5	6.53	4
NH_4ClO_4	rhomb.	V_h^{16}	9.202 5 816, 7 449	4
NH_4ClO_4(270°C)	cub., $KClO_4$		7.63	1
$(NH_4)_3Co(NO_2)_6$	cub.		10.81	4
$(NH_4)_2Cr_2O_7$	monocl.		7.78, 7 54, 13.27, β = 93° 42′	4
$(NH_4)_2CuCl_4.2H_2O$	tetr.	D_{4h}^{14}	7.58, 7 95	2
NH_4F	hex ZnO	C_{6v}^4	4.39, 7.02	2
$(NH_4)_3FeF_6$	cub.	O_h^6	9.10	4
$NH_4Fe(SO_4)_2$	hex., $KAl(SO_4)_2$	D_3^2	4.825, 8.310	1

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$NH_4Fe(SO_4)_2.12H_2O$	cub.	T_h^6	12.14	4
NH_4HF_2	rhomb.	V_h^7	8.33, 8.14, 3.68	4
$NH_4(H_2PO_2)$	rhomb.	V_h^{21}	3.98, 7.57, 11.47	4
$(NH_4)H_2PO_4$	tetr., KH_2PO_4	V_d^{12}	7.530, , 7.542	4
$(NH_4)_3HfF_7$	cub.	O_h^4	9.400	4
NH_4I	cub., NaCl	O_h^5	7.244	4
$NH_4I(-17°C)$	cub., CsCl	O_h^1	4.37	1
NH_4IO_4	tetr., $CaWO_4$	C_{4h}^6	5.94, . . ., 12.80	4
NH_4I_3	rhomb.	V_h^{16}	6.64, 9.66, 10.82	4
$(NH_4)_3MoO_3F_3$	cub., $(NH_4)_3FeF_6$	O_h^5	9.10	4
NH_4NO_3	rhomb.	V_h^{13}	4.928, 5.434, 5.732	2
NH_4N_3	rhomb.	D_{2h}^7	8.930, 8.642, 3.800	4
$(NH_4)_2PbCl_6$	cub., $(NH_4)_2PtCl_6$	O_h^5	10.135	4
$NH_4Pb_2Br_5$	tetr.	D_{4h}^{18}	8.39, , 14.34	4
$(NH_4)_2PdCl_4$	tetr., K_2PtCl_4	D_{4h}^1	7.21, , 4.26	1
$(NH_4)_2PtCl_6$	cub.	O_h^5	9.834	4
$(NH_4)_2Pt(SCN)_6$	hex., $K_2Pt(SCN)_6$	D_{3d}^1 or D_{3d}^3	6.77, , 10.45	1
NH_4SH	tetr.	.	6.01, , 4.01	
$(NH_4)_2SO_4$	rhomb., K_2SO_4	V_h^{16}	5.951, 10.560, 7.729	4
$(NH_4)_2S_2O_8$	monocl.	C_{2h}^5	7.83, 8.04, 6.13, β = 95° 9′	2
$(NH_4)_2SeCl_6$	cub.	O_h^5	9.935	
$(NH_4)_2SiF_6$	cub., $(NH_4)_2PtCl_6$	O_h^5	8.38	4
$(NH_4)_2SiF_6$	hex.	D_{3d}^3	5.76, , 4.77	
$(NH_4)_2SnCl_6$	cub., $(NH_4)_2PtCl_6$	O_h^5	10.038	4
$(NH_4)_2TeCl_6$	cub.	O_h^5	10.178	
$(NH_4)_3W_2Cl_9$	hex.	C_{6h}^2	7.16, , 16.17	2
$(NH_4)_3ZrF_7$	cub.	O_h^4	9.353	4
NO_2	cub.	T^5	7.77	6
$N_2H_6Cl_2$	cub., FeS_2	T_h^6	7.89	4
N_2O	cub., CO_2	T^4	5.77	4
N_4S_4	rhomb.	V_h^1	8.87, 8.47, 7.20	4
NaBr	cub., NaCl	O_h^5	5.94	4
$NaBrO_3$	cub., $NaClO_3$	T^4	6.71	4

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$NaCbO_3$	cub., $CaTiO_3$	O_h^1	3.89	1
NaCl (18°C)	cub.	O_h^5	5.62737	4
Rock salt			5.62768	
$NaClO_3$	cub.	T^4	6.570	4
$NaClO_4$ (380°C)	cub.		7.25	
$NaClO_4$	rhomb., $CaSO_4$	V_h^{17}	6.48, 7.06, 7.08	4
NaF	cub., NaCl	O_h^5	4.62	4
$NaHCO_3$	monocl.	C_{2h}^5	7.51, 9.70, 3.53, β = 93° 19′	4
$NaHC_2$	tetr., CaC_2	D_{4h}^{17}	3.82, . . , 8.17	2
$NaHF_2$	hex. (rhbdr.), $CsCl_2I$	D_{3d}^5	5.17, α = 39° 44′	1
NaI	cub., NaCl	O_h^5	6.46	4
$NaIO_3$	rhomb.	V_h^{19}	5.75, 6.37, 4.05	2
$NaIO_4$	tetr., $CaWO_4$	C_{4h}^6	5.32, . , 11.93	4
$NaIO_4.3H_2O$	hex.	C_3^4	5.58, α = 65° 1′	1
$NaNO_2$	rhomb.		3.55, 5.56, 5.37	2
$NaNO_3$	rhbdr.	D_{3d}^6	6.3108, α = 47° 15′ 59″	
NaN_3	hex. (rhbdr.), $CsCl_2I$	D_{3d}^5	5.48, α = 38° 43′	1
NaSH	rhdbr.	D_{3d}^5	3.99, α = 68° 5′	
$NaSb(AlO_3)_2$	hex.	D_{6h}^4	5.40, . . . , 8.81	2
$Na_2B_4O_7.10H_2O$	monocl.	C_{2h}^6	11.82, 10.61, 12.30, α = 106° 35′	4
$Na_2CO_3.H_2O$ (73°C)	rhomb.		10.721. 6.440, 5.243	4
$Na_2Ca(CO_3)_2$	hex.		20.3, . , 12.02	32
Na_2CaSiO_4	cub.		7.497	4
Na_2CrO_4	rhomb.	V_h^6	5.91, 9.23, 7.20	4
$Na_2Mg(CO_3)_2$	hex.	C_3^1	4.95, . . , 16.50	6
Na_2S	cub., CaF_2	O_h^5	6.53	4
Na_2SO_3	hex.		5.441, . . ., 6.133	2
Na_2SO_4	rhomb.	V_h^{24}	5.85, 12.29, 9.75	8
Na_3AlF_6	monocl.	C_{2h}^1 or C_{2h}^2	5.39, 5.59, 7.76, β = 90° 11′	2
$Na_4Ca(SiO_3)_3$	cub. (?)		7.547	
$Na_{15}Pb_4$	cub.	T_d^6	13.29	
$Na_{15}Sn_4$	rhomb.		9.79, 22.78, 5.56	2
NdAl	cub.		3.73	1
NdC_2	tetr., CaC_2	D_{4h}^{17}	3.82, , 6.23	2
NdF_3	hex., CeF_3	D_6^6	7.021, . , 7.196	6
$NdPMo_{12}O_{40}.30H_2O$	cub.	O_h^7	23.1	8

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Nd_2O_3.	hex., La_2O_3	D_{3d}^3	3.841, , 6.009	1
NiAl.....	cub., CsCl	O_h^1	2.82	1
$NiAl_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.045	8
$NiAl_3(\epsilon)$	rhomb.	C_{2h}^{16}	6.5982, 7.3515, 4.8021	4
NiAs.	hex.	D_{6h}^4	3.61, . , 5.03	2
NiAsS	cub., CoAsS	T^4	5.68	4
NiBe	cub., CsCl	O_h^1	2.603	
$NiBr_2$	hex.		3.71, , 18.30	
$NiBr_2$	rhbdr.		6.46, α = 16° 40′	
$NiBr_2.6NH_3$	cub., $(NH_4)_2PtCl_6$	O_h^5	10.48	4
$NiCl_2$.	hex., $CdCl_2$	D_{3d}^5	6.13, α = 33° 36′	1
$NiCl_2.6NH_3$	cub., $(NH_4)_2PtCl_6$	O_h^5	10.09	4
(Ni, Co) $(Co, Ni)_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.112	8
NiF_2 .	tetr., SnO_2	D_{4h}^{14}	4.710, , 3.118	2
(Ni, Fe)S (synthetic)	hex.	C_{6v}^4	3.408, , 5.434	2
$NiFe_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.340	8
NiI_2..	hex.		3.89, , 19.63	
NiI_2 .	rhbdr.		6.92, α = 16° 20′	
$NiI_2.6NH_3$.	cub., $(NH_4)_2PtCl_6$	O_h^5	11.01	4
$Ni(NH_3)_6(NO_3)_2$	cub., $(NH_4)_2PtCl_6$	T_h^6	10.96	4
NiO	cub., NaCl	O_h^5	4.172	4
$Ni(OH)_2$	hex., CdI_2	D_{3d}^3	3.07, , 4.605	1
NiS (β).	hex.	...	3.42, . 5.30	
NiS (γ).	rhbdr.	..	9.61, , 3.15	
NiS (synthetic)	hex., NiAs	D_{6h}^4	3.42, . 5.30	2
$NiSO_3.6H_2O$	hemi. trig.	C_3^4	8.773, , 9.013, α = 96° 18′	
$NiSO_4$	rhomb.	..	4.62, 6.51, 8.49	
$NiSO_4.7H_2O$	rhomb., $MgSO_4.7H_2O$	V^4	11.86, 12.08, 6.81	4
NiS_2..	cub., FeS_2	T_h^6	5.74	4
NiSb...	hex., NiAs	D_{6h}^4	3.94, , 5.14	2
$Ni(SbO_3)_2.12H_2O$	hex.	D_{3d}^1	16.019, , 9.768	2
NiSbS	cub., CoAsS	T^4	5.91	4
NiSe (β)	hex., NiAs	D_{6h}^4	3.66, , 5.33	2
NiSe (γ)	rhbdr.	...	9.84, . , 3.18	
NiSi	cub., FeSi	T^4	4.437	
$NiSiF_6.6H_2O$.	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.21, α = 96° 20′	1
NiSn	hex., NiAs	D_{6h}^4	4.081, . ., 5.174	2

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$NiSnCl_6.6H_2O$	hex. (rhbdr.)	C_{3i}^2	7.09, α = 96° 45′	1
NiTe	hex., NiAs	D_{6h}^4	3.957, , 5.354	2
$NiTiO_3$	hex., $MgTiO_3$	C_{3i}^2	5.448, α = 55° 0′	2
$Ni_2SiMo_{12}O_{40}.31H_2O$.	cub.	O_h^7	23.0	8
Ni_2SiO_4	rhomb.		4.705, 10.11, 5.914	
Ni_3C	hex.		2.646, , 4.329	
Ni_3S_2	cub. (?)	.	4.08	1
OsO_2	tetr., SnO_2	D_{4h}^{14}	4.51, . . , 3.19	2
OsS_2	cub., FeS_2	T_h^6	5.64	4
$OsSe_2$	cub., FeS_2	T_h^6	5.933	4
$OsTe_2$	cub., FeS_2	T_h^6	6.369	4
PH_4I	tetr., PbO	D_{4h}^7	6.34, , 4.62	2
$PSBr_3$.	cub.	T_h^6	11.03	8
P_2O_5 .	hex.	.	11.12, , 1.12	12
$P_3N_3Cl_6$	rhomb.	V_h^{16}		4
$P_4N_4Cl_8$	tetr.	C_{4h}^4	10.79, , 5.93	2
$PbBr_2$	rhomb.	V_h^{16}	4.71, 8.02, 9.48	4
$PbCO_3$..	rhomb., KNO_3	V_h^{16}	5.14, 8.45, 6.10	4
$PbCl_2$.	rhomb., $HgCl_2$	V_h^{16}	4.496, 7.667, 9.153	4
$PbCrO_4$.	monocl.	C_{2h}^5	6.82, 7.48, 7.16, β = 102° 33′	4
PbF_2 .			3.80, 6.41, 7.61	4
PbF_2 (β).	cub., CaF_2	O_h^5	5.93	4
PbI_2	hex., CdI_2	D_{3d}	4.54, , 6.86	1
$PbMoO_4$.	tetr., $CaWO_4$	C_{4h}^6	5.41, , 12.08	4
$Pb(NO_3)_2$.	cub., $Ba(NO_3)_2$	T_h^6	7.84	4
PbO (red)	tetr., PbO	D_{4h}^7	3.98, , 5.01	2
PbO (yellow).	rhomb.	V_h^{19}	5.50, 4.72, 5.88	4
PbO_2	tetr., SnO_2	D_{4h}^{14}	4.97, , 3.40	2
PbS	cub., NaCl	O_h^5	5.97	4
$PbSO_4$.	rhomb., $BaSO_4$	V_h^{16}	8.45, 5.38, 6.93	4
PbSe .	cub., NaCl	O_h^5	6.14	4
PbTe	cub., NaCl	O_h^5	6.34	4
$PbTiO_3$ (375°C)	rhomb.	D_{2h}^1	4.000, 4.211, 3.875	
$PbWO_4$. .	tetr., $CaWO_4$	C_{4h}^6	5.44, , 12.01	4

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Pb_2O	cub., Cu_2O	O_h^4	5.38	2
$Pb_3(PO_4)_2$	hex.	. . . .	9.66, . . . , 7.11	3
$PdAs_2$	cub., FeS_2	T_h^6	5.970	4
$Pd(NH_3)_4Cl_2.H_2O$	tetr.	D_{4h}^5(?)	10.302, , 4.34	2
PdO	tetr., PbO	D_{4h}^7	3.209, , 5.314	2
PdSb	hex., NiAs	D_{6h}^4	4.070, . , 5.582	2
$PdSb_2$	cub., FeS_2	T_h^6	6.439	4
PdTe	hex., NiAs	D_{6h}^4	4.127, . , 5.663	2
$PdTe_2$	hex., CdI_2	D_{3d}^3	4.028, , 5.118	1
PrC_2	tetr., CaC_2	D_{4h}^{17}	3.85, . , 6.38	2
PrF_3	hex., CeF_3	$D_6^{[illegible]}$	7.061, . , 7.218	6
PrN	cub., f.c	. . . . . .	5.155	
PrO_2	cub., CaF_2	O_h^5	5.36	4
PrP	cub., f.c.	.	5.86	
Pr_2O_3	hex., La_2O_3	D_{3d}^3	3.851, , 5.996	1
Pr_6O_{11}	cub.	.	10.98	
$PtAs_2$	cub., FeS_2	T_h^6	5.957	4
$PtBr_2$	cub., f.c.	. .	10.35	4
PtP_2	cub., FeS_2	T_h^6	5.683	4
PtS_2	hex., CdI_2	D_{3d}^3	3.537, . , 5.019	1
PtSb	hex., NiAs	D_{6h}^4	4.130, , 5.472	2
$PtSb_2$	cub., FeS_2	T_h^6	6.428	4
$PtSe_2$	hex., CdI_2	D_{3d}^3	3.724, . , 5.062	1
PtSn	hex., NiAs	D_{6h}^4	4.103, . , 5.428	2
$PtTe_2$	hex., CdI_2	D_{3d}^3	4.010, , 5.201	1
PtTl	hex.	. . . . . .	5.605, . , 4.639	3
RaF_2	cub	. .	6.368	4
$RbAl(SO_4)_2.12H_2O$	cub.	T_h^6	12.20	4
$RbBF_4$	rhomb.	V_h^{16}	9.07, 5.60, 7.23	4
RbBr	cub., NaCl	O_h^5	6.868	4
RbCl	cub., NaCl	O_h^5	6.571	4
RbCl(α) (temp. liq. air)	cub., CsCl	O_h^1	3.742	
$RbClO_4$	rhomb., $BaSO_4$	V_h^{16}	9.27, 5.81, 7.53	4
$RbClO_4$(320°C)	cub.	T_d^2	7.65	
RbF	cub., NaCl	O_h^5	5.63	4

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
RbI	cub., NaCl	O_h^5	7.325	4
$RbIO_3$	cub., $CaTiO_3$	O_h^1	4.52	1
$Rb(NO_3)$	rhomb.	C_{3v}^2	18.08, 10.45, 7.38	18
RbN_3	tetr., KN_3	D_{4h}^{18}	6.36, , 7.41	4
$RbPb_2Br_5$	tetr.	D_{4h}^{18}	8.41, . . , 14.5	4
RbSH	rhbdr.	D_{3d}^5	4.53, $\alpha = 69° 20'$	
$Rb_2CuCl_4.2H_2O$	tetr., $(NH_4)_2CuCl_4.2H_2O$	D_{4h}^{14}	7.81, . . , 8.00	2
Rb_2PbCl_6	cub.	O_h^5	10.195	
Rb_2PtCl_6	cub.	O_h^5	9.884	4
$Rb_2Pt(SCN)_6$	hex., $K_2Pt(SCN)_6$	D_{3d}^1 or D_{3d}^3	6.75, , 10.47	1
Rb_2SO_4	rhomb., K_2SO_4	V_h^{16}	5.949, 10.391, 7.780	4
$Rb_2S_2O_6$	hex.	D_3^2	10.144, , 6.409	3
Rb_2SeCl_6	cub.	O_h^5	9.978	
Rb_2SnCl_6	cub.	O_h^5	10.099	
Rb_2TeCl_6	cub.	O_h^5	10.233	
Rb_2TiCl_6	cub.	O_h^5	9.922	
Rb_2ZrCl_6	cub.	O_h^5	10.178	
$Rb_3Co(NO_2)_6$	cub.		10.73	4
Rb_3N	tetr.	D_{4h}^1	4.497, , 3.707	1
$Rb_3W_2Cl_9$	hex.	C_{6h}^2	7.24, , 16.95	2
$Rh(NH_3)_5Cl)Cl_2$	rhomb.	V_h^{16}	13.32, 6.71, 10.42	4
RhS_2	cub., FeS_2	T_h^6	5.574	4
Rh_2O_3	hex., Fe_2O_3	D_{3d}^6	5.47, $\alpha = 55° 40'$	2
RuO_2	tetr., SnO_2	D_{4h}^{14}	4.51, , 3.11	2
RuS_2	cub., FeS_2	T_h^6	5.57	4
$RuSe_2$	cub., FeS_2	T_h^6	5.921	4
$RuTe_2$	cub., FeS_2	T_h^6	6.360	4
SaF_3	hex., CeF_3	D_6^6	6.98, . . , 7.15	6
Sa_2O_3	cub., Tl_2O_3	T_h^7	10.85	16
SbI_3	hex., AsI_3	C_3^1	7.466, . , 20.89	6
SbSn(43–55 % Sb)	cub., NaCl	O_h^5	6.130	4
Sb_2O_3	cub., As_2O_3	O_h^7	11.06	16

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Sb_2S_3	rhomb.	V_h^{16}	11.39, 11.48, 3.89	4
Sb_2Tl_7	cub.	....	11.59	6
$(Sc, In)_2O_3$	cub.	O_h^{10}	9.90	16
ScN	cub., NaCl	O_h^5	4.44	4
Sc_2O_3	cub., Tl_2O_3	T_h^7	9.79	16
SiC (I)	hex.	C_{3v}^5	12.78, $\alpha = 13° 55'$	15
SiC (II)	hex.	C_{6v}^4	3.095, , 15.17	6
SiC (III)	hex.	C_{6v}^4	3.095, ... 10.10	4
SiC (IV)	cub., ZnS	T_d^2	4.348	
SiC (V)	hex.	. . .	43.15, $\alpha = 4° 6'$	51
SiI_4	cub.	T_h^6	11.99	8
SiO_2 (β cristobalite) (290°C)	cub.	O_h^7	7.12	8
SiO_2 (α quartz)	hex.	D_3^4 or D_3^6	4.903, ... , 5.393	3
SiO_2 (β quartz) (600°C)	hex.	D_6^4 or D_6^5	5.01, ... 5.47	
SiO_2 (α tridymite)	rhomb.	D_{6h}^4	9.88, 17.1, 16.3	64
SiO_2 (β tridymite)	hex.	D_{6h}^4	5.03, ... , 8.22	64
$SiO_3ZnO_2H_2$	rhomb.	C_{2v}^{20}	8.41, 5.14, 10.73, β = 90°	4
SiP_2O_7	cub.	T_h^6	7.46	4
$SmPMo_{12}O_{40}.30H_2O$	cub.	O_h^7	23.1	8
SnAs	cub., NaCl	O_h^5	5.716	4
SnI_4	cub.	T_h^6	12.23	8
SnO	tetr., PbO	D_{4h}^7	3.77, , 4.77	2
SnO_2	tetr.	D_{4h}^{14}	4.72, .. , 3.16	2
SnP_2O_7	cub.	T_h^6	7.89	4
SnS_2	hex., CdI_2	D_{3d}^3	3.639, ... , 5.868	1
SnSb	rhbdr.	.	6.117, $\alpha = 89.70°$	
SnTe	cub., NaCl	O_h^5	6.285	4
Sn_3As_2	rhbdr.	D_{3d}^5	12.23, $\alpha = 19.22°$	7 at.
Sn_8Cu_{31}	cub.	.	17.91	
$SrCO_3$	rhomb., KNO_3	V_h^{16}	5.13, 8.42, 6.10	4
SrC_2	tetr., CaC_2	D_{4h}^{17}	5.81, . .., 6.68	2
$SrC_2O_4.2.5H_2O$	tetr.	..	12.795, ..., 7.509	8
$SrCl_2$	cub., CaF_2	O_h^5	7.00	4
$SrCl_2.6H_2O$	hex.	C_{3i}^2	7.906, ..., 4.07	1

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
SrF_2	cub., CaF_2	O_h^5	5.86	4
$SrMoO_4$	tetr., $CaWO_4$	C_{4h}^6	5.36, ..., 11.94	4
$Sr(NO_3)_2$	cub., $Ba(NO_3)_2$	T_h^6	7.81	4
SrO	cub., NaCl	O_h^5	5.10	4
$Sr(OH)_2.8H_2O$	tetr.	D_{4h}^1	6.41, , 5.807	1
SrO_2	tetr., CaC_2	O_{4h}^{17}	5.02, . , 6.55	
$SrO_2.8H_2O$	tetr.		6.32, .. , 5.56	1
$SrPb_3$	tetr.		4.955, ..., 5.025	
SrS	cub., NaCl	O_h^5	5.87	4
$SrSO_4$	rhomb., $BaSO_4$	V_h^{16}	8.36, 5.36, 6.84	4
SrSe	cub., NaCl	O_h^5	6.23	4
SrTe	cub., NaCl	O_h^5	6.48	4
$SrTiO_3$	cub., $CaTiO_3$	O_h^1	3.92	1
$SrZrO_3$	cub., $CaTiO_3$	O_h^1	4.09	1
TaC	cub., NaCl		4.53	4
TaN	hex., ZnO	C_{6v}^4	3.05, .. , 4.94	2
Tb_2O_3	cub., Tl_2O_3	T_h^7	10.70	16
Tb_4O_7	cub.		10.55	
TeO_2	tetr., SnO_2	D_{4h}^{14}	4.79, , 3.77	2
TeO_6H_6	cub.	O_h^5	7.83	4
TeO_6H_6	monocl.	C_{2h}^5	5.54, 9.30, 9.74, β = 104° 30′	4
ThB_6	cub.		4.32	1
ThC_2	tetr.		5.85, . , 5.28	4
ThO_2	cub., CaF_2	O_h^5	5.59	4
$TiBr_4$	cub.		11.25	
TiC	cub., NaCl	O_h^5	4.311	4
TiI_4	cub.		12.00	
TiN	cub., NaCl	O_h^5	4.40	4
TiO	cub., NaCl	O_h^5	4.235	4
TiO_2 (anatase)	tetr.	D_{4h}^{19}	3.73, . . . 9.37	4
TiO_2 (brookite)	rhomb.	V_h^{15}	9.166, 5.436, 5.135	8
TiO_2 (rutile)	tetr., SnO_2	D_{4h}^{14}	4.58, . . 2.95	2
TiP_2O_7	cub.	T_h^6	7.80	4
TiS_2	hex., CdI_2	D_{3d}^3	5.691, ... , 3.397	1
$TiSe_2$	hex., CdI_2	D_{3d}^3	5.995, . 3.533	1

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$TiTe_2$	hex., CdI_2	D^3_{3d}	6.539, , 3.774	1
Tl_2O_3	hex., Fe_2O_3	D^6_{3d}	5.37, $\alpha = 56° 48'$	2
$TlAl(SO_4)_2.12H_2O$	cub.	T^6_h	12.21	4
TlBi	cub., CsCl	O^1_h	3.98	1
TlBr	cub., CsCl	O^1_h	3.97	1
TlCNS	rhomb.	V^{11}_h	6.80, 6.78, 7.52	4
TlCl	cub., CsCl	O^1_h	3.84	1
$TlClO_4$	rhomb., $BaSO_4$	V^{16}_h	9.42, 5.88, 7.50	4
$TlClO_4$(280°C)	cub., $KClO_4$	T^2_d	7.61	
TlF	rhomb., f.c.	V^{23}_{2h}	5.180, 5.495, 6.080	4
$TlHF_2$	cub.	. . . . . .	8.58	8
TlI	rhomb.	D^{17}_{2h}	5.24, 4.57, 12.92	4
TlN_3	tetr., KN_3	D^{18}_{4h}	6.21, , 7.37	
TlSb (Tl in excess)	cub., CsCl	O^1_h	3.84	1
Tl_2O_3	cub.	T^7_h	10.57	16
Tl_2PtCl_6	cub.	O^5_h	9.755	
Tl_2SnCl_6	cub.	O^5_h	9.970	
Tl_2TeCl_6	cub.	O^5_h	10.107	
$Tl_3Co(NO_2)_6$	cub.		10.72	4
$Tl_3W_2Cl_9$	hex.	C^2_{6h}	7.15, , 16.33	2
Tm_2O_3	cub., Tl_2O_3	T^7_h	10.52	16
UO_2	cub., CaF_2	O^5_h	5.47	4
$UO_2(NO_3)_2.6H_2O$	rhomb.	V^{17}_h	11.42, 13.15, 8.02	4
VC(ϵ)	cub., NaCl	O^5_h	4.30	4
VN	cub., NaCl	O^5_h	4.28	4
VO_2	tetr., SnO_2	D^{14}_{4h}	4.54, , 2.88	2
V_2O_3	hex., Fe_2O_3	D^6_{3d}	5.43, $\alpha = 53° 53'$	2
V_2O_5	. . .	. . . . . .	11.48, 4.36, 3.55	2
WC	hex.		2.901, , 2.830	1
$W(CO)_6$	rhomb.	C^9_{2v}	11.90, 6.42, 11.27	4
WO_2	tetr., SnO_2	D^{14}_{4h}	4.86, , 2.77	2
WS_2	hex., MoS_2	D^4_{6h}	3.18, , 12.5	2
WSi_2	tetr.	D^{17}_{4h}	3.212, , 7.880	2

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
W_2C (β) (2600°C)	hex.	.	2.99, , 4.72	1
$YAlO_3$	cub., $CaTiO_3$	O_h^1	3.67	1
$(Y, Bi)_2O_3$	cub.	O_h^{10}	10.72	16
$YCbO_4$	tetr		7.76, ., 11.32	8
YF_3	cub.	.	5.49	4
YPO_4.	tetr., $ZrSiO_4$	D_{4h}^{19}	6.88, , 6.03	4
$YTaO_4$	tetr.	.	7.75, , 11.41	8
$(Y, Tl)_2O_3$	cub.	O_h^{10}	10.53	16
$Y(VO_3)_3$	tetr.	D_{4h}^{19}	7.126, , 6.197	4
Y_2O_3 .	cub., Tl_2O_3	T_h^7	10.60	16
Yb_2O_3	cub., Tl_2O_3	T_h^7	10.39	16
$ZnAl_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.099	8
$Zn(BrO_3)_2.6H_2O$	cub., $(NH_4)_2PtCl_6$	T_h^6	10.31	4
$ZnCO_3$	hex., $NaNO_3$	D_{3d}^6	5.704, α = 48° 6′	2
$ZnCl_2$	hex., $CdCl_2$	D_{3d}^5	6.31, α = 34° 48′	1
$ZnCo_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.108	8
$ZnCr_2O_4$	cub., $MgAl_2O_4$	O_h^7	8.323	8
ZnF_2	tetr., SnO_2	D_{4h}^{14}	4.715, 3.131	2
$ZnFe_2O_4$.	cub., $MgAl_2O_4$	O_h^7	8.403	8
$Zn(NH_3)_2Br_2$	rhomb.	D_{2h}^{26}	8.12, 8.81, 8.41	4
$Zn(NH_3)_2Cl_2$	rhomb.	D_{2h}^{26}	7.78, 8.50, 8.08	4
ZnO. .	hex.	C_{6v}^4	3.24265, , 5.1948	2
$ZnO.Fe_2O_3$	cub.		8.41	8
$Zn(OH)_2$.	rhomb.	V^4	5.16, 8.53, 4.92	4
ZnS (α) (wurzite)	hex., ZnO	C_{6v}^4	3.84, , 6.28	2
ZnS (β) (blende)	cub.	T_d^2	5.43	4
$ZnSO_4$.	rhomb.		4.71, 6 73, 8.51	4
$ZnSO_4.7H_2O$	rhomb., $MgSO_4.7H_2O$	V^4	11.85, 12.09, 6.83	4
$ZnSO_4.(NH_4)_2SO_4.6H_2O$	monocl.	C_{2h}^5	9.20, 12.47, 6.23, β = 106° 52′	2
ZnSe. . .	cub., ZnS	T_d^2	5.65	4
$ZnSiF_6.6H_2O$. .	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.27, α = 96° 5′	1
$ZnSnF_6.6H_2O$	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.54, α = 95° 51′	1
$ZnSnO_3$.	cub.	. .	8.650	
ZnTe .	cub., ZnS	T_d^2	6.07	4
$ZnTiF_6.6H_2O$	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.41, α = 96° 20′	1
$ZnTiO_3$	cub.	. . .	8.460	

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
$ZnZrF_6.6H_2O$	hex., $NiSnCl_6.6H_2O$	C_{3i}^2	6.57, $\alpha = 96° 5'$	1
Zn_2SnO_4	cub., $MgAl_2O_4$	O_h^7	8.65	8
Zn_2TiO_4	cub., $MgAl_2O_4$	O_h^7	8.46	8
Zn_3As_2	cub.	...	5.81	2
Zn_3P_2	cub., Zn_3As_2		5.68	2
ZrC	cub., NaCl	O_h^5	4.73	4
$ZrCl_4$	cub., SnI_4	T_h^6	10.32	8
ZrF_4	monocl.	C_{2h}^6	9.46, 9.87, 7.64, $\beta = 94° 30'$	12
ZrN	cub., NaCl	O_h^5	4.61	4
ZrO_2	cub., CaF_2	O_h^5	5.07	4
ZrO_2	hex.		3.598, , 5.875	
ZrO_2	monocl.		5.21, 5.26, 5.37, $\beta = 80° 32'$	4
ZrO_2	tetr.		5.07, , 5.16	4
ZrP_2O_7	cub.	T_h^6	8.20	4
ZrS_2	hex., CdI_2	D_{3d}^3	3.68, , 5.85	1
$ZrSe_2$	hex., CdI_2	D_{3d}^3	3.79, ..., 6.18	1
$ZrSi_2$	rhomb.	V_h^{17}	3.72, 14.61, 3.67	4
ZrW_2	cub., f.c.		7.61	8

MINERALS

Name	Formula	Crystal system	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Actinolite	$H_2Ca_2(Mg,Fe)_5(SiO_3)_8$	monocl.		9.8, 17.9, 5.27, $\beta = ca\ 74°$	
Aenigmatite		tricl.	..	18.3, 18.3, 10.6, $\alpha = 96° 30'$, $\beta = 96° 30'$, $\gamma = 113° 30'$	
Analcite	$NaAlSi_2O_6.H_2O$	cub.	...	13.64	
Andalusite	Al_2SiO_5	rhomb.	V_h^{12}	7.76, 7.90, 5.56	4
Anhydrite	$CaSO_4$	rhomb.	V_h^{17}	6.22, 6.96, 6.97	4
Anthophyllite	$H_2Mg_7(SiO_3)_8$	rhomb.		18.52, 18.04, 5.27	
Apatite	$Ca(F,Cl)Ca_4(PO_4)_3$	hex.	C_{6h}^2	9.37, .. , 6.88	2
Apophyllite	$4(Si_2O_5H_2.CaO_2H_2)KF(?)$	tetr.		12.71, , 15.86	
Aragonite	$CaCO_3$	rhomb.	V_h^{16}	4.94, 7.94, 5.72	4
Atopite	$(Ca,Mn,Na,)_2Sb_2(O, OH, F)_7$	cub.		10.27	8
Babingtonite		tricl.	..	6.73, 7.54, 12.43, $\alpha = 112° 22'$, $\beta = 93° 48'$, $\gamma = 86° 9'$	

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Name	Formula	Crystal system	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Bastnasite	$(Ce,La)FCO_3$	hex.	D^3_{3h}	7.094, , 4.859	3
Benitoite	$BaTiSi_3O_9$	hex.		6.60, , 9.71	
Beryl	$Be_3Al_2(SiO_3)_6$	hex.	D^2_{6h}	9.21, , 9.17	2
Berzeliite	$NaCa_2Mn_2As_3O_{12}$	cub.		12.36	
Bixbyite	$(Fe,Mn)_2O_3$	cub.	T^7_h	9.365	16
Boracite	$Mg_6Cl_2B_{14}O_{26}$	rhomb.		16.97, 16.97, 12.00	8
Bornite	Cu_5FeS_4	cub.		10.91	
Braggite	Approx. $Pt_6Pd_5Ni_2S_{16}$	tetr.	C^2_{4h}	6.37, , 6.58	8
Calaverite	AuTe	monocl.		7.18, 4.40, 5.07, β = 90° ± 30′	2
Calcite	$CaCO_3$	rhbdr.	D^6_{3d}	6.361, α = 46° 6′	2
Cancrinite	$3SiO_4AlNa.CaCO_3$(?)	hex.		12.60, , 5.18	
Chalcopyrite	$CuFeS_2$	tetr.	V^5_d	3.726, , 5.194	1
Chondrodite	$Mg_3[Mg(F,OH)]_2(SiO_4)_2$	monocl.	C^5_{2h}	4.733, 10.27, 7.87, α = 109° 2′	2
Chromite	$(Fe,Mg)Cr_2O_4$	cub.	O^7_h	8.35	8
Chrysoberyl	$BeAl_2O_4$	rhomb	V^{16}_h	4.420, 9.390, 5.470	4
Chrysotile	$H_4Mg_3Si_2O_9$	rhomb.		14.66, 18.5, 5.33, β = 93° 16′	
Cinnabar	HgS	hex.	D^4_3 or D^6_3	4.14, , 9.49	3
Clinohumite	$Mg_7[Mg(F,OH)]_2(SiO_4)_4$	monocl.	C^6_{2h}	4.745, 10.27, 13.68, α = 100° 50′	2
Columbite	$(Fe,Mn)(Cb,Ta)_2O_6$	rhomb.		5.082, 14.24, 5.730	
Cooperite	PtS	tetr	D^9_{4h}	4.91, , 6.10	8
Cordierite	$Mg_2Si_5O_{12}.2Al_2O_3$	rhomb.		9.78, 17.1, 9.33	
Covellite		hex.	D^4_{6h}	3.802, , 16.43	6
Cryolithionite	$Na_3Al_2Li_3F_{12}$	cub.		12.10	
Cumengeite	$PbCl_2CuO_2H_2$(?)	tetr.		15.17, , 24.71	
Cyanite	Al_2SiO_5	tricl.	C^1_i	7.09, 7.72, 5.56, β = 101° 2′	4
Danburite	$CaB_2Si_2O_8$	rhomb.		8.75, 8.01, 7.72	
Datolite	$CaSiO_3.HBO_2$	monocl.		9.64, 7.62, 4.82, β = 90° 9′	
Davynite	$3SiO_4AlNa.Ca(SO_4,Cl_2)$	hex.		12.80, , 5.35	
Dietzeite	$Ca(IO_3)_2.CaCrO_4$	monocl.		10.16, 7.30, 14.03, β = 106° 32′	4
Diopside	$CaMg(SiO_3)_2$	monocl.	C^6_{2h}	9.71, 8.89, 5.24, β = 74° 10′	
Dioptase	CuH_2SiO_4	hex.		14.66, , 7.83	
Dolomite	$CaMg(CO_3)_2$	hex., (rhbdr.)	C^2_{3i}	6.02, α = 47° 30′	1
Dysanalyte	$(CaTiO_3,NaCbO_3)$	cub.		3.826	
Enstatite	$MgSiO_3$	rhomb.		18.20, 8.86, 5.20	
Epididymite	$NaBeSi_3O_7(OH)$	rhomb.		12.71, 7.33, 13.62	
Euclase	$BeSiO_3.HAlO_2$	monocl.		4.63, 14.30, 4.71, β = 100° 16′	
Eudialyte	$(Na,Ca,Fe)_6ZrSi_6O_{18}(OH,Cl)$	hex.		13.01, α = 66° 44′	

Name	Formula	Crystal system	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Eudidymite . . .	$NaBeSi_3O_7(OH)$	monocl.	.	12.62, 7.37, 13.99, β = 103° 43′	
Finnemanite .	$9PbO.3As_2O_3.PbCl_2$	hex.		10.21, , 6.97	1
Fluorite	CaF_2	cub.	O_h^5	5.451	4
Garnet	$(Fe'',Mn'')_3Al_2(SiO_4)_3$	cub.	O_h^{10}	11.40	8
Gehlenite. . . .	. .	tetr.		11.11, , 5.06	
Granerite .	$H_2Fe_7(SiO_3)_8$	monocl.	.	9.4, 17.9. 5.27, β = ca 74°	
Granite . .	$Al_2Ca_3(SiO_4)_3$	cub.	O_h^{10}	11.83	8
Haematophanite. .	$Pb(Cl,OH)_2.4PbO.2Fe_2O_3$	tetr.		7.80, . , 15 23	3
Hardystonite	$Ca_2ZnSi_2O_7$	tetr.		7.83, , 4.99	
Haüynite	cub.			9.04	
Helvite.	$Be_3(Mn,Fe)_3(SiO_4)_3MnS$	cub.		8.25	
Hematite	Fe_2O_3	hex.	D_{3d}^6	5.42, α = 55° 17′	2
Hemimorphite	$Zn_2SiO_4.H_2O$	rhomb.		8.41, 5.14, 10.73	
Heulandite. . . .	$H_4CaAl_2Si_6O_{18}.3H_2O$	monocl.		7.54, 17.97, 15.91, β = 83° 34′	
Hornblende	$H_2(Ca,Na,K)_{2-3}(Mg,Fe,Al)_5[(Si,Al)O_3]_8$	monocl.		ca 9.8, 17.9, 5.28, β = ca 74°	
Humite. .	$Mg_5[Mg(F,OH)]_2(SiO_4)_3$	rhomb.	V_h^{16}	4.738, 10.23, 20.86	4
Ice (α)	H_2O	hex.	D_{6h}(?)	4.52, . . 7.34	4
Ice (β).	H_2O	rhbdr.	C_{3i} or C_3	4.52, . . 7.34	4
Ice II (low temp.)	H_2O	rhomb., f.c.	V^6	7.80, 4.50, 5.56	8
Ice III	H_2O	rhomb.	V_h^{26}	10.20, 5.87, 7.17	16
Ilmenite	$FeTiO_3$	rhbdr.	C_{3i}^2	5.40	2
Jacobsite	$(Mg,Mn,Fe)Fe_2O_4$	cub.	O_h^7	8.42	8
Julienite	$Na_2Co(SCN)_4.8H_2O$	tetr.		9.22, , 5.56	1
Kaliophilite.	$KAlSiO_4$	hex.		15.59. , 8.59	
Kernite	$Na_2B_4O_7.4H_2O$	monocl.	C_{2h}^4	6.96, 9.14, 15.52, β = 108° 52′	4
Krennerite	$AuTe_2$	rhomb.	C_{2v}^4	16.51, 8.80, 4.45	8
Kupfferite	$H_2Mg_7(SiO_3)_8$	monocl.		9.7, 17.8, 5.25, β = ca 74°	
Lautarite . .	$Ca(IO_3)_2$	monocl.	C_{2h}^5	7.18, 11.38, 7.32, β = 106° 22′	4
Leucite . .	$K_2O.Al_2O_3.4SiO_2$	tetr.		12.95, . , 13.65	
Magneto-plumbite	$2(Pb,Mn)O.3Fe_2O_3$	hex.		6.06, , 23.69	4
Manganite	$Mn(OH)O$	monocl.		8.86 5.24, 5.70, β = 90°	
Marcasite. .	FeS_2	rhomb.	V_h^{12}	3.35, 4.40, 5.35	2
Mauzeliite. .	$(Ca_8,Na_2)(Sb_8,Ti_2)O_{31}F_4$	cub.		12.30	
Melilite. .	$(Ca,Na)_2(Mg,Al)(Si,Al)_2O_7$	tetr.		7.73, , 5.01	
Meliphanite. . .	$(Ca,Na)_2Be(Si.Al)_2(O,F)_7$	tetr.		7.47, . , 4.92	
Metacinnabar.	HgS	cub.	T_d^2	5.84	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Name	Formula	Crystal system	Space group	Lattice constants: a, b, c, Ax. ang.	Mol.
Metavoltine. .	$K_5H_7(SO_4)_6.3FeO_3H_3.H_2O$	hex.	. . .	19.43, , 18.60	8
Miersite	$4AgI.CuI$	cub.	T_d^2	6.35	4
Millerite	NiS	hex., (rhbdr.)	C_{3v}^5	5.655, α = 116° 36′	3
Mimetite	$9PbO.3As_2O_5.PbCl_2$	hex.	.	10.01, . , 7.28	1
Monticellite . .	$CaMgSiO_4$	rhomb.	. .	4.815, 11.08, 6.37	
Mossite. .	$Fe(Cb, Ta)_2O_6$	tetr.	D_{4h}^{14}	4.71, . , 9.12	2
Muscovite	$KH_2Al_2Si_3AlO_{12}$	monocl.	.	5.18, 9.02, 20.04, β = 95° 30′	
Natrolite	$Na_2Al_2Si_3O_{10}.2H_2O$	rhomb.	C_{2v}^{19}	18.19, 18.62, 6.58	8
Nephelite	$NaAlSiO_4$	hex.	. .	10.09, , 8.49	
Neptunite	$Na_2FeSi_2O_6.Si_2TiO_6$	monocl.		16.54, 12.64, 10.04, β = 115° 38′	
Norbergite	$Mg(F,OH)_2Mg_2SiO_4$	rhomb.	V_h^{16}	4.70, 10.2, 8.72	4
Olivine .	$(Mg,Fe'')_2SiO_4$	rhomb.	V_h^5	4.77, , 6.00	4
Pentlandite	$(Ni,Fe)S$	cub.	O_h^5	10.00	32
Perovskite	$CaTiO_3$	cub.	O_h^1	3.80	1
Petalite	$LiAlSiO_4.3SiO_2$	monocl.		11.77, 5.13, 15.17, β = 112° 44′	
Phenacite	Be_2SiO_4	hex.		7.684, α = 108° 1′	
Plumboferrite	$PbO.2Fe_2O_3$	hex.		11.86, , 47.14	42
Pollucite .	$[Si_4Al_2O_{12}]Cs_2.H_2O$	cub.	O_h^{10}	13.71	2
Polydymite .	Ni_3S_4	cub	O_h^7	9.65	8
Proustite	Ag_3AsS_3	rhbdr. trig	C_{3v}^6	. . .	
Pseudo-boleite	$5PbCl_2.4CuO.6H_2O$	tetr.	. .	15.4, . , 31.2	12
Pseudobrookite.	Fe_2TiO_5	rhomb.		9.78, 9.80, 3.65	4
Pyrargyrite	Ag_3SbS_3	rhbdr. trig.	C_{3v}^6	. . . . . .	
Pyrite	FeS_2	cub.	T_h^6	5.404	4
Quartz (α)	SiO_2	hex.	D_3^4 or D_3^6	4.903, , 5.393	3
Rhodonite	$Mn_4Ca(SiO_3)_5$	tricl.	. . . .	7.77, 12.45, 6.74, α = 85° 10′, β = 94° 4′, γ = 111° 29′	
Rutile	TiO_2	tetr.	D_{4h}^{14}	4.58, . . , 2.95	2
Scapolite .	$nNa_4Al_3Si_9O_{24}Cl + m\ Ca_4Al_6Si_6O_{26}$	tetr.	C_{4h}^5	12.72, . . , 7.66	2
Scheelite	$CaWO_4$	tetr.	C_{4h}^6	5.24, , 11.38	4
Sillimanite	$Al_2O_3.SiO_2$	rhomb.		7.43, 7.58, 5.74	
Skutterudite	$CoAs_3$	cub.	T_h^5	8.18	8
Sodalite	$Na_4Al_3Si_3O_{12}Cl$	cub.		8.87	
Spinel.	Al_2MgO_4	cub.	O_h^7	8.09	8
Spodumene	$Li_2O.Al_2O_3.4SiO_2$	monocl.	. .	9.50, 8.30, 5.24, β = 69° 40′	4
Staurolite.	$Fe(OH)_2.2Al_2SiO_5$	rhomb.	V_h^{17}	7.82, 16.52, 5.63	4

Name	Formula	Crystal system	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Sulfohalite	$2Na_2SO_4.NaCl$ NaF	cub., f c.		10.08	4
Sulvanite	Cu_3VS_4	cub.	T_d^2	5.370	1
Talc	$3MgO.4SiO_2.H_2O$	pseudo-hex. (monocl. or rhomb.)	C_s^4	5.25	
Tetrahedrite	Cu_3SbS_3	cub		10.32	
Thortveitite	$Sc_2Si_2O_7$	monocl.		6.56, 8.58, 4.74, β = 103° 8′	
Tincalconite	$Na_2B_4O_7.5H_2O$	hex.		11.3, , 20.9	9
Tincalconite	$Na_2B_4O_7$ $5H_2O$	rhbdr.	C_{3i}^2	9.46, α = 71° 42′	3
Titanite	$CaTiSiO_5$	monocl.		6.55, 8.70, 7.43, β = 119° 43′	
Topaz	$Al_2F_2SiO_4$	rhomb.	V_h^{16}	4.64, 8.78, 8.37	4
Tourmaline		hex.	C_{3v}^1	16.23, , 7.26	
Tremolite	$H_2Ca_2Mg_5(SiO_3)_8$	monocl.		9.78, 17.8, 5.26, β = 73° 58′	
Tridymite (α)	SiO_2	rhomb.	D_{6h}^4	9.88, 17.1, 16.3	64
Tridymite (β)	SiO_2	hex.	D_{6h}^4	5.03, , 8.22	64
Trimerite	$Be(Ca,Mn)SiO_4$	hex.		16.11, , 7.60	
Tysonite	(Ce, La)F_3	hex.	D_{6h}^3	7.124, , 7.280	6
Vaterite	$CaCO_3$	hex.		4.120, , 8.556	2
Vesuvianite		tetr.		22.03, , 11.89	
Vivianite	$3FeO.P_2O_5.8H_2O$	monocl., one-f.c.		9.997, 13.37, 4.696, β = 104° 16′	
Voltaite		cub.		27.33	20
Willemite	Zn_2SiO_4	hex.		8.63, α = 107° 45′	
Wollastonite	$CaSiO_3$	monocl.		15.31, 7.35, 7.08, β = 95° 25′	
Wurtzite		hex.	C_{6v}^4	3.811, , 6.234	
Zircon	$ZrSiO_4$	tetr.	D_{4h}^{19}	6.58, , 5.93	4

Metal-Organic Compounds

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Aluminum acetylacetone	monocl.	C_{2h}^5	14.1, 7.42, 16.5, β = 98° 54′	4
Ammonium chlorofumarate	monocl.	C_2^2	9.30, 6.70, 6.735, β = 108° 25′	2
hydrogen fumarate	tricl.	C_i^1	7.00, 7.44, 6.56, α = 107° 1′, β = 117° 58′, γ = 69° 16′	2
oxalate + $1H_2O$	rhomb.	V^3	8.06, 10.34, 3.82	2
Barium dicalcium propionate	cub.	O_h^7	18.20	8
formate	rhomb.	V^4	6.78, 8.89, 7.68	4
succinate	tetr.	D_{4h}^{19}	7.57, , 10.28	4

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol
Beryllium				
oxalate + $3H_2O$	rhomb.	V_h^{16}	6.37, 7.53, 12.45	4
oxyacetate	cub.	T_h^4	15.72	8
oxypivalate	monocl.	C_{2h}^6	19.3, 12.4, 35.4, β = 91° 21′	8
oxypropionate	monocl.	.	16.00, 9.76, 9.15, β = 116° 7′	2
Bismuth				
chloride thiourea	hex.	C_3^4	14.81, α = 111° 54′	1
cobalticyanide thiourea	hex.	D_{3d}^5	9.13, α = 100° 30′	1
Calcium				
barium propionate	cub.	O^4	18.3	8
formate	rhomb.	V_h^{15}	10.16, 13.38, 6.26	8
Chromium				
acetylacetone	monocl.	C_{2h}^5	14.2, 7.62, 16.5, β = 99° 8′	4
Cobalt				
acetylacetone	monocl.	C_{2h}^5	14.2, 7.50, 16.4, β = 98° 38′	4
Cupric				
formate + $2H_2O$	monocl.	C_{2h}^5	8.952, 6.726, 8.235	4
Gallium				
acetylacetone (α)	monocl.	C_{2h}^5	14.0, 7.63, 16.3, β = 99° 12′	4
acetylacetone (β)	rhomb.	C_{2v}^7	8.20, 13.1, 16.3	4
acetylacetone (γ)	rhomb.	C_{2v}^9	15.71, 13.74, 32.76	16
Germanium				
tetraphenyl	tetr.	V_d^4	11.60, , 6.85	2
Indium				
acetylacetone	rhomb.	C_{2v}^7	8.24, 13.4, 16.5	4
Iron				
acetylacetone	rhomb.	C_{2v}^9	15.74, 13.68, 33.0	16
Lead				
formate	rhomb.	V^4	6.52, 8.75, 7.41	4
tetraphenyl	tetr.	V_d^4	12.06, . . . , 6.50	2
Lithium				
acetate	rhomb.		12.80, 11.63, 7.43	12
butyrate	hex.		27.7, . , 10.1	48
iso-butyrate	tetr.		19.75, . , 9.25	24
caprylate	hex.		42.1, , 10.9	72
crotonate	hex.		24.8, , 10.7	48
formate	monocl.		7.61, 6.03, 4.87, β = 95° 42′	4
formate + H_2O	rhomb.	C_{2v}^9	6.49, 10.01, 4.85	4
heptylate	tetr.		27.4 . . , 9.3	32
laurate	tetr.		28.3, . . ., 11.7	24
nonylate	tetr.		36.6, . . 9.3	48
oleate	hex.		64.6, . . . , 9.5	72
oxalate	rhomb.		6.58, 7.74, 6.61	4
propionate	rhomb.		16.98, 12.15, 9.45	16
stearate	hex.		62.5, . . , 9.8	72
trimethylacetate	cub.	.	18.56	36
undecylate	tetr.(?)	.	41.8, . . , 9.2	48
undecylenate	hex. (?)		52.6, . . , 9.5	72
valerate	tetr.(?)	. . .	24.5, . . . , 9.4	32
iso-valerate	rhomb.(?)	. . . .	11.7, 8.70, 6.93	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Manganese acetylacetone	monocl.	.	14.1, 7.68, 16.5, β = 99° 24′	4
Potassium acid chloromaleate..	rhomb.	V_h^{16}	7.62, 15.74, 10.95	8
bitartrate. .	...		7.614, 10.70, 7.80	4
borotartrate. .	rhomb.	V_2	4.88, 18.00, 7.65	2
chlorosulfoacetate .	rhomb.	V_h^{14}	8.58, 8.60, 23.76	8
mesotartrate + $2H_2O$	tricl.	.	7.02, 6.90, 11.02, α = 95° 44′, β = 102° 52′, γ = 61° 46′	2
rhodium oxalate	hex.	D_3^4 or D_3^6	11.28, . , 20.25	6
Rubidium tartrate .	hex.	D_3^4 or D_3^6	7.17, . . , 13.19	3
Scandium acetylacetone	rhomb.	C_{2v}^7 or V_h^{13}	8.20, 13.52, 16.15	4
Silicon tetraphenyl	tetr.	V_d^4 or D_{4h}^6	11.50, 6.97	2
Silver uranyl acetate	tetr.	C_{4h}^6	12.98, , 28.10	16
Sodium acid acetate..	cub.	T_h^7	15.9	24
palmitate (α) (below 42.7°C)	rhomb.	D_{2h}^6	8.06, 9.24, 47.70	8
palmitate (β) (above 42.7°C)	monocl.	C_{2h}^3	7.83, 5.40	4
stearate (α) (below 51.5°C)	rhomb.	D_h^9	8.04, 9.24, 51.77	8
stearate (β) (above 51.5°C)	monocl.	C_{2h}^3	7.80, 5.33,	4
uranyl acetate	cub.	T^4	10.670	4
Strontium formate . .	rhomb	V^4	6.86, 8.72, 7.24	4
formate + $2H_2O$	rhomb.	V^4	7.30, 11.99, 7.13	4
Thallium mesotartrate	tricl.		13.26, 16.12, 7.63, α = 75° 54′, β = 86° 37′, γ = 82° 14′	4
Tin tetraphenyl	tetr.	V_d^4	11.83, , 6.42	2

ORGANIC COMPOUNDS

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Acenaphthene.. .	rhomb.	.	8.32, 14.15, 7.26	4
Acetaldehyde ammonia	hex.	D_{3d}^6	8.18, α = 84° 50′	6
Acetamide . .	hex.	C_{3v}^6	8.05, α = 91° 17′	6
Acetonyl pyrrole ..	tetr.	C_4^2 or C_4^4	10.09, ... , 23.85	4
Acetoxybisnorallocholanic acid	monocl.		57.1, 7.69, 19.45, β = 97.5°	
Acetylenedicarboxylic acid	monocl.		7.88, 9.04, 6.62, β = 111° 6′	4
Acetylsalicylic acid..	monocl.	C_{2h}^5	11.37, 6.54, 11.37, β = 95.7°	4
Adipic acid ..	monocl.	C_{2h}^5	10.27, 5.16, 10.02, β = 137° 5′	2

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Aminoazobenzene (p)	monocl.	.	13.69, 5.604, 14.18, β = 81° 49′	4
Aminophenol (o)	rhomb.	V_h^{15}	7.26, 7.71, 19.51	8
Aminophenol (m)	rhomb.	C_{2v}^4	6.14, 11.10, 8.38	4
Aminophenol ($\alpha - p$)	rhomb.	C_{2v}^5	8.25, 5.32, 13.06	4
Aminophenol ($\beta - p$)	rhomb.	C_{2v}^1	12.07, 11.85, 5.82	6
Anthracene	monocl.	C_s^1	8.58, 6.02, 11.18, β = 125°	2
Anthranilic acid I	rhomb.	V_h^{11}	. .	8
Anthranilic acid II	rhomb.	V_h^5	. .	8
Anthraquinone	rhomb.	V_h^{13}	12.05, 15.05, 2.69	2
Arabinose	rhomb.	V^4	6.48, 19.30. 4.81	4
Azelaic acid (α)	monocl.	C_{2h}^5	9.72, 4.83, 27.14, β = 129° 30′	4
Azelaic acid (β)	monocl.	C_{2h}^2	5.61, 9.58, 27.20, β = 136° 30′	4
Azobenzene	monocl.	C_{2h}^5	12.65, 6.06, 15.60, β = 114° 24′	4
Azotoluene (o)	monocl.	C_{2h}^5	13.93, 6.604, 14.55, β = 101° 4′	4
Azoxyphenetol (p)	monocl.	.	15.9, 5.42, 17.5, β = 94° 20′	
Behenolic acid	monocl.	C_{2h}^4 or C_{2h}^5	9.551, 4.686, 59.10, β = 53° 30′	4
Benzanthracene (1:2)	monocl.	C_2^2	7.91, 6.43, 23.96, β = 99°	4
Benzanthracene (2:3)	tricl.	.	7.94, 6.02, 13.5, α = 80° 40′, β = 67° 50′, γ = 92° 40′	2
Benzene (−20°C)	rhomb.	V_h^{15}	9.76, 7.39, 6.85	4
Benzene hexabromide	monocl.	C_{2h}^4	8.44, 4.04, 17.3, β = 116° 30′	2
Benzene hexachloride	monocl.	C_{2h}^4	8.10, 3.86, 16.68, β = 116° 50′	2
Benzil	hex.	D_3^4 or D_3^6	8.15, . ., 13.46	3
Benzoic acid	monocl.		5.44, 5.18, 21.6, β = 97° 5′	4
Benzophenone	. . .	D_2^4	10 17. 12.06, 7.98	4
Brassylic acid	monocl.	C_{2h}^5	9.63, 4.82, 37.95, β = 128° 20′	4
Bromostearic acid	monocl.	C_{2h}^4 or C_{2h}^5	11.039, 4.904, 52.84, β = 43° 17′	4
Carotene (β)	monocl.	C_{2h}^5	7.75, 9.5, 25.0, β = 105°	2
Catechol	monocl.	C_{2h}^5	17.46, 10.74, 5.48, β = 94° 15′	8
Cellobiose (d)	monocl.	C_2^2	5.00, 13.2, 11.1, β = 90°	2
Cellulose	tetr.	. . .	7.79, . ., 10.26	4
Cellulose hydrate	monocl.		8.14, 10.3, 9.14, β = 62°	4
Cellulose natural	monocl.	. . . .	8.3, 10.3, 7.9, β = 84°	

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Cetyl palmitate	monocl.	C_{2h}^5	5.61, 7.42, 88.79, β = 61.3	4
Chlorobromobenzene (*p*)	monocl.		15.15, 4.12, 5.81, β = 113° 9′	2
Chloronaphthalene tetrachloride (α)	monocl.		8.245, 10.1, 15.78, β = 116° 12′	4
Cholestane dibromide			20.8, 11.27, 10.72, β = 90°	
Cholestanedione.			19.6, 7.62, 7.9, β = 93°	
Cholesteryl acetate			16.3, 9.35, 17.5, β = 73.6	
Chrysene	monocl.	C_{2h}^6	8.34, 6.18, 25.0, β = 115.8°	4
Cinnamic acid (*trans*)	monocl.		11.65, 14.10, 4.26, β = 98° 36′	4
Cyanuric acid	pseud. rhomb.	C_{2h}^6	7.90, 6.74, 9.04, β = 90°	4
Cyanuric triazide	hex.		8.73, . . , 5.96	2
Cyclohexane-α-diol-1,2	rhomb.	V_h^{15}	7.62, 8.55, 19.57	8
Cyclohexane-β-diol-1,4	monocl.	C_{2h}^5	6.32, 21.2, 7.27, β = 96.0°	6
Cyclohexane-γ-diol-1,2	monocl.	C_{2h}^6	19.13, 9.92, 7.23, β = 103.9°	8
Cyclohexyl diacetate-1, 4 (β)	monocl.	C_{2h}^5	13.56, 5.83, 6.72, β = 107.4°	2
Cyclopentenophenanthrene (1: 2-)	monocl.	C_{2h}^5	18.38, 5.83, 23.61, β = 114.3°	8
Dibenzalpentaerythritol	hex.	D_6^4	6.03, , 36.7	3
Dibenzcarbazole (1: 2: 5: 6-)	rhomb.	D_{2h}^{15} (?)	31.10, 9.65, 26.61, β = 90°	24
Dibenzcarbazole (1· 2: 7: 8-)	monocl.	C_{2h}^2 (?)	14.63, 7.64, 12.08, β = 96°	4
Dibenzcarbazole (1: 2: 7: 8-)	rhomb.	D_2^7 (?)	10.27, 10.26, 50.5, β = 90°	16
Dibenzcarbazole (3: 4: 5: 6-)	rhomb.	D_2^5 (?)	14.07, 6.10, 15.36, β = 90°	4
Dibenzyl	monocl.	C_{2h}^5	12.82, 6.18, 7.74, β = 116°	2
Dibromobenzene (*p*)	monocl.		15.46, 4.11, 5.80, β = 112° 38′	2
Dibromotetramethylethane (*sym.*)	tetr.		10.45, , 8.14	4
Dichlorobenzene (*p*)	monocl.		14.83, 4.10, 5.88, β = 112° 30′	2
Dichloronaphthalene tetrachloride	monocl.	C_s^4	7.8, 12.3, 13.9, β = 116° 14′	4
Dicyanodiamide	monocl.	C_{2h}^4	13.8, 4.4, 6.2, β = 90° 35′	4
Diethyl phthalyl ketone	tetr.	D_{4h}^{10}	7.25, , 20.47	4
Diiodoethane (*sym.*)	monocl.	C_{2h}^4	. .	2
Diiodoethane (*sym.*)	rhomb.	V_h^{18}	7.582, 12.897, 5.810	4
Diiodoethylene (*sym.*)	monocl.	C_{2h}^5	. . . .	2
Diiodoethylene (*sym.*)	rhomb.	V_h^{18}	7.280, 13.310, 5.553	4
Dimesityl	monocl.	C_{2h}^5	8.21, 8.58, 22.25, β = 96° 30′	4

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Dimethyldiethyl ammonium chlorostannate	tetr.	. . .	9.06, , 14.12	2
Dimethylethyl sulfonium chlorostannate	cub.(?)	. .	12.80	
Dimethylurea (1, 2) .	rhomb.	C_{2v}^{7}	4.53, 10.9, 5.14	2
Dinitrobenzene (*o*) .	monocl.	C_{2h}^{5}	7.95, 13.0, 7.45, β = 112° 7′	4
Dinitrobenzene (*m*) . .	rhomb.	V_{h}^{16}	13.3, 14.2, 3.82	4
Dinitrobenzene (*p*) . .	monocl.	C_{2h}^{5}	11.3, 5.55, 5.8, β = 92° 18′	2
4, 6-Dinitro-1, 3-xylol	monocl.	C_{2h}^{2}	11.5, 5.49, 7.2, β = 98°	2
Diphenic acid . . .	rhomb.	. . . .	14.12, 11.90, 13.75	8
Diphenyl .	monocl.	C_{2h}^{5}	8.11, 5.67, 9.57, β = 94° 30′	2
Diphenylbenzene (*p*)	monocl.	. . . . .	8.08, 5.60, 13.59, β = 91° 55′	2
Diphenylbutadiene .	monocl.	C_{2h}^{2}	7.71, 11.70, 13.31/sin β, β = 97°	
Diphenylfurazane	. . . . .	D_{2}^{4}	11.89, 12.95, 6.99	4
Diphenylglyoxime (*α*) .	monocl.	C_{2h}^{6}	25.08, 8.68, 11.92	8
Diphenylglyoxime peroxide	monocl.	C_{2h}^{5}	12.85, 6.27, 14.96	4
Distearin (*α*, *α′*)	hex. (?)	.	81.5, . ., 10.8	48
Dulcitol . . .	monocl.	C_{2h}^{5}	8.61, 11.60, 9.05, β = 113° 45′	4
Durene.	monocl.	C_{2h}^{5}	11.57, 5.77, 7.03, β = 113.3°	2
Elaidic acid .	tetr. (?)	. . . .	26.5, . . . , 10.3	16
Ephedrine hydrobromide (*d*)	rhomb.	V^{4}	24.68, 6.93, 6.78	
Ephedrine hydrobromide (*l*)	monocl.	C_{2}^{2}	12.74, 6.20, 7.62, β = 100° 48′	
Ephedrine hydrochloride (*d*)	rhomb.	V^{4}	25.49, 6.48, 6.91	
Ephedrine hydrochloride (*l*)	monocl.	C_{2}^{2}	12.64, 6.15, 7.34, β = 102° 6′	
Ephedrine hydroiodide (*d*)	rhomb.	V^{4}	11.39, 6.83, 15.62	
Ephedrine hydroiodide (*l*)	rhomb.	V^{3}	25.66, 7.33, 19.14	
Ergosterol acetate	. . . . . .	. . . .	34.8, 7.58, 10.48, β = 92.6°	
Ergosterol acetate-maleic anhydride I	monocl.	C_{2}^{2}	31.1, 9.58, 10.60, β = 95.0°	
Ergosterol acetate-maleic anhydride II	monocl.	C_{2}^{2}	32.2, 7.91, 25.3, β = 92.1°	
Erythritol (*i*) . .	tetr.	C_{4h}^{6}	12.76, . . ., 6.83	8
Ethane . .	hex.	D_{6h}^{4}	4.46, . . ., 8.19	2
Ethylene (−175°C) .	rhomb.	. . . .	6.46, 4.87, 4.14	2
Ethylene diamine sulfate	tetr.	D_{4}^{4} or D_{4}^{8}	5.96, . ., 17.99	4
Ethylene oxide dicarboxylic acid (*cis.*)	monocl.	C_{2h}^{6}	21.50, 6.90, 6.89, β = 91° 10′	8

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Eulytine.	cub.	T_d^6	10.272	4
Fluorene .. .	monocl.	C_{2h}^5	8.48, 5.73, 19.24, β = 101° 53′	4
Fructose (d).. .	rhomb.	V^4	8.06, 10.06, 9.12	4
Fumaric acid.	monocl.	C_{2h}^5	7.60, 15.11, 6.61, β = 111° 5′	6
Glucose (d). .. .	rhomb.	V^4	10.40, 14.89, 4.99	4
Glutaric acid (α).. .	monocl.	C_{2h}^6	10.34, 5.08, 32.9, β = 129°	8
Glutaric acid (β).. ..	monocl.	C_{2h}^5	10.06, 4.87, 17.4, β = 132° 35′	4
Glycine.	monocl.	C_{2h}^5	5.1, 11.9, 5.43, β = 111° 38′	4
Glyoxaline..	monocl.	C_{2h}^1	7.67, 5.44 5.12, β = 63° 11′	2
Glyoxaline-4-sulfonic acid	tetr.	V_d^4	11.98, , 9.22	8
Guanidine carbonate	tetr.	D_4^4 or D_4^8	6.95, , 19.45	4
Guanidine dichromate.	monocl.	.	(0.8232:1:0.6942), β= 100° 0′	
Guanidine monochromate	tricl.		(1.1013:1:1.041) (?), α = 82° 34′, β = 90° 10′, γ = 53° 20′	
Guanidine tartrate (d)	monocl.		(0.7056:1: 0.3366), β = 104° 57′	2
Guanidine trichromate	monocl.		(1.686:1: 2.138), β = 122° 48′	
Guanidonium bromide.	rhomb.	V_h^{16}	6.77, 8.64, 8,305	4
Guanidonium iodide	hex.	C_{6v}^4	7.19, , 12.30	4
Harmine ...	rhomb.	.	19.22, 9.57, 5.78	4
Hexaminobenzene.	cub.	O_h^7	15.14	16
Hexabromobutylene.	monocl.	C_{2h}^5	11.5, 6.40, 10.0, β = 44° 27′	2
Hexachlorethane (above 71°C)	cub.	. .	7.43	2
Hexachlorobenzene.	monocl.	C_{2h}^5	8.07, 3.84, 16 61, β = 116° 52′	2
Hexachloroethane	rhomb.	V_h^{16}	11.51, 10.14, 6.39	4
Hexadecanedicarboxylic acid	monocl.	C_{2h}^5	9.76, 4.92, 25.10, β = 131° 10′	2
Hexaethylbenzene	tricl.		9.90, 9.84, 6.10, α = 58° 5′, β = 103° 54′, γ = 123° 43′	1
Hexahydrobenzene hexabromide (β)	cub.	T_h^6	10.49	4
Hexahydrobenzene hexachloride (β)	cub.	T_h^6	10.07	4
Hexamethylbenzene	tricl.	C_i^1	9.01, 8.926, 5.344, α = 44° 27′, β = 116° 43′, γ = 119° 34′	1
Hexamethylethane (above −125°C)	cub.	..	7.69	2
Hexamethylenetetramine	cub.	T_d^4	7.02	2
Hexane ($\alpha - n$) ..	rhomb.	......	3.51, 4.26, 11.6	1

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Hexane ($\beta - n$)..	monocl.		3.87, 4.61, 12.0, β = 120°	1
Hydrazobenzene.. ..	rhomb.		11.10, 9.93, 9.33	4
Hydrobenzoin, *iso*-.	monocl.	C_2^2	12.40, 7.92, 5.81, β = 92° 53′	2
Hydrocinnamic acid..	monocl.	....	12.90, 9.20, 6.98, β = 103° 36′	4
Hydroquinol..........	monocl.	...	13.58, 5.22, 8.13, β = 107°	4
Hydroxycholestenone dibromide	.....		15.35, 7.58, 11.55, β = 93.7°	
Iodobenzoic acid (*o*)..	monocl.	C_{2h}^5	11.30, 15.17, 4.336, β = 90° 43′ 47″	4
Iodobenzoic acid (*m*)..	monocl.	C_{2h}^5	6.206, 4.683, 25.14	4
Iodoform .	hex.	C_6^6 or C_{6h}^2	6.87	2
Iodosuccinimide..	tetr.	C_4^2 or C_4^4	6.29, ..., 15.55	4
Inositol (*i*).... .	monocl.	C_{2h}^5	6.64, 12.0, 19.7, β = 105.8°	8
Inositol (*l*).....	monocl.	C_2^2	6.17, 9.11, 6.83, β = 106.6°	2
Inositol dihydrate (*i*).	monocl.	C_{2h}^5	8.98, 16.59, 6.49, β = 109.8°	4
Lauric acid .	monocl	C_{2h}^1	9.76, 4.98, 36.9, β = 48° 6′	4
Malachite. .	monocl.	C_{2h}^5	9.38, 11.95, 3.18, β = 91° 3′	4
Maleic acid. ...	monocl.	C_{2h}^5	7.49, 10.14, 7.12, β = 117° 7′	4
Maleic anhydride	rhomb.		6.58, 11.43, 5.90	4
Malonic acid...	tricl.	C_i^1	8.36, 5.33, 5.14, α = 94° 56′, β = 103° 56′, γ = 71° 30′	2
Malonic acid (α)	rhomb.		8.70, 11.53, 17.05, β = 90°	16
Mannitol (*d*)..	rhomb.	V^4	8.66, 16.58, 5.501	4
Mannose.	rhomb.	Q_4	7.62, 18.18, 5.67	4
Metaldehyde.... ..	tetr., b.c.	C_4^5	10.40, . . ., 4.11	8
Methane.. .. .	cub.	T_d^2	5.89	4
7-Methoxy-1: 2-cyclopentenophenanthrene	monocl.	C_{2h}^5	29.9, 5.68, 8.49, β = 117.5°	4
7-Methoxy-3′: 3′-dimethyl-1: 2-cyclopentenophenanthrene	monocl.	C_{2h}^5	8.75, 6.21, 28.02, β = 95.0°	4
Methylbixin	monocl.	C_{2h}^5	10.56, 13.4, 20.62	4
Methyl glycoside (α).	rhomb.		10.80, 14.60, 5.61	4
Methyl oxalate	monocl.	C_{2h}^2	3.93, 11.84, 6.17, β = 103° 22′	2
Methyl tartrate	rhomb.	V_2	18.50, 10.00, 8.45	8
Methyl urea	rhomb.	V^4	6.89, 6.96, 8.45	4
Methyl xyloside ($\beta - d$)	monocl.	C_2^2	7.82, 6.89, 7.74, β = 113° 10′	2
Monoamyl ammonium bromide (*n*)	tetr.	....	5.00, . . , 16.95	

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Monoamyl ammonium chloride (n)	tetr.		5.01, , 16.69	
Monoamyl ammonium iodide (n)	tetr.		5.18, , 17.42	
Monobutyl ammonium bromide (n)	tetr.		5.02, , 15.23	
Monobutyl ammonium chloride (n)	tetr.		5.02, , 14.85	
Monobutyl ammonium iodide (n)	tetr.		5.18, , 15.30	
Monodecyl ammonium iodide (n)	tetr.		5.18, , 28.09	
Monoethyl ammonium bromide	monocl.		8.32, 6.24, 4.63, β = 86° 59′	
Monoethyl ammonium chloroplatinate	hex.		7.13, , 8.53	
Monoethyl ammonium chlorostannate	hex.		7.24, , 8.41	
Monoethyl ammonium iodide	monocl.		8.68, 6.63, 4.81, β = 87° 54′	
Monoheptyl ammonium chloride (n)	tetr.		4.96, , 21.09	
Monoheptyl ammonium iodide (n)	tetr.		5.18, , 21.82	
Monohexyl ammonium bromide (n)	tetr.		4.93, , 19.78	
Monohexyl ammonium chloride (n)	tetr.		4.98, , 19.55	
Monohexyl ammonium iodide (n)	tetr.		5.18, , 19.50	
Monomethyl ammonium aluminum alum	cub.		12.44	
Monomethyl ammonium bromide	tetr.		5.09, , 8.76	
Monomethyl ammonium chloride	tetr.		4.28, , 5.13	
Monomethyl ammonium chloroplatinate	hex.		8.31, α = 48° 46′	
Monomethyl ammonium chlorostannate	hex.		8.42, α = 50° 14′	
Monomethyl ammonium iodide	tetr.		5.11, , 8.97	
Monomethyl triethyl ammonium chlorostannate	cub.		13.51	
Monomethyl triethyl phosphonium chlorostannate	cub.		13.93	
Monooctyl ammonium iodide (n)	tetr.		5.18, , 23.70	
Monopropyl ammonium bromide (n)	tetr.		4.57, , 7.36	
Monopropyl ammonium chloride (n)	tetr.		4.48, , 7.40	
Monopropyl ammonium iodide (n)	tetr.		4.85, , 7.33	
Myristic acid	hex.		57.4, , 11.4	72
Naphthalene	monocl.	C_{2h}^5	8.34, 5.98, 8.68, β = 122° 44′	2
Naphthalene tetrabromide	monocl.	C_2^4	10.75, 8.97, 13.25, β = 112° 57′	4

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Naphthalene tetrachloride	monocl.	C_s^4	7.88, 10.30, 14.20, β = 112° 40′	4
Naphthol (α)	monocl.	.	13.1, 4.9, 13.4, β = 117° 10′	4
Naphthol (β) .	monocl.	.	11.70, 4.28, 17.4, β = 119° 48′	4
Nitroaniline (o)..	rhomb.	V_h^{17}	10.09, 29.44, 8.52	16
Nitroaniline (m)	rhomb.	C_{2v}^5	19.23, 6.48, 5.06	4
Nitrotoluene (p)	rhomb.	V_h^1	10.1, 11.18, 12.3	8
Nonicosane...	rhomb.	V_h^{16}	7.45, 4.97, 77.2	4
Octane ($\alpha - n$)	rhomb.		3.50, 4.36, 15.0	1
Octane ($\beta - n$).	monocl.		3.87, 4.72, 14.4, β = 120°	1
Oxalic acid + $2H_2O$	monocl.		6.12, 3.61, 12.03, β = 106° 12′	2
Palmitic acid (α)	.. .		9.41, 5.00, 45.9, β = 50° 50′	4
Pentabromofluorethane	rhomb.	V_h^{16}	11.84, 10.75, 6.55	4
Pentaerythritol ..	tetr.	C_{4v}^9	6.16, .. , 8.76	2
Pentaerythritol tetraacetate	tetr.	C_{4h}^4	12.18, , 5.58	2
Pentaerythritol tetraformate	rhomb.	V_h^{15}	19.80, 9.90, 11.70	8
Pentaerythritol tetranitrate	tetr.	V_d^4	9.38, . , 6.69	2
Pentamethylethanol	rhomb.	C_{2v}^{21}	21.35, 10.77, 7.84	8
Pentane ($\alpha - n$)	rhomb.	.	3.35, 4.31, 10.3	1
Pentane ($\beta - n$)	monocl.	.	3.86, 4.61, 10.0, β = 120°	1
Pentatriacontane	rhomb.	V_h^{16}	7.43, 4.97, 46.2	2
Phenanthrene	monocl.	..	8.60, 6.11, 19.24, β = 98° 15′	4
Phenylacetic acid.	monocl.	C_{2h}^5	14.2, 4.90, 10.1, β = 101°	4
Phenylaminoacetic acid (act.)	rhomb.	C_{2v}^5	15.2, 5.05, 9.66	4
Phenylbutyric acid (γ)	monocl.	C_{2h}^5	17.8, 4.90, 10.3, β = 98° 30′	4
Phenylpropionic acid (β) (hydrocinnamic acid)	monocl.	C_{2h}^6	32.2, 9.83, 5.54, β = 101° 13′	8
Phenylvaleric acid (δ)	monocl.		(?), 7.13, 11.32	4
Phenylene diamine (o).	monocl.	C_{2h}^4	7.74, 7.56, 11.76, β = 121° 10′	4
Phenylene diamine (m)	rhomb.	V_h^1	11.97, 8.14, 23.61	16
Phenylene diamine (p)	monocl.	C_{2h}^2	8.29, 5.93, 24.92, β = 112° 58′	8
Phthalic acid (o) ..	monocl.	. . . .	9.33, 7.13, 5.10, β = 94° 36′	2
Phthalic anhydride (o)	rhomb.	. .	7.74, 13.66, 5.86	4
Phthalocyanine ..	monocl.	C_{2h}^5	19.85, 4.72, 14.8, β = 122.25°	2
Picric acid...	rhomb.	C_{2v}^5	9.25, 19.08, 9.68	8

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Pimelic acid . . .	monocl.	C_{2h}^{5}	9.93, 4.82, 22.12, β = 130° 40′	4
Pyrene trinitrobenzene	tricl.	. . .	6.7, 8.4, 16, α = 87°, β = 84°, γ = 77°	2
Quaterphenyl. . .	monocl.	C_{2h}^{5}	8.05, 5.55, 17.81, β = 95.8°	2
Quercitol.. .	monocl.	. .	6.83, 8.53, 6.45, β = 110° 57′	2
Quinol (α)	hex.	C_{3i}^{1}	22.07, , 5.62	18
Quinol (β). .	hex.	C_{3}^{1}	16.24, . . , 5.53	9
Quinol (γ). .	monocl.	C_{2h}^{5}	13.24, 5.20, 8.11, β = 73°	4
Quinone (α).	monocl.	. . . . .	11.40, 6.43, 6.85, β = 93° 20′	4
Resorcinol..	rhomb.	C_{2v}^{9}	9.56, 10.5, 5.68	4
Rhamnose hydrate	monocl.	C_{2}^{2}	7.84, 7.84, 6.61	2
Saccharose..	monocl.	. .	10.65, 8.70, 8.00, β = 105° 44′	2
Salicylic acid.	monocl.	. .	11.56, 11.22, 4.93, β = 91° 22′	4
Sebacic acid	monocl.	C_{2h}^{5}	10.05, 4.96, 15.02, β = 133° 50′	2
Sorbose....	rhomb.	V^{4}	6.12, 18.24, 6.43	4
Stearic acid.	monocl.	C_{2h}^{4} or C_{2h}^{5}	5.546, 7.381, 48.84, β = 63° 38′	4
Stearic acid (β)	. . .		5.68, 7.39, 50.7. β = 60°	4
Stearolic acid.	monocl.	C_{2h}^{4} or C_{2h}^{5}	9.551, 4.686, 49.15, β = 53° 4′	4
Stilbene .	monocl.	C_{2h}^{5}	12.42, 5.73, 16.0, β = 114°	4
Stilbene	pseud. rhomb.		12.20, 5.72, 29.0	
Strychnine.	rhomb.	V^{4}	11.92, 12.13, 11.30	4
Suberic acid	monocl.	C_{2h}^{5}	10.12, 5.06, 12.58, β = 135° 0′	2
Succinic acid (α)	monocl.	C_{2h}^{3}	5.70, 26.2, 7.57, β = 115° 45′	8
Succinic acid (β)	monocl.	C_{2h}^{2}	5.06, 8.81, 7.57, β = 133° 37′	2
Succinic anhydride.	rhomb.	C_{2v}^{1} or V_{h}^{1}	6.95, 11.66, 5.41	4
Succinimide	rhomb.	V_{h}^{1}	7.50, 9.60, 12.75	8
Tartaric acid (*dl*)	tricl.	C_{i}^{1}	7.18, 9.71, 4.98, α = 82° 20′, β = 118° 0′, γ = 72° 58′	2
Tartaric acid (*dl*) + H_2O	tricl.	C_{i}^{1}	8.09, 10.03, 4.81	2
Tartaric acid (*d*).	monocl.	C_{2}^{2}	7.70, 6.04, 6.20, β = 100° 17′	2
Tartaric acid (*meso-*)	tricl.		9.24, 6.33, 5.45, α = 70° 30′, β = 78° 0′, γ = 79° 30′	2
Tartramic acid	rhomb.	V_{3}	12.30, 7.96, 6.00	4
Tartramide.... .	rhomb.	V_{1}	10.0, 12.2, 4.90	4
Tetrabromodimethylethane	tetr.	. . . .	8.806 . . . ., 11.27	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang	Mol.
Tetrabromodimethyl-ethane	rhomb.	V_h^{16}	11.70, 10.44, 6.57	4
Tetracarbonic acid methane, tetramethyl ester	tetr.	C_{4h}^2	9.12, . . ., 7.02	2
Tetrachlorodibromo-ethane (*sym.*)	rhomb.	V_h^{16}	11.73, 10.37, 6.50	4
Tetrachlorodibromo-ethane (*unsym.*)	rhomb.	V_h^{16}	11.61, 10.35, 6.51	4
Tetraethyl ammonium iodide	tetr.	S_4^2	8.87, . ., 6.95	
Tetramethyl ammonium bromide	tetr.	D_{4h}^7	7.76, ... , 5.53	
Tetramethyl ammonium *per*chlorate	tetr.		8.290, ... , 6.006	
Tetramethyl ammonium chloride	tetr.	D_{4h}^7	7.78, ... , 5.53	
Tetramethyl ammonium chloroplatinate	cub.	.	12.65	
Tetramethyl ammonium chlorostannate	cub.	O_h^5	12.87	4
Tetramethyl ammonium fluosilicate	tetr.	C_{4h}^5	7.88, , 11.19	2
Tetramethyl ammonium iodide	tetr.	D_{4h}^7	7.96, , 5.75	
Tetramethyl ammonium *per*manganate	tetr.	D_{4h}^7	8.439, . , 6.019	2
Tetramethyl ammonium methane	cub.	O_h^7	12.48	8
Tetranitromethane .	cub.	T^4 or T_d^1	9.2	4
Tetraphenyl methane.	tetr.	V_d^1	10.86	2
Thallic dimethyl bromide	tetr., b.c.	D_{4h}^{17}	4.47, , 13.78	2
Thallic dimethyl chloride	tetr., b.c.	D_{4h}^{17}	4.29, . , 14.01	2
Thallic dimethyl iodide	tetr., b.c.	D_{4h}^{17}	4.78, , 13.43	2
Thiophene (−170°C)	tetr.		7.22, ., 9.53	4
Thiourea...	rhomb.	V_h^{16}	5.50, 7.68, 8.57	4
Tolane... . . .	pseud. rhomb.		12.80, 5.68, 28.4	
Toluidine (*o*). .	rhomb.	V^4	6.50, 7.48, 23.62	4
Toluidine (*p*).	rhomb.		5.98, 9.05, 23.3	8
Toluolsulfamide (*o*). . .	tetr.	C_{4h}^6	18.8, . . . , 9.15	16
Tribromobenzonitrile (2,4,6)	monocl.	C_{2h}^2	12.50, 10.30, 4.87, β = 135° 36′	2
Trichlorotribromo-ethane	rhomb.	V_h^{16}	11.77, 10.44, 6.54	4
Triethyl ammonium bromide	hex.		8.56, . . , 7.49	
Triethyl ammonium chloride	hex.		8.38, . . ., 7.08	
Triethyl ammonium iodide	hex.	. . .	8.78, ., 7.74	
Triethyl methyl ammonium chlorostannate	cub.	.	13.51	4
Trimethyl ammonium chlorostannate	cub.	T_h^6	12.19	4

X-RAY CRYSTALLOGRAPHIC DATA (Continued)

Substance	System, struct. type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.
Trimethyl ethyl ammonium chlorostannate	cub.	T_h^6	13.17	4
Trimethyl sulfonium chlorostannate	cub.	.	12.41	
Trimethylene trinitroamine	rhomb.	V_h^1	11.63, 13.25, 10.78	8
Trinitrocellulose	monocl.		13.9, 25.6, 9.0, β = 90°	
Triphenyl .	monocl.	C_{2h}^5	8.14, 5.64, 14.1, β = 105°	2
Triphenylbenzene (*sym.*)	rhomb.	V_h^{16}	11.12, 19.8, 7.6	4
Triphenylbenzene (sym.) (1-3-5-)	rhomb.	C_{2v}^9	7.55, 19.76, 11.22	4
Triphenyl bromomethane	hex.	D_{3d}^5	10.8, α = 81° 30′	3
Triphenylene	rhomb.		13.20, 16.81, 5.26	4
Triphenylcarbinol	hex.		16.5, , 8.8	6
Triphenylmethane	rhomb.		15.16, 26.25, 7.66	8
Triphenyl methanol	hex.	D_{3d}^5	11.1, α = 107° 42′	3
Tyrosine hydrochloride (*d*)	monocl.	C_2^2	5.03, 8.97, 22.50, β = 101° 28′	4
Urea .	tetr.	V_d^3	5.670, , 4.726	2
Veronal	rhomb	V_h^{17}	.	4
Xylose	rhomb.	V^4	9.21, 12.48, 5.56	4

X-RAY CRYSTALLOGRAPHIC DATA

SUPPLEMENTARY TABLE

The following data have been reported since the original compilation.
Key to references will be found at the end of the Table.

THE ELEMENTS

Substances	System, structure, type	Space group	Lattice constants a, b, c, Ax. ang.	Atoms	Refs.
Au (20°)	cub.		4.0700		**ZK** (1)
Be .	hex.		5.12, , 15.77		**GC** (1)
Li (20°C)	cub. b.c.	O_h^9	3.502		**ZC** (7)
Na (20°C)	cub. b.c.		4.282	2	**ZK** (2)
Ni (170°C)	hex.		2.65, . , 4.32		**CR** (1)
U . .	rhomb.	V_h^{17}	2.852, 5.865, 4.945	4	**AC** (1)

INORGANIC COMPOUNDS

Substance	System, structure, type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.	Refs.
Ag_2Te	rhomb.	D^1_{6h}	13.0, 12.7, 12.2	57	**UT (1)**
$AgClO_3$	tetr.	C^5_{4h}	8.486, 7.894, 4.37	8	**ZK (39)**
AlB_{12}	monocl.	C^2_s or C^3_s	8.50, 10.98, 9.40, 110° 54′	lg. no.*	**ZK (15)**
AlB_{12}	pseudo-cub.		14.50, 14.30	lg. no.*	**ZK (15)**
AlB_{12}	tetr.	C^6_4, D^4_4	10.28, , 14.30	lg. no.*	**ZK (15)**
$AlKFe(CN)_6$	cub.		9.78		**GC (2)**
Al_2Ca	cub.	O^7_h	8.02		**ZK (16)**
$AuPr_2CN$	rhomb.	C^5_{2v}	17.06, 22.36, 10.0	16	**PR (2)**
Bi_2O_3	monocl.	C^1_2 or C^2_2	5.83, 8.14, 7.48, β = 67°.07	4	**AK (1)**
$Ca_3Al_2O_6$	cub.	....	15.24	24	**JR (1)**
$CoSb_2$	rhomb.	V^{12}_h	3.20, 5.78, 6.41		**ZC (1)**
$Co_2Fe(CN)_6$	cub.		10.1		**GC (2)**
CrAs			3.479, 6.210, 5.730		**ZC (3)**
Cr_2As			3.613 , 6.33		**ZC (3)**
Cr_3P	tetr.	S^2_4	9.12, , 4.56	8	**ZC (4)**
Cs_2CuCl_4	rhomb.	D^{16}_{2h}	9.69, 12.33, 7.58	4	**ZK (17)**
Cs_2SnBr_6	cub., f.c.		10.81	4	**ZK (18)**
$CuCl_4.2NH_3.(NH_4)_2$	tetr.		7.74, 8.84		**CR (2)**
$CuMg_2$	rhomb.	D^{24}_{2h}	5.273, 9.05, 18.21	16	**AK (2)**
$Cu_2Cr(CN)_6$	cub.	O^5_h	9.91		**GC (3)**
$Cu_2Fe(CN)_6$	cub.		10.0		**GC (2)**
$Cu_3[Co(CN)_6]_2$	cub.	O^5_h	9.91		**GC (3)**
$C_2N_2H_4$	monocl.	C^6_{2h}	15.00, 4.44, 13.12, β = 115° 20′	8	**AC (7)**
EuS	cub., f.c.	O^5_h	5.957	4	**ZK (19)**
$FeKFe(CN)_6$	cub.		10.2		**GC (2)**
$Fe_2Fe(CN)_6$	cub.		10.2		**GC (2)**
$HgClC_2H_5S$	monocl.	C^5_{2h}	9.34, 7.45, 7.81, 82.5	4	**AK (3)**
$HgClCH_3S$	monocl.	C^5_{2h}	7.45, 7.37, 7.82, β = 86.4	4	**AK (3)**
K_2CbF_7	monocl.	C^5_{2h}	5.58, 12.67, 8.50, β = 90°	4	**AC (8)**
$K_2CdFe(CN)_6$	cub.		10.03		**GC (2)**
$K_2HgCl_4.H_2O$		D^9_{2h}	8.27, 11.63, 8.89	4	**ZK (20)**
K_2SNBr_6	tetr.	D^2_4	7.43, , 10.61		**ZK (18)**
$K_2SnCl_4.H_2O$	rhomb.	D^{16}_{2h}	8.21, 12.05, 9.10	4	**ZK (21)**

* Large number.

Substance	System structure, type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.	Refs.
K_2TaF_7...	monocl.	C^{6}_{2h}	5.58, 12.67, 8.50, β = 90°	4	AC (8)
$K_2ZnFe(CN)_6$	cub.	....	9.98		GC (2)
K_3ZrF_7.........	cub., f.c.	O^{5}_{h}	8.95	4	AC (9)
$K_4Mo(CN)_8.2H_2O$	rhomb.	D^{16}_{2h}	16.55, 11.70, 8.68	4	AC (10)
$KB_5O_8.4H_2O$ or $KB_5O_{10}H_2.(H_2O)_2$	rhomb.	C^{17}_{2v}	11.08, 11.14, 8.97	4	ZK (22)
$KBrCuBr_2$........	monocl.	C^{2}_{2h}	4.28, 14.43, 9.71, β = 108° 23′		CR (3)
KCl_4I	monocl.	C^{5}_{2h}	13.09, 14.18, 4.2, β = 95° 7′	4	ZK (23)
KHF_2	tetr.	D_4	7.98, . , 6.74	8	RS (1)
KNO_3	hex.	C^{5}_{3v}	4.365, . α = 76° 56′	1	ZC (5)
LiCl (25°C) .	cub.	O^{5}_{h}	5.12952	4	ZC (6)
$LiOH.H_2O$	monocl.	C^{3}_{2h}	7.37, 8.26, 3.19, β = 110° 18′	4	ZK (24)
MnBi	hex.	.	4.3, 6.1	2	CR (4)
Mn_2Bi	rhomb.	.....	4.30, 5.24, 6.30		ZC (1)
Mn_3P	tetr.	S^{2}_{4}	9.160, ..., 4.599	8	ZC (4)
$NaAu_2$.(18.4°C).	cub.	O^{7}_{h}	7.7872	8	ZK (1)
NaBr ..	cub.	O^{5}_{h}	5.96095	4	ZC (5)
$NaBrO_3$.. ..	cub.	T^4	6.71	4	ZK (25)
NaCN	rhomb.	. .	3.74, 4.71, 5.61		ZK (26)
NaNCO .	hex. (rhbdr.)	C^{5}_{3v}	3.576, . . 5.10	1	CR (5)
$NaHCO_2$. .	monocl.	C^{6}_{2h}	6.19, 6.72, 6.49, β = 120° 42′	4	AC (11)
NaN_3 . .	rhbdr.	. . .	5.488, . . α = 38° 43′		CR (6)
$Na_3(B_3O_6)$	hex. (rhbdr.)	D^{6}_{3d}	7.22, ... α = 111° 29′	6	ZK (27)
NH_4CdCl_3	rhomb.	D^{16}_{2h}	8.96, 14.87, 3.97	4	AC (12)
NH_4BrICl .	rhomb.	V^{16}_{h}	6.13, 8.50, 9.94		ZK (28)
NH_4HgCl_3 .	tetr.		4.19, ..., 7.94		ZK (29)
$(NH_4)_2SnBr_6$	cub., f.c.	.	10.59	4	ZK (18)
$(NH_4)_3ZrF_7$	cub. f.c.	O^{5}_{h}	9.365...	4	AC (9)
$(NH_4Cl)_2CuCl_2.2H_2O$	tetr.	D^{14}_{4h}	7.5139, ., 8.245		JC (1)
$Ni_2Fe(CN)_6$	cub.	..	9.98		GC (2)
Ni_3P .. .	tetr.	S^{2}_{4}	8.91, . , 4.39	8	ZC (4)
$PbBr_2$	rhomb.	D^{16}_{2h}	9.48, 8.02, 4.17		ZK (30)
PbP_2O_7(300°)	cub. f.c.	T^{6}_{h}	8.01		GC (4)
$PdCl_2$	rhomb.	Pmmn*	3.81, 3.34, 11.0	2	ZK (31)
Pt_3O_4 .	cub.	..	6.226	2	JC (2)
Rb_2SNBr_6 . ..	cub. f.c.	. ....	10.64	4	ZK (18)

* Zurich notation.

Substance	System, structure, type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.	Refs.
$Rb_2S_2O_6$...	hex. (rhbdr.)	D_3^2	10.02, , 6.35	3	**ZK (32)**
ScF_3	rhbdr.	D_3^7	5.667, , 7.017	1	**ZK (33)**
ScF_3	pseudo-cub.	D_3^7	4.022, ..., β = 89° 34½′	1	**ZK (33)**
$SrBr_2$	rhomb.	D_{2h}^{16}	9.20, 11.42, 4.3	4	**ZK (30)**
$Sr(OH)_2.8H_2O$	tetr.	D_{4h}^2	8.97, ..., 11.55	4	**ZK (34)**
TeO_2	monocl.	V_h^{15}	5.50, 11.75, 5.59	8	**ZK (35)**
TlSe	tetr.	D_{4h}^{18}	8.02, . , 7.00		**ZK (36)**
Tl_2S	hex.	C_3^4	12.20, . 18.17	27	**ZK (37)**
$Zn(SbO_3)_2$	tetr., b.c.	D_{2d}^8	6.585, , 0.783	2	**ZK (38)**

MINERALS

Name	Formula	Crystal system	Space group	Lattice constants a, b, c, Ax. ang.	Mol.	Refs.
Albite	$Na_2O.Al_2O_3.6SiO$	monocl.	..	7.94, 12.90, 7.12, β = 116°		**ZK (3)**
Axinite	$HCa_3Al_2BSi_4O_{16}$	. . .	.....	7.13, 8.91, 9.14, α = 91° 51′, β = 102° 52′, γ = 81° 57′		**ZK (4)**
Nacrite	$Al_2O_3.2SiO_2.2H_2O$	monocl.	C_s^4	8.94, 5.14, 43.0, β = 90° 20′		**ZK (5)**
Schizolite	$HNa(Ca,Mn)_2Si_3O_9$	tricl.	......	8.09, 7.24, 7.05, α = 90°, β = 95°, γ = 101° 56′	2	**ZK (6)**

METAL-ORGANIC COMPOUNDS

Substance	System structure, type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.	Refs.
Cuprous acetate + H_2O	monocl.	C_{2h}^6	13.176, 8 463, 13.89, β = 117° .06′	8	**UP (1)**
Nickel acetate (ous) + $4H_2O$	monocl.	C_{2h}^5	8.46, 11.75, 4.754, β=93° 34′	2	**UP (1)**

ORGANIC COMPOUNDS

Acetamide	hex.	C_{3v}^6	11.44, . , 13.49	18	**AC (2)**
Bromanil	monocl.	C_{2h}^5	8.62, 6.22, 17.94, β = 102°	4	**ZK (7)**

Substance	System, structure, type	Space group	Lattice constants a, b, c, Ax. ang.	Mol.	Refs.
Chloranil..	monocl.	C_{2h}^{5}	8.77, 5.78, 17.05, β = 103½°	4	ZK (8)
Creatinine	monocl.	C_{2h}^{1}	14.86, 13.14, 5.85, β = 110° 36′	8	IJ (1)
Cyclohexane (180°)	cub.	T_h^2	8.41	4	PM (1)
Dicetyl ether	monocl.	C_{2h}^{6}	5.49, 7.45, 86.45, β = 63.2	4	ZK (9)
Diketopiperazine	monocl.	C_{2h}^{5}	5.19, 11.50, 3.96, β = 83°	2	AC (3)
1, 8 Dimethylpicene	monocl.	C_2^2	8.16, 6.36, c sin β = 11.92, β = 84		ZK (10)
Diphenylamine	monocl.		14.0, 13.9, 39.5	32	IJ (2)
Diphenylselenium dibromide	rhomb.	D_{2h}^{14}	13.95, 5.78, 15.40	4	AC (4)
Glycine.	monoc.	C_{2h}^{5}	5.10, 11.96, 5.45, β = 111° 38′	4	AC (5)
β-Glycine	monocl.	C_{2h}^{2}	5.07, 6.23, 5.37, β = 113° 27′		AJ (1)
Hendecamethylcellotriose.		D_2^4	21.3, 34.5, 4.50	4	CS (1)
Insulin	hex. (rhbdr.)	C_3^4	74.8 . . , 30.9		PR (1)
Menthol	hex.		11.82	8	JA (1)
β-Octamethylcellobiose		D_2^4	12.0, 43.7, 4.50	4	CS (1)
n-Paraffin ($C_{30}H_{62}$)	rhomb.	D_{2h}^{16}	7.452, 4.965, 81.60	4	ZK (11)
Pentaerythrital (above 179.5°C)	cub., f.c.		8.963		CS (2)
Phenoxselenine	rhomb.	D_2^4	5.93, 7.85, 20.5	4	PM (2)
Phenoxtellurine	rhomb.	D_2^4	5.97, 8.16, 20.5	4	PM (2)
Phenoxthionine.	rhomb.	D_2^4	5.94, 7.76, 20.5	4	PM (2)
Phenthiasine	rhomb.	C_{2v}^{9} or D_{2h}^{16}	5.91, 7.90, 2.10	4	PM (2)
Phloroglucine dihydrate		D_{2h}^{12}	6.80, 8.103, 13.70	4	IJ (3)
Selanthren	monocl.	C_{2h}^{5}	14.5, 6.24, 12.1, β = 110° 20′	4	PM (2)
Succinic acid	monocl.	C_{2h}^{5}	5.10, 8.88, 7.61, β = 133° 37′	2	ZK (12)
Sulfanilamide	rhomb.	D_{2h}^{15}	14.18, 5.6, 18.4, 1.476	8	GC
Thianthren	monocl.	C_{2h}^{5}	14.4, 6.11, 11.9 β = 110° 0′	4	PM (2)
Tricyanobromomethane	rhomb.	D_{2h}^{11}	6.05, 11.33, 17.17	8	ZC (2)
Trimethylstibine dibromide	hex.	D_{3h}^{2}	7.38, . , 8.90		ZK (13)
Trimethylstibine chloride	hex.	D_{3h}^{2}	7.27, . , 8.44		ZK (13)
Trimethylstibine diiodide	hex.	D_{3h}^{2}	7.53, . , 9.59		ZK (13)
Trinitrobenzene	rhomb.	Q_h^{15}	12.77, 26.97, 9.74	16	ZK (14)
Trisodium-Tricyanmelamine Trihydrate	hex.	D_{3h}^{4}	10.23, . . . , 5.56		AC (6)

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LIGHT

PHOTOMETRIC QUANTITIES, UNITS AND STANDARDS

Photometric quantities and units are also given in the section Quantities and Units under the sub-division Light.

Candle (or International Candle). The candle is the unit of luminous intensity. It is a specified fraction of the average horizontal candlepower of a group of 45 carbon-filament lamps preserved at the Bureau of Standards.

Lumen. The lumen is the unit of luminous flux. It is equal to the flux through a unit solid angle (steradian) from a uniform point source of one candle, or to the flux on a unit surface all points of which are at unit distance from a uniform point source of one candle.

Illumination. Illumination is the density of the luminous flux on a surface. It is the quotient of the flux by the area of the surface when the latter is uniformly illuminated.

Least Mechanical Equivalent of Light. One lumen at the wavelength of maximum visibility (0.556μ) equals 0.00161 watts ($=0.000385$ gram calories per sec.); one watt at the same wavelength equals 621 lumens.

Relative Visibility. The relative visibility factor for a particular wavelength is the ratio of the visibility factor for that wavelength to the maximum visibility factor.

Values of the relative visibility are given as a part of the specification of the standard observer under Colorimetry.

Efficiency of a Source of Light. The efficiency of a source is the ratio of the total luminous flux to the total power consumed. In the case of an electric lamp it is expressed in lumens per watt.

Spherical Candlepower. The spherical candlepower of a lamp is the average candlepower of the lamp in all directions in space. It is equal to the total luminous flux of the lamp in lumens divided by 4π.

FLAME STANDARDS

Value of Various Former Standards in International Candles

Standard Pentane Lamp, burning pentane .	10 0	candles
Standard Hefner Lamp, burning amyl acetate .	0 9	"
Standard Carcel Lamp, burning colza oil . . .	9 6	"

The *Carcel unit* is the horizontal intensity of the carcel lamp, burning 42 grams of colza oil per hour. For a consumption between 38 and 46 grams per hour the intensity may be considered proportional to the consumption.

The *Hefner unit* is the horizontal intensity of the Hefner lamp burning amyl acetate, with a flame 4 cm. high. If the flame is l mm. high, the intensity $I = 1 + 0.027(l - 40)$.

EFFICIENCIES OF ILLUMINANTS

The rating listed is the commercial rating of the lamp. The absolute efficiency is the equivalent power in light flux (at 0.556μ) per watt input. Efficiency is given in lumens per watt input.

Lamp	Rating, or Specifications	Eff.	Ab. Eff.
Acetylene . .	1 0 liters per hour	.67	0.0011
Arc, Electric			
Carbon, Enclosed, d.c..	6.6 amp., opal globe and reflector	5.9	0.0095
Carbon, Open, d.c ..	9 6 amp., clear globe	11.8	0.0190
High Intensity	150. amp., bare arc	18.5	0.0298
Magnetite, d.c........	6.6	21.6	0.0348

EFFICIENCIES OF ILLUMINANTS (Continued)

Lamp	Rating, or Specifications	Eff.	Ab. Eff.
Gas burner, Open flame..	Bray high pressure	0.22	0.00035
Gas mantle, Incandescent			
(high pressure)	.578 lumens per B.t.u. per hr.	2.0	0.0031
(low pressure) . . .	.350 lumens per B.t.u. per hr.	1.2	0.0019
Incandescent electric			
Carbon filament.......	4. watts per candle	2 6	0.0042
Treated Carbon.....	1.25 watts per candle	8.0	0.0129
Tungsten, Mazda C.	40. watts, 115 volts	10 9	0 0176
Tungsten, Mazda C	75. watts, 115 volts	13.9	0.0224
Tungsten, Mazda C.	100. watts, 115 volts	15.3	0 0247
Tungsten, Mazda C. ..	1,000 watts, 115 volts	19 3	0.0311
Tungsten, Mazda C....	5,000. watts, 115 volts	29.0	0.0467
Tungsten, vacuum. ..	10. watts, 115 volts	7.9	0.0127
Tungsten, vacuum..	40. watts, 115 volts	11.3	0.0182
Mercury in Glass			
Low pressure, d.c	6.6 amp., 50 in. tube	13.	0.0210
Optimum pressure, a.c.	400. watts	35.	0.0565
Mercury in Quartz	110. volts, d.c. (Arc only)	22.	0.0354
Moore nitrogen vacuum tube...........	220-v. 60-cycle, 113 ft.	5.21	0.0083
Nernst lamp....	....	4 8	0 0076
Sodium Arc.... ..	11,000 lumens	60	0.0966

INTRINSIC BRILLIANCY OF LIGHT SOURCES

Brightness of source is given in candles per square centimeter.

Source	$\frac{cd}{cm^2}$
Carbon Filament at 2200° K	107
Clear sky, average	.4
Crater, Low Intensity Carbon arc	17,500
Crater, High Intensity Carbon Arc 150 amp	83,000
Flames, candle	0 4–0.6
gas, argand burner	1.14
Kerosene, flat wick	1.2
Mercury, High Pressure.	27 0
Mercury, Low Pressure...	2 1
Moon (Full)	0 25
Sodium Arc	4 7
Star (Algol)	840,000
Sun (Max)...........	160,000
Tungsten at 15 lumens per watt. ...	380
Tungsten at 30 lumens per watt...	1,550
Tungsten lamp, 40-watt vacuum, filament	206
Tungsten lamp, 40-watt vacuum, frosted-bulb	2.5
Tungsten lamp, projection 1000 watt, color temperature 3175° K	2,065

VELOCITY OF LIGHT (IN VACUO)

$(2.99776 \pm .00004) \times 10^{10}$ cm/sec.
299,776. km/sec.
186,272. miles/sec.

WAVE LENGTHS OF VARIOUS RADIATIONS

	Ångströms
Cosmic Rays	0.0005
Gamma Rays	0.010–1.40
X-Rays	10–150
Ultra Violet, below	4000
Limit of suns U.V. at earth's surface	2920
Visible Spectrum	4000–7000
Violet, representative, 4100, limits	4000–4240
Blue, representative, 4700, limits	4240–4912
Green, representative, 5200, limits	4912–5750
Maximum visibility	5560
Yellow, representative 5800, limits	5750–5850
Orange, representative, 6000, limits	5850–6470
Red, representative, 6500, limits	6470–7000
Infra Red, greater than	7000
Hertzian Waves, beyond	2.20×10^6

BRIGHTNESS OF TUNGSTEN

Characteristics of Straight Tungsten Wire in a Vacuum
(Forsythe and Worthing, 1924).

Temperature °K			Brightness Candles/cm²	$\frac{B}{dB}\frac{dt}{T}$
Absolute	Brightness	Color		
1000	966	1006	0.00012	22.0
1200	1149	1210	0.006	20.0
1400	1330	1414	0.11	17.2
1600	1509	1619	0.92	15.2
1800	1684	1825	5 05	13.7
2000	1857	2033	20 0	12.3
2200	2026	2242	61.3	11.2
2400	2192	2452	157.0	10 3
2600	2356	2663	347 0	9.6
2800	2516	2878	694 0	8 9
3000	2673	3094	1257.0	8 3
3200	2827	3311	2110.0	7.8
3400	2978	3533	3370.0	7.6
3655*	3165	3817	5740 0	7.3

* Melting-point of tungsten.

COEFFICIENT OF REFLECTION OF MAGNESIUM CARBONATE

(Benford.)

Wavelength	4000 A	K = 0 930
Wavelength	4400 A	K = 0 960
Wavelength	5000 A	K = 0.975
Wavelength	6000 A	K = 0 975
Wavelength	7000 A	K = 0.975

WAVE LENGTHS OF THE FRAUNHOFER LINES

Sun's Spectrum

At 15° C and 76 cm pressure. Wave length in Ångström units (Fabry and Buisson system).

Line	Due to	Wave length	Line	Due to	Wave length
U	Fe	2947.9	*h*	H	4101.750
t	Fe	2994 4	*g*	Ca	4226 742
T	Fe	3021.067	*G*	Fe	4307 914
s	Fe	3047 623		Ca	4307.749
S_1, S_2	Fe	3100 683	*G′*	H	4340.477
	Fe	3100 326	*F*	H	4861.344
	Fe	3099 943	b_4	Fe	5167.510
R	Ca	3181 277		Mg	5167.330
	Ca	3179.343	b_2	Mg	5172 700
Q	Fe	3286.773	b_1	Mg	5183 621
P	Ti	3361 194	E_2	Fe	5269 557
O	Fe	3441 020	D_2	Na	5889.977
N	Fe	3581 210	D_1	Na	5895 944
M	Fe	3727 636	*C*	H	6562 816
L	Fe	3820.438	*B*	O	6869.955
K	Ca	3933 684	*A*	O	7621
H	Ca	3968 494		O	7594
			Z		8228 5
			Y		8990 0

WAVE LENGTHS FOR SPECTROSCOPE CALIBRATION

Source	Wave Length	Source	Wave Length
Potassium flame	0.7699μ	*E*, solar	0.5270μ
Potassium flame	0 7665	b_1, solar or magnesium flame	0 5184
Mercury arc	0.6907	b_2, solar or magnesium flame	0.5173
B, solar	0.6869	Mercury arc	0 4960
Lithium flame	0.6708	Mercury arc	0 4916
C, solar or hydrogen tube	0.6563	*F*, solar or hydrogen tube	0 4861
Mercury arc	0.6234	Strontium flame	0 4608
D_1, solar or sodium flame	0 5896	Mercury arc	0.4358
D_2, solar or sodium flame	0.5890	*G′*, solar or hydrogen tube	0 4340
Mercury arc	0 5791	Mercury arc	0 4047
Mercury arc	0 5770	H_1, solar	0 3969
Mercury arc	0 5461	*K*, solar	0 3934
Thallium flame	0.5351		

FLAME SPECTRA

Compiled by T. G. Kennard

Listed below are the prominent lines and bands given by volatile compounds when introduced into a gas flame. Additional, weaker lines are often observed. Wave lengths are stated in ångstroms, and in the case of bands refer to the position of the band head. Bands are designated by the symbol (b); the most sensitive or persistent lines or bands are designated by P.

Barium	5137 (b) 5347 (b) 5535 (b) P	Boron	5193 (b) 5440 (b) 5481 (b) P	Calcium	5544 (b) 6182 (b) P 6203 (b) P

Cesium. . .	4555 5	P	Potassium. . . .	4044.16	
	4593.18	P		4047.22	
	6213.0			7664.94	P
	6723 3			7699 01	P
	6973.3		Rubidium. . .	4201.8	P
Indium. . .	4101 76			4215.6	P
	4511 31	P		7800.30	
				7947.63	
Lithium.	6103 59				
	6707 86	P	Sodium . . .	5889.965	
				5895 932	
Manganese chloride . . .	5158 (b)				
	5193 (b)		Strontium	6060 (b)	P
	5230 (b)			6628 (b)	
	5360 (b)			6747 (b)	
	5392 (b)				
	5424 (b)		Thallium. . .	5350.47	
	5592 (b)				

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS*

The following table gives the wave lengths of the principal lines of the emission spectra of elementary substances, produced by the arc, spark or Geissler tube.

Wave Lengths are stated in ångstroms and refer to air at a pressure of 1 atmosphere except in the Schumann region. 1 ångstrom (Å) = 10^{-8} cm = 10^{-4} microns (μ) = 10^{-1} millimicrons (mμ) = 100$\mu\mu$.

Intensities of lines are indicated by the numbers 1 to 10, the latter, the higher intensity. For more complete tables the reader is referred to Kayser: *Handbuch der Spektroscopie.*

Characteristics of the lines are indicated by symbols following the intensity numbers, as shown below.

The **number of components** of an unresolved line is indicated by the subscripts: $_2$, $_3$, $_4$ attached to the intensity number.

Classes of spectra are indicated by the symbols I, II, III etc. referring to lines emitted by the neutral, ionized or doubly ionized atom. These symbols precede the wave length.

Persistent lines are indicated by p. The most sensitive of the persistent lines by P. These symbols follow the wave length.

r, easily reversed
n, broad or nebulous
N, very broad and diffuse
<, broadened toward greater wave lengths
>, broadened toward shorter wave lengths
$_2$, $_3$, $_4$, etc., unresolved line of 2, 3 or 4 components
I, II, III etc., classes of spectra emitted by the neutral, ionized or doubly ionized atom respectively
p, persistent lines
P, the most sensitive of the persistent lines.

* See also supplementary tables following this collection.

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS

Aluminum

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
III 695.82	..	3	I 2 210 05	2r	...	III 3 702.09	.	2n
III 696 23	.	2	I 2 258 0	2		III 3 713.10	..	3n
III 854 98	..	3	I 2 263 45	4r	2r	II 3 900.68	.	2
III 856.80	..	3	I 2 263 73	2	....	I 3 944 03 p	10r	8r
II 1 190.07	..	2	I 2 269 09	4r	2r	I 3 961 54 P	10r	8r
II 1 191 83	..	2	I 2 269 21	2r	..	II 4 226 81	..	6
II 1 211.93	..	1	I 2 312 4	..	1	III 4 479.97	..	5n
1 310 ?	..	6	II 2 321 56	2	6	III 4 512 53	.	5n
1 319.?	..	6	I 2 367 06	8r	4r	III 4 529 18	.	6
III 1 384.	.	5	II 2 369 30	1	4	II 4 585 82	.	6
III 1 606.	..	8	I 2 372 06	3	3	II 4 663.05		10
III 1 612	.	8	I 2 373 13	8r	4r	III 4 701.65		6
II 1 671. p	..	10	I 2 373 36	2r	2r	I 5 105.	?(2)	...
II 1 719.	.	9	I 2 378 43	3	1	III 5 150 86	.	5
II 1 721.	..	9	II 2 545 60	..	6	III 5 163.90	..	7
II 1 725.		10	II 2 568.00	10r	6r	I 5 557.05	2	
II 1 750.	..	2	I 2 575.11	10r	6r	I 5 557.95	2	.
1 752.	..	3	I 2 575.44	3r	2	II 5 593 23	..	10
II 1 760.1	..	7	II 2 631 73	..	7n	III 5 696 45	.	5
II 1 761.9	..	7	I 2 652.48	10r	4r	III 5 722.65		6
II 1 763.9	..	10(2)	I 2 660.39	10r	5r	II 5 861.53	..	7
II 1 765.7	.	7	II 2 669 17	..	10	6 151 7	1n	....
II 1 767.6	.	9	III 2 762.81	..	9	6 176	1n	.
1 777.	..	4	II 2 816.3	..	10n	II 6 231 76	..	7
1 792.		3	III 2 907.5	.	10	II 6 243 35	..	10
1 818.3	..	2	II 3 050 08	4	8	I 6 696 07	3	
III 1 854 67 p		10	3 054.70	4	2	I 6 698 73	3	
II 1 858.15 p	..	7	II 3 057.15	4	10	7 362.5	2<	.
II 1 862.48 p	..	10	3 059.93	2	1	7 466.	..	
III 1 862 90 p	.	10	3 064.31	4	2	I 7 836.9	6<	. .
II 1 930.3	..	2	3 066.16	4	2	I 8 774.5	5<	
III 1 935.2	..	7	I 3 082.16 p	10r	8r	I 11 255.	.	
II 1 989 8	.	8	I 3 092.72 p	10r	8r	I 13 125.		.
II 2 016 1		1	I 3 092 85 p	6r	4r	I 13 151.	.	
II 2 094 8	.	5	II 3 443 65		6	I 16 720.		
I 2 168 00	1r	1	II 3 587.06	..	10n(3)	I 16 752.		..
I 2 174.02	1r	1	III 3 601.62	..	7n	I 21 098.	..	
I 2 199.57	1	.	III 3 612.35	..	7n	I 21 166.	.	
I 2 204.63	2r		II 3 655.00		8(2)	I 39 108.	..	.

Antimony

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
456		1	1 211		10	1 926 6	..	5
691.	.	2	1 225.		10	2 023 9	.	4
723.	.	3	1 307.		10	2 039.7	..	5
805.	.	5	1 438.		10	2 054 0	.	6
861.	.	6	1 514.		10	2 068 4 p	4r	1
976.		10	1 566.3	.	8	I 2 175.9 p	5r	3r
981.	..	10	1 585.	.	8	2 179.25	4r	3r
1 012.		10	1 712.		6	2 306 5	5r	4
1 042.	.	10	1 725.		6	I 2 311 5 p	6r	10r
1 048.	..	10	1 731.	.	5	2 373 7	4r	3
1 162.	..	10	1 762.	..	10	2 383.64	3r	4
1 168.	.	10	1 783.		10	2 426.36	3r	3
1 171.	.	10	1 810.		5	I 2 445 55	3r	6
1 193.	.	10	1 867.	..	8	2 478.34	2	6
1 205.	.	10	1 870.6	..	10	I 2 528.54 p	6r	10r

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Antimony (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 590.29	..	10	3 473.9	..	10	6 806 3	6	1
I 2 598.08 p	10r	10r	3 498 5	..	10	7 844.4	4	. .
2 612.32	3r	8	I 3 504 5	3	10	7 924 6	6	. . .
2 652 60	3r	8	I 3 637.8	9	6	9 520.	2	. . .
I 2 670 67	5r	5	I 3 722.8	8	5	9 951.	2	. . .
2 682 77	4r	5	I 4 033.5	6	4	10 080.	4	....
2 692 27	3r	3	4 195.1	..	8	10 263.	4	..
2 718 90	3r	10	4 265 0	.	10	10 587.	5	...
2 727 22	5r	8	4 352.2	..	10	10 678.	10	. .
I 2 769 95	10r	10r	4 591 8	..	5	10 743.	5	. . .
2 790 4	..	10	4 693 0	.	10	10 840.	5	...
2 851 1	4	4	5 568 0	3	3	10 880.	3	. . .
I 2 877 92	10r	10r	5 632 0	4	.	11 013.	2	. ..
2 913 3	.	5	5 639 7	2	5	11 082	2	. .
I 3 029 8	8r	10	5 730 4	4	.	11 109.	2	....
3 040 7	.	10	6 005 0	6	3	11 190.	1	.
I 3 232 5 p	8r	10	6 079 6	6	1	11 268.	4	..
3 241 2	.	10	6 129 9	6	3	11 864.	4	.
I 3 267 5 p	8r	10	6 611.4	3	2	12 118.	2	..
I 3 383 2	5	2	6 778 4	6				

Argon, Blue Spectrum

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
1 333 7	5	2 313.9	4	2 796.7	2
1 334 5	7	2 316 4	4	2 806 2	6
1 335 8	7	2 331 6	4	2 842 6	2
1 460 1	5	2 337.7	5	2 855.2	3
1 589 5	4	2 344.3	5	2 865 9	4
1 600 7	5	2 350.5	4	2 878.8	3
1 669 7	7	2 364.1	4	2 884.1	4
1 673 5	7	2 395 6	4	2 891.7	4
1 675 6	7	2 404 3	4	2 896 8	2
1 788 1	5	2 415 6	6	2 924 7	3
1 820 0	7	2 438 7	6	2 931 5	2
1 830 6	10	2 452 9	1	2 943 0	7
1 831.4	9	2 479 1	6	2 955.4	5
1 836.3	9	2 480 8	5	2 979 1	6
1 843 1	9	2 490 9	6	3 029 0	4
1 855 7	9	2 499 4	4	3 033 6	3
1 865 9	8	2 500 3	4	3 093 40	6
1 868 7	8	2 512.2	3	3 139 06	5
1 873.2	10	2 515 5	8	3 161 44	5
1 877.7	8	2 516.7	8	3 169.71	5
1 879.7	8	2 544 7	6	3 181 09	4
1 886 1	7	2 562 2	6	3 204 35	3
2 050 4	1	2 647.5	8	3 212 62	2
2 219 8	4	2 708 3	8	3 243 72	3
2 234 6	4	2 732.6	6	3 249.83	3
2 243 6	4	2 744.8	8	3 263.58	3
2 252.3	4	2 753 8	8	3 281.71	5
2 281.5	5	2 762.0	3	3 285.77	7
2 309.3	4	2 769.6	6	3 293.65	4

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

ARGON, BLUE SPECTRUM (Continued)

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
3 301.81	6	3 753 5	3	4 203.4	2
3 307.23	4	3 763.59	4	4 218.66	3
3 311.19	5	3 765.32	6	4 222.64	4
3 336 15	4	3 766.14	3	4 226.98	3
3 344.73	4	3 770 61	3	4 228.2	7
3 350.97	4	3 780 89	7	4 237.21	4
3 358.51	4	3 786 42	4	4 266.29	6
3 366.61	2	3 795 38	5	4 266 4	6
3 370.93	2	3 799.47	3	4 277.5	8
3 376.47	4	3 803.23	3	4 282.88	4
3 388.54	5	3 808.58	2	4 300.66	2
3 391 77	5	3 809 46	4	4 309.15	2
3 421.67	3	3 826 80	4	4 331.17	7
3 429.69	2	3 830 43	3	4 332.04	3
3 430 48	2	3 845.37	3	4 348.0	10
3 454.15	3	3 850.56	9	4 352.21	4
3 464 20	4	3 868 55	7	4 362.04	3
3 466 3	3	3 872.14	4	4 370 75	5
3 476.79	7	3 875.25	5	4 371 31	5
3 478.26	4	3 880 29	3	4 379 64	6
3 480 51	5	3 891 39	4	4 400 09	4
3 491 29	5	3 891.99	6	4 401 00	5
3 491.57	8	3 907.70	3	4 425 99	8
3 499 68	3	3 911 56	3	4 430 18	4
3 503.59	2	3 914 78	5	4 431 00	4
3 509 36	2	3 925 76	4	4 433.90	2
3 509.80	4	3 928 61	8	4 481 83	5
3 511 16	5	3 931 20	3	4 488 2	2
3 514 40	6	3 932 56	5	4 491 0	2
3 520 02	4	3 944 30	5	4 498 5	2
3 521 29	3	3 946 10	4	4 502 95	3
3 521 97	2	3 958 40	3	4 545 06	6
3 535 37	5	3 960 45	3	4 547 7	2
3 545 64	7	3 968 37	4	4 579 35	6
3 545 86	7	3 974 52	4	4 589 89	6
3 548 53	3	3 979 40	5	4 609 56	6
I 3 559 54	7	3 992.03	4	4 637 17	3
3 561.06	6	4 013 84	7	4 657 88	4
I 3 564 41	2	4 033 85	3	4 726 83	4
3 565 06	3	4 035 45	3	4 735 87	5
3 576.65	8	4 038 83	4	4 764 85	4
3 581 66	5	4 042 89	6	4 805 99	8
3 582 39	6	4 052 96	4	4 847 77	6
3 588 49	9	4 072 02	7	4 865 9	4
3 622.18	4	4 072 43	4	4 867 5	4
3 637 08	3	4 076 70	6	4 879 9	6
3 637 86	4	4 077 03	2	4 882 3	2
3 639 86	4	4 079 61	4	4 888.7	2
3 650 9	3	4 080 61	2	4 904.8	2
3 655 35	4	4 082 41	4	4 933.2	4
3 656 12	2	4 099 45	2	4 942 9	2
3 660.52	3	4 103 95	9	4 955.1	2
3 717.21	3	4 112 82	3	4 965.1	4
3 718.25	5	4 128 6	3	4 972 2	3
3 720.46	3	4 131 78	6	5 009.3	6
3 724.53	3	4 156 14	4	5 017.2	5
3 729.33	9	4 178.38	3	5 024 3	1
3 737.92	5	4 179.30	3	5 062 1	6

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Argon, Blue Spectrum (Continued)

Wave length	Geissler tube	Wave length	Geissler tube	Wave length	Geissler tube
5 142 0	4	5 217 0	2	6 172 2	4
5 145 40	4	5 287 0	3	6 243 4	2
5 165.8	4	5 305 8	6	6 640.2	0
5 176.4	3	6 114.8	3		

Argon, Red Spectrum

Wave length	Geissler tube	Wave length	Geissler tube	Wave length	Geissler tube
2 516.2	4	I 4 158 59	9	5 506 4	2
2 614 5	4	I 4 164 18	7	5 525 1	2
2 802 1	3	I 4 181 88	7	5 558 8	5
2 833 5	3	I 4 190 71	5	5 559.7	2
2 873 4	3	I 4 191 03	8	5 572 6	4
2 967.2	5	I 4 198 32	8	5 581 6	2
2 968 3	2	I 4 200 68	9	5 597 7	2
3 021.8	3	4 201 9	2	5 607.0	6
3 034 6	3	I 4 251 18	5	5 618 1	2
3 295 3	2	4 259 36	9	5 648 8	2
I 3 319 3	2	4 266 29	8	5 650 8	5
3 325.49	2	I 4 272 17	8	5 659.2	3
3 373.5	2	I 4 300 10	8	5 682 4	2
3 392.8	2	I 4 333 56	7	5 691 7	1
I 3 393.8	3	I 4 335 29	6	5 739 7	3
I 3 461.06	3	I 4 345 17	7	5 772 3	2
I 3 554 31	4	I 4 363 78	3	5 802 2	1
3 555.31	2	4 501 5	1	5 832 1	1
3 556.00	2	I 4 510 73	8	5 860 4	3
I 3 563 2	3	I 4 522 33	4	5 882 7	3
I 3 564 3	2	4 596 10	5	5 888 7	4
I 3 567 68	4	I 4 528 45	5	5 900 5	1
I 3 572 27	2	4 702 32	4	5 912.1	5
I 3 599 3	1	4 768 4	1	5 916 6	2
I 3 606 53	5	4 888 1	1	5 927 1	2
I 3 632 65	4	4 894 8	1	5 928 5	4
I 3 634 46	4	5 049.	2	5 940 9	2
I 3 643 1	2	5 054 3	1	5 943 0	3
I 3 649.9	3	5 060 2	3	5 949 3	3
3 659 5	2	5 063 0	1	5 964 5	2
3 670 7	3	5 152 5	3	5 968 4	2
3 678 31	5	5 162 4	4	5 971 7	3
3 680 1	4	5 177 6	1	5 987 3	3
I 3 690 9	1	5 187 3	3	5 999 2	2
I 3 696 5	1	5 188.3	3	6 005 8	2
3 770 4	3	5 221 6	3	6 013 6	3
I 3 775 4	1	5 252 9	3	6 025 4	3
I 3 781 33	3	5 254 4	2	6 032 13	6
I 3 834 65	5	5 373 6	2	6 043 2	6
I 3 866 14	1	5 410 6	2	6 052.6	4
I 3 894 64	3	5 421 6	4	6 059 4	5
I 3 899 90	2	5 440 1	2	6 064 7	3
I 3 947 55	4	5 442 1	1	6 067 7	1
I 3 948 98	7	5 443 3	2	6 090 8	3
I 4 032 96	2	5 451 7	5	6 098.7	4
I 4 044 42	8	5 457 8	2	6 101 1	2
4 045 88	4	5 467 2	2	6 104 5	2
I 4 054 50	3	5 473.6	2	6 105.8	4
4 152 7	3	5 495 9	6	6 113 4	2

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

ARGON, RED SPECTRUM (Continued)

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
6 119.5	2	6 660 7	3	I 7 503.87 p	4
6 121.7	2	6 664.1	3	I 7 514.65	4
6 127.4	3	I 6 677 28	5	I 7 635.11	6
6 145 4	4	6 684 4	1	I 7 723.76	5
6 155.1	3	6 698.9	3	I 7 948.18	5
6 165 1	3	6 719 2	2	I 8 006.16	8
6 170 1	3	6 752.83	5	I 8 014.79	3
6 172.9	4	6 756.4	1	I 8 103.69	3
6 212.4	4	6 786.3	1	I 8 115 31 p	10
6 215.9	4	6 871.29	4	I 8 264.52	5
6 248.5	3	6 888 8	1	8 405.	6
6 278.6	2	6 937.67	2	I 8 408.21	6
6 296 8	3	I 6 965.43 p	6	I 8 424.65	10
6 307.6	3	7 030.25	2	I 8 521.44	5
6 364.8	3	I 7 067.22 p	5	I 9 123.7	10
6 369.6	3	I 7 147.04	1	I 9 225.9	5
6 384 5	4	7 206.99	1	I 9 658 9	7
6 416 31	6	I 7 272.94	3	I 10 640	12
6 431.6	3	7 311.6	1	I 11 590.	8
6 466.5	3	7 315 9	1	12 500.	30
6 481.0	2	7 353 32	1	13 505.	4
6 493 9	2	7 372 12	1	13 719.	4
6 513.7	1	I 7 383 98	5		.. .
6 604.9	3	7 435 5	1	.	. .. ..

ARSENIC

Wave length.	Arc.	Spark.	Geissler tube.	Wave length.	Arc.	Spark.	Geissler tube.
529.	. .	1	.	2 074	.	12	. . . .
827.	. .	5	.	2 113	2	3	.
873.	.	8	.	2 134	2	2	.
878.	. .	8	.	2 144 2	4	1	
926.	. .	8	.	2 165 5	4	2	
952.	.	8		2 183 0	1	1	
956.	. .	8	.	2 192 1		2	. .
963.	.	10		2 205 2	2		. .
984.	.	10		2 206 0	2		. .
1 001.	.	10		2 228 7	2	1	. .
1 009.	.	10	.	2 271 39	4	1	. . .
1 081.	.	50	.	I 2 288 14 p	10r	3	. .
1 093.	.	20		I 2 349 84 p	10r	6	4
1 106.	.	10		2 369 67	4r	5	4
1 171.	.	15		2 370 77	4r	5	4
1 208.	. .	30	.	I 2 381 20	4r	5	5
1 267.	.	40		2 437 22	1	5	3
1 287.	.	10		2 456.52	4r	7	5
1 700 2		10		2 492 91	2	5	4
1 733.0		15	.	2 602.9	. . .	2	6
1 742.9	.	20	.	I 2 745 00	6r	5	7
1 890. p	. .	4r		I 2 780 23 p	8r	10	8
1 936. p	. .	5	.	2 830 4	. .	4	8
1 972. p	.	4r	. . . . .	I 2 860.46	4r	8	7
2 031.	. . .	10	. . . . . .	I 2 898 73	4r	6	6

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Arsenic (Continued)

Wave length.	Arc.	Spark.	Geissler tube.	Wave length.	Arc.	Spark.	Geissler tube.
2 926.2	...	1	6	4 458 6	...	2	7
2 959 6	. .	7	6	4 461 1	..	....	8
I 2 990 99	2	4	5	4 466.4	. .	1	7
3 003 8	...	2	6	4 474.4	.	4	8
I 3 032 84	4	8	6	4 494 4	.	3	7
I 3 075 32	2	5	5	4 515 9		. .	7
3 116 5	...	3	7	4 528.4	. .	.	7
I 3 119.6	4	7	5	4 539 8	..	3	8
3 126.9	. .	. . .	6	4 543 6	. .	. ...	7
3 180 6	.	. .	6	4 549 0	...	2	9
3 255.	.	2	6	4 552 2		2	7
3 513 0	. .	.	6	4 590 8	.		7
3 551.6	.	. .	5	4 602 5	.	.	7
3 671.7	.	. .	6	4 607.3	...	2	5
3 787.2	.	3	6	4 619 4	..	. .	7
3 842 9	.	4	7	4 629 9	...		7
3 922 5	.	10	7	4 672 5	...	.	7
3 931.1	.	2	7	4 707 6	...		7
3 948.6	.	3	6	4 730 7	..	..	8
4 006 2	.	3	6	4 787 1	...	1	6
4 037 0	.	6	6	4 799 5	...	1	6
4 062.6		.	7	4 802.1	...	1	6
4 065 4	.	2	7	4 811.8	...	1	6
4 082.4	...	. .	7	4 888 6	...	2	8
4 157 5	.	.	7	4 915 3	...	.....	7
4 190 2	. .	2	7	4 985.4	...	5	9
4 197.5	. .	3	7	5 105.5	...	8	8
4 207.8	. .	2	7	5 107.6	...	8	8
4 221 0	. .	. .	7	5 161.1	..	7	7
4 228 2	.	2	7	5 182 2	..	.....	7
4 243 1	...	. . .	7	5 205 3	..	1	6
4 299 4	.	3	6	5 331.3	...	8	7
4 302 1	.	. . .	8	5 496 9	...	5	6
4 315 7	...	1	7	5 497 8	...	10	7
4 324 0	.		7	5 558.1	..	10	8
4 336 7	.	5	7	5 620.6	...	1	10
4 352.1	.	5	7	5 651.3	...	10	10
4 352 9	.	. .	8	5 657.0	...	1	8
4 371.	.	5	7	5 684 8	.	1	7
4 412.0		.	7	5 731 8	.	1	6
4 413 5	.	. .	7	5 837 9	.	... .	6
4 420.9	.	.	7	6 023.	. .	6	......
4 427.2		.	7	6 110.	.	6	.. ...
4 431.6	.	4	8	6 170.	.	6	......

Barium

Wave length.	Arc.	Spark	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
1 331.	.	2	II 1 869	.	5	II 2 634 80	5	8<
1 415.	. .	3	II 2 304 22	6r	8r	II 2 647.29	4	4
1 504.	. .	4	II 2 335 25	6r	10r	I 2 702.65	6<	2
1 554.	.	3	II 2 347.58	5	7	II 2 771.4	2	3<
1 674.	.	4	II 2 528.51	.	6<	I 2 785.26	6<	....
II 1 694.	. .	6	I 2 596 68	6<	.	I 3 071 60	8r	6r

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Barium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
I 3 262 4	3r		5 680 17	5	1	9 370 1	3	..
I 3 356.9	6<		I 5 777 7 p	10r	5	9 527	10	.. .
I 3 377 0	8		5 800 34	7	2	9 611	10	. .
I 3 377 4			5 805 71	5r	2	9 713.	2	..
I 3 420 3			I 5 826 30	7r	4	I 9 832	7	....
I 3 421.0	10		II 5 853 7	8r	5	10 002	3	.
I 3 421 5			I 5 907.6	6	2	II 10 034.	6	. ..
I 3 501 12	8r	2	I 5 971.71	10	3	I 10 189	1	
I 3 525 0	6<	. .	I 5 997.10	7r	3	10 234.	6	. ..
I 3 544 7	6<		I 6 019 49	7r	3	I 10 273.	5	. ..
I 3 547 7	4n	.	I 6 063.16	8r	4	I 10 326.	..	. .
I 3 579 7	6<	2	I 6 110 80	8r	5	10 474	6	.
3 630 65	8<	2	II 6 141 74	10r	10r	II 10 651	8	. .
3 889 32	5	2	I 6 341 70	7r	3	10 692	2	
II 3 891.78	8<	8r	I 6 450 85	7	3	11 016	4	. .
3 892 65	5		6 482 93	7r	3	11 116	2	. .
I 3 909.92	6<	6<	II 6 496 91	10r	10r	I 11 304	2	.
I 3 935.72	7<	6<	I 6 498 77	8r	4	11 608.	2	.
I 3 937.88	5	3	I 6 527.32	8r	3	11 886.	5	.
I 3 993.40	8r	6	I 6 595 35	7r	3	11 978.	2	..
II 4 130.68	8r	10r	I 6 675 29	6r	2	II 12 084.	5	. ..
4 132 44	5	3	I 6 693 86	6r	2	12 554	3	. .
II 4 166 04	5<	10<	6 865 69	5		12 815	1	.
I 4 283 12	8	8	I 7 059.96	8r		13 057.	1	. ..
I 4 323 00	4>	1	II 7 120 30	6		I 13 207.	4	. .
I 4 332 91	4>	1	I 7 195 26	6		13 811.	4	..
4 350 38	8	5	7 228 82	5	.	13 957.	2	. .
4 402.55	8	6	7 280 31	8r	..	14 078.	4	
I 4 431 91	7	6	I 7 392 44	6		14 160.	3	
I 4 488 97	7>	2	7 417 55	4		14 211.	3	.
I 4 493 64	5>	2	7 459 7	5		14 325	3	
4 505 94	8	5	7 488 10	5	.	I 15 000.	4	
4 523 25	8<	3	7 642 9	5	.	17 065.	1	.
II 4 524 95	8	10<	7 672 10	7		17 182.	1	.
II 4 554 04 P	10r	10r	7 780 50	8	.	18 204.	2	.
4 573 88	6r	4	7 839 58	5	.	19 075.	2	
4 579 66	8r	8	I 7 905 77	7	..	19 988.	3	
4 599 75	6r	2	I 7 911.35	6		I 20 712.	4	
I 4 619 98	5<	1	8 120 5	3		I 21 477.	2	
I 4 628.83	5>	1	8 147 8	2		22 221.	2	.
I 4 673.61	7>	2	8 210 32	10		22 313.	2	
4 691 63	7r	4	8 559 91	10	. .	23 255.	3	
I 4 700 45	6<	1	8 567 6	3	.	I 25 516.	5	.
I 4 726.46	8<	5	8 582 1	4	.	26 221.	2	.
II 4 899 96	8	10	8 654.03	4	.	27 751.	3	.
I 4 902 88	4<	...	I 8 799 7	2n	.	I 29 224.	5	
II 4 934 10 p	10r	10r	8 860 96	4	. .	29 791.	4	..
I 5 424 63 p	7<	3	8 915 00	4	..	30 469.	2	
I 5 519.11 p	8r	5	9 189 4	2	...	I 30 687.	2	....
I 5 535 53 P	10r	6	9 219 7	2	..	I 30 934.	3	. .

Beryllium

II 1 036 32		3	II 1 776 34	.	8	I 2 351 50	6	....
II 1 512.30		8	I 2 056 71	4	..	I 2 494 53	7	3
II 1 512.45	..	10	I 2 175 72	10	...	I 2 494 58	7	3
II 1 776.12	.	6	2 348.62 P	8r	3	I 2 494 72	7	3

BERYLLIUM (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
I 2 651.	10	10(6)	II 4 674 55		8	15 393 }	6	. . .
II 3 047.86	.	4	II 5 274.28	.	4	15 400. }		
II 3 131 32	9	10	10 283.	5	. .	15 951.	.	. .
3 131 97	9	5	10 674.	4		16 794	2	.
II 3 198.01	..	4	12 141.	7		17 571	2	
II 3 275 57	.	5	12 329.	4		21 560.	3	..
I 3 321 97	8	2	12 355.	6	.	21 897	2(2)	. .
I 3 322 04	8	2	13 227.	6		22 239.	2	. .
I 3 322 30	8	2	14 904.	3	. .	23 097 }	6	. .
II 4 362 21	.	7	15 006. }	3	..	23 110 }		
4 572 69	8	1	15 013. }					

BISMUTH

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
670.	..	1	2 627 93	8r	4	5 742.55	6	..
791.		2	2 696 76	6r(2)	4r	5 861 14	.	4
967.		3	2 730 50	4r(2)	2r	6 128.1		4
1 045.		10	2 780 52 p	7r	4	6 134.85	5	1
1 051.		10	2 809 63 p	8r	2	6 475.5	3	.
1 306.		10	2 897 98 p	10r	5r	6 476 2	3	
1 317.	.	15	2 938 31 p	10r	8r	6 497 5	.	4
1 346		10	2 989.04 p	9r	5r	6 600 1		7
1 533 7	5	3	2 993 34	9r	4	6 809 1		7
1 776 7	3	4	3 024 64	8r	4r	6 991 1	4	.
1 787 1	3	4	3 067 73 P	9r	6r	7 036 2	2	
1 791.7	4	4	3 076 67	3	2	7 335 0	1	. .
1 823.5	3	5	3 397 21	5r	2	7 441.3	1	
1 902.5		1	3 405 23	2r	1	7 502 3	2	
1 959.6		3	3 510.85	6r	5	7 838.7	3	
1 973 2		3	3 596.11	3r	4	7 840.3	2	.
2 061.7 p	8r	3	3 695 53	..	8	8 210 8	10	
2 110.3	8r	2	3 792 9	.	8	8 501.8	1	
2 113.8	3	. .	3 887.94	2	1	8 544.5	2	
2 133.6	7r		3 888.22	2	1	8 579 7	1	
2 134 4	8r	1	4 079 22	..	10	8 627 9	1	
2 143 6	..	2	4 121 52	6	4	I 8 754 9	2	
2 144 4		2	4 121 85	6	4	8 761 5	3	
2 152 9	7r	.	4 259 64	.	10	8 907 8	2	
2 153.5	4r	.	4 302 13	.	10	9 058.6	2	.
2 156 9	4r	.	4 308 20	4	2	9 342 6	4	
2 164 1	4r		4 308 56	4	2	9 657 2	10	
2 177 3	6r	1	4 328 6		3	9 829.	2	
2 189 59	6r	. . .	4 340 6	.	4	10 106	2	.
2 203 1	4n	1	4 561 15		8	10 302.	2	. . .
2 214 1	3	1	4 722 2	10	5	10 540	1	..
2 228.25	6r	2r	4 722 5	10	8	11 073.	1	
2 230 62	8r	4r	4 722 7	8	8	11 556.	1	. .
2 276.57 p	5r	2	4 729 9		3	11 711	10	. . .
2 309 3	4N	. .	4 733.8	2<	....	11 995.	1	. .
2 328.2	2n	.	4 797 5	.	3	12 167.	4	.
2 400.89	8r	7	5 124 4		4	12 691.	3	.
2 430 5	2n	. . .	5 144 50		6	14 332.	3	
2 489.4	5N	1	5 209 28	.	10	25 554	1	.
2 515.68	6r	1	5 552 24	8	3			
2 524.52	7r	2	5 599.41	3	....			

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Boron

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
III 677.01	..	5	I 1 825 87		1	I 2 089 6	.	2
III 677.16			I 1 826 41			2 266 3	..	2
III 758 47	..	3	III 2 066.4	.	2	2 266 9	.	2
III 758.68			III 2 067.9			I 2 496.78 p	9r	9r
II 1 624.4	..	8(5)	I 2 088.8	..	1	I 2 497.73 P	10r	10r
						II 3 451.2 p	.	10

Bromine

Wave length.	Spark.	Geissler tube.	Wave length	Spark.	Geissler tube.	Wave length.	Spark.	Geissler tube.
1 251 8	. ..	4	3 929 57	..	6	4 742 70	3	8
1 384 6	...	8	3 935 16		6	4 766 07	2	5
1 488 6	. .	8	3 939 70	2	5	4 767 1	2	8
1 531 9		7	3 950 60	1	7	4 776 43	2	7
1 540 8 p	.	6	3 955.35	. .	8	4 780 33	.	6
1 575 0		9	3 968 65		5	4 785 48 p	10	10
1 576 5		6	3 980 01	.	5	4 816 72 p	8	8
1 582.4	.	8	3 980 43	.	10	4 848 80	1	6
1 633 6 p	.	10	3 986.53	1	8	4 928 7	1	5
2 386 8	3	.	4 007.30		5	4 930 6	1	5
2 389.8	3		4 008.78	.	6	4 979 77		4
2 522.	4		4 024 04		5	5 054 7		4
2 541.	4		4 135.64	.	5	5 164 4		5
2 557.	4		4 140 22	1	6	5 182 4	3	7
2 594.	3		4 175 76	. .	5	5 183.9		4
2 660.	3		4 179 62	1	8	5 238.3	2	8
2 872.	3	.	4 193 45	1	6	5 272 7	. .	4
2 892.	3		4 223.85	..	6	5 304 1		7
2 926.	5		4 236 85	.	6	5 332 0		10
2 968.	4		4 291.38	2	6	5 396 5		5
3 020 8	4		4 365 58	4	8	5 422 8		7
3 074.	4		4 425.13	..	5	5 425 0		5
3 168.	3		4 441.74	.	8	5 435.1	.	5
3 282 1	3		4 472 64	.	8	5 466 2		5
3 333 0	5		4 477.78	..	10	5 488 8		6
3 396 9	4		4 490 48		5	5 490 4		7
3 417	5	.	4 513 47	1	5	5 536 3	.	4
3 506 5	5		4 525 6	.	8	5 589 9	.	8
3 517 4	5		4 529 80	.	5	5 600.7	. .	4
3 540.1	8		4 538 75	1	5	5 657 6	. .	4
3 562.4	10	.	4 542 93	2	8	5 711.0	..	4
3 693 5	3		4 575 77	.	6	5 719.0	.	4
3 794 0	3	4	4 601 4		5	5 830.8	...	7
3 834 71	. .	6	4 614 6		6	5 852.2	...	5
3 857 21		6	4 622 7	3	8	5 940.6	.	4
3 871.23		6	4 652 00	1	6	6 118.7	.	4
3 891 64	1	8	4 672 58	1	6	6 123 3	.	3
3 914 26	1	10	4 678 70	8	8	6 149 7	.	10
3 919 6	..	6	4 693 30	5	3	6 350 8		10
3 920 68	.	6	4 704 83 p	10	10	6 560 0	.	4
3 923.36	...	6	4 719 76	3	8	6 631 8	. .	5
3 924 09	2	8	4 735 47	....	5	6 682.	.	2

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Cadmium

Wave length.	Arc.	Spark.	Wave length.	Arc	Spark.	Wave length.	Arc.	Spark.
396		1	I 2 836 92	8r	6N	I 5 085.82	10r	10
847.	..	10	I 2 868 3	6<	3<	I 5 297 7	3	.
1 369.		20	I 2 880 78	8r	6	II 5 337 49	3	25
1 397.	.	20	I 2 881 24	4r	3N	5 338 5	..	10
1 462.	.	20	I 2 980.62	8r	6	I 5 339.	2	.
1 466.	.	8	I 3 080.83	8<	3<	5 378.	3	.
1 472.	.	8	3 095.5	.	5<	II 5 378.12	.	10
1 514		20	3 129 23	.	5n	II 5 381.82	.	10
1 628 7	.	6	I 3 133.17	2<	5<	5 497.		10n
1 707 5		8	3 185 53	.	5	I 5 598 8	3	.
1 747 9		6	II 3 250 29	..	25	I 5 604 7	2	
1 768 8		6	I 3 252.53	8<	6n	5 637 3	5	. .
1 773 1		6	I 3 261 05	10r	7	I 6 031 4	3	.
1 844 5		10	3 298 97	4	4r	I 6 099 1	5	. .
1 856 0	..	15	I 3 403 65 p	10r	10	I 6 111 5	3	.
1 873 6		15	II 3 417 40	.	10	I 6 116 12	3	1
1 900 7	.	6	I 3 466 20 p	10r	8r	I 6 325 1	5	1
1 921 8		2	I 3 467 66	8r	10	I 6 329 94	5	..
1 939	.	2	II 3 495 36	.	15	II 6 359.93		10
I 1 942.		2	II 3 535 67	.	20	I 6 438 47	10	10r
1 995		3	I 3 610 51 p	10r	10r	II 6 464 98	.	10
2 004 2	.	5	I 3 612 88	8r	9	II 6 725 83		15
2 055 3		3	I 3 614 4	7	7	I 6 777 7	2n	.
2 062 0	.	5	I 3 729 06	4r		I 7 346 0	1n	.
II 2 144 39 P	4r	6r	3 852 1	.	3	I 7 382 3	2n	.
II 2 194 62	1	4r	3 940 3		5	I 7 399.	5	.
2 239 86	6r	3	3 976 6	.	5	I 8 200.1	1n	.
II 2 265 03 p	4r	10r	3 977.3		5	I 10 394.6	10	.
2 267.47	4r	2	3 988 2		4	I 11 268.	4	.
I 2 288 03 P	10r	10r	II 4 029 08		10	I 11 630.	2	.
2 306 63	4r	3	4 057 5		5	I 13 979.	10	.
II 2 312 88	4	10r	4 094 8		4	I 14 327.	10	.
II 2 321.15	1	7	4 127 0	.	4	I 14 354.	8	. .
2 329 27	8r	6	II 4 134 78	..	15	I 14 473.	8	.
2 469.76	.	4	4 191.6	.	4	I 14 849.	2	.
I 2 553 6	4<	....	4 216 9	.	6	I 15 154.	10	.
II 2 573 04	4	10	4 245 6		4	15 258.	7	.
I 2 639.50	6r	1n	II 4 412 31		10	I 15 711.	7	.
I 2 677 6	8(2)	3n	4 415 68	1	6	I 16 402.	2	. .
I 2 712 6	6<	1n	I 4 678 15	10	10	I 16 432.	6	. .
II 2 748 58		10	I 4 799 91	10r	10	I 16 482.	6	.
I 2 763 9	6r	3N	II 4 881 73	..	10	I 39 086	..	

Calcium

Wave length.	Arc.	Spark.	Wave length.	Arc	Spark.	Wave length.	Arc.	Spark.
404		6	1 562.	.	4	II 2 208 7	3	3
410.	.	6	1 667	.	5	I 2 275 5	1	4r
537.	..	5	II 1 807 8		7	I 2 398 58	8r	1r
655	.	6	II 1 815 0		8	2 493 00	7	. .
669	.	6	II 1 838.	.	9(2)	2 899 78	9	. .
688	.	5	II 1 840 2	.	10	2 924.33	8	. . .
718.	.	6	II 1 843 7		6	I 2 994.95	3	2
832.	..	10	II 1 851.3	.	7	I 2 997.31	3	2
840.	.	6	2 035.	4	.	I 3 000.87	4	2
902.	.	10	2 040	4		I 3 006.85	4	4
II 1 434.	.	6	II 2 103 2	2	3	I 3 009.21	2	2
II 1 553.		7	II 2 112.7	2	3	3 119.66	..	8
II 1 555.	.	8(2)	II 2 197.8	3	3	II 3 158.87	8	10r

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

CALCIUM (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
II 3 179 34	6	10r	I 4 455 88 p	8r	8	6 449 82	5	3
II 3 181 3	4	10	I 4 456.62 p	4	5	6 455.57	3	2
I 3 215.1	3>	. .	4 499.90	. .	10	I 6 462 57	6r	6
I 3 225 8	4<	. .	I 4 526.98	6	5	I 6 471 68	5	5
I 3 286.1	5	.	I 4 578.57	8	5	I 6 493 76	8	5
I 3 344.49	5>	. . .	I 4 581.45	8	6	I 6 499 64	5	4
I 3 350 19	6>	1	I 4 585.84	6	. .	I 6 572 75	2	1
I 3 361 91	6>	1	I 4 585 91	2	8	I 6 717 7	8	2
I 3 468 48	4<	. . . .	I 4 685.2	4>	1	7 148 18	10	. .
I 3 474 78	4<	. . .	I 4 878 17	10<	8<	7 202 18	8	
I 3 487.61	6<	1	I 5 141 65	8<	3	I 7 326 12	8	
I 3 624.10	6	1	I 5 188 84	6	5	7 610	6<	.
I 3 630 73	6	1	I 5 260 39	4	3	II 8 498 0	8	
I 3 630.96	5	1	5 261.70	6	5	II 8 542 1	10	.
I 3 644.39	10	4	5 262.23	6	5	II 8 662.1	9	. .
I 3 644 76	5	. . .	I 5 264 23	6	5	9 251.	3	
II 3 706 03	6	8<	5 265 55	8	8	9 547.	7	
II 3 736.91	6	10r	I 5 270.27	10	10	9 695.	7	
I 3 875 7	3	. . .	5 349 46	10	5	I 10 345.	10	
II 3 933 67 P	10r	10r	I 5 512 93	8	2	I 12 822.	5(?)	
I 3 948 91	4<	1	5 581.96	8	4	13 038.	3	
I 3 957 07	6<	2	5 588.74	10	10	I 16 145.	2	
II 3 968 47 P	10r	10r	5 590.10	10	6	I 16 162.	2	
I 3 973 7	6<	3<	I 5 594.47	8	6	I 16 200.	3	.
I 4 098.6	4<	2<	5 598.46	10	8	16 433.	1	
I 4 226.73	10r	10r	I 5 601.26	8	4	I 19 311.	4	.
I 4 240.44	4	2	5 602.84	8	5	I 19 453.	5	
I 4 283.00	8r	8r	5 857 49	10	10	I 19 507.	3	
I 4 289.36	8r	8r	5 867.62	4<	. . .	I 19 777.	6	
I 4 298.99	6	8r	I 6 102 73	8r	8r	19 817.	1	.
I 4 302.53	10r	10r	I 6 122.24	10r	10r	I 19 857.	4	
I 4 307.74	8r	8r	I 6 161 32	5	2	I 19 865.	4	. .
I 4 318 65	8r	8r	I 6 162 20	10r	8r	I 19 918.	1	. .
I 4 355.2	6n	2	I 6 163 80	4	2	I 19 936.	3	
I 4 425.44	10r	10	I 6 166 49	4	2	I 19 947.	1	
I 4 434.96	10r	10r	I 6 169 08	4	3	I 22 610.	1	
I 4 435.68	8r	8	I 6 169 60	7	3	I 22 625.	3	
I 4 454 78 p	10r	10r	I 6 439 06	10r	8	I 22 656.	4	

CAESIUM

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
1 884 0	.	6	2 544.	.	10	2 977.	. .	6
1 889 2		6	2 573		8	3 067		10
1 935 2		8	2 597		10	3 149.6		8
2 035.7	. .	8	2 600.		8	3 152 7		6
2 080 6	. .	8	2 631	. .	10	3 211.	.	6
2 089 2	. .	8	2 700	. .	8	3 268.3	.	10
2 102 4	. .	10	2 707	. .	10	3 300.	.	8
2 132.4	. .	10	2 776.	. .	10	3 316.	.	8
2 142 2	.	10	2 811.	. .	6	3 341.	. .	8
2 147 5	. .	10	2 838.	. .	8	3 350.	. .	8
2 180.2	. .	9	2 845.	.	10	3 411.3	.	9
2 206.3	.	10	2 859.	. .	10	3 559.8	. .	5
2 221.3	. .	10	2 887.	.	10	3 597.4	. .	6
2 268.3	.	10	2 894.	. .	8	3 608.3	. .	5
2 274.5	.	10	2 931.1	. .	10	3 661.4	. .	6
2 495.	. .	8	2 938.	. .	8	3 699.5	. .	5
2 526.	. .	10	2 963.	. .	8	II 3 785.4	. .	5

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Caesium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark	Wave length.	Arc.	Spark
II 3 805 1	..	6	II 4 646 5		5	I 7 280 0	5<	1
3 876 2	1	...	4 763.6		5	I 7 609 0	8	
3 888 4	2	2	II 4 830 2	.	6	I 7 944 0	8	.
II 3 897 0	.	7	4 870 0		6	I 8 016 2	5<	...
II 3 925 6	.	6	II 4 952 8	..	6	8 016 9		
II 3 965 2		6	II 4 972.6	..	5	I 8 079 1	10<	...
3 974 2		6	II 5 043.8	..	6	I 8 079.8		
4 006 5		6	II 5 096.6	.	4	I 8 521 2 P	10r	...
4 039 8	.	9	II 5 227 0	..	8	I 8 761 3	4	. .
4 068 0		6	II 5 249 4		6	I 8 944 P	6r	. .
4 068.8		6	5 274 0	.	4	I 9 172.2	4	.
4 158.6	..	4	II 5 371.0		6	I 9 209.	6	. .
4 213 3	.	6	5 402.8		4	I 10 026.	10	
4 232 19		6	II 5 419.7		5	I 10 124.	10	.
4 264 68		10	II 5 563.0		4	I 13 589.	8	..
II 4 277.1		9	II 5 831.2		5	I 13 605.		.
II 4 288 4		7	5 925 7		5	I 14 695.	10	. .
4 300 6	.	6	6 010.4	4	2	I 29 317	8	
II 4 373 0	..	6	II 6 128.6		4	I 30 103.	6	
II 4 384 4	.	5	6 213 0	8	2	I 30 963.	4	
4 405 3	.	7	6 217.5	3	1	I 34 893.	7	.
II 4 435 7	.	4	6 354 5	4	1	I 36 128.	2	....
4 501 5		7	6 562 8		5	I 39 180.	1	....
II 4 526 7	.	7	I 6 586 5	10	1	I 42 202	4	....
II 4 538 9	.	6	I 6 587.1	5<	.	I 68 070.	2	....
I 4 555.5 p	10r	4	I 6 723.3	10r	3	69 310.	2	. ..
I 4 593.18 p	10r	3	II 6 955 5		4	71 110.	1	....
II 4 603 8	10	10	I 6 973.3	10r	3	I 71 930.	1	....
4 616.1		4	I 6 983.4	6	1	74 250.	1	...
4 623.1		4	I 7 228 6	5<	1			

Carbon

Wave length.	Arc.	Spark.	Geissler tube.	Wave length.	Arc.	Spark.	Geissler tube.
313		1	. .	IV 1 550 9	.	3	.
372		1	.	I 1 561.3	5	5	5
III 459 7		6		1 657.	6	6(4)	.
II 533 9		1		III 1 930 98	5	7(2)	.
III 538 4		7		III 2 297.59	2	10	
II 543 4		2		I 2 478 3 P	10	10	10
II 560 5		2		II 2 746 50			4n
574 4	.	6		II 2 747.31			6n
II 594.9	4	5		II 2 836 71			10
II 636.2		2		II 2 837 60			8
651	2	6(2)		II 2 992 63			4
II 687.1	8	7	8	II 3 919 06			6
II 858 2	8	8	8	II 3 920 77			8
II? 904.	4	10(4)	.	II 4 267.02 p			8n
III 977.02		12		II 4 267 27 p	.		10n
I 1 010 1	9	10		III 4 648.70	.	3	.
II 1 036 2		10	5	III 4 651.46	.	2	.
II 1 036 8			5	III 4 652 68	.	7	. .
1 176	10	15(5)	. .	II 6 578 03	.		10
1 323 7	7	7	...	II 6 582 85	.		8
1 329 1	8	4	...	II 7 231 12			6n
1 329.6	8			II 7 236.19	.	.	8n
1 334 5 p	10	10	.....				
1 335.7 p	10						

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Cerium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
399.	.	1	4 083.24	10	5	5 655 14	5	1
741.	.	5	4 106 89	5r	3	5 669.96	5	1
830.	..	20	4 133 82	10	10	5 677 74	4	1
1 332.	.	20	4 137 64	9	10	5 696 99	5	1
1 373	.	20	4 149 94	10r	10	5 699 22	5	1
2 651.02	4	1	4 152 01	8	10	5 719 04	5	....
2 696 06	4	...	4 165 61 p	9	10	5 725 84	4	. .
2 791.42	4	....	4 186 60 p	10	10	5 743 54	5	...
2 833 30	4	...	4 222 62	10	5<	5 768 94	4	1
2 896 75	4	...	4 248 67	8	6	5 773.12	4	...
2 976 90	4	1	4 255 79	8	3	5 788 15	4	. .
3 017 18	4	1	4 289 94	9	6	5 804.42	4	.
3 051 98	5	1	4 296 68	9	8	5 812 9	5	.
3 063.00	6	2	4 306 73	8	4	5 838 12	4	1
3 103 38	6	1	4 320 73	8	3	5 862 49	4	. .
3 146.40	6	1	4 337 76	9	4	5 871 58	3	. .
3 171 63	6r	1	4 349 79	8	4	5 910 00	5r	. .
3 194.83	7	1	4 375 18	8	3	5 928 34	4	. .
3 201 72	7	1	4 382 17	8	5	5 934 40	4	.
3 221.17	7	1	4 391 66	8	8	5 940 86	4	1
3 234.17	7	1	4 396 58	3r	2	5 975 87	4	...
3 272.25	7	2	4 418 78	7	5	6 013 41	5	.
3 285.23	6	1	4 449.33	9	4	6 024 18	5	.
3 304.84	7	1	4 460.21	10	10	6 043 39	5	2
3 344.76	7	2	4 471 24	10	5	6 057 99	3	. .
3 366.56	7	1	4 509.18	4r	3	6 069 48	3	. .
3 377.13	7	2	4 527 35	10	5	6 098 35	4	1
3 426 20	8	1	4 528.47	10	5	6 123 66	4	...
3 442 38	7	1	4 539 74	10	5	6 186 16	3	..
3 476 84	6	2	4 562 35	10	10	6 209 00	3	.
3 485 06	8	2	4 572 28	10	10	6 228 98	4	1
3 488.55	7	1	4 593.93	10	10	6 232 47	3	1
3 517 38	7	2	4 606.41	4	5	6 272 05	4	2
3 539.08	7	2	4 628 15	10	10	6 295.58	3	. .
3 560 82	8	4<	4 654.28	4	2	6 300 22	3	..
3 577 45	8	4<	4 684.61	4	3	6 310 03	3	..
3 613 70	10r	2	4 714 01	4	3	6 343 98	4	1
3 623 84	7	3	4 725.09	4	2	6 371 13	4	....
3 655 85	10	3	4 737 24	4	3	6 393 06	3	1
3 667 97	9	3	4 773.93	4	3	6 458 06	3	...
3 679 42	6	2	4 882 44	4	3	6 466 89	3	....
3 709 29	8	3<	4 893.93	3	2	6 467 40	3	. .
3 716 36	9	3	4 971.50	4	2	6 473 69	3	...
3 764 12	8	3<	5 022 85	4	1	6 513 63	3	....
3 786 63	8	3	5 044.02	4	1	6 555 65	3	...
3 801 53	10	8	5 079.68	5	2	6 606 87	3	....
3 853 16	8	2	5 117.14	4	1	6 628 90	3	. .
3 875 04	6r	2	5 187 44	6	2	6 652 75	3	.
3 878 37	9	2	5 191.63	5	1	6 665 65	3	.
3 890 00	8	3<	5 211 91	4	...	6 700 67	3	..
3 942 75	10	5	5 274 23	5	3	6 704 40	3	...
3 952 58	9r	8<	5 330.53	5	2	6 774 27	2	. .
3 956.29	9	3	5 393 39	7	3	6 898.49	2	..
3 992 39	9	3	5 409 23	6	3	6 899 07	2	.
3 993 83	9	4	5 472 27	5	3	6 924.80	3	...
3 999 25	10	6	5 512.06	8	3	6 986 00	2	..
4 012 40 p	10	10	5 556 27	4	1	6 999 87	2	...
4 040 76 p	9	8	5 601.28	5	1	7 030 98	2	...
4 073 49	9	4	5 614.73	3	....	7 061.69	3	..

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Cerium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
7 086 31	3		7 860.54	2	. . .	8 355.32	2	.
7 150 21	2	.	8 002 66	2		8 363.82	2	
7 238 38	2	.	8 025.59	2	.	8 371 90	2	. .
7 252 72	3	.	8 171.32	2	. .	8 396 20	2	.
7 329 92	2	.	8 234.12	3n	.	8 495.64	3	.
7 397 78	2	.	8 245.10	2	.	8 560 60	2	
7 689.13	2	.	8 261 03	2	.	8 612 62	2	.
7 797.73	2	.	8 300.58	2	.	8 647 59	2	. .
7 835 81	2		8 310 22	2		8 772.08	3	. .
7 859.05	2							

Chlorine

Wave length.	Spark.	Geissler tube.	Wave length.	Spark.	Geissler tube.	Wave length.	Spark.	Geissler tube.
IV 538 08	.	3	2 532 5	. . . .	7	3 805 2	2	6
556.4	.	4	2 577 1	. . .	6	3 820 3	1	5
561 5	. .	4	2 580 7	. . .	8	3 827 7	2	5
574 3		4	2 601 2	. . . .	5	3 833 4	2	8
586 9		4	2 603 5	. . .	6	3 843	2	5
V 629 33		6	2 609 50	. .	7	3 845 4	. . .	8
V 633 18	. .	6	2 611 4	. . . .	5	3 845 7	2	8
V 635 31		6	2 616 99	. . .	8	3 851 0	. . . .	10
V 639 24	.	5	2 620 07	. . .	6	3 851 5	3	8
653 7		4	2 624 72	.	6	3 861	5	10
663 2	.	4	2 658 7	. . . .	4	3 868 7	1	6
712 6	.	4	2 661 5	. .	4	3 914	2	5
VI 730 31	.	4	2 665 5	. .	6	4 032 2	. .	5
787 8		4	2 684 75	.	5	4 104 8	.	4
VII 800.70	.	3	2 685 40	. .	5	4 132 5	10	3
VII 813 00	. .	2	2 688 03		6	4 158 0	2	4
840 9	.	6	2 691 49		6	4 209 7	. . .	5
888 0	.	4	2 710 37	. .	6	4 226 4	. .	7
960 4		6	2 782 4	.	6	4 234 0	. .	5
984 8		4	2 996 5	.	5	4 241 3	. . .	8
1 008 6		4	3 063 0	.	6	4 253 4	2	9
1 014 9		4	3 071 3	1	6	4 291 8	2	5
1 070 9	.	4	3 076 6	.	7	4 304 1	1	4
1 145 0	.	2	3 139 2	. .	6	4 307 6	3	6
1 547 2	. .	3	3 191 4	3	7	4 323.4	. . . .	6
1 577 7	.	2	3 259 2	2	4	4 336.3	2	5
1 821 9		2	3 289.7	1	6	4 343.7	5	10
2 087 1		5	3 315 3	1	6	4 363 3	. . . .	8
2 093 4	. .	4	3 320 5	2	8	4 369 5	. . . .	6
2 251.0	. .	5	3 329 0	. . .	8	4 371 6	. . . .	5
2 251 5		5	3 340 3	3	8	4 373 0	2	6
2 283 9	.	4	3 353 3	3	7	4 379 9	. . . .	8
2 359 6	. . . .	4	3 392 8	.	8	4 387 6	. . . .	5
2 370 4	. .	4	3 522 0	. .	6	4 389 8	. . . .	8
2 403 2	. . .	5	3 602 1	4	2	4 403 4	. . . .	5
2 434 5	. . .	5	3 650 1	1	4	4 438 6	. . . .	4
2 448 6	. . .	4	3 750 0	. . . .	5	4 469 4	. . . .	5
2 471 1		4	3 781.2	. . .	5	4 475.3	. . .	4
2 519 5	.	6	3 798.8	2	5	4 490.0	1	3

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Chlorine (Continued)

Wave length.	Spark.	Geissler tube.	Wave length.	Spark.	Geissler tube.	Wave length.	Spark.	Geissler tube
4 526 3	....	5	4 819 4p	10	9	5 392 1	2	4
4 572 6	1	5	4 896 7	2	5	5 423 2	2	6
4 601 0	...	4	4 904 7	2	4	5 443 4	1	5
4 768 6	2	4	5 078 2	2	4	5 444 2	...	3
4 781 3	3	5	5 317 8	1	3	5 457 1		3
4 794 5p	10	10	5 321 3	1	4	5 634 9	.	1
4 810 0p	10	9						

Chromium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark	Wave length.	Arc	Spark.
202.6		1	2 812 01	2	10	3 346 73	4r	1
438.3		4	2 822 38	2	10	3 358 50	3	10
456 8		4	2 830 48	2	10	3 360 32	3	10
464 0		4	II 2 835 64 P	5r	10	3 368 05	4	10
469 8		4	II 2 843 25 p	4	10r	3 382.68	2	10
575 3		5	II 2 849 83 p	4	10	3 403 32	2	10
619 9		6	II 2 855.68 p	4	10	3 408 76	3	10
629 9		6	II 2 862 58	3	10	3 421 21	3	9
637 8		6	2 879 28	3r	1	3 422 74	3	10
648 7		5	2 893 26	3r	1	3 433 60	5r	2
667 1		5	2 910.91	4r	1	3 550 64	4	2
681 3		5	2 967 64	4r	1	I 3 578 69	10r	10r
840		3	2 971 90	2	10	I 3 593 48	10r	10r
885 2		10	2 979 74	2	10	I 3 605 33	10r	10
925 5		2	2 985 32	2	10	3 636.59	5r	3
1 004 4		3	2 986 47	6r	2	3 639 81	6r	5
1 018 7		3	2 989.19	2	10	3 743 56	4r	3
1 816 4		10	2 995.11	4r	1	3 743 88	4r	3
2 034 4	2		2 996.58	4r	1	3 749 00	4r	3
2 039 3	3		2 998 80	4r	1	3 804 80	5	3
2 133 5	3	1	3 005 07	5r	1	I 3 885 22	5r	3
2 150 7	3	1	3 014 77	5r	1	I 3 894 05	4r	3
2 226 5	2	2	3 014 92	6r	1	I 3 908 76	6r	3
2 324 9		4	3 017 58	6r	2	I 3 919 17	7r	5
2 408 67	2	1	3 018 50	5r	1	I 3 921 03	5r	3
2 538 3		5	3 021 57	6r	2	I 3 928 65	6r	3
2 591 86	4r	1	3 034 20	5r	1	I 3 941 50	5r	3
2 677.17	5r	10	3 037.05	5r	1	3 963 70	7r	8
2 678.79	4	10	3 040.85	5r	10	3 969 75	7r	8
2 691 05	4	10	3 050.14	2	10	3 976 68	7r	8
2 731 90	5r	1	3 053.88	6r	2	3 983 92	7r	5
II 2 743 63	3	8	II 3 118 65	3	10	3 991 13	6r	4
II 2 750 73	3	10	II 3 120 37	4	10	4 001 45	4	2
II 2 751.87	3	10	II 3 124.97	4	10	4 026 17	4	2
2 752.87	3r	1	II 3 132 05	4	10	4 058 79	4	3
2 757.11	4r	2	3 180 73	3	10	4 105 58	4	1
II 2 762.60	3	10	3 197.08	3	10	4 163 63	4	4
II 2 766.54	4r	10	3 209.18	2	10	4 179 26	4	3
2 769.91	6r	1	3 217.40	3	8	I 4 254.34 P	10r	10
2 780.71	7r	...	3 307.05	1	8	I 4 274 80 p	10r	10
2 792.16	1	10	II 3 339.80	3	10	I 4 289 73 p	10r	10
2 800.77	1	10	II 3 342.58	3	10	I 4 337.57	6r	9

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Chromium (Continued)

Wave length.	Arc.	Spark	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
I 4 339.45	6r	5	I 5 345.80	10	6	I 9 009 97	10	.
I 4 339.72	5r	4	I 5 348 31	10	5	I 9 017.08	5	
I 4 344 51	7r	8	I 5 409.80	10	8	I 9 021 8	4	
I 4 351 05	5r	4	5 664 03	4	2	9 035.9	3	
I 4 351.77	7r	9	5 694 73	5	2	9 140.4	1	
I 4 359 63	6r	8	5 698 33	5	2	9 141.1	1	
I 4 371 28	6r	9	5 712.77	4	2	9 142 6	1	
I 4 384 98	6r	7	5 781.81	7	1	9 290 4	10	
4 458 53	4	3	5 783 13	8	3	9 294.1	8	.
4 465 35	4	4	5 783.93	9	3	9 447.0	10	.
I 4 496 86	6r	10	5 785 02	8	3	9 574 2	10	.
4 511 92	4	6	5 787.98	9	6	9 670 5	5	
4 540 71	4	6	5 791.02	10	8	9 734 5	10	
I 4 545 96	5r	6	5 884.44	3	2	9 948.	2	
I 4 580 06	7	3	6 102.71	3	1	10 082.	2	
I 4 591.41	6	2	6 261 27	3	1	10 486.	4	
I 4 600 75	6r	4	I 6 330 11	6	3	10 673.	3	
I 4 616 13	6r	6	I 6 362 87	5	3	10 820.	4	
I 4 626 19	6r	5	6 501 23	3	. .	10 906.	6	
I 4 646 17	7r	10	6 537 95	3	.	11 016.	8	
I 4 652 17	6r	5	6 661 12	5	2	11 158.	9	
4 708 04	7	3	6 669 26	4	. .	11 312.	2	.
4 718 45	7	6	6 715 42	3		11 337.	4	
4 737 34	5	3	I 6 881 65	9		11 392.	5	
4 756.13	6	8	I 6 882 41	9	.	11 483.	4	
4 789 35	5	3	6 883 04	9		11 611.	10	
4 801.04	5	2	I 6 924.15	10		13 462.	2	.
4 829 36	5	4	I 6 925.23	9		15 680.	3	
4 870 80	3	3	6 978 50	10		15 861.	3	
4 887 01	3	3	I 6 979 81	7	.	18 479.	3	
4 922 26	4	3	I 7 355 97	10	.	18 584	3	
4 954 80	4	2	I 7 400 3	10		18 654.	3	
5 013 31	3	2	I 7 462 4	10		18 717.	2	
5 166 24	3	4	7 722.9	2		25 460.	2	
I 5 204 54 p	9r	10	7 908 3	2	.	25 490.	1	
I 5 206 04 p	10r	10	7 942 0	2	.	25 560	1	
I 5 208 43	10r	10	8 163 2	3		25 584	2	
I 5 247.56	5r	3	8 235 9	2		25 665	1	
I 5 264 15	6r	5	8 348.3	2	. .	25 709.	1	
I 5 265 73	5r	3	8 450.3	2	.	25 785	1	
I 5 275 16	4	5	8 455.2	2	.	25 816.	1	
I 5 296.69	5	6	8 548 8	2	. .	25 850.	2	
I 5 298 28	6	10	8 947 2	2	.	25 902.	1	
I 5 328 35	10	8	8 976 8	3	. .	26 232.	2	

Cobalt

342.	.	1	1 882 2		4	2 165.6	3	2
937.	. .	5	1 928	.	6	2 196 6	5	.
1 128	.	3	1 940 3	.	6	2 213 9	3	1
1 502	.	3	1 950	. .	4	2 276 6	3	1
1 574.	.	5	1 955.2	.	4	2 286.2 P	2	6r
1 580.	.	5	1 956 6	.	5	2 307.9 p	2	6r
1 631 6	.	3	1 969 4	.	5	2 363 8	2	10
1 772.7	. .	5	1 974 1	.	4	2 378.6 p	2	10
1 790 4	.	4	2 011.5	. .	7	2 388.9 p	2	10r
1 846	.	4	2 105.	4	1	2 397 4	1	10

Cobalt (Continued)

Wave length.	Arc.	Spark.
I 2 407 3	3r	2
I 2 411.6	3r	3
I 2 415.3	3r	2
2 424.9	3r	. .
2 432.3	3r	5
2 447.7	.	10
2 464.2	2	8
2 506 4	3	10
2 511 1	2r	4
2 519 8	1	10
I 2 528 97	3r	2
2 541 95	2	10
2 559 40	3	10
2 564 04	3	10
2 574 36	3r	.
2 632 4	.	10
2 648 65	4	10
2 663 53	4	10
2 675 99	4	4
2 731 11	4	2
2 745 10	4	3
2 766 22	4	2
2 815 55	4	1
2 886 45	5	2
I 2 987 17	5r	3
I 2 989 59	6r	3
I 3 044 00	8r	4
I 3 072 34	5r	3
I 3 082 61	5r	3
I 3 086 77	6r	3
I 3 137 32	6r	3
I 3 139 94	7r	3
I 3 147 06	7r	3
I 3 149 30	6r	2
I 3 158 76	6r	3
I 3 159 66	6r	1
3 243 84	8r	2
3 247 17	7r	2
3 254 20	10r	2
3 260 81	7r	2
3 265 35	6r	1
3 283 45	10r	3
3 319 48	10	2
I 3 334 15	5r	4
3 346.94	10	2
I 3 354 38	6r	4
3 377 06	8r	1
I 3 385 228	9r	4
I 3 388 18	9r	5
I 3 395 38	10r	5
I 3 405 12	7r	10
I 3 409 18	4r	6
I 3 412 34	4r	4
I 3 433 04	6r	6
I 3 443 65	3r	6
I 3 449 17	6r	5
I 3 449.46	6r	5
I 3 453.51 P	6r	10
I 3 462.81	6r	5
I 3 465.79 p	6r	5
I 3 474 02	9r	8
3 485.35	7	3
I 3 489.40	5r	7
I 3 495.68	6r	5
I 3 502.28	5r	6
I 3 506.32	6r	8
I 3 509 85	4r	5
I 3 510 42	4r	4
I 3 512.64	4r	6
I 3 513 48	4r	4
I 3 518 35	6r	7
I 3 520 09	4r	3
3 521 57	5r	5
I 3 523 44	4r	5
I 3 526 85	9r	6
I 3 529 04	4r	3
I 3 529 81 p	8r	6
I 3 533 36	6r	4
I 3 550 60	5r	3
I 3 564 95	5r	4
I 3 569.38	7r	10
I 3 574 96	5r	4
I 3 575 36	6r	5
I 3 587 19	8r	10
I 3 602 08	5r	4
I 3 627 81	8r	4
3 639 44	10	2
3 676 56	8	6
3 683 05	8	8
I 3 704 06	8	7
3 732 40	8	7
I 3 745 50	6r	10
3 755 45	6r	4
I 3 842 06	6r	10
I 3 845.48	10r	10
I 3 861 17	7r	10
I 3 873 12	9r	10
I 3 876 84	8r	5
I 3 894 09	9r	10
I 3 935 97	6r	10
I 3 941 74	5r	4
I 3 957 94	6r	4
I 3 974 73	5r	4
I 3 995 31	8r	10
I 3 997 91	7r	10
I 4 020 90	7r	5
I 4 045 40	8r	5
I 4 066 39	7r	5
I 4 086 32	8	9
I 4 092 40	8r	8
I 4 110 54	9	10
I 4 118 78	8r	10
I 4 121 33	10r	10r
4 160 7	1	8
I 4 190 71	7	4
4 252 30	5	2
4 339 64	5	3
I 4 469.57	8	5
I 4 530 97	7	10
4 549.66	6	5
4 565.61	7	7
I 4 581.62	8	8
4 594 62	6	3
4 596 90	6	3
I 4 629 38	8	4
I 4 663 41	8	4
I 4 682.36	7	3
I 4 749.69	8	3
I 4 792 87	7	7
I 4 813.49	8	10
I 4 840 28	8	8
I 4 867.88	8	8
I 4 971 95	6	.
I 5 122.76	5	1
5 133.45	5	1
5 176.07	6	.
I 5 212.70	5	1
I 5 230.21	5	1
5 266.49	6	1
I 5 280 63	5	1
5 342 68	8	2
5 343.38	7	2
I 5 352.05	8	2
5 353.48	7	2
5 362.76	8	1
I 5 369 59	7	1
5 444.56	8	1
5 454.55	9	1
I 5 483 35	10	2
I 5 530.77	8	1
I 5 590 73	8	1
5 647 22	8	1
5 830 06	7	
5 890 48	7	2
5 915 53	8	3
5 946 51	8	1
I 5 984.19	10	2
5 991 88	10	5
6 000 71	8	1
6 006 30	8	2
6 007 63	8	2
6 049 06	10	2
6 082 46	10	5
6 086 66	7	2
I 6 093 14	6	2
6 107 93	7	1
6 122 68	10	2
I 6 188 98	8	3
6 211 13	8	1
I 6 231 02	7	3
6 257.61	10	3
6 271 40	10	
I 6 282 65	10	4
6 320 35	10	2
6 347 79	10	1
6 395 19	7	1
6 417 80	8	1

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Cobalt (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
6 429.89	7	...	7 840 1	7	.	9 544 5	2	.
I 6 450 23	10	6	7 855.9	7		9 597 9	2	
6 455.02	10	5	7 869 9	6	.	10 020 7	..	. .
6 477 89	9	...	7 871.4	6	.	10 189 2	..	.
6 490.32	7	1	7 908.8	10		10 206.1	..	
6 563 40	9	3	7 926.6	8		10 210.8	..	.
6 595 90	6	3	7 987.4	7		10 213 3	.	
6 617.30	10(?)	1	8 007.3	10	.	10 236 4	..	
6 632.44	6	2	8 022 2	7		10 272 9	.	
I 6 678 81	6	...	8 029 3	7		10 284.6	.	
I 6 771.05	10	2	8 043 3	8		10 366.6		
I 6 814.96	10	1	8 056 0	8		11 275 5	.	
6 872.38	7	2	8 066.5	7	.	11 293.5		
6 937 8	7	...	8 094.0	10		11 340.8	..	
I 7 016 6	10	.	8 116.4	7	.	11 453.4	..	.
7 027.82	8	. .	8 152.0	6		11 634.	2	.
I 7 052 85	10	.	8 193 1	8	.	11 895.	1	.
7 054.04	8	..	8 208 7	8		14 062.	4	
I 7 084 97	10	.	8 269 4	8	.	14 559.	2	
7 134 33	8	.	8 299 0	5		14 611.	4	
I 7 154 7	8	.	8 372 8	10		14 681.	2	
7 159 16	8	.	8 378.4	7	.	14 958.	3	
7 193.60	8	. .	8 575.3	4	.	15 210.	2	
7 285.3	7	.	8 819 2	10	.	16 133.	5	
I 7 354 6	6	.	8 835 2	8		16 257.	5	
7 388.7	7	..	8 850.7	10		16 388.	3	
I 7 417 4	8	.	8 870 8	4		16 447.	2	
7 457.4	8	. .	8 904.7	8	. .	16 574.	3	
7 554 0	8	. .	8 926.2	10	.	17 005	5	
7 590 6	6	.	8 958 5	6		17 080	3	
7 610.3	6	.	9 037.9	8	.	18 176.	3	
7 712.7	9	. .	9 095 4	6		18 274.	2	
7 734 3	6	. .	9 357.0	10		19 779	3	
7 838.2	8	.						

Columbium

2 584 03	2	6	I 3 580 27	10	3	4 079.73 p	10	6
II 2 697 07	3	7	3 697.84	10	3	4 100.97	10	6
II 2 927 82	8	10	3 713.05	10	3	4 123 85 p	10	4
I 2 941 57	4	8	3 726 24	10	3	4 129 97	10	3
II 2 950 91	6	10	3 739 82	10	3	4 137.13 p	10	4
II 3 094 19 P	10	10	3 740 80	10	5	4 139 74	10	4
II 3 130 78 p	8	10	3 742 41	10	3	4 152 63	10	5
II 3 163 37 p	5	10	3 759 57	10	3	4 163.64	10	10
II 3 194 95 p	5	10	3 787 08	10	3	4 164.66	10	5
II 3 225 47 p	5	10	3 790 14	10	3	4 168.13	10	5
II 3 236 44	3	10	3 791 24	10	4	4 190 91	10	4
3 341 95	10	4	3 798 11	10	4	4 192.07	10	3
3 358 38	10		3 802 98	10	4	4 205.32	10	3
3 498 62	10	2	3 810 48	10	3	4 214.74	10	3
I 3 510 30	3	8	3 818 92	1	8	4 217.95	10	3
I 3 535.30	10	3	3 914 71	10	3	4 229.15	10	3
I 3 537.50	10	2	3 937 47	10	3	4 262.10	8	3
I 3 554.62	10(?)	2	3 966.23	10	3	4 299.63	8	4
I 3 563.53	10	2	4 032.55	10	3	4 301.10	10	5
I 3 575 85	10	2	4 058.97 P	10	10	4 326.37	10	3

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Columbium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
4 331.42	10	3	4 713.48	5	3	5 437.29	7	2
4 351.60	10	3	4 733.88	5	3	5 551.38	6	2
4 377.90	10	4	4 810 57	6	3	5 664.72	6	2
4 410.22	10	3	4 816 33	7	1	5 665.57	6	3
4 437.23	10	8	4 924 84	3	8	5 671.1	7	1
4 447.22	10	3	4 989.0	5	2	5 729.2	6	2
4 523 40	8	3	5 039 04	6	2	5 787.53	6	2
4 546 83	10	4	5 078 95	8	3	5 819.47	6	3
4 573.09	10	5	5 095 29	10	3	5 838.66	8	5
4 581.64	10	5	5 134.73	5	2	5 866.5	6	3
4 606.76	10	10	5 160.33	6	3	5 900.62	10(2)	2
4 630.12	10	10	5 164.36	7	2	5 983.26	7	2
4 648.94	7	3	5 180.30	6	2	6 430.50	8	1
4 663.83	9	4	5 271.53	9	3	6 544.67	6	1
4 672.10	10	9	5 276.20	10	3	6 677.34	8	1
4 675.38	10	8	5 344.15	10	5	6 723.66	6	1
4 708.26	7	4	5 350.72	7	3	6 828.14	4	

Copper

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
155.7	.	0	2 400.10	2	5	3 317.20	5	2
324.5	.	6	I 2 441.62	5	2	3 337.85	8	3
329.2	.	5	2 473.46	1	4	3 365 36	6	2
358.0	..	5	I 2 492.15	5r	2	3 381.43	3	1
452.8	..	7	2 506.4	1	6	3 402 23	4	1
777.3	..	5	2 529.43	1	5	3 450.33	7	6
788.3	..	6	I 2 618 39	10r	3	3 454 72	6	3
1 594.	..	5	2 701.1	1	5	I 3 457.85	4	1
1 642.	..	8	2 713.6	1	5	3 483.75	6	3
1 652.	.	6	I 2 766 39	10	4	I 3 512 11	6	3
1 670.	..	6	2 824.38	10	5	3 520.00	4	1
1 672.		6	2 882 95	6	3	3 527.49	5	1
1 679.		6	2 961 18	9	6	3 530 38	7	2
1 687.	.	6	2 997 37	6	4	3 533 74	7	1
1 702.		5	3 010 84	7	1	I 3 599 14	8	2
1 722.		6	3 036 10	8	2	3 602 04	8	2
I 1 741.		6	I 3 063 42	7	3	3 621 23	6	2
1 750.		6	3 073.82	5	2	3 700.54	3	1
1 769.	.	4	3 094.00	6	2	3 741.25	3	1
1 783.	.	3	3 099 92	6	3	3 771 9	3	1
1 840.	..	8	3 108 60	8	5	I 3 861.75	3	1
1 979 2	4	1	3 116 33	7	2	I 4 022.70	10	8
1 999.6	5	2	3 126.10	7	3	I 4 062.7	10	7
2 149.	1	3	3 128.67	6	2	I 4 063 4	6	1
2 199.62	4r(2)	2	3 140 33	6	2	4 177.7	6	2
I 2 214.57	4r	2	3 142.43	7	2	4 248.97	6	4
I 2 227.75	4r	2	3 146.82	6	2	4 275 13	8	8
2 230.08	4r	2	I 3 194.10	8	3	4 378.2	8	8
2 242.60	2	6	3 208 20	6	2	I 4 480 38	7	2
2 246.98	3	6r	3 231.17	4	2	4 509.39	6	3<
I 2 263.1	3r	2	3 243.15	6	4	I 4 530.84	8<	2
2 276.24	1	4	I 3 247 55	10r	10r	4 587.00	10	10
2 293.85	6r	3	I 3 273.97 p	10r	10r	4 651.17	8	7<
2 294 34	3	5	3 279.80	5	3	4 674.78	5	3
2 356 63	2	4	3 290.55	10	6	4 704.60	4	2
I 2 369.88	5	8	3 293.92	4r	2r	5 016 63	2	2
I 2 392.64	7	1	3 307.95	9	7	I 5 105.55	7	6

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

COPPER (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
I 5 153 26	8	8	6 268.3	6	. .	I 7 933.23	10	....
I 5 218.20	10	10	6 325.4	4	..	I 8 092.77	10	..
I 5 220.06	6	5	6 474.20	5	.	I 16 008.	5	...
5 292 54	4	4	6 485.16	5	...	I 16 653.	4	.
5 535 8	1	1	6 672.23	5	...	I 18 194.	7	...
5 554.94	2	1	6 741.4	6	...	I 18 229.	5	...
I 5 700 24	5	4	6 905.9	6	..			
I 5 782.15	6	6	7 570.1	5	.			

DYSPROSIUM

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 422 75	3	. .	3 724 42	5	5	4 832 43	5	1
2 560 19	3	.	3 757 37	4	3	4 890 12	5	1
2 600 17	3	. .	3 786 20	6	5	4 923.14	6	1
2 634 80	3	1	3 806.25	6	10	4 957.41	10	2
2 772 59	3	. . .	3 836 49	6	4	5 003 86	5	....
2 816.38	3	2	3 898 54	6	10	5 032 98	6	.
2 877 90	3	1	3 944 69	10	10	5 120 01	5	.
2 906 39	3	1	3 968.42	10	10	5 139 58	8	1
2 948.30	3	1	3 978.57	6	10	5 169.64	6	...
2 985.92	3	1	3 996.72	5	4	5 197.66	8	..
3 016 98	3	1	4 000 50 p	8	10	5 260.58	5	.
3 043 46	4	1	4 046 00 p	10	4	5 301.59	5	.
3 141 09	4	2	4 077 98 p	10	10	5 380.68	6	.
3 162.79	4	3	4 103 34	8	8	5 389.58	6	
3 216 60	5	3	4 111 35	8	4	5 423.30	5	.
3 235 87	5	3	4 146 06	6	2	5 515.40	5	1
3 269 12	5	1	4 167 99 p	10	4	5 547.27	5	...
3 282 78	5	3	4 183.68	6	3	5 600.68	5	.
3 308 87	6	3	4 186 80	8	4	5 651.99	6	..
3 319 87	6	3	4 194 85	8	4	5 685.57	4	..
3 353 57	5	2	4 211.74 p	10	5	5 702 91	4	..
3 385 03	6	3	4 215 13	6	3	5 740 23	3	.
3 393.58	6	3	4 221.12	8	3	5 805.55	3	. .
3 407.77	8	3	4 225.14	6	3	5 868.18	3	
3 413 77	6	3	4 256.33	8	3	5 915.18	3	
3 454 36	6	10	4 295.02	6	5	5 974.52	5	
3 484 66	6	3	4 308 66	5	4	6 010.85	5	.
3 494 47	8	5	4 358 50	5	2	6 088.27	6	. .
3 524 03	5	10	4 375 33	5	2	6 168 47	6	
3 531 70	10	10	4 409.40	8	3	6 259 12	10	
3 536 04	5	5	4 449.72	8	4	6 343.32	5	.
3 546 83	6	4	4 503.25	5	2	6 386.89	5	.
3 550 21	8	10	4 577.81	6	3	6 421.95	6	.
3 563 12	6	4	4 589.35	10	5	6 486 62	5	. .
3 576.89	6	3	4 612.27	8	4	6 579 42	6	. .
3 600 34	6	10	4 698.72	4	2	6 667 93	6	..
3 645.40	8	10	4 731.84	10	3	6 747 96	3	..
3 676.56	3	10	4 745 79	6	2	6 835 51	6	...
3 694 75	6	10	4 775.81	6	1	6 899.40	4	....
3 698.17	4	10	4 825.00	5	1			

ERBIUM

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 910.36	5	4	3 025.91	4	2	3 154.28	4	3
2 964.52	4	3	3 070.77	4	2	3 230.95	5	....

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Erbium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
3 267.11	5	4	4 522 67	6	.	5 456.58	5	1
3 312 42	6	5	4 552.12	6	4	5 485 93	5	2
3 368 07	6	4	4 563 28	6	3	5 593 40	4	1
3 372 77	10	10	4 606 62	5	3	5 601.19	4	1
3 401.84	4	4	4 630.91	6	4	5 626 52	4	1
3 464.50	5	2	4 675.61	5	10	5 665 45	4	2
3 499.12 p	10	10	4 679.07	6	5	5 710 88	4	1
3 599 84	5	8	4 724.54	6	3	5 739 17	5	1
3 638 68	6	1	4 731 61	6	3	5 757.62	5	1
3 692.65 p	..	10	4 751.55	6	2	5 762.80	5	1
3 729 56	5	5	4 762.65	6	3	5 826.78	6	1
3 766 26	10	3	4 795.50	8	3	5 902 10	5	...
3 787 88	6	3	4 820.33	6	4	6 006 80	5	..
3 797 08	6	3	4 831.14	8	3	6 076 46	5	..
3 830.54	6	6	4 848.83	6	2	6 221 01	6	1
3 892.72	6	2	4 861.60	5	1	6 299 43	5	.
3 896 26	6	6	4 872.09	5	3	6 308 79	8	
3 906 34 p	10	10	4 900.09	5	4	6 326 13	5	.
3 938 65	8	4	4 951.73	8	3	6 388.19	6	..
3 969 46	5	2	5 007.24	5	1	6 441.33	5	.
3 987 64	5	1	5 028 90	5	1	6 583.47	5	
4 007 96	10	4	5 042 06	5	2	6 601.11	6	
4 048 34	5	3	5 127.41	5	2	6 616 75	4	
4 087 66	10	1	5 133.83	5	2	6 721.93	4	
4 123 10	6	..	5 188 91	5	2	6 759.88	4	
4 151.11	6	4	5 218 22	5	2	6 848 11	4	
4 194.81	10r	2	5 255 93	6	2	6 897 53	3	
4 230.19	6	3	5 279 31	5	....	6 951.87	3	
4 276 50	6	3	5 302 31	5	1	7 001.44	3	
4 319 95	5	3	5 344 49	5	1	7 135 69	3	
4 374 95	10	6	5 395 86	6	2	7 316 29	3	.
4 419.62	8	10	5 414 63	6	1	7 469 46	5	
4 473 51	5	4	5 422 79	5	1	7 680 00	3	.
4 500 75	8	6	5 454.25	5	1			

Europium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 727 77	4	6	4 594.07	10	10	5 967 09	10	1
2 906 68	5	5	4 627.26	10	10	6 083 89	9	1
3 111 43	5	1	4 661.90	10	10	6 173 03	10	3
3 334 32	5	2	4 911 40	8	2	6 188 10	10	2
3 688 42	10	10	5 022 91	6	1	6 262.26	10	2
3 724 97	10	10	5 133.52	5	1	6 303 42	10	3
3 819 64	10r	10	5 223 48	5	1	6 350.02	10	1
3 907 10	10	10	5 357 61	9	1	6 437.63	10	5
3 930 51	10	10	5 402.77	10	2	6 501.57	7	
3 971 95	10	10	5 451 52	9	2	6 645 20	10	10
4 129 72 p	10	10	5 452 95	9	2	6 802 78	10	.
4 202 01	10	...	5 547.44	10	1	6 864 57	10	. .
4 205.01 p	10	10	5 570.31	10	1	7 077.14	8	.
4 435 54	10	10	5 577.12	9	1	7 194.80	8	.
4 522.56	10	10	5 831.98	10	3	7 217.55	8	...

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Fluorine

Wave length.	Geissler tube.	Spark.	Wave length.	Geissler tube.	Spark.	Wave length.	Geissler tube.	Spark
378 6	1	....	3 164.1	4	. ..	I 6 239 66	6	....
420.1	1	....	3 201.1	3	. .	I 6 348 50	6	.
III 430 15	4	....	3 240 8	3	..	I 6 413 65	5	....
III 467 70	7	....	3 262.7	3	....	6 569 72	2	.
II 546.84	4	....	3 416.4	4	.	6 762 9	2	.
IV 572 65	4	.	3 473 5	5	.	I 6 774 00	6	
II 605 67	8	...	3 475 2	5	. .	I 6 834 29	8	
II 606.27	7	.. .	3 501.9	8	....	I 6 856 05 p	10	.
II 606 81	9	. .	3 503 3	9	. .	I 6 870.25	7	.
II 606.95	4	..	3 505 8	10	.	I 6 902 49 p	9	..
II 607 48	7	.	3 598 9	5	. .	I 6 909 88	7	
II 608 06	8	.	3 601.	5	. .	I 7 037 56	9	.
III 656 10	7	.	3 602 7	5		7 202 4	3	. .
III 656.86	6	.	3 847.1	5	.. .	7 311 2	4	7
III 658.34	8	. .	3 850 0	5	.	7 332 1	5	10
IV 676.06	4	. .	3 851.7	5	. .	I 7 398 8	6	10
IV 677.17	5	. .	3 898 8	5	....	7 426	3	6
IV 679 19	5	.	4 025 1	10	.	7 482 95	1	2
I 951 81	5	. .	4 103 4	10	.	7 552 2	2	2
I 954 78	7	.	4 246.3	10	...	7 573 5	2	2
I 955 53	6	.	4 299 1	8	.	7 754.9	5	2
I 958 49	5		4 446.8	10	...	7 800 6	4	1
3 151 7	3	.						

Gadolinium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
2 564 51	.	6	3 494 41	5	5	3 894.72	6	4
2 628 12	..	10	3 545 78	9	10	3 916 57	9	8
2 655 59	..	6	3 549 37	7	10	3 934 81	6	3
2 679 41	.	8	3 584 96	8	10	3 957 69	5	5
2 717.30	..	8	3 592 69	5	8	3 959 51	7	6
2 904.73	..	10	3 613 42	5	4	3 994 20	5	3
2 955 50	.	10	3 646.19 p	10	10	4 037 34	9	6
2 999 06	5	4	3 654 64	7	8	4 037 89	7	5
3 010 15	5	6	3 656 15	7	8	4 049.44	6	4
3 027 60	6	6	3 664.64	7	10	4 049 90	8	6
3 032 85	7	8	3 671.24	10	8	4 063.46	10	5
3 034.06	7	6	3 687.76	5	5	4 070 36	9	5
3 082.00	10	6	3 697 74	5	5	4 073.80	8	8
3 100.51	8	8	3 712 71	6	10	4 078.46	5	4
3 145.00	5	4	3 716.38	5	4	4 078 73	5	3
3 350.48	7	10	3 719.48	9	10	4 085.59	8	8
3 358.60	7	8	3 730.87	5	5	4 098.64	8	6
3 362.25	6	10	3 743.41	7	10	4 098.91	5	4
3 416.93	5	4	3 758.29	5	4	4 130.39	10	10
3 418.72	7	4	3 768.40 p	10	10	4 132.29	5	5
3 422.46	8	10	3 770.70	4	6	4 137.10	6	8
3 439 21	6	5	3 796.43	9	10	4 184 28	9	10
3 440.06	7	6	3 813.99	9	6	4 197.68	5	5
3 450.38	5	6	3 850.69	7	4	4 212.00	7	5
3 481.33	6	8	3 851.00	7	5	4 214.97	6	5
3 481 83	5	5	3 852.50	10	8	4 217.15	5	5

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Gadolinium (Continued)

Wave length.	Arc.	Spark.	Wave length	Arc.	Spark.	Wave length.	Arc.	Spark
4 225.10	5	3	4 732.58	5	4	6 857.14	5	..
4 225.87	7	3	4 743.64	6	3	6 887.65	5	
4 238.77	5	4	4 758.67	6	2	6 916.58	7	
4 251 75	8	10	4 767.23	6	2	6 957.71	4	
4 262.09	9	10	4 786.80	5	1	6 985.86	7	.
4 280 54	7	5	4 801.03	5	3	6 991 89	6	
4 316 05	5	3	4 821 69	6	2	6 996.77	10	.
4 325.66	9	5	5 015 03	6	2	7 006 13	5	
4 327 11	8	4	5 092.24	5	2	7 037 24	5	.
4 341.25	7	5	5 103.46	5	1	7 050.97	4	
4 342.18	10	10	5 155 84	6	1	7 054 61	4	.
4 346.45	8	2	5 342.98	5	1	7 068 07	4	
4 347.25	5	3	5 350 36	5	1	7 118 90	4	
4 387.63	5	3	5 353 21	5	1	7 122 58	5	
4 401.86	5	3	5 370.69	5	...	7 147.37	5	
4 406 67	4	10	5 393 64	8	..	7 168 3	10	
4 419 04	5	8	5 535 16	7	..	7 172 30	6	
4 421 27	3	8	5 617 91	5	..	7 189 64	5	.
4 422.44	6	3	5 643 24	5	..	7 201 43	4	
4 436 18	6	10	5 696 20	8	...	7 252.72	5	..
4 438.23	5	8	5 701 35	5	...	7 262.7	5	.
4 476 13	5	3	5 733.86	6	1	7 301 24	4	.
4 506 24	6	2	5 751.85	5	..	7 313.28	4	
4 519.62	5	3	5 754 20	5	...	7 324.91	5	.
4 540.01	4	10	5 913.56	4	1	7 394.91	4	
4 582.50	5	3	6 114.07	6	1	7 464.37	4	
4 596 97	4	4	6 305 16	5	1	7 563 02	6	
4 597.90	4	5	6 634 4	5	..	7 733.50	4	
4 601 03	5	5	6 752 67	5	..	7 846.36	3	
4 683.34	5	2	6 828.30	6	...			
4 728.46	6	4	6 846 61	8				

Gallium

Wave length.	Arc.	Spark.	Wave length	Arc.	Spark.	Wave length.	Arc.	Spark
124.	..	0	1 192.9	.	6	1 845 0	..	8
425	.	4	1 195 0	..	6	2 294.	1r	2
509.	.	3	1 228 0	..	7	2 338.	1r	.
511.	..	3	1 258.8		9	2 371 30	1	3
645.	..	2	1 264.6		6	2 418 70	1	4
800.4	..	5	1 267.1	..	7	I 2 450.07	1	4
828.8	..	5	1 279.2	..	7	I 2 500.18	2	7
839.9	..	5	1 285.3	..	7	I 2 659.87	2	7
860.4	..	5	1 293 5	..	6	I 2 719.66	3	8
874 4	..	6	1 295.9	..	10	2 780.2	.	9
909.3	..	5	1 299.5	..	9	I 2 874.24	10r	2
938.5	.	6	1 303 5	..	10	I 2 943.65	10r	2
989 5	..	6	1 338.1	..	7	I 2 944.20	5r	1
1 050.2	.	6	1 414.4	..	10	3 004.1	..	6
1 102 7	..	7	1 483.9	..	6	3 575.3	..	7n
1 120.6	..	5	1 495.4	..	10	3 806.8	..	5
1 133.6	..	6	1 534 5	..	10	4 033.01 p	10r	10r
1 135 9	..	5	1 586.3	..	8	4 172.05 P	10r	10r
1 136.9	..	5	1 625.3	..	7	4 864.9	..	5
1 156.1	..	7	1 799.2	..	7	I 6 396 8	10	5
1 163.5	.	6	1 802.3	..	7	I 6 413 74	8r	....
1 170.4	..	9	1 813.9	..	9			

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Germanium

Wave length.	Arc.	Spark.	Geissler tube.	Wave length.	Arc.	Spark.	Geissler tube.
547.0		1	. .	I 2 533 24	3	6	.. ...
760.3		3	. . .	2 556 29	1	....	.. ..
847.9	.	5	. .	I 2 589 20	3	5	.. .
868.3	..	6	. . . .	I 2 592 55	10	10r	. . .
892.6	.	5		2 644 18	2	2	.. ..
915.0	..	8	.	I 2 651 18 p	10	10r	. .
936.7	..	9	. .	I 2 651 58 p	10	10r	. . .
938.9	..	6	.	I 2 691 35	10	10	. . .
989.0	..	6	. .	2 709 68	10	10r	.. .
995.7	..	8	. .	2 740 44	8	7	. ..
996.5	.	8	.	I 2 754 59	10	10r	.. ..
1 004 2	.	6		2 793 94	3	2	. ..
1 011 2	.	9	.	2 829 01	3	2	.. .
1 016 5	..	8	.	2 845 4		4	....
1 045.5	..	7		I 3 039.09 p	10r	10r	....
1 058 8	..	6	. .	3 067 04	7	1	.. .
1 072.4		6		I 3 124 83	10	5	. . .
1 088.3	..	8	. .	I 3 269 50 p	10	10	. . .
1 098.6	.	5	.	4 179 0	..	10	.. ...
1 105.0	..	6		I 4 226 73 p	7	10	.. . .
1 116.8	..	6	. . .	4 260 81	..	10	.. ...
1 138.0	..	8	.	4 291 56	..	3n	. ...
1 159.5	..	8	. .	I 4 685 84	5	10	. ...
1 160.8	..	8	.	4 743 8	..	2	. .
1 173.7	..	6	. . . . .	4 814.70	..	9	8
1 183.4	..	8	. .	4 854 74	6	...	......
1 189.0	..	10	. . .	5 131 69	..	7	......
1 229.8	..	10	. . .	5 134.71	..	. ..	10
1 237.0	..	6	. .	5 178.57	..	. ..	7
1 393 8	..	8	.	5 229 37	..	6	.. ...
1 402.8	..	6	. .	5 564 72	..	...	5
1 500 6	..	6	.	5 606.98	.	.	1
1 733		6		5 621 41		.	6
2 198.71		2r		5 691 94			6
2 314.22	1	3		5 701 88	..	. .	4
2 327.93	1	3		5 893 42			10
2 379 15	1	3		6 021 04	.		10
2 417.28	3	10		6 484 2	..		5
I 2 497.97	3	7					

Gold

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
458.		1	1 590	.	3	1 727.	..	3
832.	.	5	1 600.	..	3	1 740.	..	4
854.	.	4	1 622.	..	4	1 767.	..	3
864.		5	1 629.	..	3	1 784.	..	5
975.	.	20	1 639	..	3	1 795.	..	5
1 402.	.	2	1 659	..	3	1 802.	..	5
1 435.		4	1 673	..	6	1 822.4	..	4
1 488.	.	4(?)	1 694.	..	6	1 845.7	..	3
1 500.	..	4(?)	1 699.	..	3	1 850.1	..	2
1 534.	.	3	1 720	..	3	1 861.1	..	3
1 562.	..	3	1 726.	..	4	1 871.1	..	3

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Gold (Continued)

Wave length.	Arc.	Spark.	Wave length	Arc	Spark.	Wave length.	Arc.	Spark.
I 1 879.1	..	3	I 2 688.7	4	3	3 586.7	..	5
1 886 3	..	4	I 2 700.88	4	3	3 614.0	..	2
1 889.8	..	2	I 2 748 26	6r	4	3 633.25	..	3
1 903.9	..	2	2 780 83	..	3	3 649 1	..	3
I 1 918.9	..	4	2 802.21	.	10	3 706.8	..	4
1 921 0	..	4	2 819.98	.	8	3 804.0	..	5
I 1 951.2	.	3	2 822.7	.	3	3 825.7	..	3
1 977.3	..	3	2 825.4		4	3 853 6	1	2
2 000 6	.	3	2 838.0	..	3	3 874 7	..	2
2 082.0	.	3	I 2 883.45	4	3	I 3 897.89	4	8
2 110.7	.	2	I 2 891.95	4	2	I 3 909.39	2	2
2 201.3	.	3	2 905.90	6	3	4 016.1	..	4
2 229.0	.	3	2 907.1	..	4	I 4 040 95	2	2
2 242.7	..	3	2 913.5	4	10	4 052 8	..	5
2 283.3	..	3	2 932.19	5	4	I 4 065.08	6	8
2 291.51	.	3	2 954.4	..	4	I 4 084 14	1	2
2 304 80		4	2 963 77	2	1	I 4 241.82	1	3
2 314.67	..	3	2 970.41	2		I 4 315.1	1	3
2 340.22	..	3	2 973.25	2N		I 4 437 29	4	3
I 2 352.67	4	3	2 990.3	..	5	I 4 488 25	4	4
I 2 364.58	4	2	2 995.0	.	5	I 4 607 4	4	2
I 2 376.25	3	2	I 3 029.21	6>	5	I 4 792 62	8	6
I 2 387.77	4	3	3 033.4	2N	2N	I 4 811 61	3	2
I 2 427.98 P	10r	10r	3 117.0	4	1	I 5 064 61	2	2
2 503.3	..	5	3 122.5	..	5	5 230 30	2	3
I 2 510.51	4	2	I 3 122.79	6r	8	I 5 655.8	2	2
I 2 544 2	4	2	I 3 194.71	4	2	5 759.9	..	3
I 2 590.07	4	2	I 3 204.74	4	3	I 5 837 41	4	6
I 2 641.50	4	4	3 230 61	3	3	I 5 863 0	2	3
I 2 675.95 p	10r	10	I 3 308.31	2	2	I 5 957 0	2	3
2 687.6	..	3	I 3 320.16	3	2	I 6 278.2	4	3
2 688.2	..	3	3 553 55	2	4	I 7 510 7	5	.

Hafnium

Wave length.	Arc.	Spark.	Wave length	Arc	Spark.	Wave length.	Arc.	Spark.
2 351.2	5	6	2 861 0	5	6	3 194.2	6	6
2 410.1	5	6	2 861.7	6	6	3 253.7	6	6
2 417.7	5	6	2 866.4	6	6	3 255.3	5	6
2 447.2	5	6	2 898.3 p	6	5	3 312.9	6	6
2 460.5	6	6	2 916 5 p	6	5	3 318.0	5	6
2 469 2	4	6	2 919.6	6	6	3 332.7	6	6
2 512.7	6	5	2 929.6	6	5	3 352.0	6	6
2 513.0 p	6	5	2 968.9	6	5	3 399.8	6	6
2 516.9 p	6	6	2 975.9	5	6	3 410.2	5	6
2 551.4	5	6	3 012.9	6	6	3 479.2	6	6
2 571.7	5	6	3 016.8	6	5	3 505.2	6	6
2 622.8	6	6	3 031.2	5	6	3 552.7	5	6
2 638.7	6	6	3 067.4	6	5	3 561.6	6	6
2 641.4 p	6	6	3 072.9 p	6	5	3 569.0	5	6
2 647.3	6	6	3 080 8	6	6	3 616.9	5	6
2 683.4	5	6	3 101.4	6	6	3 644.3	6	6
2 705.6	6	6	3 109.1	6	6	3 682.2	6	6
2 706.7	6	5	3 134 8 p	6	6	3 701.1	5	6
2 738.7	5	6	3 145.3	5	6	3 719.3	6	6
2 773.4 p	6	6	3 162.6	5	6	3 918.1	6	6
2 820.2 p	6	6	3 172.9	5	6	4 044.4	8	3
2 822.7	6	6	3 176.9	6	6	4 093.2 p	6	6

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Hafnium (Continued)

Wave length.	Arc	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
4 232 4	4	6	5 018 1	6	4	5 550 6	6	4
4 336 7	5	6	5 037 3	6	1	5 552.1	6	4
4 350 5	4	6	5 040 8	6	6	5 719 2	6	4
4 356 3	5	6	5 181 9	6	3	5 902 9	6	3
4 417 9	4	6	5 298.0	6	3	6 644 7	6	
4 598 9	6	6	5 311 5	6	4	6 789 4	6	
4 620 8	6	5	5 354.7	6	2	6 819 0	6	
4 800 5	6	6	5 373 9	6	3	7 131 8	6	
4 975.2	6	5	5 463.3	6	3			

Helium

Wave length.		Geissler tube.	Wave length.		Geissler tube	Wave length		Geissler tube.
I	585 ? p	10	I	3 203 17	8	I	4 713 14	3
II	1 215 ?		I	3 447 59	2	I	4 921 93	4
II	1 640 ? p	5	I	3 613 64	3	I	5 015 7	8
I	2 252 81	2	I	3 819 60	4	I	5 875 62 p	10
I	2 306 12	2	I	3 888 65 P	10	II	6 560 1	8
I	2 385 39	5	I	3 964 73	4	I	6 678 15	6
I	2 511 22	5	I	4 026 19	5	I	7 065 19	5
II	2 533 3	8	I	4 120 81	3	I	7 281 35	3
I	2 733 24	7	I	4 143 76	2	I	10 829.	1
I	2 763 80	2	I	4 387 93	3	I	10 830	5
I	2 829 06	4	I	4 471 48	6	I	20 581.	20
I	2 945 10	6	II	4 685 8	8	I	40 540.	.
I	3 187 74	8						

Holmium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
2 433 0	.	10	3 574 80	5	10	4 356.72	8	8
2 774 70	.	10	3 598 77	10	10	4 629 1	8	5
2 936 77 p	.	10r	3 626.68	10	8	4 649 8	8	1
3 166 61	5	8	3 627.18	8	8	4 742 0	10	3
3 171 71	5	8	3 662.28 p	10	5	5 566.5	8	..
3 181 50	4	10	3 685 16	3	8	5 674.7	10	.
3 289 37	5	10	3 748.19 p	10	10	5 691 5	10	.
3 343 56	10	10	3 757 26	10	10	5 860 3	10	. .
3 398 97	10	10	3 796 73	10	10	5 883 0	10	. .
3 410 25	10	8	3 810.73	10	10	5 921 8	10	.. .
3 414 90	10	10	3 854 07	4	10	5 933 7	10	.
3 416 46	10	10	3 861 68	..	10	5 948 0	10	..
3 421 62	10	10	3 888 96	10	10	5 982 9	10	.. .
3 425 35	10	10	3 891 01 p	10	10	6 081 8	8	...
3 428 10	10	10	4 040 81	8	3	6 133 6	10	....
3 453 13	10	10	4 045 44	10	10	6 234 2	10	...
3 456 00	10	10	4 053.92	10	8	6 255.7	10	.
3 461 96	10	10	4 065 08	10	5	6 305.4	10	. .
3 474 26	10	10	4 103 84	10	10	6 372.6	10	...
3 484 8	10	10	4 108 5	10	5	6 550.9	10	. .
3 494 8	10	10	4 127 15	10	5	6 604 9	10	..
3 515 58	10	10	4 173 22	10	...	6 629 0	10	..
3 546 00	10	10	4 254 42	10	8	6 694 3	7	.
3 556 77	8	10	4 350 73	10	5			

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Hydrogen, First Spectrum

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
972.54	.... .	3 671 34	.. .	3 835 40	.
992.	......	3 673.7	.. .	3 889 06	.
1 025.73	. .. .	3 676 34	. ..	3 970 07	
1 086.	......	3 679.35	.... ..	4 101 74	
1 215.68 p	......	3 682 82	...	4 340 47	..
3 656 6	....	3 686.83	. .. .	4 861 33 p	
3 657 6	. .. .	3 691.55	..	6 562.73	
3 658 0	. . .	3 697.15	.. .	6 562 85 p	..
3 660 3	. .	3 703 86	. .	9 500.	
3 661 2	. .	3 711 98	. .	10 900.	
3 662 2		3 721 95		12 817.	
3 663 4		3 734.37	. .	18 751.	.
3 664 6	....	3 750 15	......	26 300.	
3 666 1		3 770 06		40 500.	
3 667 7	. .	3 797.91	. .	74 000	.
3 669 42	. .. .				

Hydrogen, Second Spectrum

3 990.03	4	4 849.32	5	5 888 16	6
3 991 9	4	4 873.03	5	5 931 4	7
4 062 49	6	4 928 7	9	5 938 62	7
4 069 65	6	4 934.27	6	5 949 91	7
4 087.75	4	4 973.26	6	5 975 44	9
4 171.29	5	5 013 05	6	5 982.55	7
4 177 07	6	5 055 07	6	6 018 30	9
4 205 10	7	5 084 84	5	6 027 98	6
4 212 51	6	5 113 18	5	6 031 9	10
4 412 25	5	5 196 38	5	6 070 00	7
4 447.56	5	5 266.04	5	6 079 80	9
4 460 96	6	5 303 16	7	6 090 93	6
4 490 45	6	5 336 51	5	6 095 98	6
4 498 10	6	5 366 0	5	6 121 78	10
4 568 11	7	5 388 2	7	6 127 3	6
4 572 72	6	5 419.90	6	6 135.35	8
4 580 03	7	5 434 84	5	6 182.98	6
4 582 60	6	5 481 09	5	6 199 38	6
4 625 3	5	5 505 5	5	6 224 81	9
4 627 96	6	5 537 45	6	6 238 37	7
4 631 88	9	5 688 20	6	6 299.40	6
4 634 0	9	5 731.90	6	6 327.04	8
4 662 77	5	5 736 86	7	6 935 8	10
4 683 78	6	5 775 0	6	6 940 4	10
4 719 01	6	5 812 58	9	6 962 6	10
4 723.00	6	5 836 0	7	7 072.	10
4 797.74	5				

Indium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
161.8	..	0	684.	..	2	882.	.	4
583.	.	1	752.	..	1	954.7	.	4

INDIUM (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
973.	..	3	I 2 306 1	5	7	3 008 2	..	10
1 031.5	..	5	I 2 340 2	6r	..	I 3 039 36	10r	4r
1 054.	.	6	I 2 389 6	8r	.	I 3 256 06	10r	8r
1 082.	.	6	I 2 399 2	4r	. .	I 3 258 54	6r	3
1 222.5	..	6	I 2 460.1	6r	..	I 4 101.8 p	8r	10
1 233.	..	6	I 2 468.0	4r		I 4 511.31 P	10r	10
1 320.	..	7	I 2 521 4	8r	1	4 638 9	..	10
1 381.	..	9	I 2 523.9	4r		4 656.6	.	10
1 406.	..	8	I 2 560 2	8r	3	4 681.9	.	10
1 435.	..	5	I 2 601.8	4r	1	5 248.6	..	10
III 1 488.	..	8	I 2 710.25	10r	3	5 644.87	..	10
1 521 6	..	9	I 2 713.94	6r	1	I 5 709.7	5	. .
1 533 5	.	9	I 2 753.89	6r	3	5 819.9	4	10
II 1 625.6	..	10	2 836.9	8	.	6 097.0	..	7
III 1 749 2	1	12	2 890 23		5	6 197.8	.	6
1 966 7	2	9	I 2 932.66	6r	4	I 6 847.8	8	.
1 977.3	2	8	2 941 24	..	8	6 891.3	.	10
2 062.7	..	8	2 983.0	.	6	6 900.37	6	. . .
2 079.2	4	10						

IODINE

Wave length.	Spark	Geissler tube.	Wave length.	Spark.	Geissler tube.	Wave length.	Spark.	Geissler tube.
1 234 2		3	3 686 6	3	8	5 065 5		6
1 336 7		6	3 688 3	3	8	5 119.3	.	10
1 355 5		6	3 724 9	3	8	5 161.2 p	10	10
1 390.9		5	3 741 9	3	8	5 204.1		10
1 425 7	.	8	3 808 2	5	10	5 216 2	1	10
1 458 2		6	3 897 4	5	10	5 234 6	....	10
1 459 2	.	6	3 931 1		10	5 245 6	4	10
1 514 8		9	3 940 1		10	5 265 2	1	10(2)
1 518 3		7	4 128 7	2	10	5 269.4	1	10
1 641 1		7	4 221 1	3	10	5 309 0	..	8
1 642 5		7	4 342 1	1	8	5 338 2	3	10
1 782 9 p		9	4 399 0	1	8	5 345 1	3	10
1 830 4		10	4 410 1	1	10	5 369 7	1	10
1 844 5		9	4 434 3	1	10	5 405 3	1	10(4)
1 876 4		7	4 453 0	2	10	5 407 3	1	10
2 062 1 p		10	4 512 6	1	8	5 435.7	1	10
3 038 4	4	5	4 528 1	1	8	5 437.9	.	8
3 055 2	10	3	4 574 3	1	10	5 464 7 p	5	10
3 077.9		6	4 632 4	2	10	5 491 5	..	8(2)
3 081 7	8	5	4 640 8		10	5 493 3	.	8(2)
3 194 0	10	8	4 666 5		10	5 496 9	2	10(3)
3 275 0	5	10	4 675 6		10	5 598 7	..	6(2)
3 288 3	10	10	4 708 0		8	5 612 9	.	6
3 303 0	3	10	4 730 5	1	8	5 625 7	1	10
3 342 5	3	8	4 763 4	1	10	5 678.1	1	10(2)
3 350.1	2	8	4 806 5		8	5 690 8	1	10(2)
3 461.0	3	8	4 850 4		10	5 710 4	1	10
3 481 8	1	8	4 862 3	.	10	5 738.5	. . .	10
3 498.0	4	8	4 896 7	.	10	5 739 5	. . .	10
3 561 2	3	8	4 916 9	.	10	5 774 8	1	10
3 583 3	3	8	4 987.0	. . .	10	5 787.1	....	6

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Iodine (Continued)

Wave length.	Spark.	Geissler tube.
5 830 0		6
5 893 8		8
5 950 1	1	10
6 023 9		6
6 074 9		6
6 082 3		10
6 127 4		8
6 204 7		6
6 257 4		4
6 293 9		6
6 337.9		4
6 339 5		6
6 359 1		4
6 488 1		4
6 560.3		4
6 585 0		4

Iridium

Wave length.	Arc.	Spark.
2 024 4		4
2 051 1		5
2 092 7		3
2 221 1		5
2 372 78	4	2
2 475 11	4	2
2 512 57	2	5
2 543 98	5	4
2 661 99	6	3
2 664 77	5	3
2 694 22	6	3
2 712.72	4	2
2 774 98	2	5
2 823 18	5	2
2 824 44	6	4
2 833.23	4	10
2 839 18	6	2
2 849 74 p	7	4
2 924 81 p	8	4
2 934 63	6	3
2 936 71	5	3
2 943 17	7	4
2 951.23	5	3
3 039 25	5	3
3 042 63	2	6
3 100 42	8	3
3 120 77	5	3
3 133 31	6	5
3 168 88	5	3
3 198 93	5	1
3 220 79 P	8	5
3 229 28	5	3
3 241 52	5	3
3 266 45	8	3
3 277 28	4	2
3 334 19	5	3
3 368 50	8	3
3 437 05 p	8	4
3 448 99	7	4
3 513 67 p	9	8
3 515 96	6	3
3 522 05	6	4
3 573.74	6	6
3 605 83	2	10
3 609 78	6	3
3 617 23	6	4
3 628 69	7	5
3 636 22	6	3
3 653 20	1	6
3 661 72	5	3
3 675 00	4	4
3 731 35	4	8
3 734 75	2	6
3 747 21	5	6
3 800 10	6	6
3 895 6		8
3 915 38	4	6
3 976 33	5	10
3 992 14	6	6
4 020 05	5	8
4 033 77	4	4
4 069 93	4	8
4 115 80	4	5
4 259 12	4	2
4 268 09	4	5
4 311 50	5	4
4 399 48	6	8
4 426 29	6	4
4 616 37	6	2
4 778 15	4	2
4 938 07	10	
4 970 46	8	
4 999 72	10	
5 002 70	10	
5 015 00	10	
5 046.06	8	
5 123 66	8	
5 177 93	8	
5 238 92	10	
5 273 77	6	
5 340 74	8	
5 364 32	10	
5 385.62	7	
5 390 98	7	
5 449 50	10	1
5 454 50	10	
5 620.05	6	
5 625.55	10	
5 709 32	6	
5 736 23	5	
5 768 89	4	
5 778.28	4	
5 828.54	7	
5 873 49	5	
5 882 29	9	
5 887 38	5	
5 894 09	10	
6 026 12	5	
6 067.85	7	
6 110 68	8	
6 211 33	4	
6 288 3	7	
6 334.45	6	
6 496 9	4	
6 624.74	5	
6 686.08	7	
6 830 06	4	
6 888 72	4	
6 893 4	4	
6 929 9	5	
7 037 85	4	
7 183 74	5	
7 834 32	5	

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Iron

Wave length.	Arc	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
294 3	..	2	2 191 8	5	. .	2 383.25	4	2
365 8	..	5	2 196 0	5	.	2 388.63	6	3
381.1	..	4	2 199 5	5	. . .	2 389.98	4	. . . .
392 9	..	7	2 200 7	5	.	2 395 42	4	3
417 5	..	4	2 213 6	4	.	II 2 395 63 p	8	4
552 1	..	7	2 221 3	4	.	2 399 24	6	5
602 4	..	4	2 229 1	6	. .	2 404.43	4	2
609.1?	..	9	2 231 2	7	. .	II 2 404.89 p	6	6
666.9	..	4	2 240 6	5	. . .	2 406.66	6	4
669.9	..	4	2 245 6	6	. .	II 2 410 53 p	6	5
859.9	..	4	2 248 9	6	. .	2 411 07	6	3
863.2	..	3	2 249 2	7	. .	2 413 31 p	6	3
929.2	..	3	2 251 9	6	. . .	2 439.75	4	1
983 8	..	3	2 253 2	6	. .	2 442 57	4	1
1 006.0	..	2	2 255.8	7	.	2 443.87	4	1
1 017 6	..	6	2 260 8	6	. .	2 444.5	. .	4
1 031.8	.	4	2 265 2	5	. .	I 2 447.72	4	2
1 062 1	..	2	2 266 9	5	. .	2 453.48	4	1
1 143 4		2	2 267 1	5	. .	2 457.60	6	1
1 186 4		2	2 267 6	5	. .	I 2 462.19	6	1
1 228 9		2	2 272 8	5	. .	I 2 462 65	6	1
1 254 1	..	2	2 274 1	5	. .	2 465 16	5	. . .
1 260 8		2	I 2 276 0	5	. .	2 468 88	5	1
1 272 2		2	2 279 9	6	. .	2 472 35	5	. . . .
1 373 9	.	2	2 280 2	6	. .	I 2 472 87	5	. .
1 387 8	.	2	2 287 3	5	. . .	I 2 472 91	4	1
1 409 4	..	2	2 287 6	5	. . .	2 473 16	4	. . .
1 430 6	.	2	2 289.0	6	. . .	2 474 82	5	2
1 525 5		2	2 290 6	5	.	I 2 479 78	4	1
1 532 3	.	2	2 291.1	6	. . .	2 483 28	5r	1
1 538 3		2	2 292 5	5	. .	2 483 54	4	. . . .
1 597 7		2	I 2 297 8	6	. . . .	I 2 484.19	6	. . .
1 630 9		2	I 2 298 2	7	. . .	2 486.38	4	3
1 702 0	.	3	I 2 299 2	5	. . .	2 486 69	4	1
1 718 3		2	2 300 1	5	. . .	2 487 07	4	1
1 724 0		2	2 310 01	5	.	2 487 37	4	1
1 787 0	.	5	2 313 1	5	. .	I 2 488.15	4	2
1 788 3		5	2 327 39	6		I 2 489 76	6	.
1 843.9	.	2	2 332.80	6	.	I 2 490 66	4	. .
1 869 7		4	2 338 01	6	.	I 2 491 16	4	. .
1 895.6	..	4	2 343 50	7	.	2 493 3	. .	8
1 913 3		4	2 344 3	4	.	2 496 54	5	1
1 914 2		3	2 348 12	5	. .	2 507 90	4	1
1 953 6	.	2	2 348 3	5	.	I 2 510 84	6	1
2 000 3	3		2 351 2	4	. .	2 511 8	. .	5
2 020 6	3		2 354 9	6	.	2 512 37	4	. . . .
2 040 6	3		2 359.11	6	. .	2 517.66	4	1
2 063 7	3		II 2 360 3	5	. . .	I 2 518 11	6	1
2 084 2	4		2 362 1	8	. .	I 2 522.86	4	3
2 093 7	4		2 364 83	8	. . .	2 523 66	4	1
2 106.4	4		2 366 59	5	.	I 2 524 29	6	1
2 139.7	5		II 2 368 59	7	. .	2 525 4	. .	4
2 144 4	5	.	2 370 5	6	.	I 2 527.44	4	2
2 151 7	5	.	2 373 62	4	.	I 2 529.14	6	1
2 159 9	5		II 2 373 73	6	4	I 2 529.84	6	.
2 165 8	5	.	II 2 375 19	4	. .	2 533.7	. .	5
2 166 8	6		2 379 28	4	3	I 2 535.61	6	. . .
2 171 3	5		2 380.76	4	3	2 537 18	6	. . .
2 178 1	5		II 2 382 04 P	8	10	I 2 540 98	6	. . . .

Iron (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 542.11	5	1	2 696.29	5	. . . .	2 778.85	4	1
2 543 93	5	1	2 699.11	4	1	2 779 30	3	4
2 544.72	4	. .	2 704 00	3	4	I 2 781.80	4	1
I 2 549.62	6	. . . .	2 706.59	5	2	2 783.69	3	5
II 2 562.54	5	5	2 708.58	4	1	2 787.94	4	. .
2 563.48	5	4	2 710.55	4	1	2 788.11	6	2
2 566.92	4	3	2 711.66	5	. . . .	2 789 81	3	1
2 570.54	3	1	II 2 714 42	6	5	2 791 79	3	1
2 570.86	3	3	2 714 88	4	. . . .	2 797.78	4	1
2 574.37	3	4	2 718.45	4	1	2 804 52	7	1
2 575.76	4	1	2 719 04	7	2	2 806 99	7	2
2 576.70	4	. . . .	2 719 43	4	2	I 2 813.29	9	2
2 576.87	4	3	I 2 720.91	7	2	2 823 28	7	2
2 577.94	4	3	I 2 723.58	6	2	2 825 56	6	1
2 582.31	4	. .	2 724.89	3	3	I 2 825 69	4	1
II 2 582.59	4	4	2 724 96	4	. . . .	I 2 827.89	4	1
2 584.54	4	1	2 726 06	4	1	2 831 56	3	4
II 2 585.88	7	10	2 726 24	3	1	2 832 44	6	1
2 587 96	3	.	2 727.39	3	2	2 838 12	6	1
2 588.01	5	3	2 727.54	5	6	2 843.63	5	1
II 2 591.55	4	4	2 728.03	4	1	2 843 97	7	2
2 592 80	4	4	2 730 74	4	3	2 845.60	4(2)	2
2 598.38	7	8	I 2 733.58	9	2	2 848 72	4	1
II 2 599.40	6	10	2 734.01	4	1	2 851 80	8	2
2 599.57	3	. .	2 734 27	4	1	I 2 858 90	4	. .
2 606 83	5	. . .	I 2 735.48	8	2	2 863 43	4	1
2 607.10	7	10	II 2 736.97	4	4	I 2 863.87	5	1
II 2 611 88	8	10	I 2 737.31	6	1	2 866.63	4	1
2 613.84	8	8	II 2 739.55	9	10	I 2 869 31	6	1
2 617.62	6	6	I 2 742.26	4	1	2 872 34	4	3
2 618.03	4	1	I 2 742.41	6	1	I 2 874 18	7	1
2 619.08	3	2	II 2 743 20	6	8	2 877 30	5	1
2 620.42	3	2	I 2 744 07	8	1	2 887 81	4	1
2 620.70	3	2	2 744 53	5	1	2 894 51	4	1
2 621.67	6	4	II 2 746 49	7	10	2 895 04	4	1
2 623.54	4	1	II 2 746 99	7	8	2 899 42	4	1
2 625.50	4	3	2 749.18	4	.	I 2 912.16	8	2
II 2 625.68	8	4	II 2 749 32	7	10	2 918 03	5	2
2 628.30	6	8	I 2 750.15	6	2	II 2 926 58	7	3
I 2 629 60	5	3	2 750.87	4	.	I 2 929 01	7	1
2 630 08	3	2	2 753 29	4	5	I 2 936 90	7r	2
2 631.05	6	4	2 753.69	4	1	2 937 81	6	
2 631 33	6	3	I 2 754.03	4	1	I 2 941 35	8	3
2 632 25	4	1	II 2 755 74	8	10	2 944.40	4	4
2 635 82	4	1	I 2 756 33	5(2)	1	2 947.66	4	4
2 641.65	3	1	2 757 32	4	1	I 2 947.88	5	3
2 651 72	3	1	2 759.82	4	1	2 948 44	4	1
2 656.15	3	1	I 2 761 79	5	2	2 950 25	6	1
2 664 67	3	4	2 761 81	4	.	I 2 953 94	4	2
2 666 64	3	4	I 2 762.03	5	1	I 2 957 37	5	2
2 666.82	4	. . . .	2 763.11	4	1	2 960 00	4	2
2 679 06	6	2	2 764 33	4	1	I 2 965 26	5	2
2 681.59	4	. . .	I 2 766.91	4	1	I 2 966 90	6r	3
2 684.76	3	4	I 2 767 52	7	5	I 2 969 48	4	2
2 689.22	5	2	2 772 08	4	. . .	I 2 970.11	4	2
2 689 84	4	1	I 2 772 11	6	1	I 2 973.14	4	2
2 692.61	3	4	2 773 23	4	1	I 2 973.24	4	2
2 694.54	4	. . . .	I 2 774 73	4	2	I 2 981.45	4	2
2 696.00	4	. . .	I 2 778.23	6	1	II 2 984.83	4	6

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Iron (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
								1
I 2 987.30	5	1	3 171 35	4	1	3 341.91	4	1
2 990 40	4	1	3 175.45	6	1	3 347.93	4	1
I 2 994.44	6r	3	3 178.01	6	1	3 355.23	4	
2 999.52	5	2	3 180.23	8	2	3 370.79	6	2
3 000 45	4	1	I 3 180.77	4	: .	3 378.68	4	1
I 3 000 95	5	2	3 181.53	4	1	3 379 02	4	1
3 007 15	4	1	I 3 184 90	4	1	3 380 12	5	1
I 3 007.29	4	1	3 188 84	5	1	3 383 70	4	1
3 008 15	5	2	3 191.66	5	1	3 383 99	5	1
I 3 009 58	5	2	3 192.81	5	2	3 392 31	4	2
3 011 49	4	1	3 196.94	4	2	3 392.66	5	2
I 3 017 63	5	2	I 3 199.53	6	1	3 394.59	4	1
I 3 018 99	5	2	3 200.48	6	1	3 399 34	6	2
I 3 020 50	5	2	3 205.40	7	1	3 402 26	4	1
I 3 020 65	6r	3	3 210 25	4	1	3 404.35	6(2)	2
I 3 021.08	6r	3	3 210 84	5	1	3 407.46	7(2)	4
I 3 024 04	5	2	3 211.70	4	1	3 413.14	7	3
3 025.64	4	2	3 212 00	4	2	3 417.85	6	2
I 3 025 85	5	2	II 3 213 32	4	2	3 418 51	5	2
I 3 026 47	6	2	3 214 05	8	2	3 422 66	4	2
3 030 16	4	2	3 215 94	5	2	3 424 29	6	2
3 031 22	4	2	3 217 39	4	1	I 3 426 39	4(2)	1
I 3 031 64	5	2	3 219.58	5	. . .	3 426 64	6	1
I 3 037 39	5	3	3 219 82	4	.	3 427 12	6	4
3 040 43	4	2	3 222.07	6	3	3 428 20	6	2
I 3 041.75	4	2	3 225.79	8	3	I 3 440 61	7r	4
I 3 042 03	4	1	II 3 227 76	4	5	I 3 440 99	6r	4
I 3 042 67	5	2	3 227 82	4	5	3 442 37	4	1
3 045 09	4	. . . .	3 228 26	4	1	I 3 443.88	6r	3
I 3 047 61	6	3	3 233 06	5	2	3 445 15	4	2
3 053 07	4	1	3 233 98	6	.	3 447.28	6	1
3 055 27	4	.	3 234.62	5	1	3 450 33	6	1
I 3 057 45	5	3	I 3 236 23	5	1	3 451 92	6	1
I 3 059 09	5r	3	3 239 44	8	2	I 3 452.28	4	1
3 067 12	4	.	3 244 19	8	2	3 459 92	4	1
I 3 067 25	5	3	3 246 97	4	1	I 3 465 87	6r	3
3 068 18	4	1	3 248 21	6	1	3 468 85	4	1
I 3 075 73	5	3	3 251 24	5	1	I 3 475 46	6r	3
I 3 083 75	4	3	3 254 37	4	2	3 475.65	4	.
I 3 091 58	4	2	3 257 60	4	1	I 3 476.71	5	3
I 3 099 90	4	. . .	3 264.52	4	1	I 3 483 01	4	1
I 3 099 97	4	4	3 265 05	3	1	3 485 34	6	1
I 3 100 31	4	2	3 265.62	6	2	3 489 67	4	1
I 3 100 67	4	3	3 268 25	4		I 3 490 58	6r	4
I 3 116 64	5	1	3 271 01	6	2	3 497.11	4	2
3 119 50	4	1	3 280.27	5	1	I 3 497.84	5	3
3 120 44	4	1	3 282.90	4	1	3 506.50	5	1
I 3 125 66	6	2	3 284.59	4	1	I 3 513 82	5	3
3 129 34	4	.	3 286 76	8	3	I 3 521 27	5	3
I 3 134 11	5	1	3 290 99	4	1	3 524 08	4	1
3 142 45	4	1	3 292 03	5	1	3 524.24	4	1
3 142 89	4	1	3 292.60	5	1	I 3 526.02	4	2
3 143 99	6	1	3 298 14	5	1	I 3 526.17	5	2
3 151 35	6	1	3 305.98	8	3	3 526.38	3	. .
3 157.04	4	1	3 306.36	8	3	3 526.47	4	1
3 157.88	4	1	3 314.75	6	1	3 526.67	5	1
3 160.66	6	1	3 323.74	4	1	3 527.80	4	1
3 161.95	5	1	3 328.87	4	1	3 530.38	4	1
3 166.44	4	1	3 337.67	4	1	3 533.01	4	1

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

IRON (Continued)

	Wave length.	Arc.	Spark.		Wave length.	Arc.	Spark.		Wave length.	Arc.	Spark.
	3 533.20	5	2	I	3 687.46	6r	4		3 867.22	3	2
	3 536 56	6	3		3 689.46	6	2	I	3 872.51	6	4
	3 537.73	4	1		3 694.00	6	2		3 873.77	4	2
	3 540.13	4	1		3 701.09	6	2	I	3 878.02	6	4
	3 541.09	6	3		3 704.46	5	2	I	3 878.58	6r	5
	3 542.08	6	3	I	3 705.57	6r	4		3 878.66	4	...
	3 545.64	5	1		3 707.83	3		I	3 886 29	7r	5
	3 553.74	5	2		3 707.92	5	4(2)	I	3 887.05	6	3
	3 554.93	8	4	I	3 709.25	6	4	I	3 888 52	7	4
	3 556.88	6	2		3 716.45	6	..		3 891 93	4	1
I	3 558.52	5	4	I	3 719 94 P	8r	10		3 893 40	4	2
I	3 565.38	6r	5	I	3 722 57	6r	4	I	3 895 66	5	3
	3 568.98	4	1		3 724.38	6	2		3 897 90	4	2
I	3 570 10	7r	10	I	3 727.62	6r	5	I	3 898 01	4	2
	3 570 24	7	...		3 732.40	6	1	I	3 899.71	6	4
	3 572.00	7	2	I	3 733 32	6r	3	I	3 902.95	7	5
	3 576 76	4	1	I	3 734 87	9r	10		3 903 90	3	1
	3 581.20	8r	10	I	3 737 14 p	7r	6	I	3 906 48	5	3
	3 582.20	4	2		3 738 31	4	2		3 907 94	3	1
	3 584.66	5	2		3 743 47	4	6	I	3 917.19	5	2
	3 584 96	5	2	I	3 745 56 p	7r	5		3 918.65	4	1
I	3 585 32	6	3	I	3 745 90 P	6	4	I	3 920.26	6	4
I	3 585.71	5	3	I	3 748 27 p	6r	4	I	3 922 92	6r	4
	3 586 12	5	3	I	3 749 49	8r	10	I	3 927 92	6	4
I	3 586 99	6	3	I	3 753 62	5	2	I	3 930.30	7r	4
I	3 589.11	4	1	I	3 758.24	7r	8		3 935.82	4	1
	3 589.45	3	1		3 760 05	5	2	I	3 940.88	4	1
	3 603 21	5	3	I	3 763 79	6r	6		3 942.45	3	1
	3 605.46	5	3		3 765.54	6	3		3 948.78	4	2
	3 606.68	5	4	I	3 767 20	6r	5		3 949.96	4	2
	3 608 86	6r	6		3 785 95	5	2		3 951 17	4	2
	3 612.08	4	1		3 787 88	6r	4		3 952.61	4	1
	3 617.79	6	3		3 790.10	4	2		3 956.46	4	2
I	3 618 77	6r	6	I	3 795 01	6	5		3 956.68	6	3
	3 621 46	6	3		3 797 52	5	3	I	3 966 07	5	2
	3 622.01	6	3	I	3 798 51	6	4		3 967 43	4	2
	3 623.19	5	2	I	3 799 55	6	5	I	3 969 26	7	5
	3 625.15	4	1		3 805 35	6	3		3 971 33	4	1
	3 631.10	5	1		3 806 70	6	3		3 977 75	5	2
I	3 631.47	6r	6	I	3 807 54	4	2		3 983 97	5	2
	3 632.04	6	2	I	3 812.97	6	4		3 997 40	6	3
	3 634.34	5	1	I	3 815 84	7r	10		3 998 06	5	2
	3 637.86	4	1	I	3 820 43	8r	10	I	4 005.25	7	6
	3 638.30	6	2		3 821 18	6	3		4 009 72	5	2
	3 640.39	6	3	I	3 824 45	6r	5		4 014.54	4	2
	3 645.83	4	2	I	3 825.89	8r	8		4 021 87	5	2
I	3 647.85	6r	6	I	3 827 83	6r	8	I	4 045.82	8r	10
	3 649.51	6	3		3 833 31	4	1		4 062.45	4	2
	3 651.74	6	3	I	3 834.23	7r	6	I	4 063 60	8r	10
	3 655.47	4	1		3 839.26	5	2		4 066 98	4	1
	3 659 52	5	1	I	3 840.44	6r	4		4 067 28	3	1
	3 669.52	6	2	I	3 841.05	6r	5		4 067 99	5	1
	3 676.31	4	1		3 843 26	5	2	I	4 071 74	7	8
	3 677.63	6	2	I	3 849 97	6	4		4 074 79	3	1
I	3 679.92	5	3	I	3 850 82	5	2		4 076.64	5	2
	3 682.24	6	3	I	3 856 37	6r	5		4 107.49	5	2
I	3 683.06	4	2		3 859 22	5	2		4 109.81	4	2
	3 684.11	5	2	I	3 859 91	7r	6		4 114.45	4	1
	3 686.00	5	2	I	3 865 53	6	4		4 118.55	6	3

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Iron (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
4 127 62	4	1	I 4 531.15	5	2	II 5 169.03	2	5
I 4 132 06	7	4	4 547.85	3	2	I 5 171.60	7	2
4 134.68	5	2	I 4 592.66	4	2	I 5 191.46	7	2
4 143.42	5	3	I 4 602.95	3	2	I 5 192.35	8	2
I 4 143.87	7	5	I 4 607.66	4	1	I 5 194.95	5	1
I 4 147.68	4	1	4 611.29	4	2	I 5 198.72	4	1
4 154.82	4	2	4 619.30	4	1	I 5 202.34	5	1
4 156.80	4	2	4 630.13	3	4	I 5 216 28	5	1
4 175.64	4	2	I 4 632.92	3	1	5 227.19	8	4
4 181.76	6	4	4 638.02	4	1	I 5 232.95	8	5
4 184.90	4	2	4 647.44	4	2	5 242 50	3	1
4 187.05	6	4	I 4 654 50	4	....	I 5 266 57	8	3
4 187.81	6	4	4 667.46	4	2	I 5 269 54	10	8
4 191.44	6	3	4 678.86	5	2	5 270 36	8	4
4 198.31	6	3	4 691.42	4	2	I 5 281.80	5	2
4 199 10	6	5	I 4 707 28	5	2	I 5 283.63	7	2
I 4 202.03	7	6	4 710.29	3	1	I 5 302.31	5	2
4 210.36	6	3	I 4 733.60	3	1	I 5 324.19	6	5
4 216.19	4	1	4 736.78	5	3	I 5 328.04	7	6
4 219.37	5	3	4 741.53	3	1	5 328.54	4	2
4 222.22	5	2	4 786.81	3	1	5 341.03	5	2
4 225.46	4	1	4 789.66	3	2	I 5 371.50	7	6
4 227.44	7	4	I 4 859.75	2	2	5 383.37	5	6
4 233.61	6	3	I 4 871 33	8	4	I 5 397 13	6	6
4 235 95	8	4	I 4 872.15	6	3	I 5 405.78	6	6
4 238.82	4	2	I 4 878.22	5	2	5 415.19	4	6
4 247.44	5	2	I 4 890.77	7	4	5 424.06	4	8
4 250 13	7	4	I 4 891.50	9	5	I 5 429.70	6	6
I 4 250.79	8	6	I 4 903.32	5	2	I 5 434.53	6	5
4 260.48	10	10	I 4 919.00	8	4	I 5 446.92	6	6
I 4 271.77	8	10	I 4 920 52	10	8	I 5 455.61	6	6
4 282.41	6	3	I 4 938.83	5	1	I 5 473.91	3	1
I 4 294.13	6	4	I 4 957.31	7	3	I 5 497.52	4	2
4 299.24	7	4	I 4 957.61	10	8	I 5 501 47	4	2
I 4 307.91	8	10	4 966.10	5	1	I 5 506.78	4	2
I 4 315.09	5	3	4 983.86	4	1	5 563.61	3	1
I 4 325 77	9	10	I 4 994 14	3	1	I 5 569.63	5	2
I 4 337 05	5	2	5 001.87	5	2	I 5 572 85	5	3
4 352.74	4	2	I 5 006.13	5	2	I 5 576.10	4	1
4 369.78	3	2	I 5 012 07	4	2	I 5 586.77	6	4
4 375 93	5	2	5 041.08	3	1	5 598.30	3	1
I 4 383 55	10	10	I 5 041.76	3	1	I 5 615.66	6	4
I 4 404.75	8	10	I 5 049.83	5	2	I 5 624.55	5	1
I 4 408.42	4	1	I 5 051 64	4	1	I 5 658.83	4	1
I 4 415 13	8	10	I 5 079.23	3	1	5 701.55	3	....
4 422 57	4	2	I 5 079.74	3	1	I 5 709 39	3	1
4 427.31	5	2	I 5 083.34	4	1	5 717 85	3	..
I 4 430 62	4	1	I 5 098.71	7	1	5 731.77	3	..
I 4 442.35	5	2	I 5 107.65	4	1	5 763 01	4	1
I 4 447 72	5	2	5 110 42	4	1	5 862 35	4	....
I 4 459.13	5	3	I 5 123 73	4	1	5 883 84	4	...
4 461 66	4	2	I 5 127.36	3	1	5 914.16	6	1
4 466.56	5	3	5 133.68	5	2	5 930 17	5	....
4 469.39	4	3	I 5 139 27	6	2	5 934.68	4	1
4 476.02	7	4	I 5 139 48	8	3	5 952.74	4	1
I 4 482.26	4	4	I 5 150.84	4	1	6 024.06	4	2
4 489.75	3	1	I 5 151 92	3	1	6 027.06	3	1
I 4 494.57	4	5	5 166 29	3	1	6 065.49	4	2
I 4 528.62	7	6	5 167.49	8	4	6 136.62	4	3

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Iron (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
6 137 70	4	3	7 068.42	5	. . .	8 999.5	4	. .
6 157.73	2	1	I 7 090.41	6	.	9 079.6	4	. .
I 6 173.34	3	1	I 7 130 95	10	. .	9 088.2	4	. .
6 191.57	5	3	I 7 164.48	9	. . .	9 089.4	4	. .
I 6 213.44	3	1	7 187.34	10	. .	9 100.5	2	. . . .
6 230.73	5	3	I 7 207 42	10	. .	9 118.9	4	. .
6 246 34	4	1	I 7 239.90	4	. .	9 210.0	2	. .
6 252 57	4	2	I 7 288.78	4	.	9 258.5	3	.
I 6 265.14	4	1	I 7 293.08	6	. .	I 9 350.5	1	.
I 6 297.80	3	. .	7 386 40	4	. . .	9 738.7	2	.
I 6 301.52	5	1	I 7 389 43	7	. .	10 063.	2	. . .
6 318.03	4	1	I 7 411.19	8	. .	10 144.	3	. .
I 6 335 34	4	1	I 7 445.78	9	. .	11 641.	3	. .
6 336 84	4	1	I 7 495.10	8	. .	11 884.	5	. .
6 393 61	5	2	7 511.05	9	. .	11 975.	8	. .
6 400.02	5	3	7 531 18	4	. .	12 034.	3	. . .
6 408.04	4	. . .	I 7 568 93	4	. .	13 564.	5	. .
6 411.67	5	1	7 586 07	7	. . .	13 899.	5	. .
6 421 36	4	1	7 664.30	4		14 237.	4	.
I 6 430 86	5	1	7 748.29	4	.	14 288.	4	.
6 462.74	4	. .	7 780 60	5	.	14 402.	10	.
6 494.99	5	3	7 832 24	6	.	14 513.	8	.
6 546.25	5	1	I 7 937.18	9	.	14 558.	4	.
6 569 23	5	. . .	7 945 89	7	. . .	14 711.	2	. .
6 592 92	5	1	I 7 998 98	6		14 828.	2	.
6 609.12	4	. . .	I 8 046.09	5	.	15 054.	2	
6 663 45	4	. .	8 085.21	5	. .	15 213.	4	
6 678.00	5	. . . .	8 220.42	7	. .	15 296.	4	
6 750.16	4	.	I 8 327.06	8	. .	15 396.	3	
6 828.61	4	. . . .	I 8 331.95	6	. . .	15 625.	3	
6 841.36	5	. .	I 8 387 79	8	.	15 771.	4	.
6 843.68	4	. . . .	I 8 468.42	7	. .	15 815.	3	
6 855.18	6	. .	I 8 661.92	6	. .	15 821.	3	. . .
6 885.77	4	. . .	I 8 688.64	7	. .	16 166.	2	.
6 916.71	4	.	I 8 824.25	6	.	16 317.	2	.
6 945.21	7		8 838.4	2	.	25 987.	3	. .
6 978.86	7	.	8 866.9	3		26 229.	2	. .

Krypton

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
2 227.9	6	2 320.8	6	2 413.9	9
2 237.0	5	2 329.2	8	2 415.0	9
2 245 3	6	2 344.5	8	2 418.2	10
2 273.1	6	2 359 9	10	2 420 2	10
2 277.4	7	2 362.9	8	2 426.4	9
2 282.8	10	2 371 5	8	2 428 3	10
2 287.7	10	2 375 6	10	2 439 2	8
2 300.3	8	2 392 8	7	2 442 6	7
2 301 6	8	2 394.0	8	2 446.5	8
2 211.9	8	2 398.3	10	2 452 3	6
2 314.1	8	2 406 3	6	2 453 3	6
2 315.4	9	2 408.5	7	2 456.1	8
2 316.2	10	2 409.1	8	2 457 7	8

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Krypton (Continued)

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
2 459.6	7	3 679.5	4	4 489 9	4
2 464.8	8	3 680 4	7	4 501 0	7
2 478.9	4	3 686.1	6	4 502 2	9
2 506.6	9	3 690.6	5	4 523.1	5
2 592 5	5	3 718.0	10	4 524 6	4
2 620 4	4	3 718.6	8	4 556 6	4
2 639 8	4	3 721.3	7	4 577 2	6
2 648 2	4	3 735 8	5	4 582 7	4
2 681.2	4	3 741.69	10	4 615 3	5
2 712 4	8	3 744.8	9	4 619 12	6
2 795.8	5	3 754 2	5	4 624 28	10
2 816 5	6	3 778 11	10	4 633 88	5
2 833 0	6	3 783 2	10	4 658 9	5
2 892.2	5	3 796.9	4	4 671 23	10
2 967.3	5	3 860.4	5	4 680 5	4
3 046 9	5	3 863.8	5	4 694 9	4
3 063 1	5	3 875.4	7	4 734 1	4
3 124 4	6	3 894.7	5	4 738.96	7
3 141 3	6	3 906 2	8	4 762 45	5
3 189 1	7	3 912 3	5	4 765 7	6
3 191 2	6	3 917 6	6	4 807 0	4
3 200 4	6	3 920 4	8	4 829 7	3
3 207 8	8	3 954 7	5	5 498 0	3
3 239 5	6	3 994 8	6	5 519 4	4
3 240 4	6	3 997 9	5	5 562 2	6
3 245 7	10	4 044 6	5	5 570 29 p	10
3 264 8	8	4 050.5	5	5 633 0	6
3 268 5	7	4 057 01	8	5 660 1	3
3 311 5	6	4 065 05	8	5 681 9	5
3 320 3	10	4 088 36	8	5 870 92 p	10
3 325.7	9	4 098 7	7	6 056 1	2
3 330 7	7	4 109 2	6	6 456 3	5
3 351 9	6	4 145.12	6	6 904 6	5
3 405 1	7	4 273 97	10	7 587 40	10
3 439 5	6	4 282 97	4	7 601 55	10
3 446 5	7	4 292 94	6	7 685 22	7
3 460 1	6	4 300 5	5	7 694.53	8
3 470 0	7	4 318 0	5	7 854 81	7
3 474 6	7	4 318 55	8	8 059 47	4
3 488 6	8	4 319.58	10	8 104 33	7
3 503 2	6	4 355 47	10	8 112 89	10
3 507 4	9	4 362 6	9	8 190 02	6
3 535 3	6	4 376 1	10	8 263 22	4
3 589 6	7	4 399 9	6	8 281 02	3
3 599 9	6	4 436 8	4	8 298 07	6
3 607 9	9	4 453 91	10	8 508 85	2
3 631 9	10	4 463 68	10	8 776 73	3
3 653 96	10	4 475 0	4	8 928 72	1
3 669 0	9				

Lanthanum

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
2 297.8	..	7	2 476 7	..	7	2 651.7	..	8
2 379 4	..	10	2 610 34	4	5	2 808.36	5	3

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

LANTHANUM (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
3 171.7	..	10	4 383.45	6	8	5 808.32	5r	1
3 245.12	6	4	4 385 18	5	4	5 821.99	6r	1
3 249 35	5	3	4 427.56	7	8	5 823.83	4r	.
3 265.65	6	4	4 429.90	10	10	5 829 73	4r	
3 303.11	6	5	4 452.17	6	1	5 845 03	4r	.
3 337.49	8	10	4 522 38	9	10	5 848 36	4r	..
3 344.56	8	7	4 525.29	6	8	5 855.59	4r	.
3 380.91	8	10	4 526.11	8	8	5 863.70	5r	2
3 517.1	..	10	4 549.50	6	1	5 880.63	5r	2
3 645.41	6	8	4 558.45	7	5	5 894.83	4r	..
3 650.17	5	4	4 567.90	6	1	5 930.59 P	6r	3
3 713 55	5	6	4 570.02	6	1	6 038.59	4r	.
3 715.52	5	4	4 574 85	8	5	6 068 74	4r	
3 759 07	8	10	4 580.06	6	3	6 108 49	5r	..
3 790.82	8	10	4 613 38	6	5	6 111.74	4r	.
3 794.76	8	10	4 619.83	5	6	6 126 09	4r	3
3 840 70	5	5	4 655.49	7	10	6 129 57	5r	3
3 849.00	6	10	4 662.51	6	4	6 134 42	5r	. .
3 871 63	8	10	4 663.76	5	8	6 165 73	5r	
3 886.34	7	10	4 668 90	5	8	6 249.94 p	7r	5
3 916.03	7	10	4 671.81	4	5	6 262.29	5r	6
3 921.54	7	10	4 692.49	5	5	6 266.06	4r	1
3 929 21	8	10	4 728 41	7	3	6 293 60	4r	2
3 949 10 P	10	10	4 740.27	8	5	6 296 11	5r	5
3 988.52	10	10	4 743 08	8	10	6 320 39	5r	5
3 995.75	10	5	4 748.72	6	5	6 325.93	5r	1
4 025.87	6	4	4 809 00	6	3	6 390 48	5r	7
4 031.70	7	10	4 824 06	6	4	6 394.24	6r	6
4 042 92	8	10	4 860 90	6	3	6 399.04	5	5
4 050 09	6	10	4 899.92	7	4	6 411.00	10	3
4 067 39	6	8	4 920.98	7	5	6 454.53	6	1
4 077.35 p	10	10	4 921.80	7	5	6 456 00	5r	3
4 086.71	10	10	4 986.83	6	2	6 526.98	8	4
4 099 55	7	10	4 999.46	6	3	6 543.17	8	1
4 123 23 p	10	10	5 106.22	6	1	6 578.54	5	3
4 141 75	10	10	5 114 54	6	3	6 616 60	4	..
4 151.97	8	10	5 122 96	5	3	6 650 81	4	
4 152.78	4	5	5 183 41	8	5	6 661.41	4	1
4 192.34	7	8	5 301.96	5	1	6 671.41	4	2
4 196 55	10	10	5 455 14 p	6	1	6 709.51	4	
4 204.04	5	4	5 464.39	5	1	6 753 07	4	
4 217 55	6	10	5 501 35	6r	1	6 774 28	6	3
4 230 95	4	6	5 541 26	4r		6 925 26	3	.
4 238 39	10	10	5 588.34	4r		7 066 21	5	
4 249.99	5	6	5 648 25	5		7 068 34	4	
4 263 59	6	8	5 740 65	6r	1	7 161 22	4	.
4 269 49	6	10	5 744 41	5r		7 282 33	5	.
4 275.64	4	4	5 761 84	5r	1	7 334 17	5	.
4 286.95	8	10	5 769 07	7r	3	7 345.34	4	
4 296.06	9	8	5 769.35	7r	1	7 483 48	4	.
4 322 53	6	5	5 769 97	5r	.	8 324 69	3	
4 333 80	10	10	5 789.23	6r	1	8 346.55	3	.
4 334.97	6	8	5 791.33	7r	1	8 545.43	3	.
4 354.39	8	10	5 797.59	7r	2	8 674.38	3	.
4 378.09	7	4	5 805.76	5r	2	8 748.42	2	....

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Lead

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
884.	..	5	2 059.	7r	10	3 176.5	..	10
890.	..	3	2 060.	7r	7	3 572.74	5r	10
894.	..	5	2 088.2	5r	....	3 639.58 p	6r	10r
907.	..	7	2 115.0	5r	....	3 683.47 p	3r	10r
927.	..	7	2 159 6	3r	....	3 739.95	5r	4r
954.	..	3	2 170 0 P	6r	2r	3 854.0	..	10
1 004.	..	3	2 175.6	4r	....	4 019.64	3	10
1 029.	..	10	2 203 5 P	3	4r	4 057.83 p	5r	10r
1 166.	..	7	2 237.42	3r	2r	4 062.15	3	10
1 203.	..	7	2 246.90	6r	4r	4 168.04	3	10
1 213.	..	3	2 332.47	4r	2	4 242.5	..	10
1 232.	..	7	2 393.81	5r	3r	4 245.2	..	10
1 250.	..	10	2 401.94	4r	3	4 386.	..	10
1 267.	..	7	2 411.75	4r	2	5 005.45	3	2
1 316.	..	10	2 443 86	4r	4	5 608.8	4	10
1 349	.	3	2 446 20	4r	4	5 895.7	5	...
1 434.	.	10	2 476.39	4r	2r	6 002.	5	....
1 534.	..	7	2 577.28	6r	3r	7 228 98	6	....
1 554	.	10	2 613.68	3r	3r	10 291.	10	...
1 660.	.	2	2 614.20	6r	5r	10 500.	10	....
1 671.	.	2	2 663.17	10r	10r	10 651.	6	....
1 682 5 p	6	2	2 802 01	5r	10r	10 888.	1	....
1 726.	6	2	2 823 20	4r	10r	10 971.	3	....
1 781.	..	2	2 833.07 p	6r	10r	12 564.	4	...
1 796.5	6	3	2 873.32	6r	10r	13 102.	4	....
1 822.	8	3	3 043.87	1	10	14 744.	3	....
1 869.	..	5	3 137 8	..	10	15 315.	3	....

Lithium

I 2 394 4	1r	....	I 4 148.	.	...	13 566.	2	...
2 425.6	3r	...	I 4 273.3	5	2	I 17 552.	2	....
I 2 475.	4r	...	I 4 602.0	9r	10	18 697.	5	...
I 2 562 5	5r	. .	I 4 603.0	9r	10	I 19 290.	1	....
I 2 741.3	6r	2r	I 4 636.	3	. .	23 991.	2	....
I 3 232.7 p	8r	8r	I 4 971 9	7	4	I 24 467.	8	...
I 3 719.	3	....	I 6 103.6	10r	10	I 26 875.	2	....
I 3 794.	5	...	I 6 240.6	1	. . .	26 891.	1	....
I 3 915.	2r	1	I 6 707.86 P	10r	10r	I 40 475.	1	..
I 3 985 7	3	....	I 8 126 4	10	...	I 74 360.	1	....
I 4 132 3	5	1	I 12 232.	1	..			

Lutecium

2 578 79	4	5	2 963 33	7	10	3 281.75	10	5
2 603 32	..	10	2 969 81	6	10	3 312 12	10	5
2 615 42	10	10	3 020 56	4	10	3 359 59	10	5
2 657.83	4	10	3 056 74	10	10	3 376 54	10	5
2 754 19	4	10	3 057.96		10	3 397 02 p	10	10
2 772.60	..	10	3 077.62	10	10	3 472.49 p	10	10
2 796.64	4	10	3 081.48	9	3	3 507.40	10	10
2 847.50	5	10	3 118 42	7	3	3 508.41	10	3
2 894 86 p	10	10	3 191.78	2	10	3 544.93	5	...
2 900.32	10	10	3 198.13	10	10	3 554.43 p	10	10
2 911.40 p	10	10	3 254 31	10	10	3 567.84	10	5
2 951.68	3	8	3 278 96	10	4	3 623.97	10	10

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Lutecium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
3 636.26	10	3	4 839.52	4	1	6 160.00	6	1
3 647.77	5	2	4 904.87	5	1	6 199 73	5	. . .
3 684.34	4	. . .	4 994 13	10	3	6 221 88	10	4
3 841 15	7	2	5 001.14	6	1	6 235 39	5	1
3 876.65	10	10	5 135.11	10	1	6 242 42	7	1
4 054 46	5	2	5 402 57	10	1	6 345 44	7	. . .
4 124.73	10	5	5 476 70	10	10	6 463 16	10	3
4 184 24	10	10	5 736.54	10	1	6 523.16	10	. . . .
4 281.03	5	1	5 775 39	6	. . . .	6 793.80	5	. .
4 296.02	5	1	5 983.65	10	1	6 917.28	7	. .
4 518.54 p	10	5	5 984.11	10	1	7 031.18	4	. .
4 658.00	10	3	6 004.54	10	1	7 125.85	7	. . .
4 785.45	5	3	6 055 05	6	. . .			

Magnesium

1 231.6	.	2	II 2 802.71 p	10r	10r	I 4 571 12	5	2
1 320.9	.	5	I 2 846.78	4	1	I 4 703 07	10	5
1 323.2	. .	4	I 2 848.42	5	1	II 4 739 6	.	5
II 1 735.	1	6	I 2 852.13 P	10r	10r	II 4 851 1	.	5
II 1 737.	2	7	2 915.5	3	8	I 5 167 33	8r	10
1 741.	5	. . . .	II 2 928.7	3	10	I 5 172 68	10r	10
1 744	5	. . .	II 2 936.6	4	10r	I 5 183.60	10r	10
II 1 750.9	. .	5	I 2 936 8	4	. .	I 5 528 48	10	5
II 1 753 6	. .	6	I 2 938 5	5	. . .	I 5 711 13	5	1
I 1 828.	3	. . . .	I 2 942 06	6	2	I 6 318 5	2	. .
1 856	5	. .	I 3 091 09	8r	1	II 6 347 1	4	. . .
1 864	4	. . . .	I 3 093.05	8r	2	I 7 658	2	.
1 886.	5	. . . .	I 3 096.92	10r	2	II 7 877 1	. .	4
1 931.	6	. . . .	II 3 104.7	.	10	II 7 896 3	.	5
I 2 026	6	6	II 3 104.8	. .	10	I 8 806.8	5	. .
II 2 660.76	. .	5	I 3 329.94	8	3	I 8 929.	2	.
II 2 660 82	. .	5	I 3 332.17	10	5	9 224.	1	
I 2 668 2	3	. . .	I 3 336.69	10	8	I 9 258.	3	.
I 2 669 7	6	. . . .	II 3 535.0	. .	5	I 10 813.	3	.
I 2 672.6	8	. . . .	II 3 538 8	.	6	I 10 963.	1	
I 2 693 8	2	. . .	I 3 829.36 p	8r	10r	I 10 970	3	. .
I 2 695 3	4	.	I 3 832.17 p	10r	10r	11 054 ?	2	. . .
I 2 698 2	5	.	I 3 838.29	10r	10r	I 11 828.	10	. . .
I 2 733 55	4	1	II 3 848.2	. .	7	I 12 083.	5	. .
I 2 736 6	4	1	II 3 850.4	.	6	I 14 877.	10	. .
I 2 776 71	6r	6r	I 4 167 6	4	1	I 15 028.	6	.
I 2 778 29	6r	6r	I 4 351 9	8	2	I 15 759	1	.
I 2 779.85	8r	8r	II 4 384 6	. .	8	I 15 768.	4	
I 2 781.43	6r	6r	II 4 390.6	.	10	I 17 108.	6	. .
2 782 99	6r	6r	II 4 428.0	. .	7	I 23 963.	1	
II 2 790.83	4	10r	II 4 434 0	. .	8	I 23 977.	1	. .
II 2 795.54 P	10r	10r	II 4 481.	. .	10	I 23 991.	1	.
II 2 798.0	. .	10						

Manganese

311.	. .	1	1 118.	. .	5	1 892.0	. .	4
648.	. .	2	1 438.	. .	5	1 904.	. .	5
893.	. .	10	1 573.?	. .	5	1 952.1	. .	3
1 113.	. .	5	1 789.	. .	10	1 993.	. .	5

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

MANGANESE (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
II 2 452.52	2r	10	I 3 570.10	4r	3	I 4 709.70	7	2
2 575.51	5	1	I 3 577.88	8r	5	I 4 727 46	7	2
II 2 576.12 P	5r	10r	I 3 586.55	5	5	I 4 739.00	5	2
2 592.95	5	1	I 3 607.52	8	3	I 4 754.05	10	8
II 2 593.73 p	4r	10r	I 3 608.48	6	3	I 4 761.53	5	2
II 2 605 69 p	5r	10r	I 3 610.30	6	3	I 4 762.38	9	4
2 618.15	4	8	I 3 806.86	6	8	I 4 765.86	5	2
2 625 6	.	8	I 3 809 60	6	6	I 4 766.42	6	3
2 632 35	1	8	I 3 823 51	4r	6	I 4 783.43	10	4
2 638.17	1	5	I 3 823.90	4	4	I 4 823.52	10	4
2 655.8	.	5	I 3 833.87	6	4	4 965 86	5	1
2 672.58	1	5	I 3 834.36	6r	8	5 196.60	5	1
2 695 36	1	5	I 3 839.77	4	5	5 255 33	5	2
2 701.70	3	5	I 3 841.09	4	6	I 5 341.07	10	8
2 705.74	2	8	I 3 843.99	6	4	5 377.63	8	3
2 711 6	.	5	3 985.24	4	3	5 394.68	7	2
I 2 794.82	6r	5r	I 4 018.11	8	8	5 399.51	8	3
I 2 798 27	6r	5r	I 4 030 76 P	6r	10r	I 5 407.43	7	2
I 2 801.08	6r	5r	I 4 033.07 p	8r	10r	5 413.70	7	2
2 879.49	1	5	4 033 63	3r	3	I 5 420.37	7	3
2 886.68	2	6	I 4 034.49 p	8r	10r	5 432.56	6	1
2 889.52	3	10	I 4 035 73	5r	8	I 5 470 64	8	2
I 2 914.61	8(2)	1	I 4 041 37	8r	10	I 5 481.40	6	1
I 2 925.59	6(2)	1	4 045.20	4	5	5 505 88	6	1
II 2 933 06	6	10	I 4 048.76	4	8	I 5 516.77	8	2
II 2 939 31	6	10	I 4 055 55	8	8	I 5 537 75	7	2
I 2 940 39	6	1	I 4 079.25	6	5	5 551 99	5	1
II 2 949 21	6	10	I 4 079 43	6	5	5 567.77	4	1
I 3 044 57	4	2	I 4 082.95	6	6	5 738.28	4	..
I 3 054 38	4	2	I 4 083.64	6	6	5 780 17	5	...
I 3 062.13	4	1	4 131.12	4	4	5 848.97	3	...
I 3 079.63	5	1	4 176.60	4	4	I 6 013.50	10	1
3 110.69	5	1	4 189.99	4	4	I 6 016.64	10	1
I 3 148 19	4	1	I 4 235.14	8	.	I 6 021.79	10	1
I 3 178 53	8	1	I 4 235.29	8	10	6 078 40	3	.
I 3 212 89	6	2	I 4 239 73	5	5	6 382.19	3	
3 228.10	5	3	I 4 257.67	5	4	6 440.97	5	
I 3 236 79	6	3	I 4 265.92	5	5	6 491.71	7	
I 3 243.79	4	2	I 4 281.10	5	5	6 605.57	4	
I 3 248.52	4	3	4 374.94	4	2	6 942.55	5	...
I 3 256.14	4	2	I 4 414 87	8	6	6 989 94	4	
I 3 258 42	4	2	I 4 436.36	7	5	7 069.86	4	.
3 317 30	6n	1	I 4 451.59	9	3	7 151.33	8	...
3 320.70	4	1	I 4 453 01	5	3	7 184.29	5	....
3 330 67	4	3	I 4 455.02	6	3	7 247.83	5	...
I 3 442 00	5	10	I 4 455.32	6	3	7 283.80	6	..
I 3 460 33	3	10	I 4 455.82	5	3	7 302.92	6	...
I 3 474 14	4	10	I 4 457.04	5	2	7 326.55	7	....
I 3 482 92	4	10	I 4 457.55	6	4	7 646.34	3	....
I 3 488 69	4	10	I 4 458.27	6	5	7 680.20	5	...
I 3 495 84	5	6	I 4 461 09	6	4	7 710.2	5	....
I 3 531 84	4r	2	I 4 462.03	9	8	7 712.4	5	....
I 3 532.00	5r	3	I 4 464.68	7	5	7 764.8	5	...
I 3 532 11	5r	3	I 4 470 14	7	4	7 821.3	2	....
I 3 547.79	5r	4	I 4 472 80	7	3	7 942.9	2	...
I 3 548.02	4r	3	I 4 490.09	5	3	8 212.4	2	...
I 3 548.19	4r	3	I 4 498.90	7	4	8 654.6	2	....
I 3 569.50	6r	5	I 4 502.22	7	4	I 8 670.8	2	...
I 3 569.80	8r	4	4 626.54	5	2	I 8 672.1	2	....

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Manganese (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
I 8 703.7	3	....	I 13 294	5	. . .	I 13 997.	10	.
I 8 740 9	3	....	I 13 318	3	.	14 970.	3	.
11 378.	2	....	13 416	8	. . .	15 218.	8	.
11 614.	4	. . .	13 500	10	. .	15 263.	10	. .
11 782.	6	....	I 13 626	10	. .	15 965	10	. . .
12 307.?	..	. . .	13 685.	8	.	17 336	8	. . .
I 12 900.	8	. . .	I 13 864	10	.	17 608.	2	. .
12 976.	4	. . .						

Mercury

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
I 1 269 7	..	5	I 3 021 50	5	4	I 6 072 63	5	
1 527.	..	5	I 3 125 6	8	8r	6 123.47	6	.
1 592	..	8	I 3 131 56	7	5r	I 6 234 35	8	
1 599	.	7	I 3 131.84	7	4r	I 6 907.5	10	.
II 1 650 p	.	10	I 3 341 48	6	5	I 7 082.0	4	
1 677 9	..	10	I 3 650 15	10	9r	7 729.2	6	
1 738 3	..	8	I 3 654.83 p	7	5	I 10 140.	10	
1 798.7	..	9	I 3 662 87	4	4	I 11 287.	9	
I 1 849. P	10	10	I 3 663.27	6	5	I 11 888.	1	.
II 1 942 p	10	5	I 3 906 4	6	. . .	I 13 570.	6	.
II 2 224 7	4	4	3 983 99	6	8	I 13 673.	8	
I 2 378 3	3	. .	I 4 046 56	10	10r	I 13 950.	4	.
I 2 399 4	3	. .	I 4 077.8	7	5r	15 295.	5	
I 2 482 7	3	. . .	I 4 339 23	6	1	I 16 921.	2(?)	
I 2 534.8	4	2	I 4 347.50	6	1	I 17 073.	2	
I 2 536 P	10r	10r	I 4 358 34	10	10r	I 17 110.	2	
I 2 652 0	5	2	I 4 916 0	5	1	18 333.	1	.
2 698 9	3	. .	4 960 3	5	. .	19 701.	1(?)	
I 2 752 8	4	4	I 5 460 73	10r	10r	I 23 253.	1	
I 2 803 5	4	. . .	I 5 675 8	5	. .	36 492.	2	.
II 2 847.7	..	8	I 5 769 60	10	5	I 39 425.	10	
I 2 893 6	5	5	I 5 790 66	10	5	40 159.	8	
I 2 967.28	5	8r						

Molybdenum

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
1 377.	.	1	II 2 911 91	5	10	3 504 41	6	2
1 548.	.	4	II 2 923.40	4	10	3 524.62	2	7
1 692.	.	2	3 087.61	2	10	3 614 25	8	3
1 697.	.	4	3 116.08	1	8	3 635.15	2	10
1 809.8	..	7	3 121.99	2	10	3 651.14	1	8
2 538.46	2	10	I 3 132.60	10r	2	II 3 688.33	1	10
II 2 638.75	3	10	3 158.16	9r	2	II 3 692 66	2	9
II 2 644.33	2	10	I 3 170.35	10r	2	II 3 702.56	2	8
II 2 660.58	2	10	I 3 193.98	10r	2	I 3 798.26 P	10r	10r
2 672.84	2	10	3 208.85	10	2	3 833.76	7	3
II 2 684.13	3	10	3 292.32	1	10	I 3 864.12 p	10r	10
II 2 701.42	2	10	3 325.67	10	1	I 3 902.96 p	10r	10
2 775.40	3	10	I 3 327.30	10	1	II 3 941.50	1	10
2 780.04	3	10	3 344.75	8	2	3 961.49	3	10
II 2 816.15 P	5	10	3 347.02	6	1	4 069.91	9	8
II 2 848.21 p	5	10	I 3 358.12	9	2	4 084.39	8	3
2 853.19	1	10	I 3 384.62	8	2	I 4 102.16	7	3
II 2 871.50 p	4	10	3 402.81	1	8	4 143.56	9	5
2 903 07	2	10	3 447.13	10	3	4 185.82	8	4

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Molybdenum (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
4 188 32	10	5	4 731 45	10	7	6 357.21	5	3
4 232.61	10	5	4 760.20	9	9	6 424.37	8	8
4 250.69	1	10	4 819.26	10	4	6 519 84	4	3
4 251.86	10r	2	4 830.52	10	4	I 6 619.15	9	8
4 276.92	10	5	4 868 03	5	2	6 650.38	7	1
I 4 277.26	10	6	4 979.12	5	2	I 6 733.99	7	1
II 4 279.03	2	10	I 5 172 94	9	1	6 746.28	5	1
I 4 292.21	9	4	I 5 174.15	9	2	6 838.95	4	.
I 4 293 24	10	4	I 5 238.20	7	3	6 886 37	4	
I 4 293 89	9	3	I 5 240 94	6	3	6 914 05	5	
4 326.14	9	4	I 5 360.59	10	8	6 989.01	4	
II 4 363 65	1	10	5 473 35	6	6	I 7 060 23	4	
II 4 377.76	1	10	I 5 506 50	10	10	I 7 109 87	8	
4 381 65	10	8	I 5 533 03	10	10	I 7 134 09	4	
4 411.71	10	8	I 5 570 46	10	10	I 7 242 54	7	
II 4 433.51	1	8	I 5 632 47	9	8	7 245.87	4	
4 434.96	10	4	I 5 650 13	8	6	I 7 391.36	5	
4 468 27	10	2	I 5 689 15	9	10	I 7 485.73	7	
4 491 29	6	2	I 5 722 77	8	7	I 7 656 74	5	
I 4 524 34	7	2	I 5 751 42	10	10	7 720 74	4	
I 4 576 49	8	2	I 5 791 84	10	10	I 8 245 06	3	.
I 4 595 15	7	2	I 5 858.28	8	10	I 8 328 43	5	
4 621 35	7	2	I 5 888 32	10	10	I 8 389 28	6	
I 4 626 45	10	4	I 5 928.82	9	10	8 695.53	2	.
4 707.25	10	5	I 6 030.66	9	10	9 348.01	2	

Neodymium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
3 092.91	4	2	4 061 09	10	10	4 811 33	5	5
3 133 56	4	2	4 069 26	5	4	4 825 47	8	8
3 217 10	4	1	4 075 24	7	2	4 859 01	5	5
3 275.20	4	2	4 109 09	8	6	4 920.66	9	3
3 300 14	4	2	4 109 47	9	8	5 192 62	6	3
3 328 26	5	2	4 135 33	9	7	5 249 54	7	4
3 388 01	5	1	4 156.16	10	10	5 293 17	9	5
3 410 21	4	1	4 177 34 p	9	10	5 319 80	9	4
3 543 33	5	2	4 178.68	6	3	5 361.47	5	4
3 592 58	5	2	4 232 40	8	5	5 431.53	4	3
3 609 78	5	1	4 247.37	10	8	5 485.68	7	4
3 653 10	6	2	4 282 51	10	8	5 594 40	8	5
3 735 59	7	5	4 303.61 p	10	10	5 620 58	8	5
3 780 40	5	3	4 314 50	7	8	5 688 49	6	3
3 851 73	8	5	4 325.77	10	5	5 708 25	5	2
3 863 37	10	8	4 327.93	7	5	5 729 28	4	.
3 875 85	6	2	4 351.23	9	8	5 804.00	5	2
3 889 95	6	3	4 358 20	9	8	6 007 63	4	.
3 890 59	6	4	4 375 00	10	6	6 066 05	4	.
3 890 96	7	4	4 385 68	10	8	6 071 70	4	..
3 892 06	6	4	4 400.84	10	5	6 073.97	4	...
3 894 65	6	3	4 411.03	8	5	6 178.55	4	1
3 900 25	6	6	4 446.37	10	10	6 310.48	7	1
3 905 90	7	4	4 451 55	10	10	6 341 48	7	2
3 941.53	7	8	4 462 96	10	10	6 385.18	8	3
3 951 15 p	9	8	4 501 82	7	5	6 485.69	4	1
3 963 12	7	6	4 541 25	5	5	6 630.16	4	...
3 990 13	9	6	4 563 21	6	5	6 650.56	4	1
3 994 70	8	5	4 579 30	5	4	6 655.67	4	....
4 012.28	9	10	4 634.21	5	3	6 740.10	4	....
4 021.76	7	3	4 706.54	7	4	6 790.42	4	....

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Neodymium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
6 803.98	4	. .	7 511 15	4	. . . .	7 965 69	4	.
6 846.74	5	. .	7 513 77	4	. . .	7 982 34	4	. . .
7 037.34	4	. . .	7 529 03	4	. .	8 000 75	4	. . .
7 066 90	4	.	7 538 27	4	. . .	8 043 33	4	. .
7 129.36	4	. .	7 696 60	4	.	8 141.72	4	.
7 189 41	4	. .	7 808 53	4	. . .	8 143 29	4	. . .
7 418.18	4	. .	7 862 84	4	. .	8 375 23	3	. .
7 448.73	4	. .	7 958 93	4	. . . .	8 456.80	3	. . .

Neon

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
2 595 21	6	3 600 16	6	4 790.22	8
2 645 51	6	3 609 17	5	4 810.07	5
2 645.70	5	3 633.66	6	4 817.64	6
2 647.42	8	3 664.3	7	4 818 79	5
2 651.01	6	3 682 23	7	4 821 93	6
2 675.24	6	3 685.73	7	4 827.34	8
2 675.64	6	3 694 4	9	4 827 59	6
2 795.10	5	3 701.22	7	4 837 31	7
2 872.66	5	3 713.3	9	4 884.91	8
2 913.17	6	3 727.3	6	4 892.08	7
2 932.72	5	4 422.52	6	4 955.38	5
2 947.30	6	4 424 81	6	4 957 03	8
2 974.71	7	4 425.42	5	4 957.12	5
2 982.66	7	4 483 19	5	4 994.92	5
2 992.42	6	4 488 09	6	5 005 15	8
2 992.44	6	4 536 31	5	5 031.34	7
3 057.39	7	4 537.68	6	5 037 74	8
3 063.69	6	4 537.76	10	5 080 38	6
3 076.97	6	4 538 31	6	5 113 66	5
3 078.87	5	4 540.38	8	5 116 49	6
3 079.18	5	4 575.06	6	5 122 25	6
3 126.19	6	4 575.86	10	5 122.34	6
3 148.60	5	4 582.05	5	5 144.93	8
3 335.1	7	4 582.45	5	5 145 01	8
3 355.2	6	4 609.91	7	5 151 96	5
3 369.81	8	4 628.30	7	5 188.61	6
3 369.91	10	4 645.41	6	5 193.12	6
3 417.90	8	4 656.38	6	5 193.23	6
3 447.70	7	4 661.09	5	5 203.90	6
3 454.20	6	4 678.21	6	5 208.87	5
3 460.52	5	4 679.13	5	5 298.20	6
3 464.34	5	4 702.53	5	5 301.77	5
3 466.58	6	4 704.39	10	5 326.41	5
3 472.57	8	4 708.86	10	5 330.78	10
3 498.06	5	4 710.06	8	5 341.10	10
3 501.21	6	4 712.06	8	5 343.29	9
3 515.19	6	4 715.34	10	5 349.21	6
3 520.47	10	4 749.56	6	5 355.18	6
3 568.7	8	4 752.73	8	5 355.40	6
3 574.9	6	4 758.72	5	5 358.02	10
3 593.52	8	4 780.34	6	5 360.02	6
3 593.63	7	4 788.93	10	5 372.31	5

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Neon (Continued)

Wave length.	Geissler tube.	Wave length.	Geissler tube	Wave length.	Geissler tube.
5 400 56 p	10	5 974.64	9	6 678.28	8
5 412.66	7	5 975.53	8	6 717.04	5
5 418 56	6	5 987.93	7	6 929.47	9
5 433.65	7	5 991.68	6	7 024.05	6
5 448 51	6	6 000.95	5	7 032.41	6
5 533.68	5	6 030.00	7	7 051.30	4
5 562.44	6	6 074.34	9	7 059.12	4
5 562.76	8	6 096.16	8	7 173.94	10
5 563.05	5	6 128.45	6	7 245.17	10
5 652.57	5	6 142.51	5	7 438.89	8
5 656 03	5	6 143.06	10	7 472.46	6
5 656.66	8	6 150.27	5	7 488.89	5
5 662.55	6	6 163.60	8	7 535.78	8
5 689.81	7	6 182.15	5	7 544.05	8
5 718.90	7	6 205.76	5	7 943.19	8
5 719.22	9	6 213.88	6	8 082.46	8
5 719.53	6	6 217.28	9	8 136.41	4
5 748.29	9	6 246.71	5	8 236.42	7
5 748.65	6	6 258.78	5	8 259.36	4
5 764 42	9	6 266.50	10	8 266.02	5
5 804.10	6	6 293.7	5	8 300.35	7
5 804.45	9	6 304.79	5	8 377.62	7
5 811.42	7	6 313.65	6	8 418.41	7
5 820 17	9	6 328.15	7	8 495.37	7
5 828.91	6	6 330.89	6	8 591.25	6
5 852 49	10	6 334 43	9	8 634.63	5
5 868 4	5	6 351.8	5	8 654.38	6
5 872 17	5	6 364 96	5	8 679.52	3
5 872 84	9	6 382.99	10	8 681.86	3
5 881.90	10	6 401 08	5	8 780.63	4
5 902 48	5	6 402.25 p	10	8 783.75	4
5 906.44	5	6 409.71	6	8 853.97	3
5 913.63	7	6 421.68	5	8 865.72	3
5 918.92	7	6 444.70	6	9 148.72	2
5 939.32	5	6 506.53	10	9 201.88	2
5 944.83	9	6 532.88	5	9 220.28	2
5 961.63	5	6 598.95	8	9 300 70	2
5 965.44	10				

Nickel

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
1 398	.	2	2 029.1	..	6	I 2 798 66	4	1
1 499.	.	2	I 2 310 99	3r	2	I 2 821.30	4	2
1 527.	.	2	I 2 312.36	3r	1	I 2 943.92	6	2
1 653.	..	6	I 2 320.08	5r	1	I 2 981.65	7	3
1 693.	.	7	I 2 325 81	3r	2	I 2 992.60	6	2
1 709.	..	6	I 2 345.53	2r	8r	I 2 994.46	7r	3
1 767.	..	6	2 375.43	1	8	I 3 002.49	10r	5
1 855.	..	5	2 394.56	2	10	I 3 003.63	9r	4
1 929.7	..	5	2 416.14	1	10	I 3 012.01	9r	5
1 979.3	..	6	2 437.90	1	10	I 3 037.94	9r	4
2 019 0	..	6	2 510.89	4	10	I 3 050.83	10r	6
2 021.0	..	6	2 545 92	1	6	I 3 054.32	8r	4

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

NICKEL (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
I 3 057.65	10r	4	I 4 592 54	9	4	I 6 339 17	10	
I 3 064.63	6	2	I 4 600.37	8	1	I 6 378.22	7	..
I 3 080.76	6	2	I 4 604.99	9	3	I 6 384.69	7	
I 3 097.12	5	2	I 4 648.66	10	3	6 421.47	7	..
I 3 101.56	9r	4	I 4 686.21	5	3	I 6 482.84	7	1
I 3 101.88	9r	3	I 4 714.42	10	8	I 6 586.33	6	
I 3 134 10	10r	4	I 4 715.76	8	3	I 6 598.54	6	
I 3 197 12	5	2	I 4 756 53	7	3	6 635 14	6	.
I 3 221 66	4r	2	I 4 786.54	10	3	I 6 643.66	10	1
I 3 225 03	5r	2	I 4 829 03	8	3	I 6 767 79	10	
I 3 232 94	8r	3	I 4 831 19	5	3	I 6 772 36	9	
I 3 234.66	5r	2	I 4 855.42	8	3	I 6 842 08	6	
I 3 243 06	8r	3	I 4 866.28	7	2	I 6 914 58	7	
I 3 315 67	7r	3	4 904.42	9	3	I 7 024 76	8	
I 3 320 26	5r	3	4 980 17	9	2	I 7 122.29	10	
I 3 361 56	5r	3	I 4 984 12	9	2	I 7 182 06	9	
I 3 365 77	4r	3	I 5 017 59	7	2	I 7 197 07	4	
I 3 366.17	5r	3	I 5 035 36	10	3	I 7 261.94	8	
I 3 369.57	10r	4	5 080.53	8	3	I 7 291 30	8	
I 3 371.99	5r	3	5 081.12	9	3	7 385.23	7	
I 3 374 22	4r	2	5 084 07	6	1	7 386.24	7	
I 3 380 58	10r	6	I 5 099 97	7	1	I 7 393.67	10	
I 3 380.88	4r	2	I 5 115 42	9	2	I 7 409 35	9	
I 3 391 05	7r	4	I 5 125 20	7	...	I 7 414 51	6	.
I 3 392 99	10r	8	I 5 129 38	8	1	I 7 422 34	9	
I 3 413 48	5r	3	I 5 137.09	8	1	I 7 481 49	5	
I 3 413 94	3r	2	I 5 142.76	10	2	I 7 522.87	8	.
I 3 414 77 P	10r	10	I 5 146.48	10	2	I 7 525 18	8	.
I 3 423 71	8r	5	I 5 155.76	9	1	I 7 555 67	9	.
I 3 433 57	9r	6	I 5 168 66	8	1	I 7 574.10	7	.
I 3 437.28	6r	5	5 176 55	6	1	I 7 617 02	10	
I 3 446.26	10r	10	5 411 20	6	1	I 7 619 24	9	
I 3 452 89	6r	5	I 5 435.87	7	1	I 7 714 27	8	
I 3 458 47	10r	10	I 5 476.91	10	10	I 7 715.64	7	
I 3 461.66	10r	10	I 5 592.24	7	2	I 7 727.68	10	.
I 3 472.55	7r	5	I 5 593.74	6	1	7 748 94	10	
I 3 483.78	6r	4	I 5 614 79	6	1	I 7 788 95	6	
I 3 492 96 p	10r	10	5 625 28	7	1	I 7 797 66	8	
3 500 85	6	4	5 682.20	7	1	I 7 863.70	5	
I 3 510 34	7r	10	5 694 97	7	1	I 7 917.47	7	
I 3 515 06 p	9r	10	I 5 709 55	8	2	I 8 862 60	4	
I 3 524 54 p	10r	10	I 5 715 09	8	1	9 106 33	3	
I 3 566 38	10r	10	I 5 754 67	6	1	I 9 519 99	2	.
I 3 571 87	7r	3	I 5 760 84	6	1	10 195.	5	..
I 3 597 70	8r	6	I 5 805 20	10	...	10 301.	3	.
I 3 610 47	9	4	5 831 60	8	....	10 330.	3	.
I 3 619 39	10	10	I 5 857 76	10	1	10 378.	4	..
I 3 674 13	6	3	I 5 892.88	9	1	10 980.	5	.
I 3 722 48	6	1	I 6 086 34	10	1	11 198.	4	....
I 3 736 81	6	3	I 6 108 14	7	1	11 591.	3	. ..
I 3 775 57	8	5	I 6 116 16	9	1	13 553.	2	. .
I 3 783 53	8	5	6 163.36	8	1	13 722.	5	. .
I 3 807 14	8	8	I 6 175.44	10	1	13 829.	3	.. .
I 3 831 69	6	2	6 176 80	10	2	13 969.	2	.. .
I 3 858.33	10	8	I 6 186 77	7	...	14 102.	2	..
I 4 401 55	10	8	I 6 191.23	7	1	14 874.	3	. .
I 4 459.04	9	8	I 6 223.97	6	....	16 313.	2	...
I 4 462 46	8	3	I 6 256.39	7	1	16 363.	10	..
I 4 470.48	9	3	I 6 314.66	10	. .	16 409.?	5	. .

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Nickel (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
16 495.	2	....	16 999.	6	.	18 040.	2	.
16 868.	2	. ..	17 986.	2	. ..			

Nitrogen

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
III 685 5	5(4)	4 176.1	5	II 5 010 6	3
II 916 82	2(4)	4 179 7	3	II 5 015 4	3
IV 922 02	....	III 4 195.7	3	II 5 025.6	3
IV 922 57	... ...	4 200 0	5	II 5 045 0	6
IV 923 18	. .	4 206 5	4	5 179 5	4
IV 923 68	..... .	I 4 223.09	5	I 5 328 67	5
IV 924 31	. ..	II 4 227.7	4	5 462.7	3
III 989 90 p	2	II 4 236 9	8	II 5 495.9	6
III 991 66 p	3	4 241.8	8	5 530.2	4
1 085.	10(4)	I 4 305 46	6	5 535.2	6
1 184 1	10	I 4 358 29	7	5 543.4	3
1 200 4 p	10	III 4 379 0	8	II 5 666 5 p	10
V 1 242 2	4	4 432 6	5	II 5 675 9 p	5
II 1 276 0	10(3)	4 447.0	10	II 5 679 5 p	10
1 335.3	10	I 4 492.45	5	II 5 686.2	5
I 1 492 83	3	I 4 494 68	5	II 5 931.9	4
I 1 494 78	3	III 4 510 8	4	II 5 941.9	7
1 561 1	7	III 4 514 8	4	I 5 999 46	5
1 657.2	7	4 530 0	6	I 6 008.49	9
I 1 742 81	5	4 552 4	4	I 6 441.70	5
I 1 745 31	5	II 4 601.5	7	I 6 482.74	9
II 3 006 8	7	II 4 607 1	7	I 6 483 77	4
II 3 329 2	3	II 4 613 9	6	I 6 484.88	8
II 3 437 1	7	II 4 621 4	7	6 610.	4
I 3 650 1	5	II 4 630 5	8	I 6 644 97	7
I 3 822 0	5	III 4 634 1	6	I 6 722 60	5
II 3 830 0	6	III 4 640 6	6	I 7 423 88	3
3 839 0	4	II 4 643 0	9	I 7 442 56	4
II 3 842 8	3	II 4 654 5	3	I 7 468.74	5
II 3 856 1	3	4 667 2	3	8 185 05	3
3 870 0	4	II 4 774 2	3	8 188 16	3
3 919 0	6	II 4 779 8	3	8 200.59	1
3 940 0	3	II 4 788 2	4	8 210 94	2
II 3 955 8	7	II 4 793 8	3	8 216 46	5
II 3 995 0	10	II 4 803 3	5	8 223 28	3
4 026 0	4	II 4 810 3	3	8 242.47	3
II 4 035 0	5	III 4 858 82	3	8 568.04	1
4 041 3	7	III 4 867.14	4	8 594 34	1
II 4 043 5	3	4 895 3	3	8 629.61	2
III 4 097 3 p	10	I 4 914.92	4	8 680.35	2
III 4 103 4 p	7	I 4 935 03	9	8 683.61	2
I 4 109 94 P	10	4 987.3	4	8 686 38	1
4 133 6	3	4 994 4	4	8 703.42	1
4 145 8	4	II 5 001 34	7	8 711.87	1
I 4 151.44	9	5 005 1	6	8 718.99	1
4 171 6	4	5 007.4	3	8 729.07	1

Osmium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 909 08	7	5	3 857 09	10	....	5 149.73	7	....
3 058 66	7	4	3 876 80	7	3	5 416 33	10	...
3 156 25	7	3	3 963 63	10	3	5 523 56	10	..
3 232.05	6	3	3 977.24	10	3	5 584.43	10	. .
3 267 94 p	8	3	4 066.71	10	3	5 721.94	10	. ..
3 301 56 p	9	2	4 091.83	9	2	5 780 81	10	....
3 370 60	7	2	4 112.03	10	4	5 857.57	10	....
3 528 60	9	3	4 135 80	10	5	5 995.99	10	...
3 559 82	9	3	4 172 55	6	1	6 227.74	10	...
3 560 88	9	4	4 173.24	9	2	6 403.18	8	.. .
3 598 11	9	2	4 175 62	7	2	6 576 81	6	....
3 656 90	7	1	4 260.85	10	5	6 729 54	9	....
3 670 90	7	2	4 293 95	8	3	6 806 61	7	....
3 719 50	10	2	4 311 39	10	3	6 955 96	8	. .
3 720 13	10	2	4 394 87	8	3	7 060 62	6	. ..
3 752 7 p	10	7	4 420 46	10	10	7 145 50	8	...
3 782 20 p	10	4	4 550 40	6	3	7 148.89	6	. .
3 790 12	9	3	4 616 78	10	2	7 253 52	5	...
3 793 90	10	3	4 631 83	10	2	7 407 97	4	. ..
3 836 03	10	2	4 794 00	10	3	7 602 96	6	..
3 840 29	10	1	4 865.61	10	. ..	7 852 18	3	.
3 849 96	10	. ..						

Oxygen

136 6	..	0	III 832 93	..	7	1 085 2		10
305 7	..	3	II 833.33	..	9	1 128 4	.	5
374 3	.	4	III 833 74	.	8	1 132 3	.	10
III 507.38	.	4	II 834 46	..	10	1 134.8	.	10(2)
III 507 68	..	5	III 835 09	.	3	1 152.6	.	6
III 508.18	..	6	III 835.29	.	9	1 175.6		10
III 525 79		6	889 7	.	8	1 200		10(2)
IV 553 33	.	5	904.7	..	10	1 217 62		10
IV 554 07	..	5	916 4	.	15	1 247 7		10(3)
IV 554 52	..	5	917.8	..	15	1 277.		5
IV 555 23	..	5	I 948 7	4	. ..	I 1 302 3 p	10	. ..
580 41		3	I 950.2	4	. ..	I 1 305.0 p	10	.
580 98		4	I 950 9	4	. ..	I 1 306 1 p	10	.
II 616 31	..	5	I 952.4	4	..	I 1 355 7	8	. .
II 617.06	.	5	I 953 0	2	. ..	I 1 358 7	5	.
II 644.16	.	6	I 971 76	8	8	1 743 1		5
II 672.91	.	5	I 973.26	5	5	1 760 9	.	8
II 673.75	..	5	I 973 92	4	4	1 781 4		7
III 702 33	.	6	I 976 50	5	5	1 787.0		7
III 702.82	..	6	I 978.00	5	5	II 1 961.60	.	3(3)
III 702.90	.	6	I 978.62	4	4	II 2 182 72		4
III 703 85	..	7	990.	.	10(2)	2 435 2		6
II 718.50	.	7	991.5	..	10(2)	2 478 5	.	6
II 718.57	..	7	1 010 5	.	10	2 506 8	.	5
V 758.69	..	4	I 1 026.0	9	5	2 514 3	.	4
V 759 45	.	4	I 1 027.5	8	..	2 516 1		7
V 760.23	..	3	I 1 028.2	7	..	2 524 1		4
V 760.46	..	5	1 036.9	..	7	2 528 6	.	5
V 761.13	..	4	I 1 039.26	8	8	2 631 3	.	4
V 762.00	.	4	I 1 041.0	8	8	2 881 5	..	8
II 796.61	.	6	I 1 041 71	5	7	I 2 883 84	6	. .
II 832.76	..	8	1 066 3	..	5	I 3 692.44	7	....

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Oxygen (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
3 712 7	.	4	4 349 44		7	I 5 328.97	6	
3 727.36	.	5	4 351.28		7	I 5 329 58	7	
3 754.72	..	4	4 366 91		6	I 5 330 65	10	.
3 759.86		5	I 4 368 30	10	.	I 5 435.16	5	.
I 3 823 56	7	.	4 414 89	..	10	I 5 435 76	6	...
I 3 825 07	6		4 416 97	.	9	I 5 436.83	8	...
3 882 2	..	5	4 448 3	.	4	I 5 950 60	5	...
3 911 95		5	4 590 98	..	8	I 5 958 53	6	.
3 945 03		5	4 596.19	.	7	I 6 046.34	7	...
I 3 947.29	10	..	4 638 87	.	5	6 105.	..	5
I 3 947 48	7	.	4 641 83		8	6 115	.	5
I 3 947 58	4		4 649.15	.	9	I 6 155 99	7	...
3 954 37	.	7	4 650.85	.	5	I 6 156.78	8	...
3 973 27	.	7	I 4 655 36	4	.	I 6 158 21	10	...
3 982.73	.	6	4 661 65	.	5	6 265	..	5
4 069 90	.	9	4 676 25	.	5	I 6 453 69	6	
4 072.16	..	10	4 699 0		5	I 6 454.55	7	
4 075 87	.	10	4 705 2	.	6	I 6 456.08	9	
4 085 2	..	5	4 751 5		4	6 549	.	5
4 089 3	.	5	I 4 772 54	3	.	6 641 3	..	4
4 092 9		4	I 4 772 89	4	.	6 654 7		4
4 097.	.	4	I 4 773 36	5		I 7 002 22	4	...
4 105 00	.	6	I 4 803 00	4		7 157 3	..	10
4 119 22		8	4 857 0		4	I 7 771 97 p	10	
4 120 27		6	II 4 906 88		5	I 7 774 20 p	8	..
4 132 99		5	II 4 924 60	.	6	I 7 775 42 p	6	..
4 153.31	.	6	4 941 0		4	I? 7 947.7	..	6
4 185.45	..	8	4 943 2		6	I? 7 950 8	..	5
4 189 79	.	8	I 4 967 40	4		I? 7 952.3	.	5
I 4 217 09	4	.	I 4 967 86	5	.	I 8 446 37	..	
I 4 222.78	5		I 4 968 76	6	.	I 8 446 77	.	...
I 4 233.32	7	..	I 5 018.78	3		I 9 263 9	7	.
4 254.1		4	I 5 019 34	4		I 11 287.	4	..
4 317 16		6	I 5 020 13	5		I 11 294.	2	
4 319 65		6	I 5 146 06	5		I 11 300.	2	.
4 345 57		6	I 5 299 00	5		I 13 163.	1	..
4 347 43	.	5						

Palladium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
II 1 596 8		5	II 2 505 72 p	2	10	I 3 302 14	6r	10
II 1 625.8		5	2 551 78	1	10	I 3 373 00	6r	10
II 1 667 6		7	II 2 565 51	1	10	I 3 404 59 P	10r	10
II 1 693.4		6	II 2 628 24	1	10	I 3 421 23 p	8r	10
II 1 704.3	.	8	2 635 92	2	10	I 3 433 44	5r	10
II 1 741 0	.	6	2 658 74 p	2	10	I 3 441.41	6r	10
II 1 781.8		6	I 2 763.09	8r	6	3 451 36	..	10
II 2 367.96	1	10	2 776 87		10	I 3 460 75	7r	10
2 372 16	2	10	2 787 94	..	10	I 3 481.16	7r	10
2 418 73	1	10	2 854 60 p	2	10	I 3 489.78	4r	10
I 2 426 87	1	10	I 2 922.51	7r	3	I 3 516.95 p	8r	10
II 2 433.11	2	10	2 980 66	1	10	I 3 553.09	7r	10
2 446.18	1	10	I 3 027 92	4r	6	I 3 571.17	5r	10
I 2 447.92	10r	8	I 3 065.31	4r	4	I 3 609 55 p	9r	10
I 2 476 43	10r	2	I 3 114 05	5r	8	I 3 634.68 p	10r	10
2 486.53	1	10	I 3 242 71	10r	10	I 3 690 37	6r	10
2 488.92 p	4	10	I 3 251 64	5r	6	I 3 718.91	4r	10
2 498.79 p	3	10	I 3 258.78	6r	8	I 3 799.20	5r	8

PALLADIUM (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
I 3 832.32	10	10	I 5 395.26	10		I 6 833.42	8	. .
I 3 894.21	6r	10	I 5 542.79	10	1	I 6 916.56	9	
I 3 958 65	5r	10	I 5 670.04	10	1	7 194.11	6	
I 4 212 98	6r	10	I 5 695.08	9	1	I 7 368.14	10	
I 4 473 61	7	4	I 5 739 66	4	.	I 7 486.93	7	.
I 4 788.20	8	2	I 6 130.60	8	..	I 7 763.99	10	.
I 4 817 52	9	2	I 6 508.4	6	.	I 7 915.89	7	
I 5 163.80	10	1	I 6 774.6	6	.	I 8 132 85	6	. . .
5 295.60	10	2	I 6 784.6	10	1			

PHOSPHORUS

Wave length.	Arc.	Spark.	Geissler tube.	Wave length.	Arc	Spark.	Geissler tube.
IV 823.21	..	5	.. ..	I 2 553 31	3	5	..
IV 824 76	..	6	.. .	I 2 554 95	3	4	1
IV 827.95	..	6	... .	2 644 2	..	1	5
III 859 69		6	.	IV 2 725 67		4	4
V 865 48		4		IV 2 739 3	.	2	5
V 871.42		5		III 2 884 75		5	.
III 913.99		4		III 2 896 17	.	5	5
III 917.14		5	.	V 3 176 06	.	5	5
III 918 69		5		III 3 220 23		6	...
III 921 86	.	5	. .	III 3 234 54	..	6	6
III 998 03	.	5	.	IV 3 347 7	..	6	6
III 1 003 64	.	5		IV 3 364.4	..	6	6
IV 1 035 54	.	4	.	IV 3 371.1	.	5	5
V 1 118 02	.	10	.	I 3 424 91	1	3	6
V 1 128 04	.	10	.	3 556.5	.	2	6
1 671.5	..	..	3	3 706.1	.	6	7
1 685.8	.	.	5	3 827.4		3	7
1 693.8		. .	4	3 978.3		6	8
1 774 8 p	..	.	7	III 4 060 41		6	6
1 782 7 p	.	.	7	III 4 081 18	.	7	7
1 787.5 p	.	. .	6	4 178.4	..	5	8
1 834 5	.	. . .	4	III 4 223 34	.	7	7
I 1 846 8	.	..	7	III 4 247 87	.	7	7
I 1 851.11	6	.	6	4 385 3	.	2	6
I 1 859.36	6	.	6	4 479 7	..	2	5
I 2 023.98	7	....	7	4 587 9	.	5	8
I 2 024.98	6	. .	6	4 602 0	.	5	8
I 2 032.98	6	..	6	4 727 5	.		6
I 2 034 02	7	...	7	4 943 4		2	7
I 2 136.10	6	. . .	6	5 253 5	..	5	8
I 2 136.79 p	8	.. .	8	5 296 1	.	4	8
I 2 149.81 p	8	..	8	5 425 9	.	7	7
I 2 153.63	6	..	6	5 499 7	.	3	7
I 2 154 77	7	..	7	5 676 9	.	. .	5
I 2 533.98	2	4	.. ...	III 6 024 14	..	..	8
I 2 535.62	4	5	.... .	III 6 043 05	.	. ..	9

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Platinum

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
390.	.	1	2 467 44	6r	2	3 628.11	10	4
696.	..	3	2 487.18	4r	2	3 672 00	8	3
702.	..	3	2 628.05	7r	5	3 922 98	8	10
714.	..	3	2 646 89	6r	4	4 118 69	10	10
805.	.	3	2 650.86	4r	4	4 327.07	6	3
930.	.	3	2 659.44 p	10r	10	4 442 55	10	5
935.	..	3	2 702.40	6r	6	4 498 75	10	10
1 056.	.	3	2 705.89	5r	5	4 520.90	10	4
1 118.	..	3	2 719.02	5r	4	4 552.41	10	10
1 199.	..	3	2 733 94	8r	6	4 657.95	6	3
1 213.	..	3	2 771 67	4r	2	4 684 09	5	1
1 226	.	5	2 794.21	5r	6	5 059.48	10	3
1 287.	.	5	2 830.29 p	8r	5	5 227.64	10	2
1 461.	.	4	2 893 87	6	3	5 301 02	10	5
1 473.		4	2 929 79 p	8r	4	5 368 99	10	1
1 597.	.	3	2 997 96 p	7r	10	5 475 78	10	2
1 680.		5	3 042 62	4r	4	5 478 50	10	2
1 723		4	3 064 71 P	6r	10	5 840.13	4	1
1 889.	..	5	3 139 37	8	3	6 326 6	10	1
1 928 5	.	5	3 156 56	8	3	6 523 5	4	.
2 288 19	6	3	3 200 72	7	3	6 710.39	10	
2 310 97	3	5	3 204.05	9	4	6 842.60	8	.
2 357.10	4r	2	3 301.87	10	5	7 113.75	10	
2 424.90	1	10	3 408 14	8	8	7 217.58	6	
2 428 05	8r	2	3 485.27	8	3	8 224.79	6	.

Potassium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
382.5	..	2	I 3 446.37	8r	3	I 5 112.5	3r	1
470 4	..	4	I 3 447.38	6r	2	I 5 323.4	4r	1
612.5	..	3	3 530.71		8	I 5 339.9	4r	2
765.7	..	3	3 608.88	.	5	I 5 343.2	4r	1
1 669.	..	4(?)	3 618.43	..	5	I 5 359.7	5r	2
1 703.		9	3 681.5	.	4	I 5 782.6	5r	3
1 771.	.	6	3 897 9	.	8	I 5 801.9	6r	4
1 787.	.	4	4 001.2	.	5	I 5 812.4	6r	3
1 944.	..	5	I 4 044 16 p	10r	10r	I 5 832.0	7r	4
2 078	.	10	I 4 047.22 p	10r	10r	I 6 911 3	10	4
2 190	.	6	4 134 7	.	5	I 6 939 0	10	6
2 241	.	5	4 149.2	..	5	I 7 664 94 P	10r	5r
2 358.	.	3	4 186.1	..	10	I 7 699 01 p	10r	5r
2 550	..	5	4 223.0	..	5	7 931.	..	
I 2 942 7	1r	. . .	4 225.6	..	4	I 8 500.	1	.
I 2 963 2	1r	. .	4 263.3	..	8	I 8 908.	1	
I 2 992 2	1r(?)	3	4 309.0		5	I 9 590.	1	
I 3 034.8	4r(?)	. .	4 388.13		5	I 11 028.0	10	
3 062 4	..	5	4 466.66	.	4	I 11 689.76	10	.
I 3 102.0	4r	1	4 505.34		5	I 11 771.73	10	.
I 3 102 2	2r	..	4 608.43	..	6	I 12 434.3	10	
I 3 217 2	6r	1	I 4 942 9	1r	1	I 12 523.0	9	
I 3 217.6	4r	1	I 4 952.0	1r	....	I 15 165.8	10	
3 345.7		5	I 4 956 6	1r	.	27 065.6	2	
3 363 3		8	I 4 965.3	1r		I 27 215.0	1	
3 364 7		6	5 005.58	..	5	I 31 395.	8	. .
3 381 1		4	I 5 084.3	2r	1	I 31 596.8	4	
3 385 3		4	I 5 097 6	2r	. . .	I 36 372.7	1	
3 440.4	..	3	I 5 099.3	3r	1	I 36 626 4	3	

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Potassium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
I 37 075 6	3	..	I 62 030	2	. .	I 74 260	1	.
I 37 354 3	4	.	I 62 360.	2		I 84 520.	1	.
I 37 370 7	1	. .	I 64 310.	1	..	I 85 100.	1	
I 40 115.5	6	..	I 64 610.	1	.			

Praseodymium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 488.75	..	5	4 189 52	10	10	5 381 27	4	2
2 980 51	..	8	4 206 72	10	10	5 469 88	5	
2 985.77	..	8	4 223 00	10	10	5 509.16	4	2
3 355.66	3	1	4 225 34 p	10	10	5 605 63	5	2
3 645 66	3	1	4 241 03	10	10	5 668 46	6	.
3 687.05	4	3	4 272 27	9	5	5 707.60	6	..
3 739 19	4	3	4 280 09	8	4	5 815 24	8	1
3 762.35	4	1	4 297 75	8	5	5 823 70	6	1
3 800 31	5	4	4 305 80	10	10	5 879 18	6	1
3 816 10	9	8	4 333 98	10	8	5 939 94	5	2
3 877 22	10	10	4 368 33	9	8	6 017 82	5	2
3 908 05	7	4	4 405 84	8	5	6 055 13	6	. .
3 908 43	10	8	4 408 83	10	10	6 161 20	5	2
3 918 85	7	5	4 429 23	10	10	6 281 34	5	.
3 947 63	9	4	4 449 84	8	4	6 359 07	5	.
3 964 82	9	4	4 468 67	9	8	6 429 7	5	1
3 972 15	8	3	4 496 43	10	10	6 431 9	5	
3 982 06	9	6	4 510 15	10	10	6 478 1	5	
3 989 70	10	5	4 517 58	6	2	6 566 8	5	
3 994.81	10	5	4 534.15	6	4	6 656.9	6	.
4 008.73	10	8	4 563 13	5	3	6 673.68	10	
4 054.87	9	6	4 628 74	4	3	6 747 17	6	
4 056.54	9	8	4 736 72	4	2	6 798 69	8	
4 062.83 p	10	8	4 783 39	4	1	6 827.70	6	
4 100.75	10	10	5 110 40	6	2	7 021 55	6	
4 118.49	10	10	5 110 79	6	3	7 114.58	4	
4 141.26	10	6	5 173 92	6	4	7 451 72	4	
4 143 14	10	10	5 220 11	5	3	7 645 68	3	
4 164 19	10	10	5 322 77	5	3	7 721.82	3	
4 179 43 p	10	10						

Radium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 708 94	8	8	II 4 682 20 p	10	10	5 616.6	1	8
2 813.73	10	10	I 4 825 94 P	10	10	5 660.6	5	10
II 3 649 60	10	10	4 856 1	5	8	II 5 813.7	3	10
II 3 814 44 P	10	10	4 971 7	2	8	5 958.2	1	10
4 305	3	7	5 400 1	2	8	6 167.2	1	8
II 4 340 67	10	10	5 406 6	2	8	6 200.4	5	10
II 4 436.22	5	10	5 501 8	1	8	6 337.0	1	6
II 4 533.17	10	10	5 601.5	.	8	6 446.1	5	8

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

RADON

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
3 612.	4	4 371.7	5	4 768.8	7?
3 665.	5	4 435.	5	4 797.	2
3 867.6	3	4 460.	7	4 817.5	7
3 957.3	5	4 508.	6	4 979.0	10
3 971.8	7	4 578.	8	5 084.5	10
3 981.8	9	4 604.6	9	5 393.	3
4 017.9	7	4 609.7	7	5 582.4	8
4 114.7	6	4 625.7	10	5 716.	6
4 166.5	10	4 644 4	10	5 945.	2
4 188.	4	4 681 0	10	5 977.	3
4 203.3	10	4 702.	5	6 309.	5
4 308.	10	4 721.7	5	7 057.	3
4 349.9	10				

RHODIUM

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 490 76	3	10	3 748 22	9	10	5 424 04	10	2
2 520 53	2	10	3 765 08	10r	10	5 535 02	10	1
2 625 40	2	8	3 793 22	10r	10	5 544.60	10	1
2 705 62	3	10	3 799 31	10r	10	5 599 43	10	3
2 715.30	2	10	3 822.35	10r	10	5 686 36	10	1
2 968 67	5	1	3 828 47	10r	10	5 806 86	10	1
3 263 14	9	2	3 833 87	10r	10	5 831.57	10	1
3 280 54	10r	5	3 856 50	10r	10	5 983.58	8	2
3 283 56	10r	5	3 934.23	10r	6	6 102 72	8	1
3 323 10 p	10r	10	3 958.86	10r	10	6 414 7	8	1
3 396 82 p	10r	10	4 082 80	10	5	6 519.72	10	. .
3 434 90 P	10r	10	4 097 54	8	4	6 630.16	10	. . .
3 462.04	10r	8	4 128 90	10r	10	6 752.40	10	1
3 470 76	10r	8	4 135 29	10r	10	6 879 94	10	. .
3 474.78	10r	7	4 211.14	10r	10	6 965 65	10	.
3 478 91	10r	10	4 288 72	10r	8	7 101.68	10	.
3 502 53	10r	10	4 374 82	10r	10	7 270 82	10	. .
3 528 03	10r	10	4 379.93	8	3	7 475 74	10	
3 583.10	10r	8	4 528.73	10	5	7 495 22	10	. .
3 596 19	10r	10	4 675.02	10	5	7 791.61	9	. .
3 597 15	10r	10	4 851.62	10	3	7 824.91	10	. .
3 626 60	10r	10	5 193.12	10	3	7 830.05	6	. .
3 657 99 p	10r	10	5 354.38	10	5	8 045.40	7	. .
3 690 72	10r	10	5 379 08	10	3	8 136 20	4	. .
3 692 35 p	10r	10	5 390 43	10	3	8 425.51	2	. .
3 700.92	10r	10						

RUBIDIUM

2 561 9		5	3 111.4		6	3 340.6	. .	8
2 631.8	.	6	3 198.8	.	8	I 3 348 7	4r	4r
2 807.6		6	I 3 228.0	2r	2r	I 3 350 9	5r	5r
2 956.1	.	10	I 3 229.1	2r	2r	3 393 1	. .	7
3 023 7	.	5	3 271.0	. .	7	3 434 2	. .	8
3 086.9	.	5	3 321.5	. .	8	3 461.6	. .	10

Rubidium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
3 492 7	..	10	4 377 1	..	10	I 7 280 2	10	...
3 531 6	..	10	4 380.7	..	10	I 7 408.4	10	
I 3 587 1	4r	4r	4 401.4	..	10	I 7 800.30 P	10r	. .
I 3 591.6	4r	4r	4 426.1	.	10	I 7 947.63 p	8r	
3 600.7	..	10	4 430.7	..	10	I 10 082.	10	.
3 662 7	..	10	4 530.3	..	6	I 13 237.	10	.
3 699 6	..	10	4 571.8	..	10	I 13 444.	10	.
3 801 9	..	10	4 622.4	..	10	I 13 667.	10	. .
3 940.6		10	4 648.6	..	10	I 14 754.	10	.
3 978.1	..	10	4 776.0	.	9	I 15 290.	10	.
4 083.9	..	10	4 782.9	..	7	I 38 511.	3	.
4 104 3	.	10	4 885.6	.	5	I 39 827.	3	..
4 136 2	..	10	5 152.1	.	6	I 39 898.	6	. .
4 193.0	..	10	5 522.8	.	6	I 46 190.	1	. .
I 4 201 8 p	10r	9r	5 636 0	..	6	I 46 960.	8	.
I 4 215 6 p	10r	9r	5 699.2	..	6	I 52 313	2	. .
4 244.4	..	10	I 5 724 5	4	2	I 64.360.	2	.
4 273 1	..	10	I 6 206 5	8	2	I 65 670.	2	. .
4 293.9	..	10	I 6 298.6	10	3	72 690.	2	.
4 348 3	.	10	6 775 1	.	9	I 74.280.	3	.
4 371.8	..	10						

Ruthenium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
2 402.72	3	10	I 3 730.43	9r	8	5 401 00	10	1
2 678.73 p	4	10	I 3 742.28	10r	3	5 427 61	10	1
2 692.1 p	5	10	I 3 786.04	10r	10	5 454.82	10	1
2 712.40 p	4	10	I 3 790.50	10r	10	I 5 484.33	10	1
2 734.34	4	10	I 3 798.89	10r	10	5 510.72	10	1
2 875 00	7	2	I 3 799.34	10r	10	I 5 636.24	8	3
2 916.26	8	3	3 923.48	8	5	I 5 814.99	10	1
2 945.67 p	3	10	I 4 080 62	10r	10	I 5 921.45	10	1
2 965.55 p	3	10	I 4 112.76	9	5	I 6 444.81	9	. .
2 976 58 p	4	10	I 4 199.91	10r	10	6 690.0	10	.
3 064 83	7	2	I 4 212.08	10	8	6 824.06	10	.
3 177.03	3	8	I 4 297.72	10	10	6 923.22	10	.
I 3 294 13	8	8	I 4 372.21	10	10	6 981.99	10	
3 339 55	8	2	I 4 460.04	8	8	I 7 027.93	10	
3 417.35	10r	3	I 4 554.52	10r	10	7 238.95	9	.
3 428 32	10r	3	I 4 584.45	10	8	7 393.92	8	
I 3 436.74 p	10r	5	I 4 709.48	10	5	7 499.78	10	.
I 3 498.95 P	10r	8	I 4 757.85	10	3	7 621.52	6	
I 3 593.03	10r	6	I 4 815.50	10	3	7 791.87	8	.
I 3 596.17 p	10r	6	I 4 869.16	10	3	7 809.18	9	
3 634 94	10r	3	I 5 136.55	10	1	7 881.48	10	...
I 3 661.35	8r	10	I 5 171 03	10	2	7 924.46	5	.
I 3 726.93	10r	8	I 5 309.26	10	2	8 264 95	4	. .
I 3 728.02	10r	8	5 361.75	10	1	8 710.76	2	. .

Samarium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
3 365.86	3	3	3 724.91	6	....	4 118 57	6	5
3 408.66	3	3	3 739.16	6	5	4 203 03	6	6
3 592.62	5	5	3 745.60	5	3	4 229 70	6	4
3 634.27	4	4	3 986.66	4	2	4 256 40	5	5
3 661.36	4	4	4 092.29	5	4	4 280.80	5	4

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Samarium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
4 318 95	5	8	5 493 72	6	..	6 601 84	5	
4 390 86 p	5	10	5 498 22	6	..	6 679.25	5	.
4 424 35 P	6	10	5 519 64	5		6 731.86	6	.
4 434 34 p	6	8	5 550 38	6r		6 794 20	5	.
4 467 33	5	10	5 626 01	5	.	6 861 14	6	.. .
4 519 64	8	5	5 644 11	6	...	6 955 33	5	.
4 543 95	5	5	5 696 74	4		7 020 47	5	.. .
4 595 31	5	5	5 773 77	5	.	7 039 24	6	..
4 615 71	5	4	5 787 04	5		7 082 40	5	. .
4 676 92	5	4	5 814 88	5		8 068 47	4	.. .
4 704.42	5	3	5 874 22	4		8 161 88	3	.
4 760 28	5	2	5 938 91	4		8 230 34	3	..
4 844 20	4	3	5 965 70	4		8 305 79	4	.
4 883 78	4	1	6 159 49	4	.	8 510 92	4	. .
4 910 41	4	1	6 256 69	5	.	8 632 83	3	
5 044 27	4	1	6 426 63	4	1	8 717 89	3	. .
5 071 20	4	1	6 487 65	4	1	8 859 76	2	.. .
5 271 38	4	1	6 569 34	6	2	8 913 66	2	. .
5 341 26	5							

Scandium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
791.	..	5	II 3 572 55	10	10	5 031 03	10	4
1 214.	.	6	II 3 576 36	10	10	I 5 081.57	10	2
1 603	.	5	II 3 580 96	10	10	5 239 82	10	2
1 880.	..	5	II 3 589 65	10	10	5 349 29	10	1
1 993.	..	5	II 3 590 50	10	10	5 481 98	10	1
2 062	.	4	II 3 613 83 P	10	10	5 520 50	10	1
2 272 9	4	..	II 3 630.76 p	10	10	5 526 82	10	3
2 438 62	5	. .	II 3 642 80 p	10	10	II 5 657.90	10	2
II 2 552 39	10	10	II 3 645 32	10	10	I 5 671 81	10	1
II 2 560 26	5	6	II 3 651 81	10	10	I 5 686 86	10	1
2 699.12	6	10	I 3 907 50 p	10	6	I 5 700 15	10	1
2 734 10	4	8	I 3 911 81 P	10	6	I 5 711 75	10	1
2 988 95	10	3	I 3 996 61	10	2	I 6 210 67	10	1
I 3 019 33	10	1	I 4 020 41	10	8	I 6 258 98	10	1
3 039 94	10	2	I 4 023 70	10	8	I 6 305 70	10	1
3 045 73	10	3	I 4 047 82	7	2	6 413 37	10	..
3 052 92	10	4	I 4 054 55	8	3	6 604.62	4	1
3 065 1	10	5	I 4 082 42	10	3	6 737.90	10	.
I 3 269 92	5	2	4 165 21	6	...	6 817.10	10	.
I 3 273 64	5	2	II 4 246 84	10	10	6 819.51	10	..
3 353 74	10	10	II 4 314 10	10	10	6 829.52	10	.
II 3 359 69	10	8	II 4 320 73	10	10	6 835 03	10	...
II 3 361 29	10	8	II 4 325 00	10	10	7 136 13	6	...
II 3 361 95	10	8	II 4 374 50	10	10	7 697 76	10	. .
II 3 368 95	10	10	II 4 400 40	10	10	7 741.20	10	....
II 3 372 15	10	10	II 4 415 56	10	10	7 800 44	10	...
3 535 73	10	10	4 670 41	9	10	8 194.87	4	...
II 3 558 55	10	10	I 4 743 82	10	4	8 241.18	4	....
II 3 567 71	10	10						

Selenium

Wave length.	Geissler tube.	Spark.	Arc	Wave length.	Geissler tube.	Spark.	Arc.
1 854.	.	7		4 449 2	8	2	..
1 960. p	. .	10r	10	4 467 6	9	3	..
1 993.	.. .	.	5	4 516 2	8	2	
2 038	.... .	8	2	4 563 9	9	4	
2 063. p	. .	8	8	4 604 3	9	5	
2 073.	. .	3	8	4 618 7	8	3	
2 354 3	5	3	.	4 648 4	8	5	.
2 459 5	7	3		I 4 730 9 P	10	.	.
2 591.4	10	5		I 4 739 1 p	9		.
2 630 9	8	5		I 4 742 4 p	8		..
2 685.9	8	4		4 763 6	8	2	.
2 767.4	10	3	.	4 840 5	8	1	.
2 777 7	9	3	.	4 844 8	10	1	
2 837 2	8	4		4 975 7	8	.	
2 880 4	8	3		4 992 9	8	1	.
2 914 9	9	3		5 031 3	8	..	
2 951 7	10	3		5 068 6	8	1	
3 038 7	8	2		5 096 5	8	1	
3 060 8	10	.		5 142 1	8	1	
3 069.9	8	2		5 176 0	9	2	
3 094 3	8	3		5 227 5	9	2	
3 185 5	9	3		5 253 7	7	. .	.
3 225 9	8	3		5 271 1	8	. .	
3 323 1	8	3		5 305 3	9	...	
3 379 8	8	3		I 5 365.4	8	.	
3 387 2	10	6		I 5 369 9	10	...	..
3 514.	10	8		I 5 374 1	10	....	.
3 544	10	10	.	5 455 8	7	. .	
3 637 5	10	10		5 522 6	8	. . .	
3 711 6	10	6		5 567 0	9	..	.
3 738 7	10	10	..	5 591 2	8	.	.
3 800 9	10	8		I 5 617 8	5	. ..	
3 849 6	8	2		5 623 1	9	.	
3 877 3	8	4		5 697 9	8	..	
3 901 6	8		.	I 5 718 1	7	. .	.
4 008 1	8	2	.	5 747.6	7	.	
4 046 7	10	3		I 5 753 3	7	....	
4 083 2	8	3		5 842 6	6	..	
4 108 8	8	3		5 866 2	6	.	
4 169 0	10	3		I 5 961 9	5	.	
4 176.	9	10	..	I 6 325 6	6	....	
4 182	9	10	..	I 6 679 5	5	. ..	
4 280 3	8	2	.	I 6 699 6	6	. ..	
4 320 4	9	3	..	I 6 746 4	6	.	
4 382.8	10	6	..	I 6 831 0	5	..	
4 401 0	9	3		I 7 061 9	5	. .	
4 446 0	8						

Silicon

Wave length.	Arc.	Spark.	Geissler tube.	Wave length.	Arc.	Spark.	Geissler tube.
IV 361.6		. .	1	IV 749 7			3
IV 457.7		.	3	IV 815 0	..	..	7

SILICON (Continued)

Wave length.	Arc.	Spark.	Geissler tube.	Wave length.	Arc.	Spark.	Geissler tube.
IV 818 0			7	III 2 541 83	.	10	
IV 1 066 3			8	I 2 631 28	5	6	
III 1 110 47			5	I 2 881.59 P	10r	10	...
II 1 194 89			5	I 2 987.65	5	4	.
III 1 206 9	.	..	10	III 3 086 23	.		7
II 1 260.66	.	.	8	III 3 093 42		.	6
II 1 265 04	.		10	IV 3 149.56	.	.	6
IV 1 393.9	.	..	10	IV 3 165 72	.		8
IV 1 402.9	..	....	8	III 3 590 46	.	2	8
III 1 500 39	..	.	5	III 3 791.41		6	3
II 1 526 38 p	..		8	III 3 796.11	..	7	4
II 1 533 55 P	.	..	10	III 3 806.56	..	3	5
II 1 711 0			6	II 3 853 66	.	3	3
II 1 808 14			8	II 3 856.02	..	5	8
II 1 817 06		.	10	II 3 862.59	..	4	6
1 885		10	...	I 3 905 52 p	10	5	10
I 1 988 97	.	5		IV 4 088 86	..	6	10
I 2 058.20			5r	II 4 128 05	.	5	8
II 2 071 94			8	II 4 130.88		6	10
II 2 072 61		.	10	III 4 552.65		3	9
I 2 124 12		6r	.	III 4 567 87	.	2	7
I 2 216 69	3	3		III 4 574.78		1	4
IV 2 287 08		10		II 5 041.06	.	1	8
I 2 435 16	5r	5		II 5 056 02	.	2	10
I 2 506 90 p	10r	6		I 5 708 40		...	5
I 2 514 32	8r	5	.	III 5 739.76	.	. .	8
I 2 516 12 p	10r	10		II 5 957 61	.	.	5
I 2 519 21	8r	5		II 5 978 97			7
I 2 524 12	10r	8		II 6 347 09		5	10
I 2 528 52 p	10r	8		II 6 371 36		2	8

SILVER

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
1 445.	.	5	1 916 3		4	2 205.9	1	2
1 486.	..	4	1 932.3	..	2	2 208 4	1	1
1 496.	..	4	1 956 9	..	3	2 211 18		2
1 539.	..	4	1 999.5	..	2	2 219 70	.	2
1 566	..	6	2 000 6	..	3	2 226 12	.	2
1 656 8	..	5	2 033.8	..	4	2 229.51	2	4
1 674.		2	2 061.	..	1	2 238 36		2
1 693.	..	6	2 065 9	..	4	2 240 42	..	2
1 722.	..	3	2 070 0	..	1	2 246 38 p	3	3
1 751	..	6	2 113 8	2	3	2 248 73	3	3
1 769.	..	4	2 120.4	1	2	2 253 46	..	2
1 772	..	4	2 125 4	..	1	2 275 24	..	2
1 794	.	4	2 145 6	1	3	2 277.38	..	2
1 802.	..	4	2 162 0		2	2 279 97	1	5
1 816.	..	3	2 166 5	2	2	2 309.54	6r	4
1 839.	..	3	2 170 9	..	1	2 312.4	4N	2
1 860.	..	4	2 171 7	.	1	2 317.03	2	5
1 873.	..	4	2 186.76	2	3	2 320.24	2	6
1 880.	..	4	2 192.	1	1	2 321.52	.	3
1 889.	..	4	2 202.1	2	2	2 324.63	2	6

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Silver (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 325 1		4	2 824 40	6	1	3 616		1
2 331 35	4	6	2 873 59	2	4	3 624 2	1n	.
2 357.92	..	6	2 896 46	..	4	I 3 682 3	2n	1
2 358 85	..	5	I 2 902 08	..	4	3 710	1	
2 362 19	..	3	2 920 0	..	3	3 810 7	2n	1
2 363 99	.	4	2 929 3	..	5	I 3 840 79	2	1
2 375 0	4N	3	2 934 2		6	3 949 4	1	2
2 383 20	..	2	2 938 5	4	4	I 3 981 63	4<	1
2 386 32		3	2 983 52		1	3 985		2
2 386 8		2	3 012 9		1	I 4 055 25	8r	3
2 390 57	..	3	3 009 11	2	1	4 085 9	..	3
2 392 97	.	2	3 115		1	I 4 212 01	8r	4r
2 395 66	.	2	3 117 8		1	4 311 05	2<	2
2 402 57	.	3	3 130 0	3	1	4 379 24	2n	
2 411 38	.	7	3 153 1		2	4 385		1
2 413 22	4	8	3 170 6	2	1	4 396	2n	1
2 420 12	..	5	3 172 3		1	4 447 0	..	1
2 429 65		7	3 173 6		1	I 4 476 06	6	4
2 437 77 p	3	8	3 180 7	..	2	4 556	3N	1
2 444 20		4	3 185 1	.	1	4 615 9	3N	1
2 447 91	2	7	3 187 8	..	1	I 4 668 54	8<	3
2 453 37	..	6	3 191 8		1	4 677 9	2n	1
2 460 32	.	5	3 200 0		1	4 848 1	2N	
2 462 27		4	3 207 3		1	4 874 16	2<	1
2 472 94		2	3 215 6	2	1	4 888 3	2n	.
2 473 88		7	3 216 7		1	I 5 209 04	10r	8
2 477.30		6	3 223	..	2	5 276 4	1<	.
2 480 42		4	3 233	3n	1	5 329 7	4<	.
2 485 78		2	3 241 3	..	1	5 333 3	2<	
2 486 7		2	3 244 97	..	3	5 401.	..	1N
2 504 07		4	3 249 8	..	1	5 403.	.	1N
2 506 65	2	5	3 252 8	.	1	I 5 465 43	10	6
2 535 3	..	5	3 267 33		1	I 5 471 51	6	5
2 553 41	.	2	3 280 67 P	10r	9r	5 489.	..	3N
2 564 42	..	3	3 289 2	..	2	5 494.		1N
2 567.15	..	2	3 299 4	..	2	5 523 7	3	....
2 575 5	4N	1n	3 301 5		2	5 529 9	2	...
2 580 7	..	6	3 305 7	2	.	5 545 65	4<	...
2 595 6		3	3 312 6		1	5 558.	..	1N
2 606.14	.	6	3 331 8		2	5 570.	..	1N
2 614 5		6	3 349	1		5 590.	.	1n
2 628 6		2	3 352		1	5 666 4	4n	2n
2 656 8	.	6	3 364	.	1	5 970	..	1
2 660 4	3	5	I 3 382 88 p	10r	9r	6 037.	.	2
2 681 4		4	3 409.	1	.	I 7 687.85	10	
2 688 4	.	3	3 413.	1	...	I 8 273.58	10	
2 712 1		4	3 456	1	..	I 12 551.	1	
2 721.79	3	2	3 469 2	1	1	I 16 819.	3	
2 743 9	.	3	3 475 8		2	I 17 415.	1	
2 756 4	.	6	3 501 8	3	1	I 18 307.	1	
2 767.5	..	8	3 505.1		1	I 18 382.	1	
2 786 5	.	3	3 507	1	...	39 889.	5	.
2 799.64	.	6	3 520	1		39 951.	8	.
2 815.6	.	4	3 542.5	3	2			

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Sodium

Wave length.	Arc.	Spark.
1 372 3	..	2
1 376.6?	..	1
1 659 7	..	4
1 668 7	..	4
1 669 3	..	4
1 698 9?	..	10
1 703 5	.	9
1 749 3	..	8
1 770 8	..	6
1 773 5	..	6
1 787 4	.	4
2 490 7	1r	
2 493 3		2
I 2 512 1	1r	1
I 2 512 2	1r	
I 2 543 8	2r	1
I 2 543 9	1r	
I 2 593 8	3r	3
I 2 593 9	2r	
I 2 680 3	4r	4
I 2 680 4	3r	
2 847	.	4
I 2 852 8	4r	5
I 2 853 0	5r	
2 951 4		5
2 980	.	4
2 984 3	.	4
3 056 3		3
3 078 5	..	4
3 093.	..	6
3 129.	..	6
3 189	..	4
3 285	..	5
I 3 302 34 p	9r	9r
I 3 302.94 p	8r	8r
3 533.1	..	8
3 631.	..	5
3 711	.	3
I 4 393	3	1
I 4 665	3<	3n
I 4 669	4<	3n
I 4 748 1	3n	2
I 4 752 0	4n	2<
I 4 979 0	5<	4
I 4 983 2	6<	4<
I 5 675 8	..	8
I 5 682 8	8	8<
I 5 688 3	10	8<
I 5 889 97 P	10r	10
I 5 895 93 p	8r	10
I 6 154 4	4	3
I 6 160 8	5	4
I 8 183 33	8	
I 8 194 93	10	.
I 11 382 4	10	.
I 11 404.2	10	
I 18 459.5	10	....
I 40 449	8r	...
I 74 430.	1r	.
I 90 480.	..	3
I 90 850.	..	4

Strontium

Wave length.	Arc.	Spark.
II 1 613	4	
II 1 620.	5	
II 1 769.	8	
II 1 778.	9	
II 2 166	1r	1
I 2 354 3	1r	.
I 2 428 11	3r	..
I 2 569 50	3r	
I 3 301 74	5	2
I 3 307 54	4	1
I 3 322 23	5	1
3 330 01	4	2
I 3 351 26	6r	2
II 3 366 33	5	2
II 3 380 72	5	6
I 3 464 47	6	7
I 3 940 80	5	2
II 4 030 38	5	4
II 4 077 71 P	10r	10r
II 4 161 81	4	3
II 4 215 52 p	9r	9r
I 4 305 47	4	4
I 4 361 71	4	2
I 4 438 04	6	3
I 4 607 34 P	10r	6r
I 4 722 27	6	3
I 4 741 91	5	1
I 4 811 86	6r	4
I 4 832 07 p	6	3
I 4 855 07	4	1
I 4 872 48 p	6	2
I 4 876 07	6	1
I 4 876 31	6	1
I 4 892 01	6	2
I 4 962 25 p	6r	2
I 4 967 92	4	1
I 5 156 08	5	1
5 222 21	5	1
5 225 12	5	1
5 229 28	5	1
5 238 56	6	1
5 256 91	6	3
I 5 480 87	7	4
I 5 486 13	5	2
I 5 504 19	5	3
I 5 521 76	6	3
I 5 534 80	5	2
I 5 540 04	5	2
I 5 543 32	5	2
5 598 4	6	1
I 6 363 95	4	1
I 6 369 98	4	1
I 6 380 74	5	1
I 6 386 53	7	1
I 6 388 27	6	1
6 408 48	9	4
6 504 01	8	4
6 546 80	5	2
6 550 27	6	3
6 617 27	6	3
6 643 55	5	2
I 6 791 07	6	1
I 6 878 37	10	
I 7 070 15	10r	1
I 7 167 30	6	
I 7 232 24	5	.
I 7 309 45	7	
I 7 621 53	5	
7 673 10	6	.
II 10 038	10	.
II 10 328	10	.
II 10 915.	10	.
I 11 242	10	
17 137	..	
17 170	.	.
17 446.		.
I 20 262	10	
20 705	..	
20 767.		
I 26 024	6	...
26 714	.	..
26 806.		
I 26 915.	6	.
26 947		.
I 27 356.	6	.
28 516.	.	..
28 964.		.
I 29 225	6	.
I 30 110.	5	
30 482	.	.
I 30 665.		....

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Sulfur

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
IV 661.42	6	..	4 332.7	1	5	5 614 3	..	5
IV 753.75	6	.	4 362 5		6	5 640 0	..	8
IV 750 23	5	. .	4 525 0		6	5 647 1	..	8
IV 748 40	5	....	4 694.2 p		10	5 660.1	..	6
IV 744 92	5	. .	4 695.5 p	.	8	I 5 696 8	..	6
V 786.51	6	....	4 696 3 p		6	I 5 700.4	..	7
IV 815 97	5	.	4 925 3	.	6	I 5 706 2	..	8
V 854.81	5	.	5 009 6		6	I 6 042 0	.	5
VI 933 42	5	.	5 014.0		8	I 6 046 0	..	6
IV 3 098 36	5	.	5 032 5		8	I 6 052 8	..	7
3 497.3	8	.	5 201.0		6	I 6 403 5	..	2
3 717.7	5	6	5 212 6	1	8	I 6 408.1	..	3
3 837.37	4	7	5 278 1		3	I 6 415 5	..	4
3 838.29	8	8	5 278 6		5	6 538 1	.	6
3 928 5		8	5 279 0		6	I 6 743 7	..	5
3 983 7	..	5	5 320 7	.	8	I 6 748 8	..	6
3 993 5	..	5	5 345 7	.	8	I 6 757 2	.	7
4 028 8	.	6	5 428 7		9	7 244 8		6
4 142 5	2	8	5 432.8	.	10	7 679 6	.	4
4 145 1	2	10	5 453.8	.	10	7 686 1	.	6
4 153 2		8	5 473 6		8	7 696 7	..	8
4 163	3	10	I 5 507 0	.	5	8 585 6		6
4 174 31	1	7	5 509.6	.	10	8 694 3		4
4 189 9		5	5 564 9		8	I 9 212 80 p		2
4 253 60		10	5 579 1		6	I 9 228 17 p		2
4 284.97	5	8	5 606 1		8	I 9 237.71 p		3
4 294 42	..	8n						

Tantalum

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 647 46	3	2	3 566 72	4	1	5 461 29	4	2
2 714 67	3	2	3 607 40	7	2	5 518 89	3	2
2 758 31	3	1	3 626 61	9	3	5 664 88	6	3
2 802 07	3	1	3 642 05	10	2	5 776 71	7	2
2 891.85	4	1	3 918 51	3	2	5 811 09	8	.
2 933 56	5	2	4 026 95	4	2	5 882 29	5	
2 965 15	4	4	4 067 91	6	2	5 997 24	7	
3 012 53	5	3	4 129 42	5	2	6 045 4	5	
3 049 54	5	1	4 175 22	4	3	6 256 62	8	2
3 103 25	5	1	4 205 88	6	2	6 268 66	8	2
3 124 96	4	1	4 279 06	3	2	6 309 56	8	3
3 170 28	4	1	4 415.73	3	3	6 389 42	8	3
3 223 83	4	2	4 510.98	8	3	6 430 76	9	5
3 242 05	4	. . .	4 530 82	5	3	6 450 36	10	5
3 311 14 P	9	3	4 574 32	5	3	6 485 36	10	10
3 317 91	7	1	4 681 87	5	5	6 514 36	9	3
3 361 63	5	1	4 691 89	3	2	6 516 11	10	3
3 406 94 p	5	2	4 740.14	4	2	6 673 70	4	1
3 436 00	5	1	4 812 74	4	2	6 675 51	5	2
3 497 85	5	....	4 936 40	3	1	6 866 20	3	1
3 511 03	8	2	5 136 47	3	3	6 966 16	2	

Tellurium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
509.	.	1	813.		5	931		4
634.	..	1	928.	..	4	1 004	.	5

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Tellurium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
1 007.	..	5	1 297.	..	5	2 383 27 p	10r	10r
1 064.	..	5	1 345.	..	7	2 385.78 p	10r	10r
1 107.	..	5	1 461.	..	7	2 530.73 p	7	5
1 117.	..	5	1 826.	..	5	2 769.65 p	9	4
1 123.	..	7	2 081.8	8	....	3 175.13	9	2
1 150.	..	5	2 143.0 p	9r	1	4 866 5	..	4
1 167.	..	10	2 147.33	8	1	5 045 2	..	4
1 174.	..	7	2 160.12	6	1	5 449.7	..	5
1 216.	..	7	2 208.88	6	2	5 649.3	..	10
1 219.	..	7	2 255.50	5r	3	5 708.1	..	10
1 223.	..	7	2 259 02	8r	3	5 755.8	..	8
1 291.		5	2 265 52	5r	3	6 438 0	..	10

Terbium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 539 91		8	3 981 90	10	10	4 752 50	10	8
2 658 91	..	10	4 005 57	8	10	4 813.77	6	....
2 891.29	..	10	4 012 85	7	5	4 837 58	6	1
2 909 24	..	10	4 033 07	8	8	4 875 58	6	1
2 913 28	..	10	4 061.59	6	2	4 881.14	6	2
3 078 87	4	8	4 066 22	5	3	4 915 91	6	....
3 139 65	4	3	4 094.44	5	4	4 931 79	6	..
3 218 95	5	5	4 144.46	5	10	4 970 99	5	..
3 274 24	6	..	4 187.16	5	..	4 993 85	6	.
3 293 08	5	8	4 278.54	10	10	5 065 79	5	...
3 324 40	8	5	4 313.25	6	1	5 089 11	5	1
3 413 77	5	4	4 318.85	6	3	5 228.11	5	...
3 454 06	7	4	4 342 53	6	2	5 319.23	5	..
3 509.18 p	10	10	4 353 20	6	3	5 354 87	5	...
3 561 75 p	10	10	4 356.84	6	2	5 369.71	5	..
3 568 52	7	5	4 367.31	5	3	5 375 98	5	..
3 628 20	8	3	4 423.11	5	1	5 424.10	5	...
3 638 45	7	5	4 436.13	5	..	5 470 34	5	..
3 650 42	7	8	4 493 08	5	2	5 524 11	5	...
3 658 87	8	8	4 511 52	6	...	5 685 72	5	..
3 676 35	8	10	4 563 69	6	1	5 747.58	6	...
3 702 85	6	10	4 578 68	8	3	5 785 18	5	..
3 703.93	8	8	4 641 98	8	3	5 803 11	5	..
3 711 75	10	4	4 645 29	9	2	5 851.07	5	...
3 765 14	6	8	4 662.79	6	1	5 967.35	5	...
3 776 50	8	8	4 681.86	8	..	6 038 97	4	...
3 848 76 p	10	10	4 702.40	8	2	6 331 68	4	....
3 874 19 p	10	10	4 716 08	6	..	6 677.94	6	....
3 899 19	8	8	4 734.19	6	1	6 785.12	4	...
3 925 45	10	10	4 739 92	6	1	6 794.58	5	...
3 939 54	10	10	4 747.79	6	.	6 896.37	5	....
3 976 86	10	10						

Thallium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
395.	..	1	1 082.	..	4	1 561.	..	8
662.	.	3	III 1 266.	..	8	1 660.	..	10
697.	..	4	1 337.	..	4	1 793.	..	9
817.	..	3	1 478.	..	4	1 815.	..	10
908	.	2	1 492.	..	4	1 828.	..	6
1 029.	.	4	III 1 559.	..	10	1 893.	..	10

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Thallium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
I 2 207.1	4r	2	4 738 1	. .	10	I 14 515.	10	
I 2 237.8	6r	3r	5 153 3		10	I 14 593.	1	
I 2 316 0	6r	4	I 5 350 47P	10r	10	I 14 598.	3	.
I 2 379.60	8r	10r	5 948 9	8	8	I 16 123.	10	.
I 2 517 44	4r	. . .	I 6 550.	8	3	I 16 340.	10	.
I 2 552.5	6r	.	6 714.	5	2	20 486.	1	.
I 2 552 9	2r		I 8 376.	1	.	21 397.	1	
I 2 580 16	8r	6r	I 9 136.	2	.	I 21 803.	3	. . .
I 2 585 6	4r	1	I 9 171.	2		27 024.	1	. .
I 2 608 98	6r	2	I 9 513.	3	. .	I 27 889.	4	. . . .
I 2 609 75	4r	. . .	I 10 292.	6	.	I 33 393.	1	. .
I 2 709.24	8r	6r	I 10 492.	5	.	I 35 680.	1	. . .
I 2 710 7	4r	4	I 10 496.	8	.	I 35 950.	2	. . .
I 2 767 89	10r	10	I 11 482.	5	.	I 38 131.	5	. . .
I 2 826 2	8r	. . .	I 11 513.	10	. .	I 39 215.	2	. .
I 2 918 34	10r	1	I 11 594.	8	.	I 39 246.	2	.
I 2 921.53	6r	1	11 691.	1	.	39 286.	6	. .
I 3 229 76	10r	1	I 12 492.	2	. .	I 51 058.	2	
I 3 519 22	10r	10r	12 728.	2	.	I 55 590.	1	. . .
I 3 529 41	8r	10	I 12 736	10	.	I 70 230.	1	. .
I 3 775 73 p	10r	10r	I 13 014.	10		I 71 170	1	. . .

Thorium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 413 50		6	4 069.23	3	7	5 539 89	5	2
2 427 98	.	8	4 085.05	3	7	5 604 48	4	1
2 431 74	. .	7	4 116.75	2	6	5 639.71	5	1
2 441 30	. .	9	4 178 04	3	5	5 707 07	4	1
2 463 72	. .	7	4 208 85	4	8	5 749 32	4	1
2 512 72	. .	8	4 381.89	5	10	5 815 38	4	.
2 686 17	. .	6	4 391.12	5	10	5 870 51	4	1
2 898 92	. .	6	4 510 54	4	5	5 914 38	4	1
2 978 68	. .	8	4 602 88	5	1	5 989.02	7	2
3 097 92	.	6	4 619 50	7	3	6 015.41	4	1
3 108 26	4	5	4 740 47	6	4	6 087 28	5	1
3 188 22	5	5	4 752 41	6	4	6 099 08	4	1
3 216 58	.	8	4 761 10	5	3	6 104 79	4	1
3 221 27	2	10	4 774 27	5	2	6 112 84	4	1
3 232 08	1	7	4 818.62	4	4	6 120 56	4	1
3 290 59 p	.	10	4 832 78	5	2	6 261 06	4	1
3 300 54	1	10	4 863 17	9	8	6 274 14	4	1
3 313 69	1	10	4 919 80	9	6	6 342 86	4	
3 392 05	4	5	4 964 15	5	1	6 358 64	4	
3 469 94	4	5	4 987.16	5	3	6 376 94	4	
3 507 57	.	10	5 017 24	8	3	6 396 4	4	
3 511 64	5	6	5 028 59	5	2	6 411 91	4	
3 538 75 p	1	10	5 049.77	7	3	6 416.10	4	
3 601.05 p	3	7	5 067 97	5	.	6 457.26	4	
3 617 07	4	5	5 148.17	4	2	6 462 64	5	1
3 627 40	. .	2r	5 247 65	5	2	6 531.3	4	
3 659 51	3	6	5 277 45	5	2	6 584 0	4	
3 741 21	5	6	5 325 10	4	2	6 989 7	4	
3 752.58	4	6	5 435 86	4	1	6 993 1	4	
4 019.14 p	5	10	5 462.58	4	1	7 054.8	4	

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

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Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
392.	..	1	2 113.9	4r	1r	3 283.5	..	10
410.	..	2	2 121.2	3r	....	3 330.60	6r	6
502.	..	2	2 140.6	3r	1	3 352.3	..	10
508.	..	2	2 148.6	3r	1	3 801.03	9r	8r
752.	..	3	2 151.4	3r	2	4 524.74 p	6	10
784.	..	3	2 171.3	3r	....	4 585.6	..	10
892.	..	3	2 194.5	3r	2r	5 333.	..	10
902.	..	15	2 199 3	3r	2r	5 562.7	..	10
907.	..	3	2 209.63	3r	2r	5 589 4	..	10
910.	..	3	2 231.73	4r	2	5 731.70	7	3
956.	..	10	2 246.05	3r	3r	5 799 4	..	10
1 019.	..	15	2 268.92	3r	3r	5 970 3	5	....
1 044.	..	15	2 286.68	4r	3r	6 037 7	5	...
1 058.	..	3	2 317.22	5r	4r	6 054 9	5	....
1 062.	..	3	2 334 80	4r	4r	6 069 0	7	...
1 086.	..	5	2 354.84	5r	6r	6 149 6	6	....
1 089.	..	5	2 408.18	4r	3	6 154.6	5	...
1 132.	..	12	2 421 70	6r	8r	6 171 5	4	...
1 158.	..	20	2 429 51	7r	8r	6 310 8	4	..
1 224.	..	10	2 483 40	5r	4r	6 453 5	3	6
1 251.	..	20	2 495 72	5r	4r	6 579.2	..	4
1 314 7	.	10	2 546 56	5r	5r	6 844.2	2	2
1 327.	.	7	2 571 60	5r	5r	8 114.1	7	...
1 347.	..	4	2 594 43	4r	3r	8 552 6	7	
1 370	..	4	2 658 61	..	10	9 852.	1	.
1 387.	..	5	2 661 25	5r	4r	10 458.	1	...
1 410 8	..	5	2 706 50	7r	7r	10 808.	1	....
1 437.7	..	10	2 779 81	4r	5	10 896.	4	....
1 475	..	6	2 785 02	3r	4	11 194.	7	....
1 570	.	4	2 813 58	5r	4r	11 279.	10	....
1 757	..	10	2 839 99 p	8r	10r	11 457.	6	.
1 811.	..	10	2 850 61	6r	7r	11 618.	6	...
1 899.	3	10	2 863 32 p	8r	8r	11 672.	2	...
1 951 4	3r	...	2 913 54	6r	4	11 740.	9	....
1 983 4	3r	....	3 009 14 p	9r	8r	11 827.	4	....
2 040.	4r	...	3 032 78	3r	3	11 853.	4	....
2 072 9	5r	..	3 034 12 p	9r	8r	11 934.	10	...
2 091 6	3r	1	3 175 05 p	10r	9r	12 983.	5	....
2 096 3	4r	....	3 262 33 p	10r	5r	13 022.	2	...
2 100 8	4r	..						

Titanium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark
324.	..	1	III 2 375 0	.	6	I 2 646 64	9	2
781 6	..	10	I 2 384 53	3	1	I 2 661 97	5	....
834 0?	..	2	2 414 0		10	I 2 669 60	6	2
1 113 4	..	5	I 2 418 36	3	1	I,II 2 742 33	7	4
1 120 5	..	5	III 2 516 0		10	II 2 751 7	..	8
1 264 6	..	5	II 2 525 62	4	10	I 2 758 07	6	1
III 1 294 3	..	2	III 2 527 8	..	10	II 2 805 0	..	10
III 1 298 8	..	2	III 2 540 0	.	10	II 2 810.30	4	10
1 437 3	..	5	III 2 563 4	..	10	II 2 817.84	..	10
1 658 7	..	10	I 2 599 91	6	2	II 2 828.07	3	8
1 671 2	..	10	I 2 611 28	7r	1	II 2 841.94	8	4
IV 2 068 3	..	2	I 2 619.94	5	1	II 2 884.10	7	8
2 074 6	..	2	I 2 641 09	9	2	I 2 912.09	8	2
III 2 346 8	..	6	I 2 644.26	9	3	I,II 2 941.99	9	4

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

TITANIUM (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
I 2 948.25	9	2	I 3 729.81	8r	4	I 4 623 11	9	3
I 2 956.13	10	2	I 3 741.07	10	2	I 4 656 46	8	3
I 2 967 22	8	2	I 3 741 65	3	10	I 4 667 59	10	5
III 2 984 8	..	10	I 3 752.87	10	5	I 4 681 91	9	6
II 3 072 11	8	3	II 3 759 30	9	10	I 4 691 34	8	4
II 3 072.97	8	3	II 3 761 33	8	10	I 4 698 77	8	3
II 3 075 23	9	4	I 3 882.88	9	3	I 4 731 17	5r	3
II 3 078.65	9	6	II 3 900 54	5	10	I 4 758 13	8	5
II 3 088 03	10	10r	II 3 913.47	5	10	I 4 759 28	8	6
II 3 162 57	9	6	I 3 947.77	8	3	I 4 820 42	7	3
II 3 168 52	9	10	I 3 948.70	10	4	I 4 840 88	9	4
I 3 186 46	9r	3	I 3 956 34	10	4	I 4 870 14	7	3
II 3 190 88	7	10	I 3 958 21	10	5	I 4 885 09	8	5
I 3 192 00	9r	1	I 3 962 86	7	3	I 4 981 73 p	9	10
I 3 199 92	9r	3	I 3 964 27	7	3	I 4 991 07 p	9	10
II 3 202 54	6	10	I 3 989 76	10	6	I 4 999 51 p	10	10
II 3 217 06	8	8	I 3 998 64	10	6	I 5 007 21 p	9	10
II 3 222 84	7	8	I 4 009 66	7	4	I 5 014 25	10	9
II 3 224.24	5	8	I 4 024 58	7	3	I 5 020 03	8	5
II 3 234.52	8r	10r	I 4 078 48	6	4	I 5 022 87	9	5
II 3 236 58	7r	6r	II 4 163 66	4	10	I 5 024 85	9	3
II 3 239 04	7r	6r	II 4 171 92	3	10	I 5 025 58	8	3
II 3 241 99	7	10	I 4 274 59	10	4	I 5 035 91	7	9
II 3 248 60	4	10	I 4 282 71	6	3	I 5 036 47	9	8
II 3 261.60	4	10	I 4 287 42	9	4	I 5 038 41	9	8
II 3 322 94	8r	10	I 4 289 08	10	4	I 5 039 96	9	3
II 3 329 46	6r	10	II 4 290 23	4	10	I 5 064 66	10	5
II 3 332 11	5	8	I 4 290 94	8	2	I 5 173 74	7r	7
II 3 335 19	7	10	II 4 294 11	6	10	II 5 188 69	4	10
I 3 341 87	6r	10r	I 4 298 68	10	4	I 5 192 97	8r	10
II 3 349 04 P	6r	8r	II 4 300 06	6	8	I 5 210 39	8r	9
II 3 349 41	9r	10r	I 4 300 56	10	2	II 5 226 55	3	10
I 3 354 64	8	3	I 4 301 08	10	3	I 5 283 45	7	3
II 3 361 22 p	8r	10r	I 4 305 92	10	8	I 5 297 25	7	3
I 3 370 44	9r	2	II 4 307 89	..	8	II 5 336 80	3	10
I 3 371 46	9r	2	I 4 314 81	7	3	I 5 477 73	9	4
II 3 372 80 p	10	10r	II 4 337 92	5	10	I 5 488 23	6	3
II 3 380 29	7	10	II 4 395 04	7	10	I 5 512 53	8	10
II 3 383 77 p	8r	10	I 4 427.11	8	4	I 5 514 35	7	8
I 3 385 95	8r	.	I 4 443 81	6	10	I 5 514 54	8	8
II 3 387.84	8	10	II 4 455.33	10	4	I 5 565 47	7	8
II 3 394 58	2	10	I 4 457 44	9	5	I 5 644 14	7	10
II 3 444 32	4	10	I 4 468 50	6	10	I 5 662 16	7	8
II 3 452 48	1	8	II 4 501.28	5	10	I 5 662 92	7	3
II 3 456.39	2	9	I 4 512 74	10	4	I 5 675 43	7	4
II 3 461 50	9	10	I 4 518 03	9	4	I 5 689 48	8	3
II 3 477.19	9	10	I 4 522 81	9	4	I 5 702 68	6	2
II 3 504 89	7	10	I 4 527 32	10	4	I 5 708 23	5	1
II 3 510 85	8	10	I 4 533 25	10r	5	I 5 715 12	8	2
II 3 520 26	3	8	I 4 534 78	9r	4	I 5 762 28	7	2
II 3 535 41	4	10	I 4 535 58	8r	3	I 5 766 33	7	3
I 3 635 47 p	9r	3	I 4 535 92	6r	.	I 5 866 44	9	10
II 3 641 34	4	10	I 4 536 05	6r	4	I 5 899 29	9	10
I 3 642.68 p	10r	3	I 4 544 70	9	3	I 5 918 54	6	3
I 3 653 50 P	10r	4	I 4 548.77	9	3	I 5 922 10	7	4
II 3 659 77	4	10	II 4 549 63	5	10	I 5 941 75	7	4
II 3 662 24	4	10	I 4 555 49	9	3	I 5 953 16	8	10
II 3 685.19	10r	10	II 4 563 77	4	10	I 5 965.82	8	10
II 3 706 22	2	8	II 4 571.98	6	10			

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Titanium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
I 5 978 54	8	8	I 6 258 72	9	9	I 7 209 45	8	.
I 5 999 67	6	2	I 6 261.10	9	9	I 7 244 86	5	
I 6 085 24	7	4	I 6 303.77	6	3	I 7 251.7	6	...
I 6 091 18	7	5	I 6 556.09	6	5	I 8 426.5	4	....
I 6 126 22	9	5	I 6 743 15	5	3	I 8 435 6	5	
I 6 215 26	7	10	I 6 861.17	5	1	I 8 518.2	4	
I 6 258.11	9	9						

Tungsten

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
1 550 2	.	3	2 946 98	8r	3	5 071 74	5	10
1 679 2	..	3	3 017 44	6r	2	5 224 68	10	10
1 785 5	..	5	3 041 86	5r	1	5 492 34	10	10
1 787 0	..	5	3 046.44	5r	1	5 514.72	10	10
1 788 3	..	5	3 049.68	6r	1	5 648 39	7	10
1 895 5		6	3 077 50	1	10	5 735.10	8	8
2 397 11 p	2	10	3 376 14	1	10	5 804 86	7	5
2 446 4	1	8	3 401 90	1	8	5 947 58	4	2
2 488 8	2	6	3 508.74	6	5	6 012 80	4	3
2 571 46	2	6	3 545 23	6	3	6 292 05	4	2
2 572 3	.	6	3 572 47	3	10	6 404 22	4	2
2 579.3	1	5	3 592 42	3	10	6 445 15	4	2
2 579 6	..	7	3 613 79 p	3	10	6 538 15	4	....
2 589 14 p	2	8	3 617 52	8r	2	6 693 12	5	.
2 658 02	2	8	3 641.41	4	10	6 820.7	4	...
2 702.1	1	10	3 736 24	1	10	6 934.28	4	...
2 762 34	4r	2	3 867.98	5	5	6 984 29	4	.
2 764 28	4r	8	4 008 76 P	10	10	7 140 51	3	.
2 768 99	4r	1	4 074.37	7	6	7 296 57	3	..
2 769 76	4r	1	4 215 38	3	8	7 385 08	3	...
2 770 90	4r	1	4 294 62 p	6r	9	7 483 34	3	....
2 774 01	5r	2	4 302.12 p	8	5	7 569 87	3	....
2 774.48	5r	3	4 484 20	8	4	7 614 07	3	....
2 818 07	5r	2	4 570 66	7	3	7 688 93	3	....
2 879 11	5r	2	4 588 74	7	3	7 784 11	3	....
2 879.40	5r	2	4 680 52	8	5	7 940 92	3	....
2 896 01	4r	2	4 843.83	9	5	8 123.78	3	....
2 896 44	6r	3	5 006 17	8	10	8 585 07	3	....
2 934 99	5r	3	5 015 34	8	8	8 594 38	3	..
2 944 41	7r	3	5 053 30	10	2	8 613 22	3	....

Uranium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
397.	.	1	4 090 13	6	4	4 731 60	5	3
764.	..	5	4 156 65	5	2	4 756.79	5	2
1 587.	.	5	4 163.70	5	2	4 772 70	4	3
1 833	..	5	4 171 61	5	3	4 819 48	4	2
1 981	..	5	4 241 68 p	5	4	4 899 27	4	2
1 985	..	5	4 287 87	4	3	5 027 38	5	4
2 008	.	5	4 341 67	5	4	5 280 38	4	1
3 566 61	4	2	4 393 60	5	2	5 475.71	5	3
3 670 07	4	3	4 472 34	5	6	5 481.20	5	3
3 831 45	4	3	4 543 64	5	8	5 492 94	8	4
3 859 57	5	3	4 627 08	5	5	5 527.84	10	4
3 932 04	5	3	4 646 60	4	4	5 564.16	5	1
3 985 80	5	2	4 689.07	5	4	5 610.88	5	1

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Uranium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark	Wave length.	Arc.	Spark.
5 621.50	4	1	6 372 46	5		7 881 91	4	
5 669 45	4		6 395 46	6		7 970 44	3	
5 723 63	5	1	6 449 19	10	1	8 223 08	4	
5 758 18	6	..	6 465 00	4		8 262 09	4	
5 780 56	4	.	6 826 90	4		8 318 4	3	
5 798 54	4	1	7 074 78	4		8 381 93	3	
5 837 7	4	1	7 101 61	3	.	8 445 38	4	
5 915 39	8	1	7 128 88	4		8 450 04	4	
5 976 32	5		7 425 49	3	.	8 496 10	3	
5 997 32	4	.	7 533.91	5		8 504 66	4	
6 051 74	4	1	7 619 34	3		8 540 17	3	
6 077 28	4		7 631 72	3		8 607 92	5	
6 171 88	4		7 784 11	5		8 691 26	3	

Vanadium

483 0		5	II 2 952.08	8	8r	3 457 13	2	10
684 5?	..	5	2 955 80	8		3 496 94	3	8
723.	.	3	II 2 957 52	8	6	3 504 44	4	10
1 112.	.	2	2 968 38	8	10r	3 517 30	5	10
1 437 3	.	2	2 974 24	8	1	3 524 73	3	8
1 454.		2	2 976 21	8	2	3 530 77	6	10
2 074 5		15	2 976 53	8	3	3 545 20	6	10
2 677 83	7	4	2 977 55	8	1	3 556 80	4	10
2 678 60	7	3	2 989 59	1	3r	3 566.17	3	8
2 679 35	8	4	3 001 20	3	8r	3 589 75	5	10
2 687 99	10	5r	3 044 93	4r	1	3 592 02	5	10
2 700 96	8	5r	3 050 88	3r	3	3 593 33	5	10
2 706 19	8	3r	3 056 35	3r	2	3 618 95	1	8
2 715 69	10	5	3 060 45	3r	.	3 667 72	8	3
2 762 6		2r	3 066 37	4r	1r	3 669 42	1	8
2 810 24	2	8	II 3 093 14 P	4	10r	I 3 688 07	8	3
2 882 51	6	8	II 3 102 30 p	10	10r	I 3 690 29	8	4
2 882 51	6	8	II 3 110 71 p	8	10r	I 3 692 22	8	4
2 884 79	6	10	II 3 118 38 p	10r	10r	3 695 87	8	3
2 891 65	10	6r	II 3 125 29 p	8	2	3 700 34	1	8
2 892 46	10	..	II 3 126 21	6	4r	I 3 703 57	8	3
2 892 67	10	5r	II 3 130 27	5	10r	3 715 47	6	10
2 893.32	10	5r	3 134 93	2	8	3 727 46	.	10
2 904 13	8	1	3 136 51	2	8	3 732 75	5	10
2 906.13	8	4r	3 139 73	1	8	3 745 80	3	10
II 2 907 47	8	3r	I 3 183 42 p	10r	2r	3 770 97	3	10
2 908 81	8r	8r	I 3 183 99 P	10r	2r	3 787 15	2	8
2 910 02	8	4r	I 3 185 41 p	10r	2r	3 794 96	8	3
2 910 39	8	4r	3 187 70	5	8r	I 3 813 50	8	3
II 2 911 03	6	3r	3 188 51	5	8r	3 815 51	3	10
2 914 93	10	2	3 190 67	7	10r	I 3 818 24	8	3
2 919 99	8	2	3 198 10	5r	2	3 847 32	4	10
II 2 420 38	8	3	I 3 202 38	5r	2	I 3 855 85	9r	3
2 923 63	8r		3 217 11	6	10	I 3 864 86	8	3
II 2 924 02	8	8r	3 237 87	6	10	I 3 875 08	8r	2
II 2 924 65	8	8r	3 254 75	2	8	3 878 73	1	10
II 2 930 81	8	5r	3 267 71	10	10r	3 902 26	8r	2
II 2 941 43	3	10r	3 271 11	10	10r	I 3 909 88	6r	
2 942 35	10r	2	3 276 12	10	10r	3 914 31	2	8
2 943 20	8	1	3 279 84	3	10	3 916 40	2	8
II 2 944 6	2	8r	3 337.9	..	8	3 951 96	3	10

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Vanadium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
3 973 64	3	10	I 4 408 52	6r	10r	5 670.87	9	8
3 990 57	10	6	4 416 61	..	10	I 5 698 53	10r	10
3 997 13	3	8	I 4 421 59	8	5	I 5 703 61	10r	10
3 998 73	8	4	I 4 437 84	8	6	I 5 707.02	8r	9
4 005 71	3	10	I 4 441.69	7	8	I 5 727 04	10r	10
4 023 38	2	10	I 4 444.22	8	8	5 731 28	8	5
4 035 62	2	10	4 452.03	8	10	I 5 737 07	7	7
I 4 090 59	10	10	I 4 460.31	10r	10r	I 6 039 74	10	10
I 4 092 69	10	3	4 462.37	9	9	I 6 081 47	10	6
I 4 099 80	10	2	4 469 71	8	8	I 6 090 24	10r	10
I 4 105 17	10	4	4 488 90	8	10	I 6 111 67	10	9
I 4 115 18	10	2	4 545 40	9	8	I 6 119 54	10r	8
I 4 116 48	8	7	4 549 65	6	8	6 199 20	8	8
I 4 116 70	10r	7	4 560 72	7	9	I 6 216 35	8	10
I 4 128 07	10	10	4 571 79	6	10	I 6 230 78	10	9
I 4 132 00	10r	10	I 4 577.17	8	8	I 6 242 85	4	10
I 4 134 47	9	10	I 4 580 40	8	9	I 6 243 10	9	4
4 183 4	2	10	I 4 586 37	8	9	I 6 251 83	9	8
4 202 44	1	8	I 4 594 10	10r	10	I 6 268 85	5	5
4 205 08	2	10	I 4 619 68	8	9	I 6 274 67	5	8
I 4 209 85	6	8	4 776 48	6	9	I 6 285 18	9	7
4 268 64	8	8	I 4 786 52	6	8	I 6 292 83	9	7
4 271 56	6	8	I 4 796 94	7	8	I 6 296 53	10	6
4 276 96	6	8	I 4 807 56	10	8	6 326 87	5	4
4 284 06	7	10	I 4 851 50	9	8	I 6 452 38	4	..
I 4 330 03	6	10	I 4 864 75	10r	9	I 6 504 18	4	4
I 4 332 83	8	10	I 4 875 48	10r	10	I 6 531 43	10	6
I 4 341 01	9	10	I 4 881 57	10r	10	6 753 03	4	.
I 4 352 88	10	6	5 128 54	8	9	7 338 90	4	
I 4 379 24	10r	10r	5 138 44	6	10	I 8 116 76	5	
I 4 384 73	10r	10r	5 194 85	4	8	I 8 161 03	4	
I 4 389 99	10r	10r	5 401 95	7	8	8 203 0	4	
I 4 395 24	10	10	5 415 28	10	8	8 241 6	4	
I 4 400 59	9	10	5 487 9	5	8	8 253 5	4	
I 4 406 65	8r	5r	5 507 75	5	8	8 255 8	4	
I 4 407 65	8r	4r	I 5 627 66	8	9	8 919 8	3	
I 4 408 21	6r	1						

Xenon, First Spectrum

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
3 650 2	4	4 624 28? p	9	6 469 70	3
3 951 0	10	4 671 23? p	10	6 727 90	3
3 967 6	4	4 697 02	6	6 882 07	3
4 078 8	10	4 734 15	8	7 285 36	3
4 109 7	5	4 807 02	7	7 393 80	3
4 116 1	7	4 829 71	4	7 642 04	4
4 193 5	8	4 844 33	10	8 231 62	10
4 500 98 p	8	4 923.25	5	8 280 08	10
4 524.68?	6	6 182 44	2	8 409.17	4
4 582 75?	4	6 318.06	3	8 819.38	6
4 603 03	10				

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

XENON, SECOND SPECTRUM (Continued)

Wave length.	Geissler tube.	Wave length.	Geissler tube.	Wave length.	Geissler tube.
2 475.9	10	3 596 6	5	4 585.5	10
2 605.6	10	3 624 1	8	4 592 0	6
2 677.2	8	3 676.6	7	4 603 0	10
2 717.4	7	3 776.3	7	4 652 0	6
2 794.9	5	3 781.0	10	4 698 0	5
2 814 5	6	3 841.5	7	4 823 3	6
2 816.0	5	3 877.8	8	4 844.3	10
2 871 2	5	3 880.5	6	4 862.5	8
2 937.9	6	3 895.0	6	4 876.5	7
2 957.7	5	3 907.9	7	4 883 5	6
2 979.4	6	3 922 5	10	4 890.1	5
2 993.0	5	3 950.6	8	4 921 5	6
3 065.2	6	3 992.7	5	5 080.7	7
3 083.6	6	4 050 0	6	5 292.2	10
3 091 1	5	4 057.4	5	5 314.0	8
3 138.3	6	4 109 0	6	5 339.4	9
3 150.7	6	4 180 0	10	5 372 4	8
3 151.0	6	4 193.1	8	5 419 2	10
3 196 2	5	4 208 5	6	5 439 0	8
3 239 3	6	4 238 2	10	5 460.4	6
3 242.8	7	4 245.4	10	5 472 7	7
3 285.8	8	4 330 5	10	5 531.1	7
3 322.2	6	4 393 2	10	5 616 8	6
3 330 8	6	4 395.7	10	5 659 5	5
3 454 3	7	4 414.8	7	5 667.6	6
3 458 8	5	4 434 2	6	5 719.6	6
3 467 2	5	4 448 1	10	5 751 1	5
3 468 2	5	4 462 2	10	5 976 5	7
3 542 4	6	4 480 8	7	6 036 2	6
3 552 1	6	4 540 9	8	6 051 2	7
3 579 7	6	4 545.2	8	6 097 6	7
3 583 6	6	4 577.2	6	6 557.	10

YTTERBIUM

Wave length.	Arc.	Spark.	Wave length.	Arc	Spark.	Wave length.	Arc.	Spark.
2 464 53	10r		3 126 1		10	3 619 83	5	8
2 642 53	1	8	3 140 91	4	10	3 694 20 p	10	10
2 672.64	3	4	3 153 86	3	10	3 770.09	7	3
2 750 49	5	10	3 169 05	3	8	3 795 76	3	5
2 851 17	4	10	3 192 87	3	8	3 988 01 p	10	10
2 859 81	3	6	3 289 37 p	10	10	4 135 13	4	8
2 914 23	2	10	3 337 17	8	2	4 180 84	10	5
2 919 36	4	10	3 342 96	10	5	4 316 96	2	5
2 970 56	6	5	3 362 60	10	4	4 439 22	8	2
2 994 80	3	8	3 431 12	6	3	4 576 22	10	3
3 005 76	5	10	3 441 50	10	3	4 726.07	8	10
3 009 39	3	8	3 454 07	5	10	4 781 90	8	....
3 017 57	3	10	3 464 33	10	5	4 786 60	10	10
3 029 6	.	10	3 476 30	8	4	4 935.51	10	....
3 031.12	10	5	3 478 84	8	10	5 277.07	6	....
3 065.03	4	10	3 520 24	4	10	5 335 14	6	1
3 107.87	10	10r	3 560 33	8	3	5 352 94	5	1
3 117.78	4	10	3 560 69	8	5	5 481 95	8	....

WAVE LENGTH OF THE PRINCIPAL LINES IN THE EMISSION SPECTRA OF THE ELEMENTS (Continued)

Ytterbium (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
5 539 05	10	...	5 837.13	8	...	6 799.66	10	....
5 556 47	10	1	6 489.14	10	1	7 527.58	5	....
5 652 00	9	....	6 667.85	10	...	7 699.49	10	.. .
5 720 02	10	....						

Yttrium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 367 2	.	10	I 4 174 14	7	4	5 527.55	6r	3
2 414 7	.	10	II 4 177 52	10	10	II 5 544 60	5	2
2 422 20	4	8	4 220.62	7	1	5 556 45	4r	1
2 817 0	1	10	II 4 235.71	8	5	5 577 42	4r	1
2 946 0	..	10	4 251.18	7	2	5 581 88	5r	2
II 3 095.88	6	2	4 302 30	10	3	5 630 13	6r	2
3 129.93	3	8	II 4 309 62	10	10	5 644.69	4r	1
3 173 05	4	10	4 348 79	9	3	5 648 46	4r	1
II 3 195 61	8	10	II 4 358 72	7	10	5 662 95	7r	10
II 3 200 26	7	10	II 4 374 95	10	10	5 706 73	4r	2
II 3 203 32	7	10	II 4 398 03	8	10	II 5 728 90	4	2
II 3 216 67	10	10	II 4 422 60	10	10	II 5 781 68	4	2
II 3 242 28	10	10	4 505.96	8	3	5 945.72	4	1
II 3 327 88	10	10	4 527 26	8	5	6 009.20	5	3
3 361 99	5	10	4 527 79	7	3	I 6 023.42	4	2
3 496.09	9	10	I 4 643 69 p	8	5	I 6 138 45	4	2
3 548 99	10	10	4 658 31	6	3	I 6 191.72	7	4
3 584 51	4	10	I 4 674 84 Γ	8	5	I 6 222.58	6	2
I 3 592 91	8	4	II 4 682.31	5	10	I 6 435 03	8	8
II 3 600 73	10	10	II 4 823 31	4	10	6 538 58	4	2
II 3 601 92	10	10	4 839 86	9	10	II 6 613 75	5	3
II 3 611 05	10	10	4 845 68	6	5	6 664 37	4	.
I 3 620 94	10	8	4 852 69	6	4	I 6 687 57	5	1
3 668 48	3	10	II 4 854 88	10	10	6 700.71	4	1
II 3 710 30 P	10	10	4 859 83	6	3	6 735 99	4	...
II 3 747 55	6	10	II 4 883 69	10	10	I 6 793 71	4	1
II 3 774 33 p	10	10	II 4 900.12	10	10	II 6 795 41	4	1
II 3 788 69 p	9	10	II 5 087 42	10	10	6 845 23	4	....
II 3 950 35	10	10	II 5 123 21	6	4	6 887 22	4	....
II 3 982 61	10	10	II 5 200 41	10	10	6 950 32	4	.. .
I 4 047.65	7	4	II 5 205 71	10	10	II 6 951.67	4	. . .
I 4 077 38	6r	5	II 5 402 78	5	8	6 979.87	4	.
I 4 083 71	7	3	5 466 46	10	3	7 191 65	3	...
I 4 102.38	9r	8	II 5 497 41	5	8	II 7 264 16	4	....
I 4 128 32	8r	8	5 503 45	8	2	7 346 3	4	....
I 4 142 87	8r	8	II 5 509.91	9	4	II 7 450 2	4	....
I 4 167.52	8	4	II 5 521 62	6r	3	II 7 881 7	2	..

Zinc

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
677 9	..	5	1 651 9	.	7	1 839 3	..	6
I 1 457.	..	8	1 673 2	.	7	1 864	..	5
I 1 589	.	10	1 707	..	7	II 2 025 5 P	4	2r
I 1 601 2	.	6	1 743	..	10	II 2 061 9 p	4	4r
1 620 0	.	6	1 746.	..	8	II 2 100 0	..	5
1 622 9	..	7	1 750.	..	7	I 2 138 5 P	3r	2r
1 629 4	..	9	1 767.8	..	7	2 246.8	4	....
1 639 5	..	9	1 811.	..	7	2 393 80	4	1
1 645.0	..	8	1 834.	..	7	I 2 491 5	6	1

Zinc (Continued)

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
II 2 502.0	3	10	II 3 806 39	..	10	II 6 482 98	..	15
II 2 557 95	8	10	II 3 840 34		15	I 6 928 4	8	
I 2 569 92	6r	1	4 057 87	6	1	I 6 938 5	6	
II 2 570.72	..	2r	I 4 629 81	8	....	I 6 943 4	4	
I 2 582 5	8r	2	I 4 680 14	10r	10	7 026 1	4	
I 2 608 6	8r	3	I 4 722 16	10r	10	7 264 2	4	
I 2 670 57	4	1	I 4 810 53	10r	10	7 338 9	4	
I 2 684 19	6	3	II 4 911 6	10	25	II 7 478 73	4	20
I 2 712 50	6	3	II 4 924 0	10	30	II 7 588.61	..	15
I 2 756 47	6r	5	I 5 181 95	5	1	II 7 732 63	..	10
I 2 770 9	8r	8	I 5 308 57	8	.	I 7 799 1	4	
I 2 771 0	6r	. .	I 5 310 18	6		I 10 970	4	
I 2 800 0	8r	.	I 5 310 90	4		I 10 979	4	
I 2 800 8	7r	10	I 5 772 2	8		I 11 054 2	10	
I 2 802 0	3r	. . .	I 5 775 6	6		I 13 053 2	10	
I 3 018 38	6	3	I 5 777.1	5		I 13 150 4	10	
I 3 035.80	10r	6	II 5 894.39	8	20	I 13 197.5	10	
I 3 072 10	10r	10	II 6 021.26	1	15	I 13 781 4	2	
I 3 075 88	8r	6	II 6 102 54	2	20	I 13 786 1	4	
I 3 282 30 p	8r	10	II 6 111 56		10	I 14 038 5	10	
I 3 302 6 p	8r	10	II 6 214 65		12	I 15 679 7	4	
I 3 302 9	8r	10	I 6 237 9	6		I 16 485 7	4	
I 3 345.0 p	10r	10	I 6 239 20	5		I 16 503 9	4	
I 3 345 6	8r	10	I 6 362 35	10	10	16 504 0	4	
I 3 345 9	8	2	I 6 479 0	7				

Zirconium

Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.	Wave length.	Arc.	Spark.
2 449 84	4	3	II 3 572.47 p	10	10	I 4 710 07 p	10	5
2 568 87	5	6	II 3 576.86	7	10	I 4 739 48 p	9	5
2 571 41	6	8	3 611.89	4	8	I 4 772 32 p	8	4
2 678 64	5	5	II 3 614.77	6	10	I 4 815 63 p	6	3
2 734 84	5	5	II 3 674.71	6	10	4 909 57	6	
2 752 21	4	3	3 698 16	6	10	4 959 41	5	
2 844 58	4	4	3 709 27	6	10	5 046 58	5	1
2 875 98	4	..	3 751.59	6	10	5 064 90	5	1
2 968 95	6	3	3 796 49	3	8	5 155 44	4	1
2 985 39	4	1	I 3 835.97	7	2	5 191 58	4	
3 011 74	5	1	II 3 836 75	5	10	5 311 39	5	1
3 029 52	6	1	I 3 890 32	7	4	5 385 12	7	1
3 106 57	6	4	3 915 93	5	10	5 502 13	6	1
I 3 182 87	7	5	II 3 958 22	8	10	5 528 39	5	1
II 3 273 05	8	9	3 991 13	9	10	5 620 13	6	1
II 3 279 27	8	4	II 3 998 97	9	10	I 5 680 88	6	1
3 284 71	8	4	4 048 67	7	9	5 879 77	8	1
3 356 09	8	4	I 4 081 21	9	5	I 6 127 44	7	1
II 3 357 26	8	4	4 149 20	10	10	I 6 143 19	7	1
II 3 391 98 P	10	10	4 156 23	8	9	6 299 63	7	1
II 3 430 53	7	9	4 161 21	7	8	6 313 01	7	1
II 3 438 23 p	10	10	I 4 227 75	8	4	6 470 21	6	1
3 463 01	4	10	I 4 282 20	6	6	6 489 64	6	1
3 479 39	7	9	4 347 89	7	3	6 769 12	6	
3 481 15	8	10	4 379 77	8	10	6 846 95	4	
II 3 496 21 p	10	10	4 442 99	6	9	6 953 83	5	.
3 505 48	4	8	I 4 535 75	8	3	6 990 82	5	
II 3 505 66	5	8	4 575.51	7	3	I 7 097 7	4	
I 3 519 60 P	8	3	4 633 98	7	2	I 7 169 1	6	
3 542 62	5	10	I 4 687 80 p	10	5	7 280 3	4	..
II 3 556 60	9	10	4 688.45	7	4	7 318.2	3	. . .

SPARK SPECTRUM OF AIR

International Ångstroms

Wave length	In- tensity	Ele- ment	Wave length	In- tensity	Ele- ment	Wave length	In- tensity	Ele- ment
2 287 9	1	N	3 727.34	4	O	4 145.90	3	N
2 318 5	1	O	3 729.3	1	N	4 153.5	3	O
2 382 1	2	....	3 749.51	5	O	4 169.36	1	O
2 395.62	1	....	3 754.5	1	O	4 176.2	2	N
2 399.	1	....	3 759.8	1	O	4 185.5	4	O
2 404 9	2	....	3 770.9	1	N	4 189.8	6	O
2 406 9	1	. . .	3 804.0	1	O	4 199.3	0	N
2 433 6	1	O	3 830.7	1	N	4 206.7	2	N
2 445 5	1	O	3 839.1	2	N	4 211 1	1	N
2 507 2	2	...	3 842 8	1	N	4 223.3	1	N
2 514 5	1	....	3 845 1	0	N	4 228.	2	N
2 599 5	2	...	3 848 04	1	O	4 236 8	3	N
2 739 8	1	....	3 850 6	1	N	4 241.75	2	N
2 746 7	1	....	3 851 2	1	O	4 253 7	2	O
2 749	1	. .	3 856.7	1	N	4 266.4	2	N
2 755 9	2	....	3 864 6	1	O	4 275.9	1	N
2 795 5	1	..	3 882 3	2	O	4 303.7	1	O
2 858 3	1	. ..	3 893.3	1	N	4 317.11	3	O
2 927 5	1	. .	3 907 6	1	O	4 319.62	3	O
3 007	1	O	3 909 1	1	N	4 325 7	1	O
3 047 0	1		3 912 1	3	O	4 327 5	1	O
3 059.15	2	. .	3 919.10	6	N	4 328 5	1	O
3 130 1	1	.	3 933 6	9	?	4 331 04	1	N
3 135 3	1	O	3 940 2	1	N	4 331 9	1	O
3 139 3	2	O	3 945 1	1	O	4 336 8	2	O
3 158 7	1		3 947 45	1	O	4 345 54	3	O
3 265 2	1	O	3 954.4	1	O	4 347 44	2	O
3 288 9	1	.	3 955 9	4	N	4 348 0	2	N
3 301 9	1	.	3 968 4	1	A(?)	4 349.40	4	O
3 312 5	1	O	3 973 30	4	O	4 351.3	2	O
3 318 8	1	....	3 982 76	2	O	4 361.6	0	N
3 320 7	2	O	3 995 1	10	N	4 366.87	3	O
3 325	1	O	4 014 0	1	O	4 369.2	1	O
3 329 5	2	N	4 025 7	1	N	4 371 4	1	N
3 331 8	2	N	4 034 9	2	N	4 379 6	1	N
3 344 8	1	.	4 041 3	3	N	4 392 4	0	N(?)
3 354 08	1	O	4 057 8	1	N	4 396.0	1	O
3 365 8	1	N	4 063 2	1	N	4 401 2	1	N
3 367 3	1	N	4 069.90	8	O	4 414 9	6	O
3 370 9	1	N	4 072 25	8	O	4 417.0	5	O
3 374 0	2	N	4 075 93	8	O	4 425 9	1	N
3 377 2	2	O	4 078 9	2	O	4 430 1	1	N
3 390 3	2	O	4 085 20	2	O	4 432 4	2	N
3 408 3	2	O	4 089 1	1	O	4 434 0	0	N
3 437 32	3	N	4 093 00	2	O	4 443 3	1	O
3 450 9	1	...	4 097 2	3	N	4 447.04	6	N
3 471 2	2	. .	4 103 3	2	N	4 452.4	2	O
3 491 9	2	...	4 105 00	3	O	4 460 1	1	N
3 514 8	1	.	4 110 84	2	O	4 465 4	2	O
3 560 6	1	. . .	4 112 09	1	O	4 467 8	2	O
3 570 3	1	...	4 114 0	0	O	4 469.4	1	O
3 577 2	1		4 119 3	4	O	4 477.7	1	N
3 589 0	1	...	4 120 5	2	O	4 507 62	2	N
3 594 6	1	..	4 121 5	2	O	4 514 8	2	N
3 609 8	1	. . .	4 124 1	2	O	4 529.9	2	N
3 639 6	3	....	4 129 5	1	O	4 544.8	1	N
3 702 9	1	. . .	4 132 88	2	O	4 552.5	2	N
3 707.3	1	O	4 133 70	2	N	4 590.93	3	O
3 709 2	1	O	4 142 2	1	O	4 596.12	3	O
3 712 7	2	O	4 143.7	1	O	4 601.48	4	N

SPARK SPECTRUM OF AIR (Continued)

International Ångstroms

Wave length	Intensity	Element	Wave length	Intensity	Element	Wave length	Intensity	Element
4 607.14	4	N	5 016 4	2	N	5 952 4	4	N
4 609.4	1	N	5 022.9	1	N	6 158 1	0	O
4 613 84	3	N	5 025.7	2	N	6 171 0	2	O
4 621.39	4	N	5 032.	0	....	6 284.3	1	N
4 630.53	10	N	5 045.1	2	N	6 341.5	0	N
4 634 0	1	N	5 061.8	0	N	6 358 1	0	N
4 638 8	2	O	5 073 5	0	N	6 370.7	0	....
4 640.5	1	N	5 136	0	....	6 379 3	2	N
4 641.8	3	O	5 143 6	0	O	6 456	0	O
4 643.1	4	N	5 150.	0	....	6 482.0	5	N
4 649 1	4	O	5 160.1	0	O	6 563.2	3	H
4 650 8	2	O	5 172.	1	N	6 610.4	6	N
4 654 5	1	N	5 173 4	1	N	6 640.7	0	....
4 661.6	5	O	5 175 9	2	N	6 654 8	2	....
4 674 9	1	N	5 179.4	1	N	6 721 3	1	....
4 676 2	3	O	5 183 2	0	O	6 811.9	0	....
4 697.6	0	N(?)	5 185 1	0	N	6 864.	0	....
4 699.2	3	O	5 190 6	1	N	6 887.6	1	....
4 703.1	0	O	5 206 5	1	O	6 950.	0N	....
4 705.1	1	N	5 250 6	1	N(?)	6 965 9	1	A
4 705 4	3	O	5 263.	0	....	7 067 6	0	A
4 709 9	2	O	5 281 7	0	N	7 157.4	9	O(?)
4 718 4	2	N	5 320 5	1	N	7 384.5	1	A
4 735 7	1	N	5 325 1	0	O	7 424.0	8	N
4 751 2	1	O	5 328 6	0	N	7 432 9	0	....
4 764 6	1	N	5 338.7	1	N	7 442 7	10	N
4 774.2	1	N	5 341.2	1	N	7 458 7	0	....
4 779 8	2	N	5 351.2	0	N	7 468 7	10	N
4 781 2	0	N(?)	5 356 4	0	N	7 479	0	O
4 788 2	4	N	5 411.5	1	N	7 505 8	0	A
4 793.7	2	N	5 432.1	0	N(?)	7 515 2	0	A
4 803.3	5	N	5 452.1	1	N	7 635.7	1	A
4 805 9	1	N	5 454.1	1	N	7 772 1	10	O
4 810.3	2	N	5 462.8	1	N	7 774.3	7	O
4 847.7	1	N(?)	5 478.1	0	N	7 775 6	6	O
4 856 8	1	O	5 480.1	1	N	7 947 8	4	O
4 860 3	1	N	5 495.7	2	N	7 951 1	3	O
4 871.6	0	O	5 526.2	2	N	7 952 3	2	O
4 879 7	1	N	5 530.2	3	N	8 185 3	4	N
4 890 9	0	O	5 535.2	5	N	8 188.4	4	N
4 895 3	1	N	5 543.4	3	N	8 200 7	1	N
4 906 8	1	O	5 552.0	2	N	8 211 1	2	N
4 924 6	2	O	5 566.	0	N	8 216.7	7	N
4 934 8	1	N	5 592.3	0	O	8 223 5	4	N
4 941.0	1	N	5 645 6	1	N	8 230 2	0	O
4 942 5	1	N	5 666 6	5	N	8 242 8	4	N
4 943 0	1	O	5 675 9	3	N	8 446 8	5	O
4 955.	1	O	5 679 5	10	N	8 594	0	....
4 964 7	0	N	5 686 2	3	N	8 630 0	0	....
4 987.4	1	N	5 710 7	2	N	8 680 6	2	N
4 991 3	1	N	5 730 6	2	N	8 683 7	1	N
4 994 4	3	N	5 747 5	1	N	8 686 4	0	N
5 001 4	6	N	5 767 4	2	N	8 692	0	....
5 005 2	6	N	5 927 8	4	N	8 703 8	0	N
5 007 4	3	N	5 931 8	7	N	8 712 0	0	N
5 010 6	2	N	5 940 5	1	N	8 719.2	0	N
5 013.9	0	....	5 941 6	10	N			

SUPPLEMENTARY TABLES OF SPECTRA

The following collection of spectra includes tables recently published, many of which are especially important in quantitative spectrum analysis. Values of certain wave lengths which occur in the main table, just preceding, will not always agree exactly with those given here. The authority for the latter will, however, be quoted in each case.

Intensities are in most cases given on King's scale (H. N. Russell, Proc. Nat. Acad. Sci. **11**, 322, 1925)

Abbreviations:

a = absorption
b = widened, not sharp
B = band head
c = complex, hyperfine structure
cm = complex, hyperfine structure measured
d = double
e = enhanced at electrode
E = enhanced in spark spectrum
h = hazy
H = very hazy
l = shaded or displaced to longer wave lengths
M = molecular spectrum La O band head
n = head of band due to oxide
p = part of band structure
p = for list of lines of Tungsten. apparent pole-effect or transverse variation of intensity
pr = reversed only at end of line
P = most sensitive of persistent line, "rai ultime"
r = narrow, self-reversed
R = wide, self-reversed
v = violet, shaded or displaced to shorter wave lengths
w = wide, hyperfine structure
W = very wide, hyperfine structure
I = spectrum of neutral atoms
II = spectrum of singly ionized atoms
III = spectrum of doubly ionized atoms

Argon, Infrared Spectrum

Abridged from the list of Meggers and Humphreys, Jour. Research of B of S **10**, 427, 1933. The original list contains 200 lines. All lines of an intensity of 8 or above are included in the following table. The source was an "end on" Geissler tube

λair A	Intensity	λair A	Intensity	λair A	Intensity	λair A	Intensity
7618 33	30	8094 06	20	8667 94	400	9478.39	50
7628 86	50	8103.692	2000	8678 43	60	9657.76	1500
7635.107	500	8115.309	4000	8736.63	20	9666 86	50
7670 04	50	8119 18	50	8761 72	200	9677.80	8
7704 81	20	8143 50	10	8784.59	30	9784.49	1000
7723 759	200	8171 95	10	8799 13	100	9951.88	20
7724 210	200	8178 84	40	8840 82	20	10029.70	40
7798.55	30	8178 96	20	8849 97	150	10052.10	150
7814 33	10	8203.42	20	8962.19	40	10069 04	50
7855 73	8	8255 07	50	8964 48	10	10094.32	8
7861 91	15	8264 524	1500	8994 09	10	10163 45	30
7868 20	40	8291.88	8	9066.77	40	10254 04	10
7891 10	100	8332.21	20	9073 34	50	10309 15	20
7916 45	20	8384.73	60	9075.42	60	10332.76	60
7948.176	400	8392.28	80	9122.95	500	10470.09	300
7956 99	10	8399.35	20	9194.68	150	10478 09	100
8006.157	600	8408 213	3000	9198 61	50	10506.48	30
8014 785	800	8424 648	2500	9224.49	1000	10529 31	10
8037 23	20	8443.44	20	9291 58	100	10673.61	100
8046 13	50	8490.30	40	9334 80	8	10681 80	40
8053 32	100	8521.442	2000	9354 22	200	10700.97	8
8066 60	20	8605.78	150	9402.69	20	10880.92	10
8079.68	20	8620.47	100	9459 09	100	12499	31

Argon, Infrared Spectrum (Continued)

Abridged from the list of Meggers, Jour. Research of B. of S. **14**, 487, 1935. The original list contains 90 lines. All lines of an intensity of 8 or above are included in the following table. The source was an "end on" Geissler tube.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
10470.051	500	10861.04	25	11488.12	150
10478.10	200	10880.96	150	11580.39	8
10506.47	100	10892.37	30	11668.72	100
10529.32	50	10947.90	20	11719.51	30
10673.55	500	10950.74	120	11733.26	20
10681.78	200	11078.87	200	11943.50	25
10683.40	50	11106.44	60	12112.31	25
10700.98	80	11118.75	20	12139.73	20
10712.77	40	11133.86	20	12402.83	20
10733.87	50	11248.33	8	12439.34	20
10759.13	60	11393.66	50	12456.13	15
10770.35	15	11441.83	80	12487.67	15
10773.35	30	11467.57	30		

Arsenic, Arc Spectrum, AS_I

Abridged from the list of Meggers and deBruin, Jour. Research of B. of S., **3**, 765, 1929. The original list contains 100 lines. All lines of an intensity of 8 or above are included in the following table.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
1889.85	1000 *R*	2069.83	30	2363.05	10	8042.95	10
1937.02	1000 *R*	2085.29	25	2369.67	80 *r*	8305.62	50
1958.29	20 *r*	2089.79	10	2370.77	100 *r*	8355.00	10
1972.03	1000 *R*	2113.01	100	2381.18	150 *r*	8428.94	100
1989.71	200 *R*	2133.81	30	2437.23	50	8541.65	50
1990.49	50 *r*	2144.10	100 *r*	2456.53	200 *r*	8564.71	100
1994.25	25	2165.52	100 *r*	2492.91	50	8654.16	100
1994.79	100 *r*	2176.26	15	2745.00	50 *r*	8821.76	150
2002.54	20 *r*	2182.94	20	2780.22	200 *r*	8869.69	100
2003.34	300 *R*	2205.16	10	2860.44	100 *r*	8935.58	50
2009.18	100 *r*	2205.97	15	2898.71	50 *r*	8993.08	20
2010.04	20	2228.66	20	2990.99	20	9134.81	15
2012.77	20	2266.70	25	3032.85	40	9267.29	25
2013.32	50 *r*	2271.36	50	3075.32	20	9300.62	50
2047.59	50	2288.12	500 *R*	3119.60	50	9597.94	10
2065.41	40	2344.03	50	7410.07	8	9826.69	8
2067.16	25	2349.84	500 *R*	7960.26	25		

Barium, Infrared Arc Spectrum

Abridged from the list of Meggers, Jour. Research of B of S. **10**, 669, 1933. The original list contains 150 lines. All lines of an intensity of 8 or above are included in the following table.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
6580.73	20 *h*	6675.26	500	6865.67	200	7090.01	100 *h,l*
6595.32	1000	6693.82	600	6867.85	100 *h*	7120.27	800 *h,v*
6654.05	50	6771.85	60 *h*	7059.92	2000	7126.60	10 *h*

SUPPLEMENTARY TABLES OF SPECTRA (Continued)

Barium, Infrared Arc Spectrum (Continued)

λair A	Intensity	λair A	Intensity	λair A	Intensity	λair A	Intensity
7153 54	80 *h,v*	7642 91	200 *h,l*	8521.96	8 *h,l*	9450.05	15 *h*
7195 22	200	7672 06	600	8559.97	600 *h*	9455.92	100
7208.18	20 *h*	7706.51	50 *h,v*	8567.58	40 *h,l*	9524 70	60 *h*
7213.56	10	7721.78	10 *h*	8581 98	50 *h,l*	9530.30	10 *h*
7228 84	200 *h,l*	7751.68	40 *h,v*	8654 07	60	9589.37	150
7280 29	1000	7766.80	10 *h,l*	8799 76	100 *h*	9608.88	300
7307 23	10 *h*	7775 37	10 *h*	8860.98	100	9645.72	100 *h*
7326.50	10 *h*	7780 46	400	8914.99	150	9658.8	10 *n,l*
7359 29	20	7839.52	60 *h*	8937.93	10 *h*	9704 42	20 *h*
7375 59	50 *h,l*	7877.98	20 *h,l*	9133 29	15 *h*	9713 75	60
7392 42	400	7905 77	500	9159 66	10 *h*	9830 37	500 *h,l*
7409 97	30 *h,c*	7911 31	200	9189 57	60 *h*	10001.09	300
7417 48	100	7961.24	10 *h,v*	9215 42	15 *h*	10032.12	200
7459 78	300 *h,l*	7982 40	15 *h,v*	9219 69	100	10129.68	10
7476 21	30 *h*	8018 23	10	9253 08	15 *h*	10188 23	50 *h*
7488 04	200	8120.49	30 *h,v*	9306.52	10	10233 22	400 *h,l*
7523 60	20 *h*	8147 78	30 *h*	9308.08	100	10274 04	50 *h,l*
7528 20	20 *h*	8161.58	10 *h,l*	9324.58	100 *h*	10349 03	8 *h,l*
7543 48	25 *h*	8210.30	300 *h*	9367.45	80 *h*	10370.34	10 *h*
7610 45	50	8325 38	20 *h*	9370.06	500	10471.26	100
7636.90	150 *h,l*	8514.23	30 *h,l*	9403.53	10	10649.07	10

Boron, Spark Spectrum

Sawyer and Smith, J.O.S.A. **14**, 287, 1927.

λair A	Spark	λair A	Spark	λair A	Spark	λair A	Spark
2266.4	..	2610.26	1	3158 54	1	4226 15	1
2267.0	.	2652 58	1	3178 24	0	4231 07	1
2355.25	2	2652.81	1	3191 84	1	4272 86	0
2357.03	2	2671 94	0	3260.74	3	4290 90	0
2363.51	1	2694 23	0	3282 01	1	4311.9	2
2363 88	3	2695 18	2	3302 51	3	4344.77	2
2369.96	4	2696 84	1	3323 34	3	4353.17	1
2395.07	3	2697.72	0	3360 09	5	4355 68	3
2400 03	1	2698 35	0	3451 22	25	4371.69	1
2415 06	1	2731 94	1	3493 85	0	4375.60	1
2430 82	1	2749 89	1	3754 86	0	4382 95	2
2432 29	5	2779 26	8	3871.39	4	4394.25	0
2434 95	4	2785.14	5	4026.47	1	4402.95	1
2436 95	1	2809.72	1	4027.82	0	4471 97	2
2445 11	2	2886 80	1	4039.57	2	4472.70	2
2446 10	2	2888 32	1	4050.13	1	4493.1	0
2496 80	10	2889.72	1	4082 62	1	4497.71	5
2497 72	12	2918 15	1	4090 79	0	4677.9	2
2508.45	1	2981 53?	1	4121 68	10	4761.4	0
2514 39	6	3013 28	1	4150.71	1	4829.0	0
2514.96	2	3086 06	1	4164 43	2	4849 6	0
2515 06	2	3102 09	2	4192 72	0	4901 85	1
2557.52	2	3112.50	1	4194 82	1	4937.70	1
2566 26	3	3135.64	1	4201.86	0	4940.87	1
2566 40	1	3136.85	1	4214.17	0		

Bromine, Arc Spectrum

Abridged from the list of Kiess and deBruin, Jour. Research of B. of S., **4,** 667, 1930. The original list contains 330 lines. All lines of an intensity of 5 or above are included in the following table.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
3794.04	6	4780.31	15 *c,l*	6692.16	8	8153.94	12 *c*
3815.68	7	4785.19	6	6728.29	6	8246.87	5
3828.55	5	4802.65	7	6786.77	5	8264.95	10
3992.39	7	4834.46	7 *c,l*	6790.05	8	8272.46	75 *l*
4143.98	6	4849.37	7	6861.21	5	8334.69	20 *c*
4175.79	9	4860.04	5	6971.97	6	8343.70	20
4202.50	7	4979.76	15 *l*	7005.21	20 *l*	8384.02	5
4365.15	5	5345.43	6 *l*	7111.63	5	8446.55	50
4391.61	7	5395.52	8 *l*	7142.28	6	8477.47	20
4425.14	8	5466.23	8 *l*	7162.14	7	8513.38	5
4441.74	12 *l*	5833.43	6	7184.34	5	8557.73	5
4472.62	15 *l*	5852.10	8	7260.49	15	8566.28	6
4477.75	20 *l*	5940.53	5 *l*	7348.56	25 *l*	8625.40	6
4490.43	7	6122.12	7 *l*	7425.89	10	8638.66	25
4513.44	12 *l*	6148.62	12 *c*	7513.01	50 *l*	8698.51	10
4525.62	12 *l*	6177.40	6	7616.46	6	8793.46	6
4529.77	10	6350.74	20 *c,l*	7803.03	15 *l*	8819.95	10
4575.75	12 *l*	6410.32	5	7938.64	12 *c,l*	8825.26	15
4614.60	12 *l*	6544.61	10	7950.19	5	8897.64	15
4643.52	7 *l*	6559.81	12 *c*	7978.50	10	8963.99	5
4735.42	5 (Br II)?	6582.19	10	7989.94	12	9166.07	7
4752.27	12	6631.64	15 *c,l*	8026.35	6	9265.39	8
4775.21	7	6682.29	9	8131.51	12		

Calcium, Infrared Arc Spectrum

Abridged from the list of Meggers, Jour. Research of B. of S. **10,** 669, 1933. The original list contains 50 lines. All lines of an intensity of 8 or above are included in the following table.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
6572.76	50	8152.96	40 *n,l*	9228.9	20 *n,l*	9775.0	15 *n,l*
6717.75	500 *h*	8498.03	300	9233.4	20 *p*?	9807.3	20 *n,l*
6956.18	20 *n,l*	8542.11	1500	9688.6	15	9834.7	30 *n,l*
7148.12	500	8652.16	20 *n,l*	9700.0	10 *n*?	10343.85	500
7203.17	200	8662.16	1000	9701.7	20	10838.77	10
7326.11	400						

Carbon, Infrared Spectrum

Abridged from the list of Kiess, Jour. Research of B. of S. **20,** 37, 1938. All terms of an intensity of 8 or above are included.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
8335.19	10	9088.57	8	9405.77	20	10691.36	50
9061.48	15	9094.89	25	10683.18	25	10707.44	8
9062.53	10	9111.85	10	10685.44	10	10729.59	8

Cesium, Infrared Arc Spectrum

Meggers, Jour. Research of B. of S. **10**, 669, 1933.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
8521.10	4000 *R*	8943.50	2000 *R*	9208.46	200	10123.60	1200
8761.38	500	9172.24	1000	10024.39	1000		

Chlorine, Arc Spectrum

Abridged from the list of Kiess, Jour. Research of B. of S., **10**, 827, 1933. The original list contains 440 lines. All lines of an intensity of 8 or above are included in the following table. The source was a Geissler tube of special design (Kiess and deBruin, Jour. Research of B. of S., **2**, 1117, 1929).

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
4209.68	12	6252.26	8	7777.82	10	8269.15	10
4226.44	15	6341.66	10	7821.35	45	8333.29	100
4323.35	20	6398.63	20	7830.76	30	8375.95	150
4363.30	20	6425.61	8	7839.42	8	8406.20	10
4369.52	15	6434.79	15	7878.22	75	8428.25	100
4379.90	20	6450.30	12	7893.33	10	8467.32	25
4389.76	25	6531.39	20	7899.28	45	8550.46	20
4403.03	15	6542.40	8	7915.09	25	8575.25	75
4438.48	20	6678.39	10	7924.62	100	8585.96	100
4469.37	18	6709.90	15	7933.85	50	8686.28	30
4475.31	15	6810.04	15	7935.00	40	8912.88	40
4491.05	10	6840.23	15	7938.90	8	8948.01	50
4526.20	30	6854.45	10	7952.49	15	9038.96	30
4601.00	20	6865.36	8	7974.72	20	9045.40	40
4623.96	10	6932.90	25	7976.95	25	9069.66	25
4654.05	10	6966.80	8	7980.58	15	9073.15	50
4661.22	18	6981.85	25	7997.80	50	9121.10	75
4691.53	12	6995.88	12	8015.57	45	9191.67	60
4721.24	8	7008.00	10	8023.30	18	9197.49	25
4740.71	10	7086.80	25	8051.08	20	9288.82	60
4852.70	8	7094.20	8	8084.48	35	9393.81	50
4976.62	10	7256.63	125	8085.54	60	9452.06	75
5099.80	8	7414.10	90	8086.67	75	9486.89	25
5532.13	8	7462.40	8	8087.69	20	9584.77	50
5796.26	15	7489.46	8	8094.76	12	9592.20	75
5799.88	12	7492.12	10	8170.09	10	9632.37	20
5846.70	8	7547.06	100	8194.35	50	9661.90	20
5856.70	8	7672.44	25	8199.02	35	9702.35	40
6114.37	15	7702.89	10	8200.20	35	9744.33	30
6140.21	25	7717.57	100	8203.76	12	9806.90	25
6162.05	12	7744.94	125	8212.00	100	9875.95	50
6194.72	15	7769.18	30	8220.40	60	10091.64	40
6231.48	8	7771.10	12	8221.73	75		

Chromium, Infrared Arc Spectrum

Abridged from the list of Kiess, Jour. Research of B. of S. **15**, 79, 1935. The original list contains 200 lines. All lines of an intensity of 8 or above are included in the following table.

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
7771.74	8	7917.85	10	7990.50	10	8128.28	8
7908.30	12	7942.02	20	8061.27	10	8163.22	35
7910.50	10	7989.36	12	8084.98	10	8224.09	8

Chromium, Infrared Arc Spectrum (Continued)

λair A	Arc	λair A	Arc	λair A	Arc	λair A	Arc
8235.89	30	8707.95	12	9294.17	20	10667.53	15
8238.29	12	8718.70	8	9313.55	8	10672.17	18
8261.95	8	8835.67	10	9362.06	10	10801.37	12
8287.38	25	8916.20	15	9447.00	50	10816.91	8
8290.62	10	8917.14	8	9571.76	25	10821.62	12
8318.25	8	8925.75	10	9574.25	50	10905.83	25
8322.06	20	8939.20	8	9667.20	25	10929.90	10
8336.81	8	8947.20	35	9670.48	50	10957.19	12
8348.28	20	8976.88	25	9730.32	25	11015.63	30
8378.52	10	9009.95	100	9734.52	50	11157.03	25
8450.26	15	9017.10	75	9773.30	10	11310.69	12
8455.24	12	9021.69	50	9900.87	15	11331.88	10
8537.80	8	9035.86	20	9904.47	8	11339.16	15
8543.72	10	9140.51	8	9949.06	20	11390.63	15
8548.83	12	9142.60	8	10080.32	15	11397.96	12
8583.01	10	9208.29	25	10486.24	20	11472.93	10
8636.26	10	9263.97	20	10509.96	10	11484.50	15
8643.03	12	9290.44	50	10647.66	12	11610.48	15

Columbium, Arc and Spark Spectrum

Abridged from the list of Meggers and King, Jour. Research of B. of S., **16**, 385, 1936. The original list contains 5700 lines. All lines of an intensity of 8 or above are included in the following table.

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
2103.59	20	10	2160.340	20	40	2225.096		10 *H,e*
2107.267	40	30	2163.076	10		2225.343	50	
2109.428	100	150	2167.241	40	50	2226.927	15	
2110.05	10	10	2169.892	10	15 *h*	2227.280	10	
2113.084	50	50	2175.555	8		2227.706	150 *c*	
2116.387	10		2175.844	30	40	2228.032	100 *c*	
2118.873	30	20	2176.761	40	50	2229.65	30	
2122.67		20 *h,e*	2177.25		20 *h*	2229.716	30	100 *h*
2125.209	50	60	2180.670	10 *c*	10 *c*	2230.85	..	8 *h*
2126.541	50	60	2193.011	8		2231.428	8	
2130.23		25 *h,e*	2193.805	10		2232.545	80 *c*	
2131.181	50	60	2195.77		15 *h*	2233.172	9	
2134.492	20	15	2196.39		20 *h*	2233.54	.	10 *h*
2134.710	30	40	2199.603		8 *h*	2236.22	10	
2134.952	15	20	2199.969	25	100 *h*	2236.724	20	40 *h*
2137.055	15	20	2203.637	60	150 *h*	2237.30		10 *h,l*
2137.546	20	40	2204.617	12		2237.496	80	100
2140.39	15	10	2206.016		40 *H,e*	2238.518	80 *c*	
2144.17	...	9 *h,e*	2207.182	10	20 *h*	2240.31	.	60 *H,e*
2146.14	...	15 *H,e*	2210.534	15	40 *h*	2240.645	15	50 *h,l*
2146.358		50 *H,e*	2210.917	15	20 *h*	2241.011	.	15 *h,l*
2147.197	40	20	2211.46	50 *c*	.	2241.855	8 *h*	
2148.650	30	10 (Sn)?	2214.034	40 *c*		2242.294	20	
2149.539	30	20	2215.54	30 *c*	. .	2242.579	40	50 *h,l*
2154.207	20	10	2217.18	.	10 *H,e*	2242.958	20	
2155.621	25	40 *h*	2217.24		10 *H*	2244.184	....	50 *H,e*
2156.21	...	10 *h,e*	2217.872	15	.	2244.29	....	50 *H*
2156.736	40	20	2219.328		10 *h,l*	2246.176	90 *c*	
2157.27	...	8 *h*	2220.184	70 *c*	..	2246.421	8 *c*	.
2158.135	20	10	2223.672	60 *c*	..	2246.500	....	15 *h*
2160.269	50	100	2224.667	20	30 *h,l*	2246.752	....	100 *H,e*

Columbium, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
2246 98	..	10 *h*	2302 086	100	200	2372 227	...	8 *c*
2247 997	80	.....	2302 695	30	40	2372 730	...	50 *h,e*
2248 282	....	60	2304 77		40 *H,e*	2373 967	....	10 *c*
2248.84	....	50 *H,e*	2309 239	60	100	2374 167	...	8
2249.52	..	60 *H,e*	2309 93	.	15 *H*	2376 398	30	100
2250 308	100 *c*		2310 313	....	8 *h*	2377 989	....	15
2250.463	20	60 *h,l*	2311 456	. ..	20 *h*	2380 148	....	10 *h*
2252 210	25	200	2313 31	. .	200 *H*	2385 251		10 *h*
2252 623	.	15	2313 524	15	10	2387 101	20	80
2253 802	8	. .	2314 850	30	50	2387 399	...	50 *H*
2254 564	150	.	2315 173	20	15	2387 521	30	90
2254 953	20	40	2316 929	...	15 *h*	2388 269	20	40
2255 597	80	150	2317 784	10	10 *h*	2391 912	..	20
2257 537	10	40 *h,l*	2319 589	15	25 *h*	2395 329	20	40
2257 886	160	. .	2320 238	25	20 *h*	2395 824	.	8 *c*
2260 854	20		2320 659	.	8 *h*	2398 484	30	120
2261 531	.	15 *h*	2321 996	20	30 *h*	2402 339	8 *c*	... .
2262 132	15	60 *h*	2322 992	8 *h*	. . .	2402 658	..	8 *h*
2263 219		12 *h*	2323 512		15 *h*	2404 210	.	20 *h*
2263.312	8	10 *h*	2324 063	8	40 *h*	2404 278	....	15 *h,e*
2264 556	20	120 *h*	2324 237	40	50 *h*	2404 895	..	50 *H*
2265 592	. .	50 *H,e*	2326 221		30 *h*	2405 344	25 *c*	50 *c*
2265.676	40	100 *h,l*	2327 131	10	15 *h*	2405 850	30 *c*	60 *c*
2266 732	20	100 *h,l*	2330 202	.	10 *H,e*	2406 942	10	. ..
2268.527	60 *h*	100 *h*	2332 896	10	10	2407 685	.	20 *h*
2269 202		10 *h*	2333 650	10	.	2410 285	10 *c*	20 *c*
2269 865	10	80 *h*	2335 322	15	20	2412 460	40	150 *h*
2270 180	40	120 *h*	2335.620		30	2412 805	.	30 *h,l*
2272 730	40	80	2337 744	20 *c*	. ...	2413 936	.	200 *h,l*
2273 566	60	120 *h*	2338 091		40 *H,e*	2414 485	.	150 *h,l*
2273 91	.	100 *H,e*	2340 025		20 *h*	2415 955		10 *c*
2274 128	50	100 *h*	2340 149	8	.	2416 169	15	30
2274 198	10	50 *h*	2340 277	10		2416 994	40	150 *h*
2274 770	9 *h*		2343 271	10	8	2417 157	.	20 *h,l*
2275 219		150 *H,e*	2344 12	.	15 *H,e*	2417 323	8	15 *h*
2277 426	15	.	2344 517	15 *c*	. .	2418 687	30	150 *h*
2279 386		80 *H,e*	2344 640	8 *c*	..	2419 467	.	10 *h*
2280 450	40	50	2345 333	. .	15 *h*	2421 914	..	150 *H*
2281 136	.	20	2346 532	25	40	2426 794		50 *H,l*
2281 505	.	200 *H,e*	2346 679	10 *c*	.	2427 536	9	. ..
2281 830		80 *h*	2348 756	10 *c*		2428 603		8 *h*
2283 004	100	200	2349 217	.	40 *H,e*	2428 880	. .	20 *H,e*
2284 356		9 *h*	2350 488	8	20 *h*	2431 679	.	30 *c*
2284 41		70 *H,e*	2352 338	20	60 *h*	2432 321	..	10 *c*
2285 223	40	60 *h*	2352 837	30	60 *h*	2432 822	....	8 *c*
2286 352	..	8 *h*	2353 80	10		2433 56		8 *H,e*
2286 749		15	2354 040	15	50	2433 680	10	. .
2288 861	10	30 *h*	2354 470	9		2433 792	15	60 *h,l*
2290 39		150 *H,e*	2355 533	.	20 *H,e*	2435 074		10 *h*
2291 383	8		2355 680	8	.. ..	2435 952	15	50 *h*
2291 644		20 *h*	2356 005	10	30	2436 329	12	.. .
2292 325		8 *h,l*	2356 290	15	40	2437 161	9	.
2293 926	12	40 *h,l*	2360 302	20	70	2437 411	20	50
2294 983		50 *h*	2361 051		10 *H,e*	2437 721	..	15 *H,e*
2295 681	100	250	2362 046		60 *H,e*	2440 976	.	8
2295 972		8	2362 489		30 *H,e*	2441 856	10 *c*	30
2297 611	15	50 *h*	2365 215	30	70	2442 144	15	40
2297 853	..	40 *h*	2365 624		20 *h*	2442 677	..	40
2298 385	8	10	2365 745		10 *h*	2443 529	8	.....
2299 226	8	20 *h*	2366 198	...	20 *h*	2444 479	....	10
2300 339	10	30 *h*	2368 860	15	. ..	2445 066	20	.....
2300 785	40	50	2368 941	. .	9 *h*	2445 832	..	30 *H*
2300 854	8	. ..	2369 954	30	100	2446 080	....	20 *H,e*

SUPPLEMENTARY TABLES OF SPECTRA (Continued)

Columbium, Arc and Spark Spectrum (Continued)

λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark
2446 130	10		2521 404	40	150 *h*	2602 011	8	
2446 439		30 *H,e*	2522 341		8	2603.731		10
2447 966	8	15	2524 985	10		2604 753		10 *c*
2448 258		20 *c*	2525 806	20	100 *h*	2605 013		9
2450 250		10	2527 914		25	2608 958		10
2450 433		12	2530 968	15	80 *h*	2610 268	20	
2451 870	15	60	2531 252		30 *h*	2612 377	15	
2453 084	20		2533 188		30 *h*	2613 854		8 *h*
2453 367	20		2533 914		20 *H,e*	2614 759		10 *h*
2453 853	8	15	2534 445		10 *H,e*	2616 219		15
2453 945		15	2539 224		10	2616 476	30	
2456 999		400 *H,e*	2540.611	20	80 *h*	2617 427		10 *h*
2457.243		50 *H,e*	2541 424	40	50	2620 440	25	80
2458.083	10	40 *h*	2543 980	10		2620 585	8	
2458 310		8 *H,e*	2544 802	50	200 *R*	2622 952	8	20
2459 563		8 *h*	2545 633		200 *H,e*	2623 170	8	
2460 398		100 *H,e*	2548 634	8	30 *h*	2623 507	25	
2461.174		9 *c*	2551 382	50	120 *h*	2627 435	60	
2461 757	10		2553 490		15 *h*	2628 493	20	
2462 047		60	2554 103	12		2628 679		40 *H,e*
2462 889	20		2554 793		8	2630 983		20
2463 732		10 *H,e*	2555 314		8	2632 510	20	60 *h*
2464 432	10		2555.626	20	60	2633 153		80 *H,e*
2464 648		15 *h*	2556 933	40	120	2634 154		20 *H,e*
2466 318	10		2557 942		100 *H,e*	2634 704	10	
2466 563		9	2558 936	20		2637 976	15	10 ?
2466 727	25		2560 622		20	2638 15		50 *H,e*
2468 734		60 *H,e*	2562 402	40	120	2640 918	20	
2469 072	25		2563 913		10	2641.060		30
2469 403		50 *H,e*	2564 070		15	2642 233	40	120 *r,v*
2471 318		20 *c*	2564 735	8		2645 260		30 *H,e*
2472 376		20	2564 846		15	2646 258	60	150 *r,v*
2474 655	15		2565 410	30		2647 500	80 *R*	
2474 82		8 *H*	2565.504		20	2649 515	50 *r*	
2475 881		50 *H,e*	2566 075		40 *H,e*	2651 122	20	80
2477 379	50	150	2567 42		15 *H,e*	2651 810		10
2477 936		20	2567 510	20		2652 944	8	
2478 283	20	60	2568 409		10	2653 372	10	
2479 933	25	80	2569 030	20		2654 446	60 *R*	
2483 721		15	2571 324	25	60	2655 695	8	
2483 878	15	50	2572 099	15		2655 865		8
2484 931		30	2573.136		20	2656 076	40	80 *r,v*
2485 420		9	2574 843		40	2656 984	10	
2486 028		30 *H,e*	2578 203	8		2657 613	40 *r*	
2488.746		40 *H,e*	2578 734	50		2658 027		100 *H,e*
2490 111		20 *h*	2580 284		40	2659 049		15
2490 217		25 *h*	2583 103	15		2660 036		15
2490 848		40 *H,e*	2583 219	8		2661.852	8	
2490 988		15 *H,e*	2583 982	50 *c*	250 *R*	2663 552		10
2493 020		40 *H,e*	2586 087		50 *H,e*	2665 247	20	80
2498 244		30	2587 409		8 *h*	2666 595	30	50
2499 750		300 *H,e*	2588 966		9	2667 146		10
2500 426		10	2590 940	50	200 *R*	2667 300	20	30
2501 41		150 *H,e*	2592 190	50		2667 765	12	35
2502 496	10	40	2593 764		60 *H,e*	2668 283	40 *r*	
2504.250		8 *H,e*	2594 337	10	9	2671 255		10
2504 648	30		2594 736	15	50	2671 933	60	200 *r,v*
2508 535		30 *H,e*	2596.96		20 *H,e*	2673 566	40	250 *r,v*
2511 004	30	120 *h*	2597 138	10		2675 945	40	80 *r,v*
2511.970		40 *H,e*	2597 74		20 *H,e*	2677 664		15
2517 487		10 *h*	2598 882		100 *H,e*	2678 663	15	8
2519.692		12 *c*	2600 156		10	2679 015	20	
2520 507	10		2601 285	25	100	2680 061	10	50

Columbium, Arc and Spark Spectrum (Continued)

λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark
2682 129	10		2771 398		50	2861 091	20	100
2682 469		8	2771 65		20	2864 324	20	
2686 388	10	120 *h*	2773 197	50		2865 609	10	60
2687 149	30 *r*		2779 36	8		2866 672	8	
2691 774	40	60 *r,v*	2779 71	10		2867 28		10 *h*
2692 002		10	2780 235	40 *c*	150 *c*	2868 524	30	300 *R*
2695 038	30		2782 356	20		2870 37		10 *H,l*
2696 052	8		2789 76		8	2874 564	15	
2697 067	100	300 *R,v*	2790 580		10	2875 386	50 *c*	300 *c,R*
2698 866	50	100 *r,v*	2791 742	8	80	2876 951	30	150
2700 153		15	2793 044	20	80	2877 026	50	200 *c,R*
2700 872		10	2795 14		15	2877 62		10
2702 197	30	60 *r,v*	2795 868	9		2877 85		10
2702 521	20	40	2797 693		100 *c*	2878 739	8	9
2704 250		20	2798 903		25	2879 359		15
2706 395	10	20	2800 315	10		2879 492	8	
2707 834		20	2803 810		15	2880 712	10	100
2715 344		50	2805 98		8 *h*	2882 471		10
2715 690	8		2806 913		15 *h*	2883 168	60 *c*	300 *c R*
2715 882		40	2808 050	10		2884 968	12	
2716.100	15		2809 172		8	2887 088		8
2716 309	10	15	2810.810		100	2887 70		10
2716 630	60 *r*	150 *r,v*	2811.70		15	2888 824	30 *c*	150 *r*
2717.33		10	2815 399		20	2889 898	10	
2717 63		8	2816.678		30	2890 350		10
2721 632		8	2818.199		20 *c*	2891 41		10 *H l*
2721 987	50 *r*	150 *r,v*	2819 215	15		2893 04		8 *H,l*
2723.660		40 *h*	2819 893		15	2894 43		20 *c*
2723.986	15		2820 803		12	2897 803	30	200 *R*
2727 43		8	2821 924	8		2899 230	40 *c*	200 *r*
2730 324		60	2823 34		10 *d?*	2900 67		40 *H*
2733 258	20 *r*	40 *r,v*	2823 89		10	2903 650	10	
2733.464		8	2825 180	10		2908 236	40	200 *r*
2733.74		15	2825 86		8	2908 93		120 *r*
2734.36		15	2826 47	12		2910 580	50	400 *R*
2737 083	15	60	2827 071	25		2911 740	20	200 *R*
2740 185	8	100	2827 116		30	2915 412		10
2741 146	10		2829 750		15	2916 09		8 *c*
2743 478		8	2830 56		20	2917 050	8 *d*	100
2744 97		30 *c*	2832.78		10 *h*	2918 56		10
2745.303		20 *c*	2833 312		8	2923 025	8	
2745 725		40	2835 106		50	2924 824	10	
2746 10		30 *H,l*	2836 245	30		2925 360	8	
2746 910	30 *r*		2840 929	10		2927 804	100 *c*	600 *c,R*
2748.848	30 *r*		2841 141	40 *c*	80 *c*	2930 267		60
2750.58		15	2842 642	30	100 *r*	2931 458	10	70
2753 007	10		2843 640		20	2932 13		30
2753 133		200 *c*	2844 428		40	2932 658		25
2754 523		40	2845 32		10 *H,l*	2935 282		20
2755.288	20		2845 798		20	2936 67		20
2755 632	10		2846 280	20	60	2937.327		25
2757 256		40	2847 23		15	2937 707		100
2757 50		10	2848 296		20	2938 067	15	
2758 605	50 *r*		2849 04		10 *H,l*	2941.536	60 *c*	500 *c,R*
2758 78		50	2849 557		100 *c*	2945 890	12 *c*	100 *c*
2760 990	10		2851 446	20		2946 110	10	60
2762 32		8	2851 978	15		2946 890	10	80
2763 380	15		2854 168	12		2950.876	80 *c*	800 *c,R*
2763 59		15	2855 54		8	2954 538		20
2764 561		10	2857 294	10		2956 89		20
2765 271		9	2858 974	10 *d?*		2961 64		15
2768 124	20	100 *r,v*	2859 038		20	2965 48	10	
2769 561		10	2859.962	15		2965 871		8 *c*

Columbium, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
2968.29		10	3053.631		90	3133.088	15	
2970.40		10	3055.520		200	3134.342		40
2970.47		10	3056.608	9		3135.409		25
2972.568	50 *c*	200 *c*	3057.03		12	3135.920		30
2974.094	25	400 *r,v*	3059.294		20	3136.972	15	
2974.72		10	3061.100	8		3140.506	8	100
2977.67		150 *c*	3061.232	10		3142.26		100 *r*
2978.943		80	3061.95		10	3144.353		60
2979.875		80	3063.126		40	3145.405	50	500 *r,r*
2980.717		150	3063.782	9	120	3146.92		30
2981.636	15		3064.530	40	250 *r*	3150.409		50
2982.100	20 *d*	100	3065.26	20 *c*	100 *c*	3151.870	30	
2985.04		50	3066.09		60	3152.160		200
2987.286	15		3067.523		20	3152.785		70
2987.55		9	3068.06		20	3153.851		10
2989.944		40 *h*	3069.023	10		3153.98	10	
2990.28	30 *r*	200 *c*	3069.68	15	100	3154.820		150 *c*
2991.956		80	3070.893		80	3155.599		30
2993.806		20	3071.18		40	3158.104		10
2993.97		20 *c*	3071.55	10 *c*	90 *c*	3159.855		15
2994.725	80 *c*	300 *c*	3072.18		10	3161.194	8	
2997.48		8	3072.397	10		3163.149		10
3001.125		50	3072.502		60	3163.403	100 *R*	1000 *R*
3001.85		150	3073.232	10 *d*	50	3168.599	8	
3002.204		40	3075.250		10	3171.425	10 *c*	
3004.65		10	3076.864	30 *d*	200	3171.80		50 *h*
3005.141	9		3077.44		10	3172.511	12	
3005.764		60	3080.345	15 *r*	100	3173.205	10	150
3008.39		20 *c*	3081.09		8	3175.76		50
3010.38		20	3081.77		40	3175.86	10	150
3010.685		25	3082.859	10		3179.242		8
3011.61		10 *H,l*	3083.32		30 *c*	3180.290	50	400
3014.438		15	3084.369		50	3181.403	8	40
3015.02		30	3086.09		20 *h*	3184.229		150
3015.24	8		3087.860		90	3186.550	15	
3015.82		20	3088.05	9		3187.497	40	
3018.853		100	3094.172	200 *r*	2000 *c,R*	3189.288	10 *r*	180 *c*
3019.57		8	3096.490	10		3191.096	100 *c*	200 *c*
3020.668	20		3097.115		60 *c*	3191.427	15	250
3021.885		8	3098.47		10	3194.27		30 *r*
3022.738	8	200	3099.180	15	100	3194.983	100 *r*	700 *R*
3024.258		10	3100.25		50	3197.28		20 *h*
3024.735	20 *c*	250	3100.79		20	3198.227		20
3025.372		40	3101.918		20	3200.537	15	
3028.436	80 *r*	300 *c*	3104.27		8	3203.148		10 *h*
3028.76		10	3106.520		10	3203.357	10	150
3029.76		60	3106.980		80	3204.973		100 *c*
3029.86		20	3110.800		20	3206.350	50	300 *r,r*
3032.767	40+(Sn)	400 *r,r*	3111.446	20		3207.341		20
3034.95		200 *c,R*	3113.17		30	3208.10		8
3038.18		10 *H,l*	3115.16		15	3208.585		40 *c*
3039.398		10	3115.533		20	3210.29	15	
3039.68	20		3116.366	15		3211.814		20
3039.818	20 *c*	150 *c*	3116.57		10 *r*	3212.14		10
3041.98		10 *r*	3122.646	15		3215.229	10	
3042.790		15	3125.892		10	3215.595	60 *r*	300 *c,r*
3043.272		10	3127.526	30	500	3217.00		60 *r*
3048.093	20		3128.372		20	3217.288	30	
3048.21		80 *r*	3128.92		10	3217.865	20	
3049.528		40 *c*	3129.65		60	3220.927	15	
3051.34		15	3130.780	150 *r*	1500 *c,R*	3221.126	15	
3051.990	8		3132.015		10	3221.655		8 *c*
3053.086	10		3132.767		60	3222.065		50

Columbium, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
3223.332	10	100	3296.025	80	10	3352.592	15	. .
3224.434	8	.	3296.478	10	.	3352.868	10 *c*	
3225.194	9		3297.055		20	3353.509	15	10
3225.478	150 *c*	500 *c,R*	3297.286	8 *d*		3354.743	80	15
3229.567	20	100	3297.673		15	3355.423	12	
3230.243	.. ...	40	3298.410	12		3356.465	8 *c*	.
3236.403	80	300 *r*	3299.57		50	3357.043	25	
3237.187	8		3299.608	30		3358.422	250 *r*	40
3237.690	....	60	3301.498		40	3360.904		100
3238.020	10 *c*	80 *c*	3302.183	15 *c*		3362.17	.	20 *h*
3241.818	.	40	3302.619	.	10	3362.866	10	...
3242.423		8	3303.323		50	3363.750	15 *d*	..
3242.532		40	3304.71		40	3365.594	15	100
3244.515		30	3304.836	20		3365.94		100
3246.782	15		3305.608		70	3366.956	50	10
3247.478	12 *c*	150 *c*	3308.050	40		3367.085	8	. . .
3248.941	10	80	3310.469	25		3367.382	25	. .
3249.517	50		3310.67		20 *h*	3368.426	10 *d*	. . .
3250.27		40	3311.341	15		3369.081	20 *c*	. .
3251.260	.	50	3312.607	120	15	3369.155		100
3251.490	9		3315.226	40		3369.840	20 *d*	. . .
3251.630	30		3316.61		15	3370.154	.	50
3252.430	.	10	3318.982	50		3370.609		30
3254.070	60	200 *r*	3319.22		10 *c*	3371.331	40	. .
3254.888	. .	25	3319.265	40		3372.101	10	. .
3260.139	20		3319.590	15	100	3372.565	8	120
3260.564	30 *c*	350 *c*	3320.808		80	3374.087	. .	20 *h*
3261.702		60	3322.816	8		3374.252		50
3263.365	10	300	3323.900	.	30	3374.928	60	10
3264.597	40		3324.555		30	3376.341	12	..
3266.11	. .	80 *c*	3324.661		50	3376.732	15	
3266.413	9		3325.436		20 *h*	3377.375	.	9 *c*
3267.052	15	.	3326.621	50		3379.300		60
3267.684	. ..	30	3327.923	10		3380.055	20	..
3269.125	.	20	3329.16		20 *h*	3380.420	40	. .
3270.465	25		3329.364	40		3380.862	20	..
3270.761	20		3329.622	10	.	3380.934	...	150
3271.982	10	.	3331.895	10		3382.44	.	40 *h*
3272.074	25		3332.164	25		3383.302		10 *c*
3272.224	.	100	3332.704	15		3383.802	15	.
3272.350	..	10	3333.970	10		3384.662	20	
3273.511		20	3334.529	..	8 *c*	3385.665	12	
3273.888	.	15	3334.82		8	3385.815	10	..
3274.796	. . .	30	3335.244		10 *c*	3386.243	20	250
3277.676	50		3335.420	20 *c*		3386.995	20	. .
3279.248	.	20 *c*	3336.321	15		3387.579	10	..
3279.826	8		3339.158	12 *c*		3387.754	15	.
3279.979		80 *h*	3339.268	8		3388.939	. .	30
3283.463	25	400	3340.45		60 *d*	3390.623	25 *c*	..
3285.668	60		3341.612	10	150	3391.332	10	.
3285.70	.	30 *c*	3341.982	200 *r*	20	3391.594	..	9
3286.340	.	40	3343.712	150 *r*	15	3392.345	100	10
3287.592	50		3343.967	8	80	3393.810	. .	10
3287.923	40		3344.25	.	8 *h*	3394.090	12	.....
3289.460	8		3346.286	.	20 *c*	3394.978	8	60
3289.551		10	3346.760	10	30	3395.72	.....	15
3290.007	15		3346.935	25		3395.928	40	.....
3291.055	10 *c*	30	3348.28	. .	20	3396.365	......	50 *h*
3291.921	10		3348.787		15	3397.319	...	10 *h*
3292.020	15	200	3349.068	200 *r*	10	3398.254	15	.. ..
3292.365	...	10 *c*	3349.351		100	3399.399	25	.
3294.367	...	150	3349.524	40 *c*	.	3399.714	15	30
3295.506	.	20	3352.282	12		3399.967	10	......

Columbium, Arc and Spark Spectrum (Continued)

λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark
3401 231	8	10	3462 647	15		3523 156	12	...
3402 02	..	20	3463 033	10	.	3524 93	8	...
3403 013	15 c	..	3463 685	8		3525 219	30 r	..
3403 755	10	.	3463 813	25 r	10 c	3525 88	8	...
3405 418	60	10	3465 860	30	.	3525 986		50 h
3406 140	40	.	3467 474	15	.	3527.024	..	8 c
3406 616	10		3468 127		15 c	3527 108	10	......
3406 947		10 h	3468 549	8	..	3527 959	10	...
3407 32		10	3469 442	15		3528.315	10 c	..
3407 980	10		3470 27		50	3528 474	....	30
3408 380	50		3471 198	10	.	3528 890	.	20
3408 678	20	100	3471 526	9	.	3529 394	8 c	.....
3409 191	20	100	3473 020	30 r	.	3530 093	10	.....
3409 915	15		3474 004		20	3533 667	40	...
3412 480	.	10 h	3474 68		25 r	3534 05		10 h
3412 934	25	150	3475 590	15		3534 114	20 r	..
3413 209	.	20	3475 990	10 r	.	3534 215		50
3413 51	10 d		3478 010	8	.	3535 304	400 c	20 r
3414 070	15		3478 690	40		3537 475	150	...
3415 984	30 r		3478 79		100	3537 625	8	40
3417 867	15		3479 567	20	150	3539 650	15 d	
3420 633	10	80	3480 213		80	3540 961	30	200
3421 161	..	20 r	3481 054	15		3541 247	.	50
3422 85		10	3481 265	9		3541 898	20 r	..
3423 765	30		3482 953		100	3542 560	10	
3425.432	30 d	300 r	3484 054	15	80	3542 983	15	.
3425 855	30 c		3484 625		10	3543 936	12	
3426.562	25 d	250 r	3485 102	8		3544 031	50	.
3427 454	50		3485 935	12		3544 346	.	15 h
3428 795	15 c		3488 81	.	80	3544.656	50	8
3429 059	20		3489 093	10	90	3546 031	12	.
3431 064	8 d		3490 418		10	3546.489	8	
3431 955	10		3491 024	50 d		3548 130	15	..
3432 420	15 c		3491 477	15		3549 263	12	.
3432 708	10	400	3491 896	.	20	3550 237	10	.
3433 099	12		3496 027	20 r	30 r	3550 448	50	
3436 834	..	20	3497 815	30		3551 102	8	
3436 964	15	60	3498 631	60 r	10 r	3553 613	10 c	
3438 41	...	80	3499 93		30 c	3554 524	60	.
3439 342	8		3499 957	8 r	.	3554.666	80	8
3439 925	10	60	3500 109	8		3556 022	10	.
3440 589	30	200	3500 74		10 h	3558 015	9	..
3441 64	..	10 r	3501 32		15	3559 128	12	
3442 655	12		3503 206	20		3559 592		60
3442 800	10		3505 812	12		3561 142	12	..
3443 737	..	20	3506 991	10		3563 501	100	...
3444 281		60	3507 960	80		3563 624	80	.
3445 67	40 r	8 r	3508 529	8 c		3564 075		15 h
3448 221	.	40	3510 262	20 r	400	3565 052	10 r	.
3448 674	.	20	3511 13	10 c		3566 10		40 h
3450 766	..	60	3511.189	20 r		3568 001		40 h
3451 640	..	20	3514 02		20 c	3568 50		30
3452 350	.	40	3515 421	20 r	200 r	3568 515	10 r	...
3452 373	20 c		3516 198	10		3568.727	20	..
3452 652	15 c		3516 863	15	.	3569 464	40	...
3454 708	....	60	3517.111	10		3574 202	..	10
3454 910	...	80	3517 670	..	150	3575 139	20 r	...
3456 543	12	.	3517 77	12		3575 850	200	20
3457 801	20	.	3518 180	8		3577 238	8 c	...
3458 728	...	10	3520 055	40	.	3577 721	40	...
3458 951	12	.	3520 717	12		3580 277	400 r	50
3459 56		15	3521.14	.	20 h	3580 788	9	...
3459 702	25		3522.368	...	10 h	3582 062	10 c	

SUPPLEMENTARY TABLES OF SPECTRA (Continued)
Columbium, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
3582 369	25		3641 382		20	3704 137	40 c	8 c
3584 972	100	10	3643 343	15		3705.602	10 c	....
3586 75		50 h	3643 725	25 c		3707 803	10	
3587 400	9 d		3644 935	20		3707 96	.	60 c
3588 02	.	10 h	3645 360	9		3708 900	8	..
3589 106	100	10	3647 306	20 c		3709 29	.	100 c
3589 356	100 c	10 c	3649 854	60		3709 422	25	.. ...
3589 960	8		3650 803	40 c		3710 448	20 c	.. . .
3590 712	10 c		3651 182	30	200	3711 343	60	... .
3590 904	10		3652 25		8 h	3711 782	12	..
3591 197	..	40	3654 430	10 c		3713.018	300 r	20
3591 790	9		3655 975	20		3713 356	...	25 h
3593 966	80	9	3657.110	15		3713 72	. .	50 h
3597 260	15 c		3657 897	8		3713 819	20	....
3597 514	8		3659 602	20 c	300	3716 214	30 c	. ..
3598 343	12 d	. .	3660 364	100	10	3717 01	40 c	....
3599 279	20 c		3661 680	10 c	.	3717 06	20 ?	300
3599 635	20		3662 051	15		3717 538	30	.
3602 561	60	10	3663 167	8 c		3719 63	.	30 c
3603 435	10		3663 751		60 h	3720 456	10	100
3603 962	8		3664 692	80	10	3721 517	10	.
3604 072	8 c		3665 157	10 d		3722 328	15	.
3604 66	..	8 h	3666 534	15		3722.548	..	40 h
3606 272	8 c	.	3667 001	12 c		3722 942	20 c	.
3606 492	10 d	.	3667 665	10 c		3723 44		30 h
3606 806	8		3667 760	8		3725 195	20 c	...
3607 01	..	15	3668 626	20		3726 235	250	20
3608 013	10 d		3669 009	40		3727 229	20	. . .
3608 316	9		3669 347	8 h		3731 534	8 c	....
3610 002	8 c		3669.736	20 d		3732.034	15	. ...
3612 657	9		3670 05		20 h	3733 344	15 d	....
3613 013	9		3671 372	12	..	3733 622	15	. . .
3615 500	30 c	8 c	3672 443	9		3738 427	30	.
3616 216	10	. .	3672 580	8		3739 80	300 r	30
3617 714	15		3673 227	8 c		3740.537	8 c	.. .
3618.441	15	.	3674 691	15		3740 726	10	200
3618 907	15	.	3674 787	40 c	.	3740 845	40	..
3619 207	10		3675 304	10		3741.292	. .	10
3619 514	30	200	3676 307	20		3741 776	30 c	.
3619 729	15 c	100 c	3676 335	..	15	3742 393	200 r	20
3621 030	40		3677 084	20	.	3744 007	40 c	8 c
3625 169	15		3677.771	15		3746 904	25	..
3625 717	15		3678 063	. .	40	3748 557	20	. .
3627 870	8		3678 70	10 c		3750 637	10	.
3628 180	. .	40	3679 61	.	10 h	3751 285	. ...	20
3629 47		30	3685 128	10 c	.	3752 723	9	. .
3630 623	15	.	3686 557	10	.	3753.171	40	.. .
3633 006	15		3687 440	8	.	3755 289	10	. . .
3633 318	..	100	3687 968	20 c	200 c	3755 764	20	. .
3633 717	20		3688 187	10	50 h,l	3759 556	200 r	20
3634 452	15		3688 698	15		3760 646	12	.
3634 489	.	40	3689 038	15		3760 76	. ....	15 h
3635 328	15	.	3691 174	... .	30	3761 130	30 c	.. ..
3635 852	12 c	.	3693 365	20	.	3762 445	10 h	.
3636 959	30 c	.	3694 669	20		3763 13	. .	8 h
3637.545	20	. .	3694 792		10	3763 492	40	.. ...
3637 830	35 c		3695 90	8	100	3764 115	25	. ....
3637 86	.... .	15 h	3696 68	. . .	10 h	3765 074	40 c	.. ...
3638.792	20 c	. .	3697 397	20		3766.140	30 c	.. .
3639.058	....	30	3697 850	200	20	3769 145	20	.....
3639 335	40 c		3699 928	30 c	. ...	3769 983	15	
3640 638	30	.. .	3703 167	30 c	. . . .	3770 66	.. ..	30 h
3641.293	. .	15	3703 916	20 c	.	3770.71	12 c	.....

Columbium, Arc and Spark Spectrum (Continued)

λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark
3770 870	20		3855 456	15		3936 442	10	
3771 848	40		3855.500		50 *h*	3937 437	150	15 *r*
3773 154	10		3858 953	40		3937 961	20	
3774 44	8		3860 860	12 *c*		3938 547		100 *h*
3775 449	20		3862.926	20 *c*		3941 266	40 *c*	
3777 277	8		3863 056		150	3943.663	60	10
3777 670	15 *c*		3863 383	50		3947 516	20	
3779.57		20 *h*	3864 364	8		3949 326	8	
3781 017	80		3865 019		100 *h*	3949 451		60 *h*
3781.379	10	200	3865 041	10 *d*		3949 927	9	
3783 844	20 *c*		3867.918	50 *r*	10 *c*	3952 367		100 *h*
3786 227	10		3868.570	8		3953 071	10	
3787.064	150	20 *r*	3868 829	9 *d*		3955 680	20	
3787 280	8 *c*		3871 188	20 *c*		3955 882		30 † (N)
3787 480	15		3875 421	10 *d*		3959 356	15 *c*	
3789 502	20		3875 77	20		3960 994	10 *c*	
3790 138	200 *r*	30 *r*	3876 964	20 *c*		3961 62		10 *h*
3791 209	300 *r*	40 *r*	3877 557	60 *r*	10 *r*	3962 163		8 *h*
3791 446	8		3878 817	40		3964 26		60 *h*
3792 79		30 *h*	3878 965	20		3965 692	40	
3794 476	15		3879 350	15 *c*	200 *r*	3966 094	25	
3795 543	30 *h*		3882 660	8		3966 246	100	
3796 440	20 *c*		3883.140	80	15	3966 276		80 *h*
3796 599	12		3885 453	150 *c*	30 *c*	3967 36		40 *h*
3796 850	15 *c*		3885 686	100	20	3969 130		60 *h*
3798 127	300 *r*	40 *r*	3886 074	20		3970 650	12	
3800 941	20		3887.32		15 *c*	3971 679		30 *h*
3801 146		80	3889 64	8 *c*		3971 852	20	
3801 302	20		3891 302	60	10	3971 932	15	
3802 928	400 *r*	40 *r*	3893 733	40		3972 52	40 *c*	15 *r*
3803 879	100	10	3894 039	50	10	3973 624	20 *c*	
3804 01		10	3894 70	10		3976 52		200 *h*
3804 204	10 *c*		3895 895	20		3976 677	15 *r*	
3804.733	40	100	3898 292	8	200	3977 940	20 *c*	
3806 196	20		3898 563	20		3978 753	12	
3806 631	10		3899 24	15 *r*		3979 370	10	
3810 50	80 *r*	30 *r*	3904 188	30 *r*	10 *r*	3980 483	60 *r*	10 *r*
3811.035	50		3906 900	12		3982 055	10 *c*	
3815 507	60 *r*	10 *r*	3908 592	8		3983 939		10 *h*
3816.342	15		3908 971	40		3988 158	20 *r*	
3818 862	20	200	3909 600	15		3991 677	40 *c*	8 *c*
3819 148	40		3913 011	15		3999 182	40	8
3821 201	12 *r*		3913 15	8 *c*		3999 71		8
3824 882	100	10	3914 692	150	30	4000 605		80 *h*
3827 015	12		3919 005	10		4001 135	15 *r*	
3828 242		40	3919 163	15 *r*		4008 286	30	
3830 006	10		3919 718		100	4009 707	20	
3830 601		20 *r*	3920 198	100 *r*	15 *r*	4012 165		80 *h*
3831 840	15	200	3920 754		50 *h*	4012 902		8 *h*
3833.257	10 *c*		3921 34		10 *h*	4013 268	20	
3835 176	40		3922 353	12		4016 070	10 *h*	
3836 452	20		3924 474	12 *r*		4017 558	15	
3837 077	12 *c*		3924 995	40 *r*		4022 387	9 *c*	
3841 666		10	3926 618	9		4023 141	12	
3841 820	30		3929 296	30 *r*		4023 275	8	
3842 709	20		3930 022		10 *h*	4027 311	12	
3843 397		8 *h*	3931 460	8		4027 972	15 *r*	
3843 927	10 *c*		3931 79		30 *h*	4030 348	10 *h*	
3844 090	12		3933 392	8		4032 524	150	25
3845 900	40		3934 142	12 *r*		4033 195	40	
3853 388	20		3934 405	20		4035 095	10	
3854 698	9		3935 441	20 *c*		4035 923	12	
3855 146	12		3936 02		150 *c*	4037 67		40 *h*

SUPPLEMENTARY TABLES OF SPECTRA (Continued)

Columbium, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
4038.172	8 *h*	....	4127.458	12 *c*	....	4217.946	150 *c*	25
4039.094	15	....	4129.430	100 *c*	15 *c*	4218.53	....	30 *h*
4039.530	60 *c*	12 *c*	4129.931	150 *c*	30 *c*	4220.598	....	15 *h*
4040.468	8	....	4134.592	30	....	4222.676	9	....
4042.572	10	....	4135.423	10	....	4226.528	8 *c*	....
4043.169	10 *c*	....	4137.090	200	30	4227.514	8	....
4044.103	25	....	4137.590	12 *c*	....	4228.726	8 *c*	....
4044.712	12	....	4138.300	10 *c*	....	4229.154	100 *c*	30 *c*
4049.759	20	....	4138.46	....	10 *h*	4229.832	25	....
4051.513	25	....	4139.430	90 *c*	10 *c*	4230.320	20	....
4055.186	8 *c*	....	4139.702	400 *c*	50 *c*	4231.954	25	....
4056.941	8	....	4142.243	9	....	4237.814	12 *c*	13
4058.933	2000 *c*	200 *c*	4143.201	80 *c*	10 *c*	4241.453	12	....
4059.498	40	....	4146.000	10	....	4242.637	20 *c*	....
4059.68	....	10	4147.184	25 *c*	....	4246.293	20	....
4060.32	10	....	4148.735	15	....	4248.658	8	....
4060.800	40 *c*	10 *c*	4150.124	100	25	4249.457	20	....
4061.255	9	....	4152.040	20 *c*	....	4252.977	80 *c*	20 *c*
4061.542	10	....	4152.575	500	80 *c*	4253.695	50 *c*	10 *c*
4061.98	....	60 *h*	4156.678	....	100 *c*	4254.392	....	30 *c*
4063.734	....	10 *h*	4158.007	20	....	4254.693	30	....
4064.058	....	15 *h*	4160.806	8	....	4255.439	60 *c*	20 *c*
4064.802	10	....	4161.252	20 *c*	....	4255.943	20 *c*	....
4066.120	12	....	4162.817	12 *c*	....	4258.917	12 *c*	....
4067.159	15	....	4163.474	40	....	4261.717	20 *c*	....
4068.258	40 *c*	15 *c*	4163.658	250	50	4262.056	100	20
4070.965	20	....	4164.661	300	60	4266.020	50	10
4072.064	....	15	4165.850	20	....	4266.27	....	8 *h*
4073.09	....	20 *h*	4168.122	250 *c*	50 *c*	4267.65	....	20 *h*
4076.09	8	....	4169.565	30 *c*	....	4268.667	15	....
4077.09	15 *c*	....	4173.955	12 *c*	....	4270.691	50 *c*	20 *c*
4079.10	....	10 *c*	4174.342	15	....	4272.972	8	....
4079.726	1000 *c*	100 *c*	4179.763	12	....	4274.692	20	....
4084.177	10	....	4181.341	15	....	4274.87	....	12 *h*
4084.861	40	8	4184.440	50 *c*	15 *c*	4277.500	20	....
4085.35	....	20 *h*	4185.54	....	50 *h*	4279.49	20	....
4086.630	9	....	4186.104	15	....	4279.707	8	....
4089.41	....	10 *h*	4189.997	12	....	4280.586	30	10
4090.163	20	....	4190.655	20 *c*	....	4286.216	15	....
4095.082	8 *h*	....	4190.889	150 *c*	25 *c*	4286.987	60	15
4095.930	....	20 *h*	4192.065	100 *c*	15 *c*	4289.443	30	8
4097.63	10 *c*	....	4193.80	....	10 *h*	4291.195	25	....
4098.220	10	....	4193.828	10 *c*	....	4292.035	20 *c*	....
4099.067	30	....	4195.096	80	20	4292.480	40 *c*	15 *c*
4100.389	80	15	4195.660	15	....	4295.620	15	....
4100.918	600 *c*	100 *c*	4196.948	9 *c*	....	4296.159	20 *c*	8 *c*
4104.165	....	50 *h*	4198.370	10 *c*	....	4299.596	100	20
4106.173	12	....	4198.510	30	....	4300.53	....	10 *h*
4110.32	....	20 *h*	4198.847	10	....	4300.989	100	15
4110.81	....	8 *h*	4199.23	....	8 *h*	4302.91	....	8 *h*
4112.130	20 *c*	8 *c*	4201.519	40	10	4303.875	9 *c*	....
4113.941	25	....	4204.322	10	....	4306.283	15	....
4114.56	....	10 *h*	4205.308	120	30 *c*	4308.117	15 *c*	....
4115.597	....	10 *h*	4206.127	10	....	4308.692	20 *c*	....
4116.895	50	10 *c*	4208.156	30	8	4309.564	20	....
4119.284	....	100 *h*	4212.042	12	....	4311.20	50 *c*	30 *c*
4119.74	....	10 *h*	4212.535	15	....	4311.37	20	
4122.804	15	....	4213.256	10 *c*	....	4311.695	15	....
4123.812	400	60	4213.463	10 *c*	....	4312.454	25	....
4125.243	20 *c*	....	4214.70	....	10 *c*	4313.887	10 *c*	....
4125.573	12	....	4214.732	100 *c*	....	4316.476	12 *c*	....
4126.180	....	20 *h*	4214.81	....	20	4317.72	....	40 *h*
4126.903	8 *c*	....	4216.228	....	50 *h*	4318.010	10	....

Columbium, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
4321 49		50 h	4458.117	15	.....	4670.104	.....	100
4323.466	8	.....	4460.17	.....	12 c	4672 097	200 c	100 c
4326.320	100 c	30 c	4460.203	15 c	.....	4673 589	12 c	.....
4326.540	9	.....	4460 423	20 c	8	4675 371	150	60
4327 385	25 c	8 c	4464.151	20	.....	4678 44	10	} 8 d
4328.428	30 c	9 c	4467.92	.....	20 h+(O)	4678 51	12	}
4329.732	20 c	.....	4469.322	10	.....	4682 664	10 c	.....
4331.371	60	15	4469.714	40 c	12 c	4685.133	100	40
4337.561	12 c	.....	4471 292	50 c	20 c	4685 518	9	.....
4342 818	25	.....	4472 536	40 c	10 c	4685 925	9	.....
4345 29	9	.....	4481.445	8	.....	4689 162	10	.....
4345.34	10	.....	4492.962	.....	200 h	4694.50	15 c	.....
4346 120	10	.....	4494.545	10	.....	4695 46	20 c	10 c
4347.312	8 c	.....	4495.46	.....	8 c	4697.468	30	15 c
4348.652	40 c	.....	4499.805	20	8	4699 58	.....	150
4349.026	30	.....	4503 040	50	20	4706 132	100 c	70 c
4350 302	9	.....	4503.416	10		4708 284	150	100
4351.573	40	10	4508 409	15	.....	4713 038	9 c	.....
4353.266	20	.....	4511 084	30 c	10	4713 495	80	20
4359.865	40 c	20 c	4522 21	.....	30 h	4715.819	20	8
4361 656	9	.....	4523.409	200	30	4718.024	8	.....
4367.387	.....	20 h	4524.127	20	.....	4723 795	15 c	.....
4367.966	.....	100 h	4527 648	.....	50 h	4727 320	10 c	.....
4368 434	50	10 c	4535 69	.....	8 c	4730 312	20	.....
4369 618	8	.....	4542 797	12 c	.....	4733 483	30 c	10 c
4370 361	15		4546 820	120	30	4733.885	60 c	40 c
4372 645	.....	40 h	4547 847	8	.....	4735 339	10	.....
4374 789	12 c	.....	1548.71	.	10 h	4736 49	20 c	8 c
4377.958	30 c	10 c	4550.10	.....	50 h	4740 61	15 c	.....
4379.525	12	.....	4553 839	30	10	4743 839	15	.....
4381 114	10 c		4556 854	15	.....	4744.622	30	20
4382.856	9 c		4564 530	60	20	4745 020	10 c	.....
4384 870	15 c		4573 077	200 c	60 c	4746 987	9 c	.....
4387 743	15	.....	4574.848	25 c	10 c	4749 706	200 c	150 c
4388 357	30	8	4575.372	12	.....	4751.44	20	8
4392 692	30	10	4579.446	.	150 h	4755.318	10 c	.....
4397 036	10	.....	4581.623	100	50 c	4766.80	30 c	20 c
4400 368	10 c	.....	4582 283	20	.....	4773.24	20 c	9 c
4400 832	10		4589 00		30 h	4789.959	25	100
4401.172	.....	50 h	4593.79		50 h	4790 902	9	..
4406 546	10 c		4599 475	10 c	.....	4802 442	9	..
4408 729	.....	10 h	4600 22	30	15	4807.052	10	.....
4410 214	60	15	4606.760	200	80	4809 357	30	12
4411 526	15	.....	4608 567	9 c	.....	4810 584	100 c	50 c
4414.879	8 c	.....	4609.90	.....	8 h	4811.237	12 c	.....
4419 448	40	10	4612.108	8	.....	4816 375	80 c	40 c
4419.839	10		4616.162	50	20	4824.17	..	12 h
4420 455	10		4630.115	100	50	4829 302	30	15
4420 637	30 c	8 c	4637.575	.....	20 h	4833 362	40	15
4421 660	.....	20 h	4638.105	10	.....	4837 615	15	.....
4424.66	.....	30 h	4643.315	10	.....	4837.98	20 c	8 c
4426 690	20	.....	4643.682	10 c	.....	4842 139	20 c	8 c
4427.05	.....	10 h	4646 952	20 c	10 c	4845.170	20	8
4429 446	20 c	.....	4648.949	100	40	4848.359	100 c	70 c
4437.218	100 c	60 c	4649.255	40	20	4865.99	.....	12 c
4441.802	10 c		4652.19	.....	10 h	4866 842	12 c	.....
4445 843	15 c	.....	4658.186	12	.....	4868 99	20	10
4446.181	12	.....	4660.41	.....	10 h	4880 714	8 c	.....
4447.184	100	10	4663 831	100	40	4890 739	25	15
4447.737	.....	10 h	4665.823	10	.....	4892 50	12 c	.....
4449.912	.....	50 h	4666.251	100	50	4893 885	.....	15 h
4456.800	30	.....	4667.224	50	20	4895.574	10 c	.....
4457.424	50	10	4669 868	10	.....	4900.786	20	.....

Columbium, Arc and Spark Spectrum (Continued)

λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark
4904 534	25	.	5318 597	50	30	5693 07	8	......
4910 948	30	15	5319 485	15	......	5706 16	15	8
4916 392	15 *c*		5331 19	. ..	10 *h*	5706.47	50	20
4928 969	15	.	5334.864	30 *c*	15 *c*	5709 33	15	......
4941 513	9	.	5340.793	10	......	5716 34	30	20
4945 432	12 *c*	.	5343 602	8 *c*	......	5725.66	9	......
4957 393	8 *c*	.	5344.160	200 *c*	100 *c*	5729.185	80	30
4957 74	....	8 *h*	5350 723	100 *c*	60 *c*	5746 90	....	20 *h*
4965.375	25 *c*	12 *c*	5355 683	9	......	5751 43	40	20
4967 777	30 *c*	20 *c*	5356 84	....	15 *h*	5753 06	......	30 *h*
4971 917	10 *c*	.	5363.075	...	8 ?	5760 33	80	30
4973 138	15	. ..	5365.88	.	100 *h*	5764.98	40	20
4975 135	10 *c*	. ..	5375.262	8	....	5771.06	10 *c*	....
4988 972	40	15	5381 326	10	. ....	5776.07	30 *c*	20 *c*
4994 303	12	.	5383.87	.	10 *H*	5780 31	8	.....
4997 880	15	. ..	5393.98		10 *H*	5787 52	80	30
5000 958	20 *c*	10 *c*	5408.92	. .	20 *H*	5794.24	20	10
5002 247	12	.	5411 235	8	......	5804 02	30 *d*	15
5013 275	9 *c*	..	5422 42	20	10	5815 316	15 *c*	......
5017 743	40	20 *c*	5431 25	12 *d*	....	5819.415	80	50
5019 512	8 *c*	. .	5433 54		50 *H*	5820.61	20 *c*	10 *c*
5026 362	20	10 *c*	5437 265	50	30	5834.88	40	25
5039 032	40	15	5439 78	. ..	50 *H*	5838.13	15 *c*	.....
5047 956	12 *c*	. . ..	5448 306	8	. ....	5838.61	100 *c*	60 *c*
5054 671	8	..	5455 03		30	5842 47	30	15
5057 999	40	15	5457 60	.	30 *H*	5846.10	20 *c*	10 *c*
5059.353	10	. . ..	5458 043	10 *c*	...	5866.45	80	40
5065 256	20	8	5468 10	9	...	5874 68	40 *c*	20 *c*
5078 959	150	60	5481 002	15	8	5876 30	8 *c*	......
5088 82	9 *c*	. ..	5483 48	8	. ...	5877.78	20	10
5095 298	80	25 *c*	5487 60	.	200	5893 43	15 *c*	8 *c*
5100 162	30	10	5504 58	30 *c*	10 *c*	5900.59	200 *c*	100 *c*
5120 298	20	8	5512.81	15 *c*	. .	5903 80	20 *c*	10 *c*
5121 801	12	. ..	5523 57	30	15	5927 40	10	10
5127 662	9	....	5541 461	9	. ...	5928.234	12 *c*	. ...
5134 752	40	15	5545 63		100	5934 15	15 *c*	10 *c*
5140 578	8	...	5549 60	8 *c*	... .	5957.69	15	.....
5147 537	12 *c*	..	5549 62		20 *H*	5973 26	....	8 *h*
5152 623	12 *c*	8 *c*	5551 34	60	30	5983.21	100	50
5160 335	50	20	5562 99	15	10	5986 08	30	20
5164 368	40 *c*	15 *c*	5571.41	10 *c*	...	5997.86	50 *c*	25 *c*
5180 306	50	15	5571 43		20 *H*	6029 74	12	. . ..
5186 987	15	.. .	5572 00		10 *H*	6031 83	10	.
5189 198	20	9	5576 16	15 *c*	8 *c*	6039.95	.. . .	15 *h*
5193 078	40 *c*	15 *c*	5578 28	15	10	6045 49	20	10
5195.839	20	8	5586 99	30	10	6048.71	10 *c*	. ...
5203 224	10	... ..	5590.95	15 *c*	....	6056.64	12 *c*	..
5205 132	8	. ..	5595.72		30 *H*	6107.69	9	. .
5219 09	15 *c*	8 *c*	5599.57	10 *c*	.	6120 09	8 *B,l*	. ..
5225 156	12		5603.51	30	10	6148.11	10 *c*	......
5232 813	25	10	5612 30	. . ..	20 *H*	6164 30	12	.....
5237 47	9	.	5628 25	10 *c*	.	6183.24	.... ..	8 *h*
5247 38	10 *c*		5629 17	40	20	6213.06	8	. . .
5251 62	15 *c*	10 *c*	5635.42	20 *c*	.	6221.95	20	. ...
5251.81	10 *c*		5635 48	.	20 *H*	6251.76	20 *c*	10 *c*
5253 028	10	..	5642 10	80	40	6260.77	8 *c*	.....
5253 926	15	.	5645 30	10	...	6430.46	80 *c*	20 *c*
5271 526	60 *c*	30 *c*	5664.70	100	50	6433.22	30	......
5276 196	50 *c*	20 *c*	5665 63	120	60	6473.95	20 *B,l*	.... ..
5279.418	8 *c*	..	5666 86	9	..	6484 36	30 *B,l*	... ..
5285.240	20 *c*	10 *c*	5671 09	60 *c*	40 *c*	6494 94	8 *B,l?*	.. .
5296.34	8 *c*	.... ..	5671 90	50	20	6497 84	8	......
5315.543	10	.. ..	5677 453	10		6544.61	80 *c*	20 *c*

Columbium, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
6574 73	8		7051 20	8 *c*		8614 45	20 *c*	
6575.9	20 *B,l*		7098 94	50 *c*	20 *c*	8697 55	40 *c*	
6591 00	40 *c+B*	20 *c*	7102 01	30 *c*	10 *c*	8740 96	20	
6606 14	10		7119 31	10		8767 97	12	
6607 30	10		7126 17	30	10	8815 56	100 *c*	
6614 15	20	10	7130 06	10		8905 78	30	
6629 11		20 *h*	7159 43	100	30	8959 75	20 *c*	
6660 84	300 *c*	150 *c*	7178 27	8 *c*		8967 76	20 *c*	
6677 33	200 *c*	100 *c*	7191 37	10		9039 18	8	
6701.20	100	30	7208 94	15 *c*		9061 43	20 *c*	
6709.88	10 *c*		7252 35	40	8	9125 25	10	
6721 96	8		7317 03	10		9129 44	10 *c*	
6723 62	150 *c*	50	7323 92	15		9141 31	50 *c*	
6726 28	10 + *p*		7328 38	20 *c*		9186 96	20	
6739 88	80	30	7353 16	50 *c*	15 *c*	9197 60	15	
6795 26	15 + *p*	8	7382 50	150 *c*	50 *c*	9240 9	10 *c*	
6828 11	150	50	7478 20	10		9299 2	10 + *p*	
6849.33	25 *c+p*	10	7515 93	40	10	9323 54	40 *c*	
6870 92	20		7519 77	20 *c*		9353 17	10	
6876 36	60	25	7574 58	100 *c*	20	9408 60	20	
6879 90	10 *c*		7726 68	60 *c*		9435 48	8 *c*	
6886 33	30 *c*	10 *c*	7757 31	20		9438 7	8 *h*	
6888 48	10 *c*		7873 41	25 *c*		9549 13	8 *c*	
6902 89	50 *c*	20 *c*	7885 31	60		9595 06	60 *c*	
6908 07	40	10	7938 89	30		9620 96	10	
6918 32	60	20	7952 25	20 *B,l*		9626 88	100 *c*	
6940 90		30	7954 76	10		9631 11	50 *c*	
6946 07	10		7997 80	15 *B,l*		9650 97	12	
6951 15	10 *B,l*		8135 20	80		9676 75	50	
6966 89	10 *c*		8240 00	50 *c*		9910 35	20	
6971 61	10		8320 93	500 *c*		9912 26	25	
6972 49	20		8346 08	60		9957 29	15	
6975 05	8		8350 04	10 *h*		10003 85	30 *c*	
6986 09	20		8406 23	15 *c*		10042 54	10 *c*	
6990 32	100	30	8439 77	25 *c*		10067 4	20 *c,d*?	
6996 11	10 *c*		8475 98	150 *c*		10181 33	10 *c*	
7023 48	30	10	8526 99	50		10203 44	8 *c*	
7026 15		10	8547 25	20 *c*		10419 54	10 *c*	
7038.04	10		8560 54	30 *c*		10563 7	10 *c*	
7046 81	200	80	8575 87	30 *c*				

Copper, Arc Spectrum in the Infrared

Abridged from the list of Kiess, Jour. Research of B. of S. **14,** 519, 1935. The original list contains 28 lines. All lines of an intensity of 8 or above are included in the following table.

λair A	Intensity	λair A	Intensity	λair A	Intensity	λair A	Intensity
8408.15	10 *b*	9530.3	10 *H*	10146.78	50 *b*	10172.00	20
8996.2	8 *H*						

Hafnium, Arc and Spark Spectrum

Abridged from the list of Meggers and Scribner, Jour. Research of B of S. **13**, 625, 1934. The original list contains over 1000 lines. All lines of an intensity of 8 or above are included in the following table.

λvac A	Arc	Spark
1623 06		12
1628 91	.	12
1774 81	.	10
1815 71		9
1919 52		20
1922.11	.	9
1922 74	.	12
1955 66	.	12
1963 75		9
1964 23		15
λair A		
2012 78	10	
2028.18	25	15
2064 78	15	
2068 84	20	
2082 80	15	8
2083 80	40	30
2086 29	12	
2086.80	8	
2088 77	50	50
2089 95	30	30
2090 83	40	40
2096 18	100	150
2107 47	60	60
2108 50	15	10 *h*
2110.42	15	15
2115 02	20	20
2122.94	15	15 *h*
2123 68	40	40
2124 59	50	80
2126 61		8 *h*
2129 10	60	100
2130 09	8	8 *h*
2132 28	9	10
2134 53	15	20
2139 24	30	40
2141 84	20	20
2150 30	10	10 *h*
2156 44	25	35
2158 12	15	15 *h*
2161 61	10	10 *h*
2162.48	15	15
2170 22	20	30
2173 44	15	20
2175 36	25	30
2178.90	60	80
2184 31		8
2190 22	30	30
2191 79	10	15
2199 40	..	8
2199 57	8	8 *h*
2206 11	10	10 *h*
2212 45	25	30
2218 37	10	15
2220 48	.	8 *h*
2224 29	10	10 *h*

λair A	Arc	Spark
2228 18	.	8
2228 78	.	8
2235 41		20 *h*
2243 18	15	20
2251 85	8	9
2254 00	60	80
2255 15	40	60
2257 89	10	15
2258 68	15	20
2266 52	30	40
2266 83	60	80
2269 86	8	8 *h*
2273 15	40	60
2274 64	15	20
2277 16	150	150
2284 60	20	30
2291 64	30	40
2298 33	25	50
2298 78	.	8
2305 34		8
2316 49	10	20
2318 49	8	10
2321 14	50	60
2322 47	60	60
2323 25	40	60
2324 50	20	40
2324 89	40	80
2332 44		10
2332 95	40	50
2337 33	30	30
2338 23	..	10 *h*
2340 39		8 *h*
2343 32	60	80
2347 44	80	120
2351 21	100	150
2365 98	8	10
2371 40	.	8
2380 30	30	60
2381 00	20	40
2393 17	20	40
2393 36	50	80
2393 83	80	100
2400 79	40	50
2403 60		10
2404 56	10	20
2405 42	60	100
2406 43	30	50
2410 13	40	60
2413 33	..	15
2415 95	15	20
2417 69	70	80
2424 01		8 *h*
2425 98	50	70
2428 99	20	30
2433 56	30	50
2434 76	10	20
2441 05	.	10 *h,l*
2447 25	40	50
2449.43	30	40

λair A	Arc	Spark
2452 30	10	12
2452 47		15
2453 34	10	40
2453 98	.	15
2460 49	70	80
2461 73		25 *h*
2463 96	10?	20
2464 19	60	100
2465 06	10	25
2467 96	20	20
2469 17	40	60
2473 90	8	20
2478 56	10	15
2481 44	10	25
2483 34	10	20
2494 37		10 *h*
2496 99	30	60
2500 75	10	25
2512 68	20	60
2513 02	25	80
2515 49	10	30
2516 88	60	150
2521 49	10	20
2523 64		10 *h*
2531 19	30	50
2532 97		8
2534 33		10
2537 34	20	30
2548 20	10	30
2551 40	40	150
2551 85		10
2552 36		8 *h*
2559 20	10	30
2560 74	.	20 *h*
2563 61	30	50
2567 46	.	10 *h*
2570 71		10
2571 68	30	150
2572 95		8
2573 91	25	100
2574 28	.	8
2575 50		15 *h*
2576 83	20	80
2578 15	20	60
2582 51	25	60
2591 32	15	30
2595 61		8
2599.20		25
2606 38	40	100
2607 03	50	150
2607.26	.	20
2613 61	20	100
2614 30		10
2622 75	50	150
2625 56	.	10
2626 96	10	20
2635 79	.	30
2638.71	80	200
2641 41	100	400

Hafnium, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
2647.30	60	200	2885.47	.	20	3413 74	.	8
2649 15	.	20	2898 71	15	60	3428 37	15	20
2651 17	10	40	2904 51	.	10	3438 24	10	15+ (Zr)
2657 50	..	20	2908 86		15	3462 65	10	15
2657 85	20	50	2909 91	20	30	3478 98	8	30
2661 89	30	100	2917 51	.	12	3479 29	30	40
2665 98	15	50	2919.59	40	90	3487.57	..	8
2669 01	20	25	2929 63	70	80	3495 75	12	20
2671 25	..	15	2937.79	50	120	3495 94	.	10
2676 63	..	20	2947 14	..	12	3505 22	50	150
2677 56	..	10	2960 83		15	3518 75		15
2678 42	..	10	2961.80	.	40	3535 54	50	80
2683 35	40	150	2967.24	10	30	3552 70	30	40
2685 22		30	2968 82	60	120	3561 65	70	80
2703 18	.	10	2968 94	.	15	3569 03	50	80
2706 71	10	100	2975 89	70	150	3597 42	.	10
2710 00	..	8	2977 59		25	3624 00	.	10
2711 96	.	20	3000 09	25	40	3630 86	15?	
2712 13		15	3011 24	.	20	3644 35	50	60
2712 43	20	60	3012 90	50	100	3661 05		12
2713 51	..	10	3024 78	..	15	3665 35	8	20
2717 90	.	10	3025 29	10	20	3698 39		10
2718 51	40?	50	3031 16	60	120	3699 72	10	25
2731.16	.	10	3046 03		20	3701 15	15	40
2732 68		15	3054 52	.	15	3705 40	.	15
2732 98		20 *h*	3055 43		9	3719 27	50	70
2738 77	60	150	3064 68	.	20	3737 88	..	15
2751 81	20	80	3080 64	20	100	3744.98		15
2753 61		10 *h*	3092 26	..	20	3762 51		25
2756 92		30	3101 39	40	100	3766 92	10	50
2764 89		10	3109 11	50	150	3771 36		8
2767 34		8	3110 87	10	40	3782 78	.	8
2770 44		30	3116 95	..	8	3793 37	40	60
2772 34	.	20	3134 72	70	150	3797 95		10
2773 36	50	250	3139 67	10	15	3800 39	40?	
2773 50		20	3140 77	..	15	3806 07		40
2774 02	15	60	3145 32	20	25	3810 59		10
2775 27	.	15	3162 61	.	40	3817 20		20
2786 31		12	3176 85	40	50	3849 52	.	25
2789 51		50	3193 53	30	40	3864 75	.	20
2789.73	10	60	3194 19	50	100	3867 32		15
2789 81		20	3195 63	.	8	3872 55	.	20
2808 00	30	80	3199 99	..	30	3877 11		40
2813 87	40	70	3203 67	..	10	3880 82	30	40
2814 48	15	80	3217 30	20	25	3883 77		20
2814.77	.	40	3218 20	.	8	3900 64		20
2816 08		12	3220 66	10	50	3917 47		20
2820 23	100	200	3253 70	30	80	3918 10	60	100
2820 43		10	3255 28	15	25	3923 91	15	40
2822 68	40	100	3279 98	20?	20	3932 40		10
2829 33		20	3317 99	15	20	3933 65	30	40
2841 95	.	10 *h,l*	3323 35	..	20	3935 64	.	20
2849 21	20	100	3328.21	15	20	3945 36		10 *h*
2850 15		15	3352 06	40	80	3964 96		15
2851 22	20	60	3358.30		8	3979 40		40
2852 02	10	40	3384 14	..	10	3984 03		8
2857 65	.	20	3384 70	10	20	4007 36		10
2860.32	.	15	3389.83	40	70	4008 46	..	8
2861 01	60	100	3394 58	10	25	4029 16		10
2861 69	80	160	3394 99	.	30	4047 96	..	50
2869.82	15	20	3399.80	100	150	4049 44	..	10
2876.33	10	100	3407 76	.	15	4080 44	30	60
2879.12	..	20	3410.18	15	40	4093 16	120	150

Hafnium, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
4097.21	..	8	4664.14	100	150	5673.58	..	10
4113.58	15	20	4675.45	..	10	5767.18	15	30
4123.54	..	10	4682.68	.	8	5801.71	..	15
4127.80	10	40	4699.72	15	40	5809.50	20	30
4158.90	..	30	4703.62	..	10	5842.23	50	80
4162.40	10	50	4719.10	20	30	6027.57	10	20
4177.50	10	20	4731.36	20	40	6135.10	10	20
4179.55	..	10	4735.67	..	20	6222.81	..	10
4187.68	..	8	4735.75	..	10	6230.84	10	20
4206.59	30	80	4760.59	..	20	6248.95	80	100
4232.43	30	60	4765.78	..	12	6279.84	15	20
4245.84	8	20	4790.72	15	40	6455.85	.	20
4249.33	10	30	4807.14	15	20	6473.89	.	20
4262.72		10	4817.22	20	80	6512.61		10
4269.67	10	20	4844.00	10	15	6531.66		30
4272.85	20	60	4848.46	..	20	6542.80		50
4319.51	..	8	4865.43	.	10	6548.72	.	10
4320.69	15	40	4904.51	10	30	6550.01	.	10
4321.36	.	30	4926.99	..	8	6557.91	10	100
4334.65	10	30	4934.46	50	60	6562.86	..	10
4336.66	40	200	4945.38	.	10	6567.39	..	60
4350.52	30	150	4999.69	30	40	6584.53	.	40
4367.90	30	40	5034.33	..	8	6609.20	.	8
4370.95	60	100	5040.82	100	150	6644.60	100	200
4417.37	40	100	5057.03	20	30	6647.06	30	100
4422.76	20	150	5058.18	8	10	6719.40	.	50
4426.18	.	9	5071.23	..	8	6754.61	60	100
4443.07	15	20	5075.92	10	20	6850.07	20	60?
4452.70	.	10	5079.65	40	60	6855.29	.	50
4466.41		30	5080.44	.	10	6857.03	.	10 ?
4486.14	20	30	5128.53	10	20	6935.16	.	50
4486.65		20	5164.56	.	8	6970.44		10 ?
4490.60		20	5187.75	20	30	6980.91	100	200
4519.02	.	10 *h*	5247.10	40	60	6997.83	.	20
4524.74		30	5260.44	30	40	7010.68	.	10 ?
4533.18	30	40	5264.95	50	80	7021.23	..	30
4535.38		30	5289.98	..	10	7030.33	30	150
4541.31	10	20	5298.06	80	100	7061.90	10	30 ?
4563.81		8 *h*	5299.85	8	10	7277.67	..	50
4570.70		30	5311.60	100	150	7328.64	..	30
4573.81		20	5324.26	20	30	7398.96	..	10
4586.25		10	5346.30	10	40	7561.08	..	10
4599.46	.	40	5348.40	10	15	7663.09	.	30
4605.79	20	30	5391.36	..	10	7757.89		15
4613.74	10	50	5444.07	20	30	7861.22	.	8
4622.71	30	100	5463.38	10?	10	8236.13	..	10
4640.14	8	20	5524.35	40	50	9742.28	10	..

Helium, Infrared Spectrum

From the list of Meggers and Dieke, Jour. Research of B. of S. **9**, 121, 1932. The original list contains 120 lines. All lines of an intensity of 8 or above are given in the following table. The source was an "end on" Geissler tube.

λair A	Intensity	λair A	Intensity	λair A	Intensity	λair A	Intensity
9124.29	8	9142.23	12	9257.50	20	9341.91	15
9130.66	10	9222.96	10	9297.14	20	9391.90	10

Helium, Infrared Spectrum (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
9447.12	8	9516.70	30	10027.73	40	10311.32	40
9463.66	60	9526 17	10	10031.16	15	10829 09	100
9507.74	8	9702 66	10	10138 50	10	10830.30	500

From list of Meggers, Jour. Research of B. of S. **14**, 487, 1935. The original list contains 32 lines All lines of an intensity of 8 or above are given in the following table. The source was an "end on" Geissler tube.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
10667.60	30	10830.341	2500	11012.97	30
10829.081	500	10912 92	100	11044.95	40
10830.250	1500	10916.98	50	11969 07	20

Iron, Infrared Spectrum

Abridged from the list of Kiess, Jour Research of B. of S. **20**, 33, 1938 All terms of an intensity of 8 or above are included.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
10469.59	20	11119.80	10	11607.57	12	11973.01	8
10532.21	10	11439.06	15	11689.98	8		

Krypton, First Spectrum, Kr I

Abridged from the list of deBruin, Humphreys and Meggers, Jour Research of B. of S. **7**, 643, 1931. All lines of an intensity of 8 or above are included in the following table. The source was an "end on" Geissler tube of the ordinary type.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
1164.88*	20	3837.81	30	4418.769	50	5490.94	50
1235.85*	30	3845.98	15	4425 1909	100	5500.71	50
3302.54	10	3991.08	20	4453.9183	600	5504 02	15
3424.97	15	3991 25	10	4463.6897	800	5504 34	20
3431.75	20	4184 48	20	4502.3546	600	5516 66	20
3434 16	8	4263 29	20	4550 298	40	5520.52	40
3495 99	10	4273 9705	1000	4636 14	20	5562.2251	500
3502.56	20	4282.9686	100	4671.61	10	5570.2890	2000
3503.90	15	4286.4875	40	4724.89	20	5575.6	10
3522.68	15	4300.4877	50	4812 607	40	5580 39	80
3615.48	20	4302.45	10	4955.27	15	5649.5627	100
3628.17	10	4318.5523	400	4969.08	20	5672.45	50
3665.33	80	4319.5798	1000	4969.36	15	5702.19	10
3668.74	10	4351.3605	100	5215.81	8	5707.51	40
3679.58	100	4362.6429	500	5228.18	20	5721.88	10
3773.43	50	4376.1217	800	5279.84	9	5723.56	15
3796.88	20	4399.9675	200	5334.78	10	5726.59	20
3800.55	30	4410.369	50	5339.13	20	5750.57	10
3812.22	20	4416.88	20	5379.64	15	5783.89	10

* Abbink and Dorgelo, Zeits. f. Phys., **47**, 221, 1928.

Krypton, First Spectrum, Kr_I (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
5805.53	20	6346.66	20	6904.68	100	7928.602	40
5810.80	8	6351.90	8	7057.27	10	7982.37	10
5820.10	15	6373.58	30	7143.45	8	8059.5053	100
5824.50	40	6415.65	20	7224.109	100	8104.02	30
5827.07	20	6421.028	100	7287.262	80	8104 3660	200
5832 85	100	6448.78	10	7425.54	60	8112.9023	500
5866.74	50	6456.293	200	7486.850	100	8190 0570	300
5870.9153	3000	6488.07	15	7493.58	20	8195 08	15
5879.89	50	6504.89	10	7494.15	30	8263.2412	400
5993.8500	60	6536.55	8	7587.4135	1000	8272.37	20
6012.111	50	6576.42	20	7601.5465	2000	8281.06	200
6035.82	15	6652.24	40	7685.2472	400	8298.1091	500
6056 11	60	6699.23	60	7694.5401	500	8412 45	10
6075 24	20	6740.10	20	7741.37	10	8508.8736	200
6082 85	40	6813.10	50	7746.831	50	8764.11	8
6151 38	20	6829.09	8	7776.27	15	8774.10	10
6222 71	20	6846.40	20	7806.52	15	8776.7898	300
6236 34	30	6869.63	20	7854.823	200	8928.6934	200
6241.39	10	6904.22	15	7913.443	50		

Krypton, Second Spectrum, Kr_{II}

Abridged from the list of deBruin, Humphreys and Meggers, Jour. Research of B. of S. **11**, 409, 1933. The original list contains 1100 lines. All lines of an intensity of 8 or above are included in the following table. The source was the "end on' Geissler tube.

λ_{vac} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
886 29*	8	2464 77	100 *h*	2803 20	20 *h*
964 93*	12	2470 45	10 *h*	2816.46	60
		2489 39	8 *h*	2816.87	30
		2517.95	8	2833 00	100
λ_{air} A		2559.10	8 *h*	2835 35	8 *h,l*
		2572 03	10 *h*	2838 79	20
		2589 08	30	2844.46	20
2088 16	20	2592.48	60	2847 36	25 *h*
2096 24	15	2610.98	10 *h*	2949.54	15 *h*
2118 83	12	2616 71	10 *h*	2950.21	30 *h*
2145 08	10	2620 44	40 *h*	2954 28	12 *h*
2227 92	30	2643 06	20 *h*	2958 35	20 *H*
2245 39	10	2648 15	20 *h*	2960.14	40 *H*
2250 32	8	2649 27	20	2967 25	80 *H*
2273 24	8	2656 38	15 *h*	2974 04	25 *h*
2283 07	30	2660.97	8 *h,l*	2978 87	25
2287 79	30	2664.00	8	2979 81	20
2315 52	8	2683.55	15	2996.60	20
2316 32	10	2695 70	30 *h*	2999 84	40 *h*
2344 38	10	2701 34	15 *h*	3008 42	8 *h*
2353 68	50	2712.40	80 *h*	3017 65	20 *H,v*
2375 52	20	2716.18	10 *h*	3049.23	8 *H,v*
2392 78	10	2729 46	30 *h*	3056.01	30 *H*
2413 81	10 *h*	2733 26	50	3060.84	30 *H,v*
2414 89	10	2742.56	40	3095.14	30 *h,v*
2426 36	10	2746.31	15	3096.52	20 *h,v*
2428.35	20	2772 60	10 *h*	3135.10	8
2432 74	8	2779 11	20	3139 58	20
2446 44	8	2795.81	80 *h*	3150.93	80 *h*

* J. H. Abbink and H. B Dorgelo, Zeits. f. Phys., vol. 47, p. 221, 1928.

Krypton, Second Spectrum, Kr II (Continued)

λair A	Intensity	λair A	Intensity	λair A	Intensity
3175.67	40 *H*	3836.54	30 *H,l*	4355.47	3000
3176.94	15 *H,l*	3844.45	50 *H,l*	4369.69	200
3200.40	50 *h*	3857.32	20 *H,l*	4371.25	20 *h,l*
3202.54	15 *h,l*	3875.44	150 *H,l*	4377.71	40 *h*
3208.28	40 *h*	3894.71	60 *H,l*	4381.52	100 *h*
3223.52	12 *h*	3901.15	10 *h,l*	4385.27	50 *H,l*
3247.00	12 *H*	3906.25	150 *h,l*	4386.54	300 *h,l*
3261.58	8 *h*	3912.59	70	4389.72	20 *h,l*
3282.08	15 *h*	3917.64	50 *H,l*	4399.39	15 *h,v*
3315.72	15 *h*	3920.14	200 *h,l*	4400.87	100 *h,l*
3321.16	8	3929.26	20 *h,l*	4404.33	30 *h*
3379.03	15 *H*	3938.88	20 *H,l*	4408.89	40 *h,v*
3381.11	20 *H*	3942.93	20 *H,l*	4417.24	40
3385.23	15 *H,l*	3953.59	20	4422.70	100 *h,v*
3405.16	80 *H,l*	3954.78	90 *H,l*	4431.67	500
3414.80	10	3962.34	10 *h,l*	4436.81	600
3423.73	20 *h,v*	3964.89	30 *h,l*	4453.21	50 *H,v*
3427.71	30	3987.78	25	4454.37	10 *H,l*
3431.03	8 *h,l*	3990.66	15 *h,l*	4457.25	40 *H,l*
3446.51	50 *H*	3991.94	15	4459.99	8 *h*
3460.09	50	3994.83	100	4475.00	800 *h,v*
3470.05	30 *H*	3997.95	100 *H,l*	4481.85	50 *H,l*
3488.65	30 *h*	4005.57	30 *h,l*	4489.88	400 *h,l*
3493.04	8 *H*	4008.08	25	4523.14	400 *h,l*
3503.25	50 *H,l*	4008.48	10 *H,l*	4556.61	200 *h,l*
3535.35	50 *h,l*	4037.83	30	4573.33	30 *h,l*
3544.14	30 *H,l*	4044.67	80	4577.20	800
3544.54	30 *H,l*	4050.42	50 *H,l*	4582.85	300 *h,l*
3553.49	20 *h,l*	4057.01	300 *h,v*	4592.80	150 *H,l*
3555.54	8 *H,l*	4065.11	300	4598.49	50 *h,l*
3572.68	15 *H*	4088.33	500	4604.02	60 *h,l*
3586.25	12 *h,l*	4098.72	250	4609.72	20 *h,v*
3589.65	70 *H,l*	4109.23	100 *h,v*	4610.65	60 *h,l*
3599.21	25 *h*	4113.73	8 *H,l*	4614.50	15 *g,n*
3599.90	40 *h,l*	4118.14	30 *H,l*	4615.28	500
3607.88	100 *H,l*	4137.96	50 *H*	4619.15	1000
3623.61	30 *h,l*	4139.11	100 *H,l*	4633.88	800
3631.87	200 *h,l*	4145.12	250	4635.42	8
3637.48	20 *h,l*	4172.51	20 *h,l*	4650.17	30
3648.61	40 *h,l*	4179.58	20 *H,l*	4658.87	2000
3651.02	25 *h,l*	4185.12	50	4680.41	500
3653.97	250 *h,l*	4201.42	30 *H,l*	4686.30	8 *H,l*
3661.00	15	4210.67	25 *H,l*	4687.28	10 *h,l*
3663.44	20	4222.20	20 *h,l*	4691.28	100
3669.01	150 *h,l*	4228.79	20 *h,l*	4694.44	200 *h,l*
3680.37	100 *H,l*	4229.21	8 *H,l*	4695.66	50 *h,l*
3686.15	80 *H,l*	4236.64	100 *h,l*	4699.69	30 *H,l*
3690.65	30	4250.58	150	4739.00	3000
3715.04	12 *h*	4252.67	50 *h,v*	4752.02	100 *h,l*
3718.02	300 *h,l*	4254.85	100 *h,l*	4762.43	300
3718.63	200 *h,l*	4259.44	80 *h,v*	4765.74	1000
3721.35	150 *h,l*	4268.57	60 *H,l*	4773.01	40 *h*
3732.61	15 *h*	4268.81	100 *H,l*	4796.33	60 *h,l*
3735.78	40 *h,l*	4292.92	600	4811.76	300
3741.69	200 *h,l*	4295.21	8 *h,l*	4825.18	300
3744.80	150 *h,v*	4300.49	200	4832.07	800
3754.24	80	4301.53	40	4836.56	20 *h,l*
3771.34	30 *h*	4317.81	500 *H,l*	4846.60	700
3778.09	500 *h,l*	4322.98	150 *H,l*	4857.20	150
3783.13	500 *h,l*	4331.24	80 *H*	4870.14	20 *H,v*
3804.67	30 *h,l*	4333.34	50 *H*	4915.94	100 *h,l*
3806.17	8 *H,l*	4341.33	8 *h,l*	4945.59	300
3817.11	15 *H,l*	4351.02	40 *H*	4948.50	50 *h,l*

SUPPLEMENTARY TABLES OF SPECTRA (Continued)

Krypton, Second Spectrum, Kr II (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
4960 25	100 *h,l*	5935 03	8 *h*	9006 15	10
4978 89	100 *h,l*	5967 54	15 *H,v*	9025 67	10 *h,l*
4982 83	50 *h,l*	5992 22	200	9039 95	20 *H,L*
5013 29	100	6009 99	10 *H*	9044 55	10 *H*
5021 88	100	6022 39	40	9099 72	15 *h*
5022.40	200	6040 7	10 *H,w*	9115 00	20 *H,L*
5028 36	30 *h,l*	6046 06	10 *H,w*	9133 4	8 *H,L*
5033 85	100 *H,l*	6079 71	20 *H,v*	9175 42	40 *H,L*
5046.31	80 *H,l*	6094 50	30 *h,l*	9181 23	10 *H,L*
5054 53	30 *H,l*	6119 56	10 *H,l,w*	9207.27	8 *H,d?*
5065 58	20 *H,l*	6168 80	50	9233 18	50
5072 55	40	6230.74	10 *h,l*	9238 48	500
5077 23	40	6303.66	100	9245 45	20 *H,L*
5086.52	250 *h,l*	6391 14	30	9271 99	50
5123 16	15 *H,l*	6409.84	10 *H,h,v*	9289 95	20 *H,L*
5125.73	400 *H,l*	6416 61	60 *H,v*	9293 82	500 *H,L*
5143 05	60 *h,l*	6420 18	300	9296 1	60 *H*
5166 80	80	6470.89	50	9317.84	30 *h*
5186 99	60 *H,v*	6510 14	8 *h,l*	9320 99	200 *H*
5200.22	60 *H,v*	6510 95	100	9345 11	100 *H*
5208 32	500	6570 07	150	9349 08	100 *H*
5217 45	30	6602 90	10 *h*	9361 95	300
5217.93	12	6605 00	15 *h*	9388 08	50 *H,l*
5229 52	60	6634 36	15 *h*	9402 82	200 *H,v*
5256 75	30	6763 61	100	9414 94	100
5276.50	100 *h*	6764 43	80	9437 21	20 *H*
5308 66	200	6771 22	50	9440 02	100 *H*
5317 41	30 *h,l*	6870 85	40	9470 93	200 *H*
5322 77	60 *h,l*	6944 06	10 *H,l*	9475 06	100 *H*
5333.41	500 *h*	7073 97	60	9500 60	100 *H*
5346 76	60 *h,l*	7139 99	60	9504 70	100
5355 45	10 *h*	7213 13	250	9543 64	10 *H*
5418 43	30 *H,v*	7289 78	400 *h*	9552 85	10 *H*
5438 63	40	7407 02	400 *h*	9577 52	500
5446 34	80	7434 74	15 *h*	9594 24	100
5468 17	200 *h,v*	7435 78	200 *h*	9605 80	500 *H*
5499 54	50	7524 46	300 *h*	9613 80	100 *H*
5522 94	60	7525 48	20 *h*	9619 61	400 *H*
5523 47	30	7641 16	150	9663 34	200
5552.99	100 *H,v*	7735 69	250 *h*	9711 60	200 *H*
5568 65	100	7781 97	100 *h*	9717 16	10 *H*
5633 02	100 *h*	7756 52	30 *H*	9803 14	500
5650 37	10 *H*	7931 41	40 *h*	9823 39	100 *H*
5672 78	40 *h,v*	7973 62	120 *h,v*	9826 58	100 *H*
5674 52	30 *h,v*	7993.22	200 *h*	9892.97	10 *h*
5681 89	400	8130 03	10 *h*	9954 75	20 *H*
5690 35	200 *H,v*	8145 15	100 *H*	10017 97	20 *H,v*
5699 84	10	8157 25	10 *h,v*	10042 27	20 *H,L*
5752 98	60	8202 72	200 *h*	10167 61	10 *H*
5771 41	100	8473 31	100 *h,l*	10221 46	1000
5860 75	10 *H,l*	8690 19	100 *h,v*	10361.15	100
5894.56	8 *H,l*	8707 61	8 *h*	10389.28	8 *h*
5900 89	8 *H,l*	8978 70	15 *h*	10428 40	10
5911 72	10 *H,l*				

Krypton, Infrared Spectrum

Abridged from the list of Meggers and Humphreys, Jour. Research of B. of S. **10,** 427, 1933. The original list contains 175 lines. All lines of an intensity of 8 or above are included in the following table. The source was an "end on" Geissler tube.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
7601.5465	4000	8104.02	500	8560.89	50	9273.02	8
7685.2472	1000	8104.3660	4000	8569.02	20	9326.03	10
7694.5401	1200	8112.9023	6000	8593.1	10	9352.23	100
7741.39	40	8132.98	60	8605.85	40	9862.03	100
7746.831	150	8144.96	15	8651.49	8	9450.88	20
7776.28	40	8190.0570	3000	8697.50	40	9540.89	30
7806.52	50	8195.07	50	8726.54	8	9687.83	10
7840.01	8 *h*	8205.22	20	8755.20	30	9704.22	50
7854.823	800	8206.62	40	8764.09	150	9714.85	15
7863.91	20	8218.40	80	8774.05	50	9743.11	50
7881.76	30	8228.89	10 *h*	8776.7498	6000	9751.74	2000
7882.36	10	8263.2412	3000	8780.25	30	9856.24	500
7904.62	30	8272.36	100	8805.78	20	10065.96	10
7913.443	200	8281.05	1500	8928.6934	2000	10077.66	10
7920.47	40	8298.1091	5000	8967.53	10	10120.96	30
7928.602	180	8301.39	20	8977.99	50	10147.68	10
7946.99	20	8303.20	10	8999.19	30	10296.93	80
7981.19	20	8384.90	15	9111.69	20	10360.37	100
7981.82	30	8412.45	100	9122.49	20	10374.44	10
7982.42	100	8498.21	30	9243.54	30	10592.97	30
8040.50	8 *h*	8508.8736	3000	9270.96	10	10874.84	20
8059.5053	1500	8537.93	40				

Abridged from the list of Meggers, Jour. Research of B. of S. **14,** 487, 1935. The original list contains 30 lines. All lines of an intensity of 8 or above are included in the following table. The source was an "end on" Geissler tube.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
10593.01	100	10874.92	100	11259.16	50	11819.43	100
10608.43	20	11187.13	40	11457.52	80	11997.15	10
10626.70	8	11257.74	80	11792.47	10	12204.54	10
10699.33	20						

Lanthanum, Arc and Spark Spectrum

Abridged from the list of Meggers, Jour. Research of B. of S. **9,** 239, 1932. The original list contains over 1500 lines. All lines of an intensity of 8 or above are included in the following table.

λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark
2142.81		20 *h,l*	2328.75		20 *h,l*	2452.73		8
2163.66		20 *h,l*	2379.38		200 *h*	2455.88		10
2187.87	30	40	2399.64		20 *h,l*	2471.90	15	20
2216.08		100 *h,l*	2436.42		15	2472.44		10
2256.77	40	50	2437.14		10	2476.72		100 *h,l*
2297.75		200 *h,l*	2438.02		20	2478.8		20 *h,l*
2317.82		20 *h,l*	2438.42		10	2479.85		10 *l*
2319.44	15	20	2445.56		10 *h*	2487.59	10	40

Lanthanum, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
2501.18		15 *h,l*	3303 11 *c*	100	150	3840.72	40	60
2519.22	10	50	3306.98		8	3846.00	10	20
2531.60		8	3329.07		8	3849.02	40	100
2538.14	10	15	3337 49	200	300	3854 91	15	30
2546.40		20 *h,l*	3342 23	10		3864 49		100 *l*
2560.37	10	50	3344 56	150	200	3871 64	100	200
2561.84		20 *l*	3376.33	40	50	3886 37	60	150
2566.09		10 *h,l*	3380.91	200	300	3898 60	8	
2580 82		8 *h,l*	3397 77		40 *h,l*	3910 81		10 *l*
2582 96		8	3404 53	10		3916 05 *c*	80	300
2586 35		10	3407 90		8 *h,l*	3921.54 *c*	70	200
2596.08		20	3411 76		20 *h,l*	3927 56	30	10
2610.34	50	150	3427 57		8	3929 22 *c*	100	300
2631.94		8	3452.18 *c*	30	40	3932 53		10 *l*
2651.60		300 *h,l*	3453 17 *c*	40	50	3936.22	20	50
2672 90	15	30	3461.18	10		3939.85		20 *l*
2681 49		10	3474 84		8 *l*	3949 10 *c*	400	600
2682 46		30 *h,l*	3484 39		10 *l*	3953 67	10	
2684.90		50 *h,l*	3510 00		15	3962 03		10 *l*
2695 47	15	35	3512 93		10	3979 08		8 *l*
2702.13		8	3517 14 *c*		200	3981 36		10 *l*
2714.52	8		3520 72		10 *h,l*	3988.51 *c*	300	500
2715 43		10 *h,l*	3530 67		8	3994 50 *c*		10
2725 57	15		3557 26		8	3995.74 *c*	200	400
2732 40		10	3570 10		30 *h,l*	4015.39	25	15
2748 31		8	3574.43	20		4023.58 *c*	10	40
2752.84		10	3580.10		8 *h*	4025.87	20	50
2767 40		8	3581 68		20 *h,l*	4031.68	100	300
2778 76		10	3601 07		20 *h,l*	4036.59 *c*		15 *d*
2779 78		10	3610 25		30 *l*	4037 21	25	10
2780.23		20	3612 34		50	4042 91	150	300
2791.51	8	25	3613 08	10		4050 08 *c*	50	200
2798 56	8	40 *h,l*	3628 83	20	60	4060 33	30	20
2808 39	40	150	3637.15 *c*	10	40	4064 79	25	15
2840 51		25 *h,l*	3641.53	20 ?		4065.58	15	
2855 90	10	50 *h,l*	3641 66	10	50 *l*	4067.39 *c*	60	100
2862.98		15 *h,l*	3645 43	50	200	4076.71	10	40
2880.65	8	40	3649 55	10		4077 35 *c*	200	300
2885.13	10	50	3650 19	25	80	4079 17	20	10
2893.08	10	60	3662 08	15	30	4086.72	200	300
2923 90		20	3665 22		10 *l*	4089.61	25	12
2950 50	8	50	3672.02	8		4099 54 *c*	40	150
2962 90		15	3701 81		40 *l*	4104 87	30	20
3059 91		8	3704.54	10		4109 80	10	
3096.02	8		3705 81 *c*	25	80	4113.28		40 *l*
3104 58	40	50	3713.54	30	100	4117 67	8	
3108 46		8	3714 87	10	40	4123.23	200	400
3109.42	8		3715 53	20	50	4132 50		10 *h,l*
3112.63		8 *h*	3725.05	10	20	4137 05	20	10
3142.76	30	40	3731 42		8 *h*	4141.73 *c*	80	200
3171.68 *c*	8 *e*	300	3735.85		10	4143 77		15
3174 88		10 *h,l*	3736.41		15 *l*	4151.98 *c*	100	250
3175.99	8		3759 08	100	300	4152.78	40	100
3191 39		10 *h*	3778 12	10	150 *l*	4160.26	20	10
3193 02 *c*	15 *d*	25	3780 53		50 ?	4161.94		8 *h*
3215.81	10		3780.67	20	50 ?	4177.48	15	10
3217.12		8 *h*	3784.81	8	15	4180 97		12 *l*
3245.13	100	150	3790 83	100	300	4187.31	50	30
3249.35	60	80	3794.78	150	400	4192 35 *c*	40	100
3253.41		10 *h*	3808.79	10	15	4194.36		30 *h*
3265.67 *c*	80	100	3816.25		10 *h*	4196.55 *c*	150	250
3283.95		8 *h*	3817 24		8 *h*	4204.03	40	100
3294.44		10	3835 09	15	50	4207.61		10 *l*

Lanthanum, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
4210.22		50 *h,l*	4570.02	60	50	4880 22		10 *h*
4217.56 *c*	40	200	4570 97		10	4891 43		10
4230.95 *c*	20	150	4574 87 *c*	150	200	4899 92	150	200
4238 38 *c*	200	400	4580 05	50	150	4901 87	15	10
4241.20		15 *h,l*	4581 20 *c*	10	10	4911 34		10
4249.99 *c*	20	100	4602 04 *c*	10	10	4920 98	200	300
4262.35	10		4605 78	50	100	4921 80	200	300
4263.59 *c*	60	200	4613 38	100	200	4934 83	40	100
4269.50 *c*	80	300	4615 06 *c*	8		4935 61		10
4275.64	50	100	4619 87 *c*	100	300	4946 47 *c*	20	50
4280 27	60	40	4633 4		10 *h,l*	4949 76	50	20
4286 97 *c*	80	300	4634 95		25 *l*	4952 06	10	40
4296.05 *c*	100	300	4636 42	10	80	4970 39	50	100
4300 44	40	60	4645 28	40	100	4977 95	8	
4304.11		10 *h,l*	4646 33	10	10	4986 82 *c*	60	100
4315.90 *c*	10	30	4647 50 *c*	25	100	4991 27 *c*	40	80
4322 51 *c*	60	100	4648 64	30	20	4993 87	15	
4333 76 *c*	300	500	4650 32	12	8	4996 82		50
4334 96 *c*	50	100	4652 07	15	30 *h,l*	4999 46 *c*	100	200
4337.78		10 *l*	4655 49 *c*	80	400	5001 78 *c*	20	
4340 72 *c*	10		4660 70	8	8	5002 12	10	40
4354 40	60	200	4662 51	100	200	5014 45		30 *h,l*
4354.79	20		4663 76 *c*	50	300	5019 50	10	
4363 05		50 *l*	4668 91 *c*	40	250	5046 87 *c*	30	15
4364.66 *c*	25	100	4671 82 *c*	30	200	5048 04		30 *l*
4378.10 *c*	15	50	4688 65	8	40	5050 57	60	20
4383 44	20 ?	100	4691 17 *c*	25	50	5056.46 *c*	60	20
4385.20 *c*	10	40	4692 50 *c*	50	200	5062 91	10	20
4411.21		25 *h,l*	4699.62 *c*	20	50	5066.99		20 *h*
4419 16	20	30	4700 26 *c*	8	8	5067.90 *c*	15	10
4423 90	20	15	4702 64	8		5080 21	10	40
4427.52 *c*	30	100	4703 27 *c*	30	150	5090.56		20 *l*
4429.90 *c*	200	400	4708 18 *c*	8	8	5106 23 *c*	100	40
4432.95	10 ?	20 ?	4712 92 *c*	20	40	5114.55 *c*	100	200
4435.84		10	4716 44 *c*	40	80	5120 87	10	
4443.94 *c*		20 *h,l*	4717 58	10	50	5122 99	100	200
4452.15	15	15	4719 93 *c*	40	150	5145 42	100	40
4455.79	20	50	4724 42	20	40	5156 74	20	40
4468.97	10		4728 41 *c*	80	100	5157 43	15	150
4474.03		10	4733.82 *c*	8		5158 68	40	20
4481.21		25 *h,l*	4739 80		15	5163.61	20	40
4486.06	10	10	4740 27	100	120	5167 28		10
4491.76 *c*	10	8	4743 08 *c*	100	250	5167 79	20	10
4493.11	15	10	4748 73	80	150	5172 89		20 *l*
4494.71 *c*	20	15	4750 41 *c*	10	8	5173 83	10	25 *l*
4498.76		10	4766 89	60	30	5177 30 *c*	150	50
4499.04 *c*	10	10	4770 43	10	8	5183 42 *c*	200	400
4500.21	30	30	4796 67	10	25	5183 91	10	10 ?
4502.16		10 *h,l*	4799.99	8		5188 21	40	500
4508 48		10	4800.24	9		5190 34	8	
4522 37	200	400	4804 04 *c*	50	80	5204 14	25	300
4525 31 *c*	40	100	4809.00 *c*	60	100	5211 85 *c*	150	40
4526 12	100	200	4817.17	10		5217 83		10 *h*
4530.54		15	4824.05	80	100	5226 20		40 *l*
4538 87		8 *h,l*	4826.87 *c*	10	20	5234 27 *c*	150	40
4540.71		10	4830.51		10	5253 45	100	30
4541.78 *c*	10	8	4839.51	20	10	5259 38 *c*	30	50
4549 50	40	30	4840 02	20	30	5271 18	100	30
4550.76 *c*	8		4850 58	20	30	5279 11		40
4552.47	8	8	4850.81	20	10	5290 83	30	50
4558.46	100	200	4854.95 *c*	8		5301.97 *c*	80	200
4559.28	30	100	4860.90	60	80	5302.62	30	150
4567.90	50	40	4878.86	10	10	5303.54	50	100

Lanthanum, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
5304.01 *c*	20	.....	5874.72 *c*	8	.....	6498.19	30	250
5340.66	20	100	5880.63 *c*	40	50	6520.70	15	.....
5357.85 *c*	25	10	5894.84 *c*	20	10	6526.99 *c*	100	200
5377.08	20	200	5901.95	.....	40 *l*	6543.17 *c*	300	100
5380.97	40	100	5917.64 *c*	20	.....	6565.45	40	.....
5381.77	.....	50	5927.71	.....	30	6578.51 *c*	200	100
5381.91	15	100	5930.61	200	40	6593.45 *c*	40	.....
5447.59	.....	10	5930.68	100	20	6600.17 *c*	25	.....
5455.14	200	40	5935.29 *c*	20	.....	6608.25 *c*	40	.....
5458.68 *c*	10	50	5936.22 *c*	15	20	6616.59 *c*	60	10
5464.37	10	25	5948.30 *c*	10	20	6642.79	10	100
5475.17 *c*	10	.....	5971.09	.....	8	6644.40 *c*	30	.....
5480.72	.....	25	5973.52 *c*	15	120 *l*	6650.81 *c*	80	20
5482.27 *c*	20	40	5975.75 *c*	10	.....	6661.40 *c*	60	15
5493.45	10	20	5982.34	10		6671.41 *c*	15	40
5501.34	200	70	6007.34 *c*	50	10	6692.86 *c*	20	.....
5503.80 *c*	40	10	6038.57 *c*	20	.....	6709.49	150	30
5506.00 *c*	20	.....	6068.70 *c*	20	.....	6714.08	.....	80
5517.34 *c*	20	.....	6085.43	.....	10	6718.68	.....	60
5532.17	.....	10	6100.37	10	30	6732.80 *c*	.....	40
5535.66 *c*	20	80	6108.47 *c*	40	10	6748.12 *c*	10	.....
5541.25 *c*	15	10	6111.71 *c*	20	.....	6753.05	40	10
5565.43 *c*	10		6126.09	20	50	6774.28 *c*	80	100
5565.70	10	.....	6127.04	8		6808.88 *c*	30	30
5566.92	.....	40	6129.57 *c*	30	50	6813.68	.....	50
5568.45 *c*	30	10	6134.39 *c*	20	8	6823.80	40	10
5588.33 *c*	100	20	6142.98 *c*	10	.....	6834.07	20	20
5610.53	.....	20	6146.53	10	15	6837.91	15	15
5631.22	60	10	6165.69 *c*	30	10	6917.26	10	.....
5632.02	15	.....	6172.72	10	10	6918.33	8	.....
5639.31 *c*	8	.....	6188.09		100 *l*	6925.27	80	15
5648.24 *c*	50	30	6203.51		50 *l*	6935.03	50	8
5652.3		10 *h*	6233.51	10	.....	6952.52 *c*	10	10
5654.8 *c*	20	10	6234.85 *c*	10	.....	6954.54 *c*	20	20
5657.71 *c*	30	15	6236.17	8		6958.11	30	100
5671.54	10	100	6238.58	12		6968.78		25
5696.18	30	15	6249.92 *c*	300	100	7023.67 *c*	150	20
5703.32	20	20	6262.30	100	300	7032.07	25	.....
5712.39 *c*	20	20	6266.00 *c*	40	20	7045.96 *c*	200	30
5720.01 *c*	10	.....	6273.76		100	7066.24 *c*	200	300
5727.29	.....	20	6293.57 *c*	60	10	7068.37	60	10
5740.65 *c*	80	20	6296.08 *c*	100	300	7158.11 *c*	30	10
5744.41 *c*	60	20	6305.46	10	10	7161.25	40	10
5761.83 *c*	50	20	6307.25		20 *h*	7219.92	15	.....
5769.06 *c*	40	60	6310.13	8	.....	7282.36	100	150
5769.32	80	30	6310.91	8	200	7334.18 *c*	50	10
5769.97 *c*	25	20	6315.79		50	7345.36 *c*	25	.....
5789.22 *c*	150	40	6320.39 *c*	100	200	7483.48 *c*	15	30
5791.32 *c*	200	60	6325.90	100	20	7539.24	10	.....
5797.57	100	150	6358.12	20	30	8051.38 *c*	10	.....
5805.77	80	120	6360.20 *c*	30	10	8086.10	20+ *M*	.....
5806.56	.....	8	6374.08		30	8159.05	10 *M*?	.....
5808.31	40	60	6390.48	100	200	8247.46	60	.....
5808.63		8	6394.23 *c*	400	100	8316.05	10	.....
5821.98 *c*	30	20	6399.04	20	400	8324.72	100	.....
5823.82 *c*	15	10	6410.98	200	60	8346.60	100	.....
5827.56 *c*	8		6443.05	.....	50 *h*	8379.80	20	.....
5829.71 *c*	20	10	6446.62	15	200	8467.62	15	.....
5845.02 *c*	10		6448.10	20	10	8476.48	30	.....
5848.37 *c*	15		6454.50 *c*	150	50	8507.37	10	.....
5848.95	.....	20	6455.99	250	100	8513.55	15	.....
5855.57 *c*	20	8	6468.44 *c*	10	.....	8543.46	20	.....
5863.70	30	80	6485.54 *c*	20	.....	8545.44	50	.....

Lanthanum, Arc and Spark Spectrum (Continued)

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
8672.10	30	.....	9372.57	30	.....	9881.24	100	.....
8674.40	60	.....	9412.65	100	.....	9920.82	150	.....
8720.42	20	.....	9438.30	100	.....	9980.38	10	.....
8748.42	50	.....	9461.82	60	.....	9988.47	10	.....
8818.96	20	.....	9485.15	15	.....	10005.73	50	.....
8825.86	50	.....	9541.23	20	.....	10141.20	10	.....
8839.64	20	.....	9542.06	50	.....	10154.74	40	.....
8957.74	50	.....	9560.69	10	.....	10184.60	20	.....
8963.63	10	.....	9633.72	40	.....	10274.85	10	.....
9079.10	50	.....	9640.81	30	.....	10281.34	10	.....
9119.18	20	.....	9657.00	20	.....	10294.68	10 *d*	.....
9157.13	10	.....	9672.04	8	.....	10349.08	40	.....
9172.39	10	.....	9699.64	20	.....	10357.70	20	.....
9219.64	10	.....	9706.48	20	.....	10450.82	20	.....
9226.63	30	.....	9709.45	10	.....	10461.69	15	.....
9250.06	20	.....	9737.09	100	.....	10522.09	10	.....
9254.70	10	.....	9772.24	20	.....	10612.56	10	.....
9346.69	15	.....	9775.09	8	.....			

Manganese, Infrared Arc Spectrum

Abridged from the list of Meggers, Jour. Research of B. of S. **10**, 757, 1933. The original list contains 200 lines. All lines of an intensity of 8 or above are included in the following table.

λair A	Intensity	λair A	Intensity	λair A	Intensity
7247.82	15	8043.37	8	8929.72	60 *h*
7283.80	250 *l*	8212.43	40 *h,l*	9084.29	30
7302.89	300 *l*	8380.77	40	9114.02	50
7326.51	400 *l*	8395.87	10 *H,v*	9172.09	100
7646.02	10 *H,l*	8409.88	15 *H,v*	9234.40	10
7670.42	10 *h*	8431.20	20 *H,v*	9243.29	150
7680.22	200	8521.57	10 *h*	9331.90	20 *h*
7706.52	10 *H,l*	8558.63	8 *h*	9336.47	40 *h*
7709.98	40 *H,l*	8654.63	40 *h*	9412.78	10 *h*
7712.42	100 *h*	8659.38	10 *h*	9429.58	30 *h*
7733.24	150 *h,l*	8670.92	200 *c*	9444.90	40
7734.43	50 *h*	8672.06	300 *c*	9502.12	8 *h*
7752.67	9 *H,l*	8673.97	200 *c*	9542.14	10 *h*
7755.15	20 *H,l*	8699.13	100 *c*	9550.80	20 *h*
7764.72	250 *h,l*	8701.05	300 *c*	9584.0	10 *h*
7790.82	15 *h*	8703.76	500 *c,w*	9608.56	100 *h*
7806.00	8 *h,d?*	8710.21	10	9676.50	40
7816.61	30 *h*	8734.60	30 *c*	9684.9	15
7821.25	20	8737.32	300 *c*	9686.3	15
7834.34	10 *h*	8740.93	1000 *c,w*	10052.9	20 *h*
7942.91	25	8926.06	15 *h*	10212.34	8 *h*

Neon, Infrared Spectrum

Abridged from the list of Meggers and Hunphreys, Jour. Research of B. of S. **10**, 427, 1933. The original list contains about 200 lines. All lines of an intensity of 8 or above are included in the following table. The source was an "end on" Geissler tube.

λair A	Intensity	λair A	Intensity	λair A	Intensity	λair A	Intensity
7724.63	10	7937.00	70	8082.460	200	8136.423	300
7839.08	30	7943.193	200	8118.554	100	8248.70	30
7927.13	40	7944.16	20	8128.93	60	8259.392	150

Neon, Infrared Spectrum (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
8266.092	250	8654.51	400	9121.14	20	9547.40	300
8267.11	80	8679.51	500	9148.68	600	9665.426	1000
8300.338	600	8681.94	500	9201.76	600	9837.47	20
8301.54	150	8704.15	200	9220.05	400	9900.58	40
8365.75	150	8767.55	15	9221.59	200	9902.31	30
8376.41	200	8771.70	400	9226.67	200	9915.13	20
8377.630	800	8778.75	150	9275.53	100	9936.83	10
8417.18	100	8780.65	1200	9300.85	600	9938.35	15
8418.447	400	8782.01	50	9310.58	150	9947.94	15
8463.37	150	8783.78	1000	9313.98	300	10005.54	20
8484.45	80	8792.51	30	9326.52	600	10007.31	30
8495.359	500	8830.92	50	9373.28	200	10295.40	80
8544.70	60	8853.88	700	9405.75	8	10562.38	300
8571.36	100	8865.33	100	9425.38	500	10620.63	30
8582.91	60	8865.76	500	9432.94	40	10798.02	100
8591.266	400	8892.22	10	9452.08	10	10844.47	200
8634.668	600	8919.50	300	9459.21	300	11143.04	30
8635.31	50	8929.24	10	9486.68	500	11177.51	15
8647.05	300	8988.58	200	9534.17	500	11522.83	8
8654.380	1500	9073.04	8				

Abridged from the list of Meggers, Jour. Research of B. of S **14, 487, 1935** The original list contains 60 lines All lines of an intensity of 8 or above are included in the following table. The source was an "end on" Geissler tube.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
10562.43	200	11049.80	20	11601.62	25
10620.70	40	11143.09	300	11614.18	80
10764.09	12	11160.29	10	11688.08	10
10766.15	10	11177.59	300	11766.87	60
10798.12	150	11390.53	110	11789.11	50
10844.54	200	11409.24	100	11789.93	10
10888.53	8	11522.82	150	11984.99	10
11020.93	10	11525.11	90	12066.38	15
11044.06	15	11536.41	50		

Potassium, Infrared Arc Spectrum

Meggers, Jour Research of B. of S. **10**, 669, 1933.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
9591.8	50 *H,l,W*	10480 3	3 *H*	11690.17	10
9597 1	20 *H,l,W*	10487 7	1 *H*	11769 41	3
9950.5	20 *H*	11022.3	10 *H,W*	11773 05	15 r
9955 2	10 *H*				

Rhenium, Arc Spectrum, Re I

Abridged from the list of Meggers, Jour. Research of B. of S. **6**, 1027, 1931. The original list contains 2000 lines. All lines of an intensity of 8 or above are included in the following table. Intensities are on King's scale.

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
2508.98	40	3185.56	40 *c*	4023.33	10 *c,W,v*
2516.11	15	3204.24	60 *c,W,l*	4029.62	15 *c,W,l*
2520.01	8	3235.95	10	4033.31	30 *c,w,l*
2544.75	10	3258.85	15	4048.99	10 *c*
2556.50	20	3259.55	20	4073.22?	8
2586.80	10	3322.49	40 *c,w*	4081.43	12
2599.86	8	3338.18	60	4104.42	12
2611.61	10	3342.25	50	4110.90	30 *c,w,v*
2636.64	20	3344.33	30	4113.41	8
2642.76	8	3346.19	20	4121.60	25
2651.90	20	3399.29	60 *c,w*	4133.42	80 *c,W,d*
2663.63	8	3404.72	10	4136.45	100
2674.33	40	3405.89	15 *c*	4144.36	60
2688.53	8	3419.41	20	4149.98	20 *c*
2715.47	40	3424.61	200 *c,w,v*	4152.64	8 *c*
2732.21	8	3437.72	8	4170.40	15
2758.02	8	3449.38	10 *d,c?*	4182.98	50 *c,w*
2767.75	8	3451.88	600 *c,W,l*	4194.67	12 *c*
2770.41	10	3460.47	1000 *c,W,l*	4204.55	8 *c*
2783.57	12 *c*	3464.72	800 *c,W,l*	4221.08	30
2791.29	8	3467.96	10 *c*	4227.45	200 *c*
2814.67	10	3480.86	8	4241.39	15
2819.95	30 *c,w*	3503.06	10	4257.61	50 *c*
2834.08	10 *c*	3516.65	8 *c?*	4291.18	30 *c,w*
2850.97	10	3517.33	10 *c*	4291.64	10
2867.20	8	3537.47	15 *c*	4304.41	30
2887.67	60	3579.13	10	4315.74	10 *c,W*
2896.00	20 *c,w*	3580.14	20 *c,w,l,E*	4332.25	30
2902.50	20 *c,W*	3580.97	20 *c*	4358.69	50
2909.81	15	3583.03	40 *c*	4367.57	30 *c*
2919.41	84	3617.08	20 *c*	4391.35	40 *c*
2927.42	20 *c,w*	3637.84	15	4392.47	30 *c,w*
2943.14	10	3651.97	20	4394.37	80 *c*
2962.27	8	3670.53	10	4396.79	10
2965.12	20 *c*	3689.52	30 *c,W,v?*	4402.60	15
2965.75	40 *c,w*	3691.48	40 *c*	4406.40	30 *c,w*
2976.29	10 *c*	3703.24	20	4415.82	80
2992.36	50	3709.93	10	4440.44	15 *c,w*
2999.58	80	3717.29	25 *c,W,v*	4453.88	8
3001.13	8	3725.76	100	4454.65	50 *c,W*
3016.02	20 *c,w,v*	3735.00	10 *c,W,v*	4467.93	15 *c*
3016.48	10	3735.83	50	4475.09	25
3030.44	15 *c*	3740.10	40 *c*	4477.99	10 *c*
3067.39	50	3745.45	20 *c*	4478.39	25
3069.94	10	3787.52	30 *c*	4507.03	40
3082.43	20 *c,w,v*	3796.60	12 *c,w,v*	4507.99	20
3088.76	10	3833.70	10	4513.31	300 *c*
3100.66	20	3834.23	15	4516.63	50
3108.80	40	3843.43	15 *c,w,v*	4519.76	20 *c*
3110.86	12	3869.94	15 *c*	4522.71	100
3118.20	20 *c,W,v*	3875.26	15 *c*	4523.87	30
3121.37	12 *c*	3876.88	20 *c,w,v*	4525.97	30 *c*
3128.94	15 *c,w*	3917.27	25 *c,w*	4528.95	15
3151.63	15 *c,w*	3927.60	10 *c,W,v*	4529.92	40 *c*
3153.77	10	3929.85	25	4530.89	10
3158.31	25 *c,W,v*	3936.91	10 *c*	4536.01	10
3168.36	30 *c,w*	3945.91	10 *c*	4541.81	15
3177.71	15	3961.04	15	4545.16	30
3182.87	25 *c*	3962.49	40 *c,W,v*	4559.25	10
3184.75	50 *c*	4022.95	8	4559.69	15

Rhenium, Arc Spectrum, Re_I (Continued)

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
4565.31	10	5096.48	30 c	6229.44	8 c,W,v
4565.49	15	5104.63	8 c,w	6243.28	10 c,W,v
4580.67	30	5120.32	12	6307.71	100 d
4591.67	8	5126.68	10 c,W,l	6321.89	120 d
4606.72	50	5178.89	15 c,w	6350.75	80 d
4614.68	12 c,w	5248.85	8	6511.48	20 c?
4616.61	8 c,w	5270.96	500 c	6577.12	15 c,W,v
4621.39	25	5275.54	1000 c,W,l	6592.54	25 c,W
4625.98	10 c	5278.24	30	6605.19	80 d
4630.83	30 c	5305.56	10	6623.92	15 c
4662.49	10	5317.28	8 c	6652.86	40 c
4682.32	15	5321.27	10	6665.29	8 c,W,l
4695.01	15 c,w	5327.46	30	6711.29	8 c
4700.44	10	5331.88	15 c	6751.22	25
4705.05	20 c	5333.85	8	6813.42	200 d,l
4727.60	25	5369.45	10	6829.96	200 d
4748.39	25 c	5369.80	10	6971.52	100 c
4749.03	10	5377.08	100 c,w,l	6985.19	10 c,W
4758.86	15	5431.87	8	7006.62	60 c,W
4763.68	10 c	5532.67	25 c,w	7024.12	80 d
4791.42	100 c	5563.25	50 c,w	7246.65	100 d
4820.59	10 c,w	5573.48	8 c	7273.80	50 c,W,l
4848.47	10 c,w	5584.72	8 c	7292.68	120 c,W
4889.15	2000 c,W,l	5667.88	40	7452.01	15 c
4908.56	8	5711.43	8	7578.70	100 c,w
4915.02	25	5752.92	100 c,w,l	7611.87	20
4923.91	100 c	5776.81	200 c,W,l	7620.19	60 c,w
4935.85	8	5815.89	8 c,w	7640.91	200 c,W
4946.73	50	5834.31	500	7912.90	80 c
4956.77	20	5851.98	10 c,W,l	7980.70	50 c
4985.99	40 c	5943.24	30	8417.10	60 c
5058.55	25	6146.82	8 c	8527.68	40 c

Rhenium, Infrared Arc Spectrum

Abridged from the list of Meggers, Jour. Research of B. of S. **10**, 757, 1933 The original list contains 300 lines. All lines of an intensity of 8 or above are included in the following table.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
7228.03	20	7828.13	8	8399.79	8 c,w
7246.67	200 c,W,l	7844.14	10 c	8417.14	300
7273.84	100 c,W,l	7869.60	100 c,W,l	8527.73	300 c,W,l
7292.67	250 c,W,l?	7880.72	8 c	8570.71	15
7352.03	30 c,W,l	7882.09	25 c,W,l	8630.66	8 c
7386.35	15	7898.47	40	8643.61	15
7409.47	15	7912.94	400 c,W,l	8648.97	30 c,W,l
7524.48	20 c,W	7938.57	8	8675.65	50 c,W,l
7548.71	30	7970.87	15 c?	8683.75	8
7578.72	200 c,w	7971.26	20 c?	8697.26	20 c,w
7611.90	100	7979.04	20	8786.77	40 c,W,l
7620.25	200 c,W,l	7980.75	300 c,W,l	8797.70	30 c,W,l
7640.93	400 c,W,l	8052.11	10 c,W,v	8882.95	15 c,w,v
7693.63	20 c	8060.03	30	8886.58	15 c
7705.92	25 c	8088.25	15	9250.02	10
7733.62	25	8166.63	8 c,w	9268.46	15 c,w
7743.15	15 c,w	8293.73	20	9363.13	20 c
7789.88	8 c	8301.01	20 c,w	9380.24	10 c
7825.85	10	8357.59	25	9383.74	40

Rhenium, Infrared Arc Spectrum (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
9423.44	15	9842.63	20 *c,W*	10128 78	15
9470.14	30	9872 38	15 *v,d?*	10169 85	100 *c,W*
9500.49	8	9943.70	20	10175 68	20 *w*
9581.12	8 *c*	9949.90	200 *c,W*	10206 32	20
9710.52	50	9955.45	60 *c,W*	10332 57	10 *c,W*
9762.65	20	10064.02	10 *c,W*	10639.44	10 *c,W*
9831.35	9				

Rubidium, Infrared Arc Spectrum

Meggers, Jour. Research of B. of S. **10**, 669, 1933

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
8861.5	20 *H,l*	9523.4	10 *H,l*	10055.2	30 *H,r*	10284.8	4 *H,l*
8869 7	100 *H,l*	9540.8	5 *H,l*	10076.1	500 *H,l*	10305.3	2 *H,l*

Silicon, Arc Spectrum

Abridged from the list of Kiess, Jour. Research of B. of S , **11**, 775, 1933. The original list contains 130 lines. All lines of an intensity of 8 or above are included in the following table.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
3905.527	100	6244.74	12 *h*	7424.70	20	9413.54	100
4102.926	25	6254.55	15 *h,l*	7680 48	100 *b*	9689.38	8 *b*
5645.665	25	6976.80	10 *h*	7913.49	10 *b*	10288.93	25
5665.601	25	7003.67	50 *h*	7918.37	200	10371.25	50
5684.523	50	7005.73	50 *h,v*	7932 14	250	10585.08	100
5690.470	40	7017.81	10 *h,l*	7943.91	500	10603.37	50
5701.138	25	7035.25	50 *b*	7970.25	10 *b*	10627.76	15 *b*
5708.437	75	7165 78	50 *h,l*	8093.32	25 *b*	10660.94	40
5754.258	8 *b*	7226.20	10	8502.33	10 *b*	10689 56	20 *b*
5772.258	50	7235 30	10	8556.63	100 *h*	10694.14	25 *b*
5780.452	25	7250 74	40 *b*	8648 54	100 *h,l*	10727.17	30 *b*
5793.128	30	7275.24	50	8728.36	10 *b*	10749.32	35
5797.912	40	7289.28	250	8742.57	100	10786 81	25
5948.584	100	7405.94	300	8752.16	200	10827 06	50
6145.22	15 *h*	7409.14	100	8892.96	25 *b*	10843.98	15 *b*
6155.32	50 *h*	7416.08	250	8925.52	8 *b*	10869.50	50
6156.00	10 *h*	7423.64	500	8949.34	15 *b*	10979.27	10

Silicon$_I$, Arc Spectrum

Abridged from the list of Kiess, Jour. Research of B. of S. **21**, 185, 1938. All terms of an intensity of 8 or above are included.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
1629.96	8 *r*	1700.43	15 *r*	1770.94	10	1799.14	10
1696.20	20 *r*	1769.78	15	1776.85	10	1809.05	30
1697.96	20 *r*	1770.63	8	1783.23	8	1814.02	50

Silicon$_{I}$, Arc Spectrum (Continued)

λair A	Intensity	λair A	Intensity	λair A	Intensity	λair A	Intensity
1814 09	30	2163.78	10 *b*	5780.452	25	8093.32	25 *b*
1822.46	10	2177 30	8 *b*	5793.128	30	8230.67	15
1836.52	20	2207.972	75 *r*	5797.912	40	8444.00	15 *b*
1838.00	10	2210.880	100 *r*	5948.584	100	8501.50	20 *b*
1841.16	10	2211.737	75 *r*	6145.08	10 *h*	8502.38	30 *b*
1841.47	20 *r*	2216.670	150 *r*	6155.22	20 *h*	8556.64	100 *b*
1843 77	15	2218.052	50 *r*	6243.86	10 *h*	8648.89	100 *h,l*
1845 53	25 *r*	2218.914	25 *r*	6244.56	10 *h*	8728.38	10 *b*
1846 13	12	2289.61	10	6254.25	25 *h*	8742.60	100
1847.47	35 *r*	2303.03	20	6976.53	25 *b*	8752.17	200
1848.16	20 *r*	2435.160	100 *r*	7003.58	50 *b*	8892.97	25 *b*
1848.75	18	2438.77	25	7005.84	50 *b*	8925.55	8 *b*
1850 68	50 *r*	2443.37	20	7017.68	10 *b*	8949.33	15 *b*
1851 80	10	2452 12	20	7034.96	50 *b*	9413.59	200
1852.48	25 *r*	2506.896	150 *r*	7165.62	100 *b*	9689.41	8 *b*
1853.17	10	2514 320	100 *r*	7184.89	10	10288.83	25
1873.11	8	2516 111	250 *r*	7193.56	8	10371.23	50
1874.86	25	2519.206	100 *r*	7226.20	20	10585.12	100
1875.82	10	2524.112	125 *r*	7235.32	15	10603.38	60
1881 86	12	2528.513	175 *r*	7235.86	10	10627.81	20 *b*
1887.71	12	2532.38	20	7250.69	40	10660.98	50
1893 22	25	2568.63	15	7275.28	50	10689.52	20 *b*
1901 34	50	2577.13	10	7289.25	250	10694.14	50 *b*
1904.66	12	2631.28	50 *r*	7290.21	10	10727.21	75 *b*
1976 96	15	2881.595	200 *r*	7373.02	10 *b*	10749.40	60
1978 57	12	2970.35	15	7405.85	300	10786.86	50
1980.00	10	2987.65	25	7409.11	100	10827.09	100
1982.60	20	3905.527	100	7415.37	15	10844.02	25 *b*
1985.73	20	4102.926	25	7416.00	250	10869.54	125
1988.36	30	5645.665	25	7423.54	500	10885.16	10 *b*
2010.97	8	5665.601	25	7424.63	20	10979.27	35
2054 81	8	5684.523	50	7680.35	100 *b*	11018.00	70
2058 13	50	5690.470	40	7913 47	10 *b*	11187.74	20 *b*
2061.18	8	5701.138	25	7918.38	200 *b*	11290.01	10 *b*
2082.01	15	5708.437	75	7932.20	300 *b*	11984.20	20
2084 47	20	5754.258	8 *b*	7943.94	500 *b*	11991.57	10
2122 99	10	5772.258	50	7970.26	10 *b*	12031.49	25
2124.111	100 *r*						

Sodium, Infrared Arc Spectrum

Meggers, Jour. Research of B. of S. 10, 669, 1933

λair A	Intensity	λair A	Intensity	λair A	Intensity	λair A	Intensity
10745.9	4	10748.7	2	11381.62	6	11403.96	10

Strontium, Infrared Arc Spectrum

Abridged from the list of Meggers, Jour. Research of B. of S. 10, 669, 1933. The original list contains 30 lines. All lines of an intensity of 8 or above are included in the following table.

λair A	Intensity	λair A	Intensity	λair A	Intensity	λair A	Intensity
6546.77	50	6892.56	200	7287.41	20 *h*	9196.08	10 *n,l*
6550 22	200	7070.10	2000	7309.41	500	9776.26	20 *n,l*
6617.26	300	7153.02	30	7621.50	100	10036.59	300
6643.53	200	7167.20	200 *h,l*	7673.06	200 *h,v*	10327.29	1000
6791.00	500	7232.20	100 *h,l*	8700.05	10 *n,l*	10914.83	200
6878.32	1000						

Tantalum First (Arc) Spectrum

Abridged from the list of Kiess and Stowell, Jour. Research of B. of S. **12**, 459, 1934. The original list contains 2100 lines. All lines of an intensity of 8 or above are included in the following table. Intensities are on King's scale

λ_{air} A	Arc
2396 31	8
2406 55	10
2427.63	18
2442 39	8
2472.14	8
2474.62	10
2478.22	8
2484.96	10
2486 70	8 + (Fe)?
2504.45	20
2507.45	15
2512 64	12
2519.78	12
2526.34	10
2526 66	10
2531.29	10
2533.01	10
2534 48	8 *b*
2534 98	10
2535.60	8
2535.97	8
2546 81	10
2549.39	10
2551.06	12
2551.20	8
2551.35	8
2555 07	10
2559.43	25
2560.68	15
2562.10	10
2563 34	8
2563.71	10
2566 33	12
2573.54	18
2573.80	15
2574 38	15
2575 47	15 *r*
2577.78	10 *r*
2579.62	12
2580.15	12
2584 69	10
2585 62	10
2588.54	8
2590.94	10
2592 43	8
2593 09	15
2593.67	18
2595 26	15 *r*
2596 12	10
2598.75	10
2599.40	15 + (Fe)?
2600 14	10
2601 05	15
2602 38	12
2603.83	10
2605 33	10
2608 22	8
2608 63	15 *r*
2609 00	12
2610 14	10
2611.36	12
2615.26	10
2615 48	10
2615 66	12
2617.63	10
2620 19	10
2624.12	8
2625.46	8
2635 93	8
2636 36	8
2636 67	25 *r*
2636 90	30 *r*
2642 24	10
2643 88	15
2646 21	25
2646 36	20 *r*
2647 47	30 *r*
2650 02	15
2650 28	18
2652 32	12
2653 27	50 *r*
2654 00	10
2655 68	10
2656.06	8
2656 61	30 *r*
2657 30	10
2659.66	12
2661.33	30 *r*
2661 88	18
2662.10	12
2665 94	10
2668 06	15
2668 62	20
2671 63	12
2671 98	10
2673 58	10
2674 48	10
2681 88	12
2684 27	18 *r*
2686 29	15
2690 54	10
2691 31	18 *r*
2692 39	18
2693 34	15
2693.50	10
2694 75	12
2696 80	15
2698 29	20
2700.68	10
2701 60	10
2702 21	8 *r*
2703 05	12
2704 30	15
2706.68	12
2707 83	8
2710.12	20 *r*
2714.66	18 *r*
2717 18	15
2718 37	15
2720.74	12
2721 83	10
2723 26	8
2723 86	15
2724 34	12
2726 32	8
2727.77	15
2732 05	12
2732 91	10
2736 24	20
2740 18	8
2741 16	12
2741.37	8
2742 91	8
2743 58	10
2746.68	8
2747.25	12
2748.77	20
2752 29	10
2758 31	20 *r*
2770.76	10
2774 88	10
2775 90	20 *r*
2779.11	35
2779.72	20 + (Cb)?
2780 20	10
2781.37	25
2781 79	15
2783 69	10
2787.69	50
2788 31	12
2789.77	20
2790 46	10
2790.72	25
2791.67	20
2792 66	10 *b*
2796 33	25
2796 55	15
2798 40	15 *r*
2800 56	15
2802 06	30
2802 71	20
2804.75	10
2806 29	20
2806.59	25
2810 91	25
2814 80	10
2815.11	10
2817 50	10
2819 38	8
2821.98	15
2824.81	8
2826 19	12
2826 42	10
2827 14	15 *b*
2833 63	20
2834 41	15 *b*
2836 61	12

Tantalum, First (Arc) Spectrum (Continued)

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
2837.93	12	2946 91	25	3385 05	10
2842 80	15	2947 81	10	3398 34	9
2844 23	12 *r*	2951.92	30	3406.64	8
2844 76	10 *r*	2953.55	20	3406.96	8
2845 34	20	2957 58	12	3414 14	10
2845 82	8	2963 32	35	3430 92	8
2846.75	12	2963 91	10	3480 51	10 *d?*
2848.03	15	2965 54	20 *r*	3497 85	10
2848.52	12	2969 47	20	3503.87	8
2849 82	18	2969.88	10	3511 04	10
2850 48	20	2975.54	20	3607.41	15
2850.97	25	2976.12	8	3625.23	8
2852.94	10	2976 76	10	3626 61	10
2857.29	15	2978 74	20	3642 06	20
2861.98	20	2984.35	10	3731 02	10
2864.48	15	2988 56	15	3736.77	10
2866.12	15	2989.48	20	3746 38	8
2868.62	25	2991 22	10	3784.26	15 *c*
2871.40	25	2993 13	8	3792.03	9
2873 34	15	3001.53	10	3823 60	12
2873 56	15	3004 92	12	3826 85	10
2874 14	12	3006 54	8	3828.95	10
2876 13	20 *b*	3011 11	20	3833 76	15
2878.19	8	3011 88	15	3836 62	8
2879 73	10	3016 36	10	3839 04	10
2880 00	20	3019 09	8	3848 05	10
2882 33	15	3019 66	10	3859 82	8
2889 37	15	3025 17	10	3885.20	8
2891 02	15	3027 48	20 *c*	3918 52	10
2891.84	30	3028 78	10	3922.77	10
2892 00	10	3030 28	8	3922 93	9
2894 15	12	3040 98	8	3970 10	15
2895 08	12	3043 94	20	3981 95	8
2896 41	15 (W)?	3045 95	15 *c*	3988.70	8
2898 41	10	3048 87	12	3996 16	20 *c*
2899 02	10	3049 56	18	3999 27	15
2900.34	20 *r*	3050 11	8	4006 83	10
2901 04	10	3058 65	15 *d?*	4026 94	12
2902 05	25	3060 27	15	4029 94	10
2902 61	8	3063 56	18 *r*	4033 07	8
2904 07	15	3069 21	20 *c*	4040.86	10
2904 42	8	3077 24	15 *d?*	4041 05	8
2905 73	10	3078 24	8	4061 39	10 *c*
2914.12	20	3079 96	10	4064 63	15
2914 94	8	3081 85	10	4067 23	15
2915 33	20	3103 26	8	4067 90	20 *c*
2915 49	25	3170 30	8 *c*	4079.19	8
2917 11	8 *b*	3173 58	8	4105.03	10
2924 78	8	3180 95	10 *d?*	4123 17	10 *c*
2925 21	30 *b*	3192 24	8 *c*	4127 88	8
2925 65	10	3198 67	8 *c*	4129.37	30 *c*
2926 46	10	3223 84	10	4136 21	15
2930.99	12	3229 23	10 *c*	4147 90	15
2932 67	25 *b*	3230 87	10 *c*	4175 20	40 *c*
2933 54	30	3242 05	8	4181.15	10 *c*
2934 85	10	3242.84	8	4205.88	20 *c*
2935 95	8	3274 93	10 *c*	4206 40	15
2938.44	10	3311.16	20 *c*	4228.63	10
2939 29	15	3317 93	10 *c*	4245.36	10
2940 02	20 *b*	3318 87	12 *c*	4268.27	10 *c*
2940 21	25	3331 02	10 *c*	4279.07	10
2942 13	20	3358 47	10	4302.97	15 *c*
2943.77	8	3371 54	10	4355 18	10 *c*

Tantalum, First (Arc) Spectrum (Continued)

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
4378 82	10	5115 84	35	5704 31	10
4386.07	10	5117 23	12	5706 30	15 *c*
4398 45	10	5132 10	12	5715 25	12
4402 49	20 *c*	5136.47	30 *c*	5716 53	8 *b*
4415 74	12	5141 63	30 *c*	5746 68	10
4430 40	12	5143 70	20	5755 80	12
4441.05	12	5153.42	15	5761 59	8
4441.76	12 *b* + (Cb)?	5156 33	20	5766 55	12
4450 73	10	5156 57	20	5767 90	15 *c*
4459.79	12	5161 82	18 *c*	5771 94	8
4473 53	10	5163 64	15	5776 76	20
4510.97	40 *d*?	5166 79	12	5780 01	10
4521 09	10 *b*	5212 75	35 *c*	5780 70	18
4527 50	8	5218 44	20	5811 10	20 *d*?
4530 80	12	5218 67	25	5816 51	8
4551 96	12 *c*	5230 80	15	5843 93	12
4556 35	10 *c*	5235 39	12 *c*	5849 81	12 *c*
4565 86	10	5275 01	12	5866 58	8
4573 32	8	5279 80	12	5877 36	20
4574 32	15	5281 05	10	5882 29	12
4619 52	15	5295 00	20	5901 90	12
4633 05	8	5328 38	20 *c*	5916 51	9
4661 10	12 *c*	5336 12	15	5918 94	15
4669 15	12	5341 06	35 *c*	5939 75	20 *b*
4681 88	15	5342 24	12	5944 01	30 *d*?
4684.88	8	5349 08	25 *c*	5951 78	8
4691 91	20 *c*	5349 58	25	5997 24	35 *c*
4706 10	8 + (Cb)?	5354 67	30 *c*	6009 92	10
4722 88	8	5365 92	8	6015 90	8
4730 11	8	5373 00	8	6020 72	18 *c*
4740 14	10 *c*	5388 48	15	6045 38	30
4756 50	10	5389 30	25 *c*	6047 25	18
4768 99	10	5395 96	20 *c*	6053 70	8
4780 94	8	5397 54	15	6101 56	12
4812 74	10	5402 51	40 *b*	6140 08	8
4819 52	9	5404 95	35 *b*	6144 60	10 *c,l*
4825 42	8	5408 78	15	6152 52	8
4846 43	8	5410 55	10	6154 49	15
4883 94	8	5413 47	20 *c*	6158 84	8
4904 58	20	5419 19	30 *c*	6208 37	8
4907 72	12	5431 65	10	6249 81	10
4914 97	10	5433 00	8 *b*	6254 66	8 *c,v*
4920 13	35 *c*	5435 27	30	6256 68	20
4920 88	10	5458.43	10	6268 70	25
4921 29	25	5461.31	25	6278 34	12
4923 47	15 *c*	5471 54	10	6281 36	12 *b*
4924 96	10	5475.57	25	6287 36	8
4926 02	35	5481 13	15 + (Cb)?	6287 91	10
4936 41	30	5490 13	20	6289 33	12
4937 63	15	5494.81	18	6309 07	10
4958 09	8	5500 69	15	6309 59	18
4969 73	15 *c*	5505 67	10	6312 22	9
5012 54	25	5518 91	30 *c*	6325 09	15
5037 33	30 *c*	5545.20	8 *c*	6332 89	10
5037 65	30	5548 32	10 *b*	6341.17	12
5043 32	25	5584 02	15 *c*	6345 99	10
5067 86	25	5620.69	15 *c*	6356 16	18 *b*
5076 38	18	5635.71	10	6360 84	15
5082 26	15	5640.19	12	6373 06	10
5087 37	20	5645 92	20 *d*?	6389 45	20
5090 71	25	5664.90	25 + (Cb)?	6392 18	8
5109.37	12 *c*	5688 25	15	6428.62	15 *b*
5109.78	12	5699.24	18	6430.78	30

Tantalum, First (Arc) Spectrum (Continued)

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
6444 61	10	6902 07	20	7352 87	25
6445.87	12	6927 37	20	7356 94	18
6450 37	25	6928 53	25	7369 12	20
6459 91	10	6946 88	10	7407 87	25
6485.36	30	6951 23	15	7440 14	10
6486 08	8	6953 86	10	7467 71	12
6502 43	12	6966 14	25	7486 01	12
6505.52	15	6971.50	15 *c*	7520 56	15
6514 40	20	6995 35	20 *d*?	7649.62	8
6516 14	20	7000 20	8	7722 03	10
6561 60	10	7005 05	15	7763.10	10
6564 27	10 *c*	7006 95	25	7779.68	12 *b*
6574 84	18	7025 02	20	7814 00	18
6611.91	25	7039 06	12	7815 47	10
6621 29	20	7081 35	8 *b*	7842 76	15
6662 29	8 *c,l*	7085 39	10	7882 37	25
6673 72	20	7093 00	10	7950 24	15
6675 53	25	7117 51	12 *b*	8026 49	12
6684.00	10	7121 27	10	8281 65	20
6709 36	10	7125 72	20	8447.62	10
6740 74	18	7148 61	30	8575 92	8
6754 88	10	7172 91	25	8932 63	8
6771 71	20	7174 91	10 *d*	9197 40	8 *n*?
6774 22	15 *c*	7191 34	9	9272 63	10
6788 98	18	7233 46	8	9569 57	15
6810 42	10	7250 27	20	9645 53	20
6813 24	25 *c*	7264 82	12	9784 54	8
6850 78	8	7276 95	15	9849 37	15 *n*
6866 23	25	7296 30	12	9868 62	25 *n*
6875 24	25	7301 74	25	9919.90	8 *n*
6877 46	10	7319 82	10	9941 50	10
6896 76	9	7322 71	10 *b*	10099 41	15
6900 54	12	7346 37	30		

Titanium, Infrared Spectrum

Abridged from the list of Kiess, Jour. Research of B. of S. **20,** 35, 1938
All terms of an intensity of 8 or above are included.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
10120.90	10	10553 02	8	10689.52	15	10896.10	8
10145.48	8	10584.66	25	10726 33	18	11243.90	10
10396.85	25	10607.78	10	10732.89	8	11246.88	8
10460.07	10	10661 61	20	10774.92	12	11403.89	8
10496.14	30	10677 04	10				

Tungsten$_{II}$, Arc and Spark Spectrum

Abridged from the list of Laun, Jour. Research of B. of S. **21,** 207, 1938.
All lines of an intensity of 8 or above are included.

λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark
2001.70		8	2029.99	..	20	2053 11		8
2010 21		8	2035.87		40 *b*	2054 66	15	..
2026 06	8	30 *v*	2048.04		50 *b*	2058 30	12	20 *b*

Tungsten$_{II}$, Arc and Spark Spectrum

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
2065 58	20 *r*?	10	2295.78	15	20	2490 72	12	25
2071 22	30	.	2296.96	8	.	2492.93	18	75
2074.64	20	..	2303 82	25	75	2496.65	50	120 *l*
2083.70	10	..	2306 92	15	40	2497.48	35	75
2094.72	120	15	2307.93		10	2499 69	30 *v*	100
2101 96	20	..	2309 85	8	25	2501.88	30 *l*	10
2116.94	40		2315 02	20	50	2509.95	.	40
2118 87	70	12	2323 04	15	25	2510.48	15	75
2137 64	40	.	2326 09	15 *r*?	60	2515.81	..	10
2138.14	50	30	2328 32	20	35	2519 44	8	30
2139.16	30	.	2329 69	..	15	2522.04	40	80
2139.64	12		2333 77	15	35	2526 21		10
2153.15	8		2335 21		25	2527 20	.	15
2159 96	40	.	2336 71		15	2530.70	10	8
2166.32	80 *r*?	80	2337 80		20	2532 96		15
2167 19	12	.	2339 16	15	30	2534 83	8	50
2169 95	50	12	2339.73	10	8	2539 92		20 *b*
2173 55	60	70	2339 90	..	20	2549 10	.	15
2173 83	15	10	2341 37	25	35	2550.29	..	8 *b*
2175.49	12	.	2361 19	12	10	2551 45	.	15 *b*
2177.56	40 *r*?,*r*	30	2363 46	8	14	2554 86	20?	60
2179 64	8	8	2370 62	..	12	2555 10	20	100
2180 70	10	8	2378.13	8	15	2567.62	10	30
2186.73	80 *v*	40	2378 60	10	15	2569 30	8	80
2189 36	50	40	2381 33	.	8	2571 46	40	150
2189 50	80	50	2382 36	.	20	2572.24	8	45
2193.54	30 *d*	40	2385.50	8	12	2572 36	8	30
2197 50	8	10	2390 37	25	75	2573.82	..	12 *b*
2198 00	8	.	2390 89	.	30	2573.95	25	..
2198 68	50	80	2392 93	20	60	2576 37	8	40
2199.17	40	..	2395 10	9	10	2579 56	20 *v*	100 *d*
2203.80	10	25	2395 73	.	8 *l*	2581 20	18	30
2204 49	200 *P*	300 *P*	2397 10	20 *r*	200	2585 93	..	30
2206.60	40	200	2401 86		12	2589 17	16	90
2216 03	60	40	2403 07		10	2591.49	14	12
2219.74	15	12	2411.54		20	2595 76		8
2220 94	40	100	2411.82	10	25	2596 87		15
2225 88	120	150	2420.99	12	35	2598 75	20	35
2226 40	8	15	2422.29	30	20	2601.43	8	30
2229.62	75	100	2427.49	10	40	2603 02	20 *p*	120
2235 37	.	60	2429 53		8	2605 97		15
2235 64	20	30	2431 37		18	2606.27		20 *b*
2235.85	8	8	2435 01	10	50	2606 47		40
2237.06	15	100	2440.43	10	20	2606.97		12
2245.19	25	40 *l*	2446 39	25 *v*	120	2615 45	20	80
2246 64	15	20	2449.70	..	20	2620.76	.	30
2248 27	25 *v*	40	2451.47	35 *r,l*	50 *d*?	2623.11	.	50
2248.75	60 *r*	100	2455 87	..	35	2627 72		10
2249.38	15	12	2456 07		8	2629.00		35
2251.14	30	40	2459.60	20	10	2630.38		20
2251.43	18	25	2459 88	.	30	2630.53		9
2255 71	10	10	2464.62	14	40	2633 89		25 *b*
2256 85	12	30	2466.33	.	10	2634 87	20	9
2259.07	10	25	2466.52	35	80	2635.38	.	30
2264 18	8	35	2470.81	8	70	2637.58	15	25
2265.34	.	35	2477 80	25	200	2643.09	.	10
2266.12	15	80	2478.88	.	10	2653 57	20	35
2266.25	15	80	2481 54	10	30	2655 67	15	22
2270.23	25	125	2484 01	.	20	2658 04	25	100
2271.10	10	12	2486 43	.	18	2664.35	80 *c,v,a*	200
2282.20	25	75	2488 12	8 *p*	30	2665.64	.	8 *b*
2290.56	15	20	2489.23	40 *p,r*	200	2666 49	20 *d*?	60
2294 55	10?	35	2489 51	.	12	2669 37	..	30

SUPPLEMENTARY TABLES OF SPECTRA (Continued)

Tungsten$_{II}$, Arc and Spark Spectrum

λair A	Arc	Spark
2677 79	20	60
2679.64	20	70 *b*
2688 23	.	35
2694.38	20	60
2695 00		30
2697.72	80	160
2701 49	20	60
2703.06	8	60
2703 12	8	10?
2705 60	10 *b,v*	35 *b*
2706.73	.	50 *b*
2709 58	20	80
2710.79	8	40
2715.35	25	80
2716 32	30	80
2717 70	.	18 *b*
2718 04	30	120
2720 40	..	30
2720.60	25 *d,l*	40
2721 85	.	15
2722 80	20	70
2729 62	25	75
2745 04	..	30 *b*
2750 33	10	20
2758.33	18	20
2761.59	40	100 *b*
2764.26	200	400
2768.32	30	50
2773.85		25
2776.51	20	100
2780 28	60 *a*	40
2782.14	20	80
2785.64	12 *c*	50
2786 32	.	20 *b*
2790.43		50
2799 04	20	100
2801 06		30
2801 43	.	10 *b*
2805 94	20	120
2822 54	25	125
2831 24		35
2834 21		50 *b*
2839 82		10
2866 32	8	10
2866 60		8
2866 75		20
2867.41		15
2867 93		20
2868 74	8	80
2886 92	.	35
2888 32	15	8 *b*
2904 08	8	80
2913.75	12	30
2914 65	.	15
2916 77		10
2916 90		12 *b*
2925 00		40
2926 84		15
2935.36	8	25
2938.87	.	12 *b*
2939.76		35
2940 21	8	60
2942 13	12	10 *d*
2942.26	..	10
2942.62		10
2952.26	75 *d?*	100 *d?*
2955 01	8	15
2961 02	12	50
2962 51	.	8 *b*
2967 92		20
2974.38	20	35
2976 48	15	50
2982.22	.	25
2987 29	15	60
2990 85		12 *b*
2998 69	15	50
3000 63		50
3002 29		40
3010.76		100
3021 98	50	100
3022 68	.	50
3024 51	30	300
3028 74	.	15 *b*
3036 68	8 *v*	100
3039 59		30
3048 61		40
3049 86	8	60
3051 30	40	400
3053 36	10 *b*	
3061.69	10	30
3063.42		20 *b*
3063 98		50
3066 99	8 (*r*?)	80
3067 42		10
3067 58	8	80
3069 29	10	90
3071 74	10	60
3072.75		40
3098 31		15
3100 75		60
3103 53		20
3108.79	10	80
3144.50		30 *b*
3149 87	20	500
3151 31		300
3151 58		20
3152 76		10 *b*
3154 19		15
3160 03	20	300
3175 97	20	200
3177 22	60 *d,(r)*	150
3178 04	8?	80
3179 44	15	150
3183 97		10
3185 06		30
3189 24	50 *a*	100 *l*
3192 11	.	15 *b,c*
3203 34	12	80
3203.44	8 *v*	40
3206 42	8?	80
3215 67	.	30
3216.32	.	30
3228 99	8 *c,l*	20 *b*
3230 61		25
3230 85	15 *l*	15
3233 15	.	15 *b*
3243 36	20 *v*	100
3251 25	..	50 *c,l*
3254 85	..	10 *b*
3257 81	.	20 *b*
3286 57	20	100
3299.74		30
3301 85	18 *c,v*	20
3317 41	.	25 *b*
3320.94		20 *b*
3338.63		50
3339 03		60
3342 46	30	300
3343 09	10	100
3343 40	12	120
3344 89		25
3345 86	200	200 *b*
3352.38	.	30 *b*
3358.62	70	200
3359 28	.	30
3361.11	40	100
3363.73	15 *c*	40
3374 87		30
3376 17	20	400
3379 04	..	50
3394.47	.	20
3401 90	30	150
3437 25	.	20 *b*?
3440 60		20
3442.52	.	20?
3449 88	8	80
3452 51	.	30
3463.52	20 *v*	200
3468 24		10
3472 33		15
3486.14	10	100
3489 81	..	10
3490 33	8	50
3490 92	12	80
3492 08	..	40
3527 05		40
3529.57	60 *r?*	100
3534.14		10
3539.48	.	15
3544 48	.	30
3549.08	30 *d?*	150
3555.18	12	120
3572 03	8 *v*	10
3572 48	100	200
3592 43	50	80
3613 80	30	80
3618 46	.	30
3641 42	40	150
3645 61	10	40
3646 60	10	40
3652.14	12 *b*	10 *b*
3657.59	40	120
3657.88	10	30
3691.49	10 *l*	
3716.08	10	50
3935.44	.	10
4175.63		8
4348.13	.	8

Vanadium, Arc Spectrum, V_I

Meggers and Russell, Jour. Research of B. of S. **17**, 125, 1936.

The following table is abridged from the list as published by Meggers and Russell which contains 2525 lines. All lines of an intensity of 8 or above are given.

Wave lengths are given on the International Scale, intensities according to King's scale.

λair A	Arc	λair A	Arc	λair A	Arc
2082 49	20 *r*?	2312 410	8	2428 269	100 *R*
2086 31	8	2312 531	10	2431 568	10
2088 56	15 *r*?	2314 691	20	2431.940	20 *r*?
2090 64	20 *r*	2315 634	30	2432 014	25 *r*?
2091 29	20 *r*	2316 751	25	2435.518	100 *R*
2092 30	10 *r*	2320 156	25	2439 102	50 *r*
2092.44	60 *r*	2322 096	15	2441 352	15
2094.70	25 *r*?	2324 189	10	2441.892	30
2095 75	8	2324.748	40	2465.664	10 *h*
2096.16	8	2325 873	30	2471.443	10
2100.51	8	2327 970	10	2475 178	10
2169.85	8	2329.529	30	2476 510	8 *h*
2170.74	60 *R*	2333 33	20	2480 606	30 *h*
2173.15	80 *R*	2334.434	40 *r*	2481 11	10 *h*
2177 00	100 *R*	2339 673	20	2482.115	20 *h*
2177.24	10	2340 479	50 *r*	2482 711	15 *h*
2181.97	20	2347 026	10	2487.528	10
2182 22	120 *R*	2380 266	8	2495.787	20
2187.39	10	2384 286	20	2498 024	10 *h*
2187 95	15	2386 409	20 *h*	2498.232	20 *h*
2191.10	30	2386 956	40	2499.094	15
2194 65	10	2387 780	8	2499 244	12
2196.40	40 *r*?	2388 084	35	2499.959	8
2200 174	15	2388 910	40	2501 608	60 *R*
2202 724	60 *r*	2390 774	30	2503 300	50 *r*
2204 930	12	2391 268	30 *h*	2505 540	15
2213 692	10	2392 898	40 *h*	2506 902	150 *R*
2216 666	10	2394 270	10	2507 777	100 *R*
2218 238	25 *r*	2395.104	30 *h*	2510 242	8
2222.834	15	2395.429	10 *h*	2511 182	20 *h*
2223 014	20	2396 492	15 *h*	2511 642	80 *r*
2225 029	8	2396 706	8	2511 940	100 *r*
2225 422	30	2397 775	40 *h*	2514 322	15 *h*
2225.787	10	2398 134	20	2514 41	10 *h*
2228 835	15	2398 277	20 *h*	2515 145	30 *r*
2229 734	25 *r*?	2398 697	10 *h*	2517 142	80 *R*
2230 362	20	2399 954	50 *R*	2517.500	8
2231.412	30	2401 901	60 *R*	2519 622	100 *R*
2232 252	8	2403 029	10 *h*	2520 31	10 *h*
2234 680	10	2405 245	10 *h*	2526 213	100 *R*
2237.228	50 *r*	2405 494	8	2530 174	80 *R*
2241.846	40 *r*	2406 748	50 *R*	2533 800	10 *h*
2243 742	8 *h*	2407 900	40 *R*	2534 825	15 *h*
2245 756	30	2412 686	80 *R*	2536 932	8
2247.520	9	2413 031	60 *R*	2543 723	20
2250.672	30 *r*?	2415.326	110 *R*	2545.981	30 *r*?
2256 968	50 *r*	2416 748	150 *R*	2549.965	12
2258.805	9	2417 351	100 *R*	2552 648	50 *r*
2264 39	30? (Fe)?	2418 738	15	2554.856	15
2283 382	10	2420 115	100 *R*	2556.016	9
2284 494	20	2420 221	8	2558.893	15
2286 581	8	2421 058	120 *R*	2562.125	60 *R*
2291.527	10	2421.976	140 *R*	2564 228	20 *h*
2308.287	15	2423 370	40 *r*?	2564 817	40 *r*?
2310.180	20	2426.126	15	2568.376	30 *h*
2311.465	30	2427.735	20	2574.020	50 *R*

Vanadium, Arc Spectrum, V_I (Continued)

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
2577 292	20 *r*?	2916 00	8	3088.119	30
2607 752	10	2917.94	8	3089 134	25
2611 255	8	2923 627	70 *R,a*	3091 42	20
2620 284	20	2926 258	12	3091 552	15
2634 864	8 *H*?	2927 646	10 *h*	3092.72	8
2637.222	20 *H*	2930 89	15 *h*	3093.79	25
2645 256	10	2934 72	20 *h*	3094 669	20
2647 710	40 *R*	2935.880	15	3112 93	8
2651 896	50 *R*	2937 696	15	3147 255	8
2652 919	20	2942.33	10	3156 19	10
2653 824	25	2942 354	10	3183 415	150 *R,a*
2656.224	60 *R*	2943.197	30 *r*	3183 96	125 *R,a*
2656 55	10	2943 84	12 *h*	3183 995	150 *R,a*
2661 424	70 *R*	2944 76	10 *h*	3185 404	40 *R,a*
2665 958	20	2946 54	15	3198 012	20
2671 669	40	2949 62	25	3202 383	25
2675 758	8	2953 943	50 *R*(Fe)	3205 581	15
2678 878	10	2954 33	20	3207.415	20
2683 092	80	2955 806	15	3212 437	15
2685 14	15	2957 176	8 *h*	3217.113	10
2686 356	9	2957 30	10 ?	3249 567	10
2686 512	10	2957 520	10	3254 783	10
2688 719	60	2961 127	10	3255.649	9
2696 996	40 *r*?	2962 784	30 *r*	3263 238	15
2697 744	50 *r*?	2974 217	8	3271 635	12
2698 724	40	2975.077	8	3283 311	15
2699 12	20	2976 527	8	3298 147	15
2721 139	20	2977 550	25 *r*	3309.179	8
2722 560	60 *r*	2990 93	8	3329 858	12
2731 347	80 *r*?	2999 20	12	3356 358	10
2731 518	20 *h*?	3001 90	10 *H*	3365 556	10
2733 334	8	3002 65	8	3376 059	8
2753.084	8	3004 82	10	3377 398	10
2755 653	10	3014 33	15 *H*	3377 629	15
2773 66	8	3016 17	20	3400 396	12
2777 70	8 *h*	3022 77	10 *H*	3402 572	9
2785 52	8	3031 009	10 ?	3414 77	150 *R*(Ni)
2785 66	10	3038 710	10	3461 66	125 *R*(Ni)
2846 600	20	3041 83	8	3529.743	10
2848 807	15	3042.672	15 (Fe)	3533 666	10
2849 197	15	3043 123	50 *r*	3543 498	8
2851 784	20	3043 553	50 *r*	3545 339	8
2852 899	25	3044 938	50 *r*	3583 706	8
2855 252	20	3050 396	25	3606.694	8
2857 972	20	3050 883	35 *r*	3640 392	15 (Fe)
2858 787	10	3052 195	20	3644 709	8
2859 997	25	3053 65	80 *R*	3663 582	15
2862 418	10	3056 339	100 *R*	3665 137	8
2863.076	12	3060 457	125 *R*	3667 731	15
2864.386	30 *r*	3063 725	12	3671 207	10
2866 447	20	3066 373	125 *R*	3672 394	8
2866 620	15	3066 51	20	3673 392	12
2866.971	10	3069 648	30 *r*	3675 698	20
2868 130	20	3073 825	60 *r*	3676 693	10
2870 575	35 *r*	3074 06	10 *h*	3680 103	15
2894 583	8	3074 83	8 *h*	3683 114	30
2899 207	20	3075 269	10	3686 259	8
2899 602	30	3075 935	8	3687 473	12 ?
2903.700	12	3080.34	12	3688 070	50
2904 126	20	3082.109	50 *r*	3690.277	40
2906 134	40 *r*	3083 542	30	3692 224	50
2914 924	50 *R,a*	3084 384	20	3695 331	30
2915 33	10	3087.072	15	3695 867	40

Vanadium, Arc Spectrum, V_I (Continued)

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
3703 566	100 *a*	4092 417	8	4421 585	20
3704 705	60	4092 694	50 *a*	4423 210	8
3705 037	30	4095 485	25	4426.011	20
3738 760	8	4099 796	60 *a*	4428 519	15
3747 980	8 *h*	4102.163	20	4429.802	15
3767.250	[8 *W*]	4104 392	12	4436.140	15
3778 683	25	4104 779	15	4437 842	20 *a*
3790.331	20	4105 166	60 *a*	4441.688	25
3790 467	8	4109 780	50 *a*	4444 216	20 *a*
3793 614	8	4111 790	100 *R,a*	4452.022	20
3794.962	50 *a*	4113 517	12	4457 484	15
3799 922	25	4115.179	60 *a*	4457.762	8
3803 487	25	4116 479	50 *a*	4459 766	30 *a*
3806 798	8	4118 187	8	4460 302	50 *a*
3807 506	20 *a*	4118 648	8	4462.367	20
3808 521	40	4119 463	8	4468.008	8
3809 599	15	4120.545	8	4469 712	15
3813.499	60 *a*	4123.56	60 *a*	4474 047	10
3815 514	10	4128 077	60 *a*	4474.721	12
3817 847	8	4132.019	60 *a*	4488 898	20
3818.241	60	4134 50	60 *a*	4496 062	8
3819.967	15	4159 696	8	4501 972	8
3821.485	15	4179 421	15	4524 218	15
3822 008	30	4182 596	10	4529 589	8
3822 890	15	4189 849	12	4545 394	25
3823 212	15	4191 55	10	4549.644	10
3828 562	60 *r*	4209 857	20	4560 710	20
3834 227	100 *r*(Fe)	4232 466	15	4571.783	15
3839.001	10	4232 959	12	4577 173	40 *a,cm*
3839 379	8	4234 010	12	4578.728	15
3840 443	80 *r*(Fe)	4234 531	8	4580.394	40 *a,cm*
3840 757	60 *r*	4235 765	10	4586 364	50 *a,cm*
3844.442	20	4259 320	8	4591.220	12
3847 331	20	4265 162	8 *h*	4594 103	60 *a,cm*
3855 370	30 *a*	4268 652	20	4606.146	15
3855 855	60 *r,a*	4271.563	12	4619.648	8
3862 218	12	4276 966	12	4619.771	25
3864.862	35	4284.061	15	4624.404	8
3867.610	15	4291 828	15	4635.176	15
3871 083	8	4296.121	15	4640.062	8
3875.081	35	4297 694	12	4646 396	15 *cm*
3875 909	20	4298.048	12	4670.483	25 *cm*
3876.084	20	4306.222	15	4706.178	8
3890 188	25 *a*	4307 188	12	4706 574	12
3892 864	25 *a*	4309.801	20	4710 566	12
3902 260	50 *r*	4330 033	30 *a,cm*	4714 113	10
3909 892	20	4332 832	30 *a,cm*	4717 692	10
3912 209	10	4341 016	40 *a,cm*	4722 877	8
3922 437	12	4352.892	50 *a,cm*	4750 990	8
3924.661	10	4355 958	10	4757 50	8
3925 244	10	4368 047	10	4766 635	10
3930.028	10	4379 242 *P*	150 *r,a,cm*	4776 364	10
3934 018	20	4384.730	125 *r,a*	4786 515	20
3943 666	12	4389 986	100 *a*	4796 930	20
3990 574	20	4395.243	80 *a*	4807 537	25
3992 801	12	4400.589	60 *a*	4827 458	30
3998.731	15	4406.649	80 *a*	4831 642	35
4050.961	10	4407 655	70 *a*	4832 427	30
4051.356	12	4408 209	70 *a*	4851.483	40 *a,cm*
4057 069	10	4408 515	90 *a*	4864 741	40 *a,cm*
4063 932	10	4412 142	12	4875 462	40 *a,cm*
4071 537	8	4416 480	20	4880.560	8
4090 587	25	4419.944	12	4881.554	50 *a,cm*

Vanadium, Arc Spectrum, V_I (Continued)

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
4904 285	8	6268.841	8	8342 04	60
4904.350	[9]	6274.670	15	8402 79	15
4925 657	10	6285.185	20	8431.63	10 *h* + *p*?
5194 824	10	6292 858	20	8499.50	50
5234.088	8	6296 518	15	8505 63	10
5240.878	9	6452.354	10	8534.50	30
5393 185	10 (Fe)	6504.164	9	8541 98	20
5401.945	8	6531.44	15	8580.37	8 *h*
5415.277	10	6605.98	10	8919.85	100 *c.w*
5487 915	10	6623 51	8	8932.95	50 *c,w*
5507 753	8	6753.00	80 *c*	8971.62	40
5547.080	8	6766.49	60	9021 08	20
5584 490	10	6784.98	40	9022.70	20
5592.409	12	6812 40	20	9037.58	30
5604 943	8	6829 94	10	9046.68	50
5624 605	20	6832 44	10	9085.26	40
5624 895	10	6870.86	8	9100.78	8
5626 014	8	7026 05	10 + *p*	9105.86	10
5627 628	30	7264.28	8	9156 54	20
5646 112	10	7338 92	30	9164.84	40
5657 449	12	7356.51	20	9168.76	20
5668 369	12	7361 39	10	9226 09	20
5670 827	30 *cm*	7363 16	15	9242 89	30
5698.509	60	7624.80	15	9255.84	10
5703.562	40	7937.90	30	9265 59	20
5706 973	30	8027.36	100 *c,w*	9273 31	15
5727 024	60	8028 13	20 *c,w*	9290.34	10
5727 662	20	8093 48	100 *c*	9308.64	20
5731.257	30	8102 42	40	9328.14	40
5737 040	25	8108 60	30	9341.10	100
5743 438	18	8109.07	20 *d*?	9366.86	50
5846 306	8	8109 88	15	9384 83	30
6039.690	25	8116 80	200 *c,W*	9398 92	10
6081 421	25	8136 80	20 + *p*	9411 32	30
6090.184	50	8144 58	50	9435 52	80
6111 622	25	8154 55	20	9439 80	8 *h*
6119.505	40	8161 06	150 *c,w*	9445 74	10
6135.36	15	8171 34	40	9454 44	10
6150 132	15	8180 19	15 *h*	9466 32	8 *h*
6170 340	8	8186 73	100	9476 14	10
6199.202	30	8187 33	70	9611.60	80
6213 874	15	8198 87	80	9614 68	50
6216 368	30	8203 05	100	9691.58	40
6224 507	15	8241.61	60	9708.36	10
6230.736	30	8253 51	100 *c,w*	9738 50	15
6233 187	12	8255.90	100 *c*	9865.44	10
6242.80	15	8280.39	20	10203.45	10
6243 11	30 *a*	8282.35	100	10848.0	20
6251 83	30 *a*	8324.40	30	10993.4	15
6256 906	8	8331 21	40	11107.7	10
6258 595	8				

Xenon, First Spectrum, Xe_I

Abridged from the list of Humphreys and Meggers. Jour. Research of B. of S **10**, 139, 1933. The original list contains 538 lines. All lines of an intensity of 8 or above are included in the following table.

The source was the "end on" Geissler tube.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
3549 86	10	3613 06	8	3693 49	40
3554 04	10	3669.91	10	3745.38	10
3610 32	15	3685 90	40	3796 30	40

Xenon, First Spectrum, Xe I (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
3801.39	30	5820 52	25	6533.159	100
3809 84	30	5823 890	300	6543 360	40
3823 74	10	5824 800	150	6546.12	20
3826 86	15	5830 63	20 *h*	6554.196	50 *h,l*
3948 163	60	5856 509	15	6559.97	25
3948 72	10	5875 018	100	6583.27	20
3950.925	120	5889 12	20	6590 86	8
3967 541	200	5894 988	100	6595 561	100
3974 417	40	5898 56	8	6607 41	30 *h*
3985 202	30	5904 462	20	6608 87	10
4078 8207	100	5921 85	10	6632 464	50
4109 7093	60	5922 550	20	6657.92	20
4116 1151	80	5931 241	80	6666 965	60
4135 1337	20	5934 172	100	6668 920	150
4193 01	20	5974 152	40	6678 972	25
4193 5296	150	5989 18	20	6681 036	20
4203 6945	50	5998 115	30	6728 008	200
4205.404	10	6007 909	15	6767 12	10
4372 287	20	6009.78	8	6777 57	50
4383 9092	100	6043 38	10	6778 60	40
4385 7693	70	6108 37	8	6815 64	12
4500 9772	500	6111 759	30	6818 38	15
4524 6805	400	6111 951	40	6827 315	200
4582 7474	300	6114 86	10	6840 96	8
4611 8896	100	6126 36	15	6841 50	20
4624 2757	1000	6144 97	20 *h,w*	6846 613	60
4671 226	2000	6152 069	20	6848 82	50
4690 9711	100	6163 660	90	6850 13	30
4697 020	300	6163 935	80	6860 19	40
4734 1524	600	6178 302	150	6863 20	20
4792 6192	150	6179 665	120	6866 838	50
4807 019	500	6182 420	300	6872 107	100
4829 709	400	6189 10	20	6882 155	300
4843 294	300	6198 260	100	6910 82	30
4916 508	500	6200 890	60	6922 22	8
4923 1522	500	6206 297	20	6924 67	15
5028 2796	200	6224 169	40	6925 53	100
5162 711	10	6242 09	8	6935 62	50
5362 244	15	6261 212	50	6936 69	8
5364 626	30	6265 301	40	6976 182	100
5392 795	100	6273 23	10	6982 05	30
5394 738	20	6286 011	100	7019 02	30
5439 923	30	6292 649	50	7035 53	20
5440 39	15	6294 45	15	7047 37	30
5460 037	15	6314 97	15	7119 598	500
5488 555	20 *h*	6318 062	500	7136 57	15
5552.385	80	6331 50	20	7172 70	10
5566 615	100	6333 97	40 *h,l*	7200 79	15
5579 28	40	6337 58	8 *h,l*	7244 94	20
5581.784	50	6355 77	20	7257 94	60
5612 65	15	6412 38	10	7262 54	20
5618 878	80	6418 41	30	7266 49	25
5688 373	40	6418.98	30 *h*	7283.961	40
5695.750	100	6430.155	20	7285 301	60
5696.479	80	6451 79	10 *h,l*	7316.272	70
5698 54	8	6469 705	300	7316 87	20
5709 80	10 *h*	6472.841	150	7319.94	15
5715 716	70	6487 765	120	7312.452	80
5716.252	80	6497.43	30 *h,l*	7336.480	50
5722 14	15 *h*	6498 718	100	7355.58	40
5748.20	8 *h*	6500 37	15	7386 002	100
5807.311	15	6504.18	200 *h*	7393 793	150
5814.505	60	6521 508	40	7400 41	30

Xenon, First Spectrum, Xe_I (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
7404 51	12	8171.02	100	9162 654	500
7424 05	20	8206 341	700	9167 52	100
7441 94	20	8231 6348	10000	9203.20	30
7451 00	25	8266 519	500	9211 38	25
7472 01	40	8280 1163	7000	9301.95	30
7474 01	25	8297.71	15	9306.64	40
7492 23	20	8324 58	20	9374.02	10
7501 13	20	8346 823	2000	9374 76	100
7514 54	8	8347 45	60	9412.01	60
7559 79	40	8349.05	40	9441 46	20
7584 29	10	8392 37	20	9442 68	20
7584 680	200	8409 190	2000	9445 34	80
7600 77	10	8437 55	10	9497.07	40
7642 025	500	8522 55	30	9505 78	10
7643.91	100	8530 10	30	9513 379	200
7664 02	10	8576 01	200	9585.14	20
7664 56	30	8624 24	80	9685 32	150
7666 61	10	8648 54	250	9700 99	20
7740 31	40	8692 20	100	9718.16	100
7783 66	50	8696 86	200	9799.699	2000
7789.42	15	8709 64	40	9923 192	3000
7802 651	100	8739 39	300	9966 58	10
7832 98	10	8758 20	100	10023.72	50
7841 23	15	8819 412	5000	10060 96	10
7881 320	100	8862 32	300	10084.79	20
7887 395	300	8885 71	10	10107 34	80
7937 41	40	8908 73	200	10125 47	20
7967 341	500	8930 83	200	10188.36	10
7976 03	8	8952 254	1000	10251.07	20
8003 26	10	8952 78	50	10484 83	8
8029 67	100	8981 05	100	10515 15	10
8040 56	10	8987 57	200	10527.84	40
8042 18	15	9025 98	30	10706 77	25
8057 258	200	9032 18	50	10758 85	15
8061 340	150	9045 446	400	10838 37	100
8101 98	100	9096 13	50	10895 39	10
8109 46	15	9152.12	20	11085.39	10
8118 29	15				

Xenon, Third Spectrum, Xe_{III}

Abridged from the list of Humphreys, Jour. Research of B. of S. **16,** 639, 1936. The original list contains 300 lines. All lines of an intensity of 8 or above are included in the following table.

The source was a Geissler tube operated by an alternating current transformer in a circuit containing a spark gap and condensers.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
2669.00	10	2800.22	20	2862.41	30	2930.29	20
2696 50	8	2807.25	10	2871.68	30	2932.74	25
2740 80	12	2809.07	8	2891.71	25	2939.13	10
2747.88	8	2811.67	8	2896.63	30	2940.22	40
2761.60	12	2814.47	30	2906.56	50	2945.25	60
2772.41	10	2815.94	40	2911.90	40	2947.53	40
2776 96	10	2826.05	20	2914.12	20	2948 06	40
2783.37	12	2827.45	30	2917.59	20	2964.98	15
2794.86	20	2847.66	40	2923.51	25	2966.97	10

SUPPLEMENTARY TABLES OF SPECTRA (Continued)

Xenon, Third Spectrum, Xe_{III} (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
2968.56	10	3285.89	10 *h*	3676.63	50	4214.04	20
2971.24	8	3287.92	30	3745.72	25	4216.75	10
2984.63	15	3301.60	20	3765.85	10	4240.24	10
2991.25	10	3306.80	10	3772.53	20	4272 60	20
2991.45	8	3314.87	10	3776.30	40	4285.89	30
2992.91	40	3331.65	40	3780.98	300	4308.00	10
2994.69	8	3338.98	25	3791.67	12	4434.16	50
3001.85	10	3340.06	10	3829.77	20	4453.61	8
3004.32	30	3349.76	12	3841.52	100	4503.46	10
3023.80	100	3357.98	30	3841.88	20	4537.33	30
3026.52	8	3403.89	8	3854.30	10	4657.78	9
3054.49	15	3444.23	60	3861.05	10	4673.66	30
3073 49	10	3454.25	70	3877 80	200	4683.53	60
3083.54	40	3467.20	25	3880.46	60	4723.57	30
3091.06	50	3468.19	40	3922.53	500	4794.48	12
3099.91	8	3522.83	80	3950 56	300	4869.47	40
3106.33	30	3539.96	20	3985.96	8	5008.55	10
3114.46	12	3542.33	50	3992.85	20	5107.38	20
3150.69	20	3552.13	50	4028.58	10	5223.66	20
3151.82	10	3561.38	40	4043.21	20	5238.95	60
3152.98	8	3579.69	100	4050.05	200	5367.06	30
3185.24	40	3583.64	80	4060 43	60	5401.04	50
3196.51	25	3607.01	40	4109 07	100	5413.56	12
3236.84	25	3609 44	20	4110.06	10	5524 39	40
3242.86	100	3623.13	40	4142.01	10	5552 83	12
3246.84	10	3624.05	600	4145.73	100	5748 71	12
3268.96	80	3632.14	20	4176 53	20	5857.61	10
3276.39	8	3641 00	15	4203.92	10	6221.66	25
3278.48	8	3654.63	20	4209.62	10	6238.24	60

Xenon, Infrared Spectrum

Meggers, Jour. Research of B. of S. **14**, 487, 1935.

The source was the uncondensed discharge in a Geissler tube.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
10549.76	20	11141.09	50	11537 4	1	11912 10	2
10706.78	150	11162.67	10	11614.08	25	11951.1	1
10758 86	100	11175.5	1	11742.26	50	11953.00	3
10838 34	1000	11214.89	5	11793.56	10	12084.80	3
10895 32	200	11289.10	10	11857.31	6	12235.24	5
11085 25	250	11309.56	5	11857.86	2	12257.81	1
11127.20	100	11415.04	15	11874.36	1	12623.40	5
11130.81	8	11491.22	15				

Ytterbium, Arc and Spark Spectrum

Abridged from the list of Meggers and Scribner, Jour. Research of B. of S. **19**, 651, 1937. All lines of an intensity of 8 or above are included. Classes of spectra are indicated by Roman numerals following the intensity value.

λair A	Arc	Spark	Spectrum
2073.70	....	8 *h*	II
2078 12	....	10 *h*	II
2088 05	.	15 *h*	II
2091.28		20 *h*	II
2092.31	...	30 *h*	II
2094 82	...	10 *h*	II
2095 38	....	200 *h*	III?
2096 84	..	30 *h*	II
2098 40	..	50 *h*	II
2102 72	20	200	II
2109.60	.	100 *h*	II
2116 65	50	250	II
2119.25	...	30 *h*	II
2121.54	....	15	II
2123 30	....	15	II
2126 72	40	200	II
2131.37	10	20	II
2135.22	...	20 *h*	II
2137 52	...	9	II
2137.71	...	15 Lu?	II
2138 32	..	10	II
2139.96	.	25	II
2141 00	...	10	II
2144 74	..	30 Ag?	II
2148 07		8	II
2148 92	.	10 Cu?	II
2152 32	.	10 *h*	II
2154 16	.	80 *h*	{ II / III?
2155 51	...	40	II
2160 27	...	10 *h*	II
2161.60	100	250	II
2163 87	...	10	II
2165.19	.	8 *h*	II
2174 28	.	10	II
2178 80	...	8 *h*	II
2185 69	60	100	II
2189 42	.	8	II
2198 14	.	20 *h*	II
2224 45	20	40	II
2240 09	..	25	II
2244 25		8 *h*	II
2257 01		40	II
2262.25	.	30	II
2265 65	.	50	II
2271 12	8?		I
2282 99	...	50	II
2283.38	8	10	II
2283.98	.	8 *h*	II
2285.85	.	8 *h*	II
2306.33	8	100	II
2309.26	..	20	II
2314.48		50	II
2315.20	..	10	II
2320.80	20	....	I
2335.47		15 *h*	II
2337 95	.	40	II
2340 46		8 *h*	II
2344.65	...	20	II

λair A	Arc	Spark	Spectrum
2349 39	..	8	II
2362 87	10	20	II
2365.45	..	15	II
2366 78	..	12	II
2367 58	.	10 *h*	II
2369 44	...	10	II
2373 89	..	8	II
2380 37	....	9	II
2390 72	10	30	II
2398 00	10	......	{ I / II?
2421 36	8	25	II
2454 7	..	20 *H*	II
2460.24	...	30 Ag?	II
2464 48	20	.....	I
2466 62		10	II
2484 88	..	8	II
2490.45	....	40	II
2495.69	..	10 *h*	II
2501 99	10	30	II
2505 46	..	10	II
2512 04	20	100	II
2512 58	.	10 *h*	II
2516 36	.	10	II
2516 83	..	30	II
2522.41	8	15	II
2527 85	..	10	II
2536 01	.	10	II
2537.64	8	25	II
2538 68	30	40	II
2542 82	..	8 *H*	II
2548 73	.	8	II
2552 13	10	40	II
2552 69	8	30	II
2555 31	..	50 *h*	II
2557 24	...	8	II
2565 56	.	15	II
2567.63	10 *e*	300	III
2571 34	..	20	II
2573 13	...	10	II
2577.68	...	30	II
2579 58	...	200	III
2588.65	....	8 *h*	II
2597 26	.	20	II
2599.16	....	50	II
2604 04	.	10	II
2610 86	..	20	II
2615.25	..	20	II
2617.00	.	25	II
2621 13	..	100	III
2627 04	..	20	II
2634 32	..	20	II
2638.09	..	60	III
2639 44	..	15	II
2640 52	.	15 *h*	II
2641 90	...	10	II
2642 55	..	150	III
2644 31	.	40	II
2646 45	.....	10	II

λair A	Arc	Spark	Spectrum
2648.80	..	8	II
2649 78	..	10	II
2651 72	.	60	III
2652 23	..	60	III
2653 74	50	200	II
2665 02	10	60	II
2666 11	..	150	III
2666 98	..	150	III
2668 75	..	20	II
2671 98	10	....	I
2672 65	20	80	II
2677 37	.	40	II
2683 42	.	10	II
2684 75	.	25	II
2690.99	.	40	II
2695.43	..	9	II
2700 80	...	10	II
2710 56	....	15 *d*	II
2718 35	.	40	II
2732 74	8	40	II
2741 72	.	20	II
2747 59	....	20	II
2748 65	10	40	II
2749.96	...	10	II
2750 47	50	200	II
2751 44		20	II
2758 99		10	II
2760 78		25	II
2761 38	..	25	II
2764 42	...	10	II
2771 34	...	30	II
2776 28	10	50	II
2784 66	.	30	II
2788 31	.	10	II
2793 28	..	10	II
2795 62		10	II
2797 79	.	8	II
2798 21	..	10	II
2800 04	.	15	II
2803 44	.	80	{ II / III
2814 53	.	10	II
2816 96		40	II
2818 75	...	150	{ II / III?
2821 15	10	50	II
2824 97	....	20	II
2830 98	8	80	II
2834 98		15	II
2843 01	..	10	II
2847 18	10	...	I?
2847 25	..	60 *h*	II
2848 44		30	II
2849 33	..	8	II
2851 12	20	100	II
2853.40	.	8	II
2854.12	....	20	II
2854 49	.	15	II
2858.35	.....	10	II

Ytterbium, Arc and Spark Spectrum

λair A	Arc	Spark	Spectrum	λair A	Arc	Spark	Spectrum	λair A	Arc	Spark	Spectrum
2858.45		8	II	3031.11	50	60	II	3438.83		30	II
2859.39		40	II	3034.64		10	II	3454.08	10	60	II
2859.80	20	60	II	3039.67		25	II	3458.27		20	II
2860.40		15	II	3042.65		30	II	3464.36	100	20	I
2861.21		60	II	3046.48		15	II	3476.31	30	8	I
2861.31		50	II	3047.06		9	II	3478.84	15	80	II
2867.05	10	80	II	3063.69		8	II	3485.76		10	II
2870.06		20	II	3065.04	10	50	II	3507.83		15	II
2875.90		15	II	3089.11		20	II	3520.28		30	II
2879.16		10	II	3092.54		40	II	3549.82		15	II
2886.26		10	II	3093.87		25	II	3560.33		15	II
2888.03	8	40	II	3101.36		20	II	3560.71		30	II
2891.38	100	200	II	3102.07		10	II	3570.56		10	II
2893.63		15	II	3107.79		30?	II	3585.47	15	25	II
2894.99		10 *d*	II	3107.91	15	100	II	3606.47		25	II
2896.91		10	II	3115.33		30	II	3611.30		8	II
2898.34		20	II	3116.71		9	II	3619.81	8	30	II
2899.72		20	II	3117.81	15	50	II	3637.76		15	II
2906.34		40	II	3126.06		40 *h*	II	3669.71		10	II
2909.47		8	II	3132.61		8	II	3670.68		8	II
2911.51		40	II	3136.76		20	II	3675.08		20	II
2914.21	10	60	II	3140.92	10	40	II	3690.54		10?	II
2915.27	10	40	II	3141.72		15	II	3694.19	500	1000	II
2916.43		10	II	3145.06		20	II	3698.59		15	II
2919.34	15	90	II	3153.86		40	II	3722.29		10	II
2921.12		20	II	3155.18		20	II	3724.22		15	II
2924.23		15	II	3158.29		25	II	3770.10	15		I
2927.86		10	II	3163.79		25	II	3782.54		15	II
2935.10		15	II	3165.20		20	II	3791.74	8 *h*		I
2937.18		10	II	3169.05		30	II	3807.54		15	II
2940.51		25	II	3173.77		8	II	3814.22		8	II
2945.91	10	60	II	3180.91		40	II	3872.85	20		I
2946.30		15	II	3191.41		10 *h*	II	3887.31		8	II
2946.77		8	II	3192.88	20	120	II	3900.86	20		I
2950.32		10	II	3195.57		9	II	3904.82		20	II
2955.31		9	II	3198.66		30	II	3987.98	2000	100	I
2962.53		20	II	3201.16	8	60	II	3990.89	40		I
2963.21		10	II	3210.11		10	II	4028.27		8 *h*	II
2963.46		20	II	3217.19		20	II	4040.09		8	II
2964.75	8	30	II	3218.33		15	II	4043.06		8 *h*	II
2966.76		15	II	3225.86		20	II	4052.28	8		I
2970.56	100	150	II	3228.63		15	II	4056.18		10	II
2970.84		20	II	3231.99		9	II	4077.27		30	II
2982.50		15	II	3236.16		15	II	4089.69	40		I
2983.70		8	II	3239.20		10	II	4097.87		8	II
2983.98	10	70	II	3259.10		10	II	4119.46		10?	II
2985.08		30	II	3261.51		25	II	4135.10	10	60	II
2985.87		9	II	3289.36	400	800	II	4149.07	40		I
2990.36		15	II	3304.57		10	II	4170.11		20	II
2991.86		20	II	3304.76		10	II	4174.57	10		I
2994.81	10	80	II	3305.73		30	II	4180.82	40	100	II
2995.86		10	II	3309.38		8	II	4186.90		10 *h*	II
2998.04		9	II	3319.18		15	II	4190.30		30	II
3000.46		40	II	3333.07		15	II	4218.55		50	II
3002.61		20	II	3342.94	8		I	4218.64	15		I
3005.76	30	200	II	3343.06		10	II	4227.94		10	II
3009.39		40	II	3347.53		15	II	4231.99	10		I
3010.61		30	II	3375.48		25	II	4234.55		15	II
3014.45		30	II	3391.10		9	II	4252.53		20	II
3017.56	10	80	II	3426.06	10		I	4255.78		8	II
3020.70		10	II	3428.48		20	II	4257.66		15	II
3026.67	10	80	II	3431.14	8		I	4266.99		8 *h*	II
3029.53		70 *h*	II, III?	3438.73		20	II	4277.73	9 *h*		I

Ytterbium, Arc and Spark Spectrum

λ_{air} A	Arc	Spark	Spectrum	λ_{air} A	Arc	Spark	Spectrum	λ_{air} A	Arc	Spark	Spectrum
4305.96	20 *h*		I	5062.95		15	II	5588.46	30	100	II
4309.82	8		I	5067.80	10		I	5598.48	15		I
4316.96	10	40	II	5069.15	30		I	5620.24		10	II
4322.23		20	II	5074.33	200		I	5652.00	50	80	II
4339.10		10	II	5076.75	50		I	5686.57		10 *h*	II
4370.81		40	II	5087.64		10	II	5689.92	10		I
4389.76		10	II	5104.43		50	II	5693.71		10	II
4392.83		15	II	5121.61		15	II	5713.75		10	II
4393.75	30 *h*		II	5136.00		50	II	5717.30		15 *h*	II
4402.30		20	II	5147.02		50	II	5720.01	300	8	I
4409.35		10	II	5173.13		15 *h*	II	5730.02		60	II
4427.44	10 *h*		I	5180.36		10	II	5735.80		15	II
4439.21	100	10	I	5184.18	8	30	II	5749.92	8	10	II
4472.43	20 *h*		I	5196.09	20		I	5755.90	15		I
4482.44	10		I	5200.57		10	II	5767.23		10 *h*	II
4487.27		10	II	5211.59	40		I	5771.67	30	50	II
4493.96		10	II	5227.25	10		I	5803.45	15		I
4515.16	30	100	II	5240.51	10	40	II	5819.43		100	II
4529.90	20		I	5244.11	50		I	5834.00	60 *h*		I
4553.58	10	40	II	5244.65		10	II	5837.15	50	150	II
4564.00	50		I	5249.84		8	II	5854.52	30		I
4576.21	200	10	I	5255.68		8	II	5874.70		30 *h*	II
4582.36	50		I	5257.50	15	100	II	5882.81		10	II
4589.22	20		I	5263.61		10	II	5897.22		100 *h*	II
4590.84	30		I	5277.08	200		I	5898.80		50 *h*	II
4598.37	10	50	II	5279.56	15	100	II	5908.36	20	30	II
4634.04		15 *h*	II	5300.95		60	II	5920.39		10	II
4644.54	10		I	5335.15	150	400	II	5935.06		40	II
4650.06	10		I	5345.68	20	100	II	5946.02		100	II
4657.04	9 *h*		I	5345.82	10	50	II	5950.98		8	II
4683.83	8	40	II	5347.21	40	200	II	5958.70	10		I
4712.82		30 *h*	II	5351.33	50		I	5987.91		20 *h*	II
4718.66	20 *h*		I	5352.96	100	250	II	5989.32	15		I
4726.08	60	250	II	5358.65	15	100	II	5991.51	50	150	II
4746.70		15 *h*	II	5359.98		10	II	6007.42		80 *h*	II
4752.93		20 *h*	II	5363.66	25		I	6021.97		15 *h*	II
4781.89	200		I	5368.29		20	II	6031.80	10		I
4786.62	100	500	II	5376.99		10	II	6040.80		10	II
4816.40	40 *h*		I	5389.87	8	30	II	6048.43	15		I
4818.38		30	II	5390.68	30		I	6052.88	8	30	II
4820.25	20	80	II	5390.85	30		I	6054.56	10		I
4834.72		10 *h*	II	5399.76		15	II	6056.48		20 *h*	II
4836.96	20	120	II	5403.14	20		I	6059.25	10		I
4837.47	20		I	5414.29		20	II	6082.40		10 *h*	II
4848.45		20 *h*	II	5424.68		10 *h*	II	6118.40	10 *h*?		I
4851.17	8	10	II	5426.91		60	II	6120.38		20 *h*	II
4871.16		8 *h*	II	5432.73		100	II	6146.94		15 *h*	II
4894.63	50		I	5449.30	20	100	II	6150.64	30 *h*		I
4894.98		10	II	5474.05	10		I	6152.58	60	80	II
4903.72		8 *h*	II	5478.52	10	50	II	6190.81		15	II
4912.38	20		I	5481.94	60		I	6208.11		20 *h*	II
4931.95	10		I	5498.86		20 *h,l*	II	6223.65		15	II
4935.51	500	20	I	5505.50	40		I	6246.97	40	60	II
4936.96	8 *h*		I	5524.55	10		I	6260.80		50 *h*	II
4937.22		100	II	5529.09		9	II	6274.79	100	150	II
4944.09		20	II	5529.95		8 *h*	II	6286.26	8		I
4966.91	100		I	5539.09	200		I	6297.38		15 *h*	II
4974.16	10		I	5547.19		15	II	6308.16	20	30	II
5009.53	20	50	II	5556.48	1500	50	I	6335.72	8		I
5014.50		10	II	5562.07	50		I	6345.02	15 *h*		I
5021.14		10	II	5568.11	20		I	6355.40		50 *h*	II
5027.66	10		I	5580.82		30	II	6400.40	200 *h*		I
5049.87		30 *h*	II	5586.35	20		I	6417.97	120		I

Ytterbium, Arc and Spark Spectrum

λair A	Arc	Spark	Spectrum	λair A	Arc	Spark	Spectrum	λair A	Arc	Spark	Spectrum
6432.73	30	40	II	6727 62	30	60	II	7350 09	40	......	...
6463.15	10	100	II	6768 70	80	.	I	7448 33	30	.	...
6474.74	......	50	II	6799 61	1000	50	I	7527 56	80	.	I
6489.10	800	40	I	6802 47	...	20	II	7699 49	1500	....	I
6489.27	......	30	II?	6864.26	..	10 *h*?	II	7758 03	10	..	....
6492 74	..	50	II	6871.54	10	..	I	7877 30	15		.
6550 19	10	...	I	6877 94	....	8 *h*?	II	7895.12	20	..	..
6585.42	....	20	II	6934 04	15	10	I	8053 41	10	....	.
6607.07	20	.....	I				II?	8607.51	8	.....	...
6617.06	10	.....	I	6999 87	15	...	I	8922.61	20	..	I
6643.54	50	.	I	7043 79	8	.	.	9304.44	15	....	...
5667.85	1000	20	I	7175 14	10		....	9349 27	20	.....	...
6678 17	20	......	I	7244 47	20		..	9760.37	100	.....	..
6699.38	10	8	I	7305 25	15	.	.	9799.88	10	...	....
			II?	7313 10	20	.	..				

Yttrium, Arc Spectrum, Y_I

Abridged from the list of Meggers and Russell, Jour. Research of B. of S., 2, 733, 1929. The original list contains 450 lines. All lines of an intensity of 8 or above are included in the following table.

λair A	Intensity	λair A	Intensity	λair A	Intensity	λair A	Intensity
2984.25	10	4475.72	10	4845.67	50	5648.46	10
3552.70	10	4476.96	10	4852 69	40	5706.74	15
3592 92	25	4477.45	10	4859.84	25	6009 19	8
3620.95	50	4487.28	8	4893.44	8	6191.73	50
4039.83	20	4487.47	15	4906.11	8	6222.59	10
4047.64	40	4505.95	25	4921.86	10	6402.02	10
4077.38	100	4527.25	40	5438.24	20	6435.02	100
4083.71	50	4527.80	30	5466.46	50	6538.59	15
4102.38	150	4596.55	10	5468.47	10	6557.40	10
4128.31	150	4643.69	50	5503.47	10	6687.57	25
4142.86	100	4658.32	10	5521.59	10	6700.71	15
4167.52	50	4674.84	45	5527 54	40	6793.71	25
4174.14	30	4728.52	10	5544.61	15	7346.47	10
4220.62	10	4752.79	10	5577.43	10	7563 13	10
4235.94	20	4760.98	30	5581.87	30	8344.43	10
4251.19	10	4781.04	10	5606.33	10	8450.36	8
4302.30	20	4786.89	10	5630.14	20	8800.62	10
4348.78	25	4799.30	15	5644.69	10	9231.58	8
4446.63	8	4839.87	60				

Yttrium, Arc and Spark Spectrum, Y_{II}

Abridged from the list of Meggers and Russell, Jour. Research of B. of S., 2, 733, 1929. The original list contains 220 lines. All lines of an intensity of 8 or above are included in the following table.

λair A	Arc	Spark	λair A	Arc	Spark	λair A	Arc	Spark
2243.06	25	50	2854 45	...	15	3055 3	.	50 *h,l*
2340.8	..	10 *h*	2980 7		20 *h,l*	3086.9		30 *h,l*
2398.14		10 *h,l*	3026.5	.	10 *h,l*	3093.76		10 *h*
2422.22	20	50	3036 7	.	25 *h,l*	3114.45		10 *h*
2460.62	..	20	3053.3	...	15 *h,l*	3128 8	..	20 *h,l*

Yttrium, Arc and Spark Spectrum Y_{II} (Continued)

λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark	λ_{air} A	Arc	Spark
3130 0	.	40 *h,l*	3710 30	200	500	4465.4	.	10 *h,l*
3173.07	..	100 *h,l*	3727 0		20 *h,l*	4682 32	30	20
3179 42	...	10	3747 55	30	40	4786 58	30	20
3195 62	25	50	3774 33	150	300	4823.31	40	30
3200 28	25	50	3776 56	50	75	4854 87	100	150
3203 33	30	60	3782 3	.	50 *h,l*	4883 69	150	200
3216.70	50	100	3788 70	100	200	4900 13	125	150
3242 30	60	150	3792.5		10 *h,l*	4982 13	15	15 *l*
3308.4	...	20 *h,l*	3800.9	.	15 *h,l*	5087 42	50	100 *l*
3319.8	..	15 *h,l*	3818 34	40	60	5119 12	10	20 *l*
3327.89	50	100	3832.89	50	100	5123.21	30	50 *l*
3330.9	...	20 *h,l*	3848.2	...	8 *h,l*	5196 43	...	10 *l*
3362.00	..	30 *h,l*	3878 28	15	20	5200 42	40	60
3448 82	8	10	3896 8	.	10 *h,l*	5205.73	50	80
3461.0	..	20 *h,l*	3930 66	15	15	5402.78	20	50 *l*
3496.08	40	80	3950.35	150	200	5473.40	10	20 *l*
3508.0	.	8 *h,l*	3951 59	10	..	5480 75	10	15 *l*
3549.02	50	100	3967 7		15 *h,l*	5497 42	20	50
3584.53	60	100	3982 59	100	150	5509 91	30	30 *l*
3600.74	100	300	4124.91	20	15	5521.70	.	20
3601.93	75	100	4177 54	100	125	5544.61	15	10 *l*
3605.4	...	10 *h,l*	4199.27	10	...	5546.02	8	10 *l*
3611.06	100	200	4204 69	20	10	5662 95	50	200
3628.71	50	100	4235.73	40	20	5728 91	10	10 *l*
3633.13	100	200	4309 62	70	50	6613.74	25	20
3635.4	...	20 *h,l*	4358.73	40	30	6795 41	20	30
3664.62	100	150	4374.94	200	300	6896 00		10
3668.5	...	50 *h,l*	4398 02	75	50	7264 19	..	10
3696 6	...	25 *h,l*	4422 59	50	40	7881.90	20	10

Yttrium, Spectrum of Y_{III}

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
989.21	1	2191.22	200	2284.5	100	2414.68	100
996.37	2	2200.80	50	2327.30	20	2817.03	200
2127.99	100	2206.22	30	2367.25	200	2945.92	150

Zirconium, Arc Spectrum

Abridged from the list of Kiess and Kiess, Jour. Research of B. of S. **6**, 621, 1931. The original list contains 1600 lines. All lines of an intensity of 8 or above are included in the following table. Intensities are given according to the scale adopted by the authors.

λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc	λ_{air} A	Arc
2363.52	10	2579.54	8	2985.36	10	3132.06	15
2367.33	8	2635.40	8	3011.73	20	3133.23	10
2374.43	10	2706.15	10	3029.52	20	3136.95	12
2380.55	9	2709.33	8	3085.34	10	3139.79	10
2384.16	12	2725.45	8	3094.79	10	3148.81	10
2388.00	8	2790.14	12	3095.82	10	3157.82	15
2389.21	8	2792.05	10	3108.36	8	3191.23	25
2405.52	10	2814.91	12	3113.50	8	3204.90	10
2441.30	8	2837.23	15	3120.74	30	3212.02	30
2539 62	10	2875.98	12	3131.11	12	3234.12	30

SUPPLEMENTARY TABLES OF SPECTRA (Continued)

Zirconium, Arc Spectrum (Continued)

λair A	Arc	λair A	Arc	λair A	Arc	λair A	Arc
3243.98	10	4055.03	20	4809.48	10	6717.89	8
3250.42	15	4055.71	10	4815.05	12	6752.73	10
3254.28	10	4061.53	10	4815.62	25	6762.38	20
3260.11	15	4064.16	30	4824.29	12	6769.16	20
3269.66	12	4072.71	30	4828.05	10	6772.92	8
3353.65	12	4081.22	40	4851.36	12	6790.89	10
3360.45	15	4108.39	8	4866.07	10	6828.82	10
3370.60	10	4121.45	10	4881.25	8	6832.93	12
3414.66	12	4166.37	8	4883.61	8	6847.03	18
3419.65	12	4187.56	15	4994.77	12	6849.29	8
3440.43	12	4194.76	8	4996.35	10	6888.30	15
3446.61	15	4199.08	15	5046.61	25	6900.59	8
3447.36	30	4201.45	18	5060 42	12	6907.40	8
3455.90	15	4213.86	10	5064.92	35	6948.51	8
3457.19	10	4227.76	30	5065.25	12	6953 87	20
3461.09	10	4234.63	8	5070.27	12	6966.49	12
3471.18	25	4239.31	25	5074.00	10	6990.86	18
3478.78	8	4240.35	18	5078.28	20	6994.38	12
3482.80	8	4241.20	15	5085.26	10	7027.40	15
3501.33	8	4241.68	18	5115 27	15	7087.35	20
3509.32	25	4268.01	15	5133.42	10	7095.66	8
3519.60	35	4282.20	15	5155.46	15	7097.78	25
3533.22	12	4294 78	18	5158.02	12	7102.95	20
3535.16	8	4302.88	15	5165.97	8	7103 77	18
3547.69	25	4304.68	8	5183.71	8	7111.71	12
3566.10	25	4325 44	10	5201.17	8	7112.83	8
3575.79	25	4341.13	20	5209 31	8	7169.14	40
3586.28	25	4347.89	25	5224.94	9	7201.67	8
3601.18	50	4360.80	10	5277 40	12	7264.79	8
3623.87	45	4366.45	10	5280 06	10	7318.15	9
3634.14	15	4394.94	10	5296 78	10	7336 03	8
3661.20	10	4413.04	10	5311 42	8	7343.98	8
3663.64	40	4420.45	10	5362.56	8	7439 89	20
3714.13	10	4431 48	8	5385.14	15	7467 57	8
3764.38	15	4438.04	8	5407.63	10	7479.61	8
3766.71	8	4457.42	10 (Zr II)	5502.16	12	7515 74	8
3780.53	18	4470 55	10	5528.44	10	7540.65	8
3791.39	12	4507.11	20	5545.42	8	7544.62	8
3822 41	12	4535 75	25	5620 16	10	7551 50	10
3835.96	20	4539.98	8	5664.55	12	7554 73	10
3847.01	10	4542.22	20	5680 93	12	7558 47	9
3849.26	10	4553.01	10	5735.70	12	7607 19	15
3863.88	20	4555.12	10	5797.76	12	7658.62	8
3864 33	10	4555.52	10	5869.51	8	7819 36	15
3877 60	12	4575.52	25	5879.79	25	7822 96	8
3885.41	20	4590.55	10	5885.61	10	7826.75	9
3890 32	25	4602.57	12	5935.23	10	7849.38	15
3891.39	20	4604.42	10	5955.37	12	7870.00	12
3900.51	10	4626.42	10	6121.95	12	7944.65	15
3921.80	20	4633.99	30	6124.86	10	8063.10	10
3929.53	30	4683.43	10	6127.49	35	8070.12	25
3966.65	8	4687.80	50	6134.58	25	8133 00	20
3968.25	18	4688 45	25	6140.50	10	8201.73	10
3973.51	15	4710.08	45	6143 23	30	8212.59	18
3981.59	10	4717.62	8	6213.06	8	8240.36	8
3984.75	8	4719.12	10	6214.72	8	8283.84	10
4007.59	8	4732.34	15	6313 05	12	8305.94	15
4023.99	15	4739.48	45	6345 23	15	8370 21	10
4024.92	18	4762.78	10	6445 76	8	8389.42	8
4027.20	20	4772.32	30	6470.25	10	8453.17	10
4030.03	15	4784.94	12	6489 68	10	8464.65	10
4035.89	15	4788.69	10	6592.02	8	8498.44	10
4043.57	15	4805.88	12	6603.27	8	8836.09	8
4044.57	12						

Zirconium, Spark Spectrum

Abridged from the list of Kiess and Kiess, Jour. Research of B of S. 5, 1205, 1930. All lines of an intensity of 8 or above are included in the following table. Intensities are given according to the scale adopted by the authors.

λ_{air} A	Spark	λ_{air} A	Spark	λ_{air} A	Spark	λ_{air} A	Spark
2095.80	15	2810.91	15	3250.44	20	3614.79	18
2109.66	12	2818.76	20	3272.21	8	3630.03	10
2291.15	15	2825.54	15	3273.04	75	3633.49	10
2294.08	12	2833.90	8	3279.26	65	3636.46	8
2295.53	10	2839.34	10	3282.84	12	3662.14	8
2317.27	15	2843.53	10	3284.72	20	3668.46	8
2324.77	15	2844.57	15	3288.81	10	3671.28	20
2330.38	18	2848.17	8	3305.15	15	3674.74	40
2351.69	12	2851.98	12	3306.27	25	3678.91	10
2357.45	25	2869.80	12	3313.70	8	3697.49	20
2361.76	10	2877.56	10	3314.49	10	3698.17	100
2372.92	12	2903.70	15 *b,l*	3319.03	8	3709.27	60
2387.17	15	2905.22	15	3322.99	10	3714.77	15
2389.52	8	2910.26	8	3326.81	15	3727.72	10
2392.66	10	2915.98	15	3334.25	10	3731.26	35
2419.37	10	2918.24	18	3334.62	9	3745.97	40
2434.55	8	2924.63	8	3338.41	10	3751.60	75
2441.97	12	2926.99	25	3340.55	15	3757.80	8
2449.83	20	2931.08	8 *b,l*	3344.80	15	3766.83	25
2457.43	20	2934.62	12	3356.08	18	3796.47	20
2465.37	8	2936.31	12	3357.26	15	3817.59	12
2487.28	20	2948.94	12	3359.96	12	3836.76	60
2496.48	15	2951.46	10	3373.42	8	3843.03	30
2532.47	20	2955.77	20	3374.71	15	3915.94	25
2542.09	18	2962.69	12	3387.87	12	3929.54	8
2550.71	18	2968.95	12	3388.29	15	3934.14	20
2567.62	20	2969.63	8	3391.96	100	3934.80	20
2568.85	40	2976.61	10	3393.12	10	3958.24	50
2571.42	50	2978.07	12	3399.36	10	3991.14	40
2583.38	15	2979.18	12	3403.69	8	3998.98	30
2589.02	15	2981.02	12	3404.84	12	4018.38	10
2630.91	15	3003.73	15	3408.09	10	4024.45	12
2639.07	12	3013.32	8	3410.26	20	4029.68	20
2650.37	12	3028.05	20	3414.65	12	4045.63	15
2667.77	12	3030.91	10	3430.53	30	4048.68	25
2669.48	8	3036.39	15	3433.90	8	4050.32	15
2670.94	10	3054.84	30	3437.16	10	4090.52	10
2678.59	25	3095.07	12	3438.23	100	4149.22	75
2693.52	9	3099.22	10	3457.56	12	4150.97	10
2694.05	10	3106.58	35	3458.93	10	4156.24	15
2695.42	8	3110.87	8	3463.02	35	4161.20	20
2700.12	18	3125.92	12	3471.14	8	4179.81	15
2711.48	12	3129.16	10	3479.39	30	4186.70	12
2712.38	10	3129.76	12	3481.14	35	4208.99	30
2714.22	10	3133.49	25	3483.54	12	4211.88	12
2722.62	25	3138.66	25	3496.18	50	4231.64	8
2726.48	15	3155.68	10	3497.90	12	4258.05	12
2732.72	15	3157.00	10	3499.58	8	4296.74	8
2734.84	20	3164.32	20	3505.47	15	4317.32	12
2740.49	8	3165.98	10	3505.67	12	4333.28	15
2741.64	8	3166.29	8	3525.81	8	4359.74	10
2742.54	20	3178.10	15	3542.65	25	4370.96	8
2745.86	20	3181.58	8	3549.51	10	4379.78	9
2752.21	20	3182.86	35	3551.94	18	4440.45	10
2758.80	20	3191.98	12	3556.61	30	4442.99	25
2768.73	15	3214.19	40	3572.47	30	4454.80	10
2768.84	15	3222.48	15	3573.09	8	4457.42	8
2774.15	12	3228.81	15	3576.88	20	4461.22	10
2796.92	10	3231.69	30	3611.90	15	4494.41	8
2799.16	8	3241.01	25	3613.08	12	4496.96	15
						4553.96	12

STANDARD WAVE LENGTHS

Primary Standard

Wave length of the red cadmium line in air, 760 mm. pressure 15°C., measures of Benoit, Fabry and Perot 1907.

6438.4696 Ångström units

Secondary Standards

Lines of the Iron Arc

Selected lines from list by Ch. Fabry: *International Critical Tables*, 1929. Wave lengths in international Ångströms, atmospheric pressure, 15°C.

Wave-length	Wave-length	Wave-length	Wave-length	Wave-length
3370.789	3935.816	4592.655	5232.948	6065.489
3399.337	3977.744	4602.945	5266.564	6137.697
3485.343	4021.870	4647.437	5371.493	6191.563
3513.821	4076.638	4691.414	5405.779	6230.729
3556.882	4118.549	4707.282	5434.527	6265.141
3606.682	4134.680	4736.782	5455.613	6318.023
3640.392	4147.673	4789.654	5497.520	6335.338
3676.314	4191.436	4878.219	5506.783	6393.606
3677.630	4233.609	4903 318	5569.626	6430 852
3724.381	4282.406	4919.001	5586.763	6494.985
3753.615	4315.087	5001.872	5615.652	6546.245
3805.346	4375.933	5012.072	5658.825	6592.920
3843.261	4427.313	5049.825	5709.396	6677.994
3850.820	4466.556	5083 343	5763.013	6750.157
3865.527	4494.568	5110.414	5857.759 Ni	
3906.482	4531.152	5167.491	5892.882 Ni	
3907.937	4547.851	5192.353	6027.058	

Iron, Wave Lengths in the Ultraviolet Spectrum

The following table presents the results of interferometer measurements made by Meggers and Humphreys and reported in the Jour. Research of B. of S. **18**, 543, 1937. The standard iron arc was used as a source and the wave lengths in air at 15°C. and 76 mm are given in international Ångströms.

λ_{air} A	λ_{air} A	λ_{air} A	λ_{air} A
2100.795	2163.368	2240.627	2287.632
2102.349	2163.860	2245.651	2291.122
2108.955	2164.547	2248.858	2292.5227
2110.233	2165.861	2249.177	2293.8454
2112.966	2172.581	2253.1251	2294.4059
2115.168	2173.212	2255.861	2296.9247
2130.962	2176.837	2259.511	2297.785
2132.015	2180.866	2260.079	2299.2180
2135.957	2183.979	2264.3894	2300.1397
2138.589	2186.890	2265.053	2301.6818
2139.695	2187.192	2270.8601	2303.4225
2141.715	2191.202	2271.781	2303.579
2145.188	2196.040	2272.0670	2308.9971
2147.787	2200.7227	2274.0085	2313.1022
2150.182	2201.117	2276.0247	2320.3561
2151.099	2207.068	2277.098	2327.3940
2153.004	2210.686	2279.922	2331.3067
2154.458	2211.234	2283.653	2332.7972
2157.792	2228.1704	2284.087	2338.0052
2161.577	2231.211	2287.2477	2344 2802

STANDARD WAVE LENGTHS (Continued)

Iron, Wave Lengths in the Ultraviolet Spectrum (Continued)

λair A	λair A	λair A	λair A
2354.8888	2584.5349	2863.864	3191.6583
2359.1039	2585.8753	2869.3075	3196.9288
2359.997	2598.3689	2874.1722	3200.4741
2360.294	2611.8725	2877.3005	3205.3992
2362.019	2613.8240	2894.5050	3215.9398
2364.8269	2617.6160	2895.0352	3217.3796
2366.592	2621.6690	2899.4156	3222.0682
2368.595	2625.6663	2912.1581	3225.7883
2370.497	2628.2923	2920.6906	3236.2226
2371.4285	2635.8082	2929.0081	3239.4362
2374.517	2643.9972	2941.3430	3244.1887
2375.193	2647.5576	2953.9400	3254.3628
2379 2756	2651.7059	2957.3654	3257.5937
2380.7591	2662.0563	2959.9924	3271.0014
2384.386	2673 2127	2965.2551	3280.2613
2388.6270	2679.0608	2981.4448	3284.5892
2389.9713	2689.2117	2987.2919	3286.7538
2399.2396	2699.1060	2990.3923	3298.1328
2404.430	2706.5812	2999.5123	3305.971
2406.6593	2711.6548	3003.0311	3306.356
2410.5172	2714.413	3009.5698	3314.7421
2411.0663	2718.4352	3015.9129	3323.7374
2413.3087	2723.5770	3024.0330	3328.8669
2431.025	2727.540	3030.1491	3337.6655
2438.1811	2735.473	3037.3891	3340.5659
2442.5674	2739.5467	3040.4281	3347.9262
2443.8707	2746.4833	3047.6059	3355.2285
2447.7086	2746.9823	3055.2631	3370.7845
2453.4746	2749.325	3057.4452	3380.1111
2457.5956	2755.7366	3059.0874	3383.9808
2465.1479	2763.1078	3067.2433	3396.9772
2468.8782	2767.5208	3075.7204	3399.3343
2474.8131	2778.2205	3083.7419	3401.5196
2487.0643	2781.8347	3091.5777	3407.4608
2496.5324	2797.7751	3116.6329	3413.1335
2507.8987	2804.5200	3125.653	3427.1207
2519.6279	2806.9840	3134.1113	3443.8774
2530.6938	2813.2861	3143.9896	3445.1506
2542.1007	2823.2753	3157.0388	3465.8622
2551.0936	2832.4350	3160.6582	3476.7035
2562.5348	2838.1193	3175.4465	3485.3415
2575.7442	2845.5945	3178.0137	3490.5746
2576.1033	2851.7970	3184.8948	3497.8418

Iron, Wave Lengths in the Infrared

From interferometer measurements by Meggers, Jour. Research of B. of S. 14, 33, 1935. The integrated light from the iron arc was used as a source. Wave lengths in air at 15°C and 760 mm are given as well as the intensity.

λair A	Intensity	λair A	Intensity	λair A	Intensity
7164.469	250	7418.674	5	7583.796	50
7187.341	800	7445.776	200	7586.044	150
7207.406	500	7495 088	400	7620.538	25
7389.425	80	7511.045	800	7661.223	30
7401.689	4	7531.171	60	7664.302	80
7411.178	100	7568.925	30	7710.390	25

STANDARD WAVE LENGTHS (Continued)

Iron, Wave Lengths in the Infrared (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
7748 281	125	8387.781	1200	9089.413	30
7780.586	300	8439 603	20	9118 888	25
7832.224	400	8468.413	300	9147.800	2 *n*
7912 866	6	8514 075	150	9210 030	6
7937.166	700	8526.685	8	9258 30	10 *n*
7945.878	600	8582 267	15	9350.46	6
7994.473	20	8611.807	40	9359.420	3
7998.972	700	8621 612	10	9362.370	4
8028.341	50	8661.908	600	9372 900	6
8046 073	600	8674 751	60	9430 08	3
8080 668	10 *n*	8688.633	1500	9513 24	8 *n*
8085.200	500	8757.192	25	9569.960	15 *n*
8096.874	10	8764.000	20 *n*	9626.562	12 *n*
8198.951	80	8793 376	25 *n*	9653 143	15
8207 767	40	8804.624	....	9738.624	100
8220.406	1500	8824.227	250	9753 129	10
8232 347	50	8838.433	30	9763.450	10
8239 130	8	8866.961	60	9763 913	12
8248.151	30	8945.204	10 *n*	9800.335	8 *n*
8293.527	20	8975.408	10	9861.793	12
8327 063	1200	8999.561	200	9889 082	15
8331 941	200	9012.098	10	10065.080	30
8339.431	80	9079.599	4	10145 601	40
8360.822	8	9088.326	50	10216 351	50
8365.642	25				

Helium

Merrill, Bulletin 14, Bureau of Standards 1917.

λ_{air}	λ_{air}	λ_{air}	λ_{air}
2945.104	3888.646	4387 928	5047.736
3187.743	3964.727	4471.479	5875.620
3613.641	4026.189	4713.143	6678.149
3705.003	4120.812	4921.928	7065.188
3819.606	4143 759	5015.675	7281.349

From Meggers and Humphreys, Jour. Research of B. of S. **13**, 293, 1934.

λ_{air} A	λ_{air} A	λ_{air} A	λ_{air} A
10829.081	10830.250	10830.341	....

Neon

From Meggers and Humphreys, Jour. Research of B. of S. **13**, 293, 1934. The source was an "end on" Geissler tube. Values are given for the wave length in air at 15°C and 760 mm pressure, and referred to the primary standard (Cd 6438.4696 A) and also to the red lines of neon. For complex lines the value for the principal component is given.

λ_{air} A Ne Std.	λ_{air} A Cd Std.	λ_{air} A Ne Std.	λ_{air} A Cd Std.	λ_{air} A Ne Std.	λ_{air} A Cd Std.
4334.125	....	4395.556	....	4425.400	....
4363.524	....	4422.519	....	4433.721	....
4381.220	....	4424.800	....	4460.175	....

STANDARD WAVE LENGTHS (Continued)
Neon (Continued)

λ_{air} A Ne Std.	λ_{air} A Cd Std.	λ_{air} A Ne Std.	λ_{air} A Cd Std.	λ_{air} A Ne Std.	λ_{air} A Cd Std.
4466.807	...	4957 0334	.	5965.474	...
4475.656	...	4957.122	...	5974.628	...
4483.190	.	4994.930	...	...	5975.5343
4488.0928	...	5005.160	...	5987.9069	...
4500.182	...	5011.003	...	...	6029.9968
4517.736	...	5022.870	...	...	6074.3376
4525.764	...	5031.3484	...	...	6096.1630
4537.751	...	5037.7505	.	6128.4513	6128.4502
4540 376	...	5074.200	.	...	6143.0627
4552.598	.	5080.383	...	...	6163.5937
4565.888	.	5104.705	...	6182.146	...
4573.759	...	5113.675	...	...	6217.2812
4575 060	...	5116.503	5116.501	...	6266.4952
4582.035	.	5122 257	...	...	6304.7893
4582 450	.	5144 9376	.	...	6334.4276
4609.910	...	5151.963	.	...	6382 9914
4614.391	...	5154 422		6402.247	6402 248
4617 837	.	5156 664		...	6506 5277
4628 309	.	5188.612		.	6532.8824
4636.125	...	5193.130	...	.	6598.9528
4636 634	...	5193 224	.	...	6678 2766
4645.416	.	5203 8950	...	...	6717 0430
4649 904	...	5208.863	.	...	6929.4679
4656.3923	.	5210 573	.	7024.0508	...
4661.104	...	5222 351	...	7032.4134	7032.4125
4670 884	...	5234 028	...	7059.109	7059.108
4678.218	.	5298 190	...	7173.9389	7173.9390
4679.135	...	5304.756	.	7245.1668	7245.1668
4687.671	...	5326.396	...	7438.8990	7438.8988
4704.395	.	5330 7766	5330.778	7488 8722	7488.8717
4708.854	.	5341 091	5341 093	7535.7750	7535.774
4715.344	...	5343 284	...	7544.046	...
4725.145	...	5355 422		7943.1802	7943.1802
4749.572	...	5360 012		8082.4580	8082.4585
4752.7313	...	5374 975	...	8118 5495	8118.549
4758.728	.	5400.5619	5400 5620	8136 4060	8136.4058
4780 338	.	5433 649	...	8259 380	...
4788.9258	.	5448.508		8266.076	8266.077
4790 218	.	5562 769	...	8300.3258	8300.3257
4800 111	.	5656 6585	.	8377.6068	8377.6070
4810 0625	...	5662 547	...	8418 4274	8418.4275
4817.636	.	5689.8164	5689.817	8495.3600	8495.3604
4821.924	...	5719.2254	5719.224	8591.2584	8591.2585
4827 338	...	5748.299	5748 298	8634.6480	8634.649
4827.587	.	5764.418	5764 4182	8654.3835	8654.383
4837.3118	...	5804 4488	5804.450	8679.491	...
4852.655	.	5820.1548	5820 1553	8681 920	...
4863 074	...	...	5852.4878	8780.6223	8780.6220
4865.505	.	5872.828	...	8783.755	8783.755
4866 476	.	...	5881.8950	8853 867	8853.864
4884.915	.	5902.464	5902.4634	8865.759	...
4892 090	.	5906 429	...	9486.680	...
4928 235	...	5913.633	...	9535.167	...
4939.041	.	...	5944 8340	9665.424	...
4944.987	...				

Neon$_I$, Ultraviolet Lines

From Humphreys, Jour. Research of B. of S. **20**, 17, 1938. The source was an "end on" Geissler tube. Values are given for the wave length in dry air at 15°C and 760 mm of Hg pressure and referred to the Krypton secondary standards.

λ_{air} A	λ_{air} A	λ_{air} A	λ_{air} A
3369.8086	3450.7653	3501.2165	3609.1793
3369.9081	3454.1952	3510.7214	3633.6646
3375.6498	3460.5245	3515.1908	3682.2428
3417.9036	3464.3389	3520.4717	3685.7359
3418.0066	3466.5786	3593.5259	3701.2250
3423.9127	3472.5711	3593.6398	3754.2160
3447.7029	3498.0644	3600.1693	

Argon

From Meggers and Humphreys, Jour. Research of B. of S. **13**, 293, 1934.

λ_{air} A Ne Std.	λ_{air} A Cd Std.	λ_{air} A Ne Std.	λ_{air} A Cd Std.	λ_{air} A Ne Std.	λ_{air} A Cd Std.
3948.977	....	4887.9465	....	7030.262	....
4044.4173	.....	5162.2845	.....	7067.2170	7067.2177
4054.5250	......	5187.7458	...	7147.0406	7147.0412
4158.5896	4158.5895	5221.270	..	7272.9357	7272.9356
4164.1788	4164.1789	5252.786	.....	7372.117	....
4181.8826	4181.8825	5421.346	..	7383.9800	7383.9800
....	4190.7098	5451.650	....	7503.8676	7503.8667
.....	4191.0270	5495.8720	....	7514.6510	7514.653
4198.316	4198.3160	5506.112	.....	7635.1053	7635.1055
4200.674	4200.6738	5558.702	.....	7723.7597	7723.761
4251.1842	....	5572.548	......	7724.2064	7724.206
4259.3603	4259.3607	5606.732	....	7891.075	....
4266.2853	4266.2855	5650.7034	......	7948.1754	7948.1756
4272.1680	4272.1678	5739.517	....	8006.1556	8006.155
4300.0995	4300.1000	5834.263	...	8014.7856	8014.785
4333.5595	4333.5601	5860.315	....	8053.307	....
4335.3370	4335.3363	5888.592	...	8103.6922	8103.6922
4345.1666	....	5912.084	...	8115.3115	8115.3095
4363.7936	....	5928.805	...	8264.5209	8264.5210
4423.9936	....	6032.124	..	8408.208	8408.207
4510.7322	4510.7324	6043.230	....	8424.647	8424.646
4522.3216	....	6052.721	......	8521.4407	8521.4406
4589.2884	......	6059.373	.....	8667.9430	8667.9435
4596.0964	....	6105.645	......	9122.9660	9122.9664
4628.4398	.....	6170.183	...	9224.498	9224.498
4702.3151	......	6173.106	......	9354.218	....
4752.9381	......	6416.315	....	9657.7841	......
4768.6716	....	6752.832	.....	9784.5010	....
4876.2596	.....	6965.4302	6965.4304	10470.051	.....

Argon$_{I}$

From Humphreys, Jour. Research of B. of S. 20, 17, 1938. The source was an "end on" Geissler tube. Values are given for the wave length in dry air at 15°C and 760 mm of Hg pressure, referred to the Krypton secondary standards.

λ_{air} A	λ_{air} A	λ_{air} A	λ_{air} A
3319.3446	3690 8957	4158.5906	4272.1690
3373 481	3770.3688	4164.1800	4300.1011
3393 7517	3781.3609	4181 8838	4333.5612
3461.0780	3834 6785	4190.7127	4335.3380
3554.3061	3894.6602	4191.0296	4345.1682
3567.6565	3947.5043	4198.3170	4510.7333
3606.5224	3948.9788	4200.6751	4522.3238
3632.6837	4044.4182	4251.1852	4596.0970
3634.4605	4045.9658	4259.3618	4628.4410
3649.8324	4054 5254	4266 2867	4702 3164

Krypton

Meggers, Journal Optical Society of America, 1921.

λ_{air} A	λ_{air} A	λ_{air} A	λ_{air} A
4273 9696	4362.6422	4502 354	6456.290
4282.967	4376 122	4807 065	7587.414
4318.552	4399 969	5562.224	7601.544
4319 580	4453 9174	5570 2872	
4355.478	4463.690	5870.9137	

Krypton$_{I}$

From Hunphreys, Jour. Research of B. of S. 20, 17, 1938. The source was the "end on" Geissler tube Values are given for the wave length in air at 15°C and 760 mm of Hg pressure.

λ_{air} A	λ_{air} A	λ_{air} A	λ_{air} A
3424.9433	3615.4755	3796 8839	4184.4726
3431.7217	3628.1570	3800 5437	4263.2881
3434 1423	3632.4896	3812.2155	4302.4455
3495.9900	3665 3259	3837.7028	4410.3685
3502.5537	3668.7363	3837.8162	4416 8838
3503.8981	3679.5609	3845.9778	4418.7626
3511.8963	3679.6111	3982.1699	4425.1908
3522.6747	3698.0452	3991 0797	4550.2985
3539.5416	3773 4241	3991 2581	4812.6367
3540.9538			

Titanium, Vacuum Arc Spectrum

From the measurements by Kiess, Jour. Research of B. of S. 1, 75, 1928. Wave lengths in air at 15°C, 760 mm.

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
2941 995	60 *r*	3075.225	40	3130.804	15
2948 255	60 *r*	3078.645	45	3148.033	12
2956 133	70 *R*	3088.027	60	3161 755	20

STANDARD WAVE LENGTHS (Continued)

Titanium, Vacuum Arc Spectrum (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
3168.519	30	3694 445	10	4282 702	12
3186.451	60 *r*	3717 393	20	4286.006	25
3190 801	20	3722.568	15	4287 405	22
3191.994	80 *R*	3724 570	20	4289.068	25
3199.915	100 *R*	3725 155	20	4294.101	8
3202.535	12	3729.806	50 *r*	4295.751	22
3214 240	12	3741 059	60 *r*	4298 664	40
3217.056	15	3752 860	80 *r*	4305.910	60
3222.843	15	3759.291	40	4307.900	12
3229.397	10	3761.320	40	4312 861	7
3234.517	60	3771.652	25	4314 801	25
3236.573	50	3786.043	20	4318 631	10 *n*
3239 037	40	3798.276	6	4321.655	8 *n*
3241.984	40	3866.446	15 *n*	4325.134	9 *n*
3261.596	25	3875 262	20 *n*	4337 916	10
3287 657	10	3895.243	30 *n*	4346 104	5
3292.078	20	3900 546	50	4360.487	4
3314 422	10	3904.785	40 *n*	4369 682	5 *n*
3318 024	8	3913.464	40	4372.383	3
3322.936	20	3914 334	35	4393.925	8
3326.762	5	3921 423	30	4395.031	25
3329.455	20	3924 527	50	4399 767	6
3332 111	8	3929.875	40	4417.274	15
3335 192	20	3947 770	40	4421 754	6
3340.344	15	3948 670	60	4422 823	10
3341.875	50 *r*	3956 336	60	4426 054	10
3349 399	40	3958 206	80	4427.098	40
3354 634	60 *r*	3962.851	35	4430 366	7
3358 271	10	3964 269	35	4434.003	15
3361.213	40	3981 761	70 *R*	4436 586	4
3370 436	40 *r*	3989.758	80 *R*	4440 345	10
3371.447	80 *R*	3998 635	100 *R*	4443.802	25
3377.577	30 *r*	4008 926	35	4449.143	30
3380.278	15	4013 587	12 *n*	4450.896	25
3383.761	40	4015 377	12 *n*	4453.312	30
3385 944	40 *r*	4017 771	15 *n*	4453 708	20
3387 834	15	4024.573	35	4455 321	30
3394 574	15	4026.539	25 *n*	4457 428	40
3444 306	15	4030.512	25 *n*	4465 807	20
3461 496	20	4035 828	10	4468.493	25
3477 181	15	4055.011	20	4471 238	20
3480 525	12	4058 139	7	4474.852	8
3491 053	8	4060.263	20	4481 261	30
3504 890	8	4065.094	15	4482 688	10
3510 840	10	4078 471	30	4489 089	20
3535 408	10	4082 456	20	4496 146	20
3547 029	15	4099.166	8	4501 270	25
3596.048	10	4112 708	20	4503 762	4 *n*
3598 714	15	4122 143	10	4512 734	40
3610 154	12	4127 531	15	4518 022	50
3624 826	8	4137.284	10 *n*	4522 798	40
3635 462	80 *r*	4150.963	10	4527.305	35
3641 330	10	4159.634	9	4533 238	80
3642 675	80 *r*	4163 644	8	4544.688	30
3646 198	12	4171 897	5	4548 764	35
3653 497	100 *r*	4186 119	25	4549.622	25
3654 592	15	4237 889	7	4552.453	35
3658.097	20	4249.114	5 *n*	4555.486	30
3660 631	12	4256.025	8 *n*	4559.920	6
3668.965	15	4258 523	4 *n*	4563 761	15
3671 672	20	4263 134	15	4571.971	15
3685 192	40	4274.584	15	4599.226	5
3689.916	15	4281.371	10	4617.269	30

Titanium, Vacuum Arc Spectrum (Continued)

λ_{air} A	Intensity	λ_{air} A	Intensity	λ_{air} A	Intensity
4623.098	25	5014.185	25	5512.529	25
4629.336	15	5014.277	25	5565.476	9
4645.193	12	5016.162	20	5644.137	18
4656.468	25	5020.028	25	5648.570	5
4667.585	25	5022.871	25	5662.154	12
4675.118	10	5024.842	20	5675.413	9
4681.908	30	5025.570	18	5689.465	10
4691.336	20	5035.908	25	5715.123	9
4698.766	20	5036.468	25	5739.464	9
4710.186	18	5038.400	25	5766.330	4 *n*
4715.295	4	5039.959	22	5774.037	5 *n*
4731.172	9	5052.879	8	5785.979	5 *n*
4742.791	20	5062.112	7	5804.265	5 *n*
4758.120	25	5064.654	25	5866.453	35
4759.272	25	5087.055	8	5899.295	25
4778.259	10	5113.448	10	5903.317	5
4792.482	10	5120.420	12	5918.548	10
4799.797	12	5145.465	12	5922.112	18
4805.416	12	5147.483	10	5937.806	6
4820.410	20	5173.742	30	5941.755	12
4840.874	25	5192.971	35	5953.162	30
4856.012	20	5210.386	40	5965.828	30
4868.264	18	5224.301	15	5978.543	25
4870.129	20	5224.928	8	5999.668	8
4885.082	20	5265.967	10	6064.631	9
4899.910	20	5283.441	8	6085.228	20
4913.616	20	5295.781	4	6091.175	20
4919.867	10	5297.236	6	6126.217	20
4921.768	12	5298.429	4	6258.103	40
4928.342	12	5369.635	4	6258.706	50
4938.283	8	5389.996	3	6261.101	35
4975.344	10	5397.093	4	6303.754	10
4978.191	10	5409.609	6	6312.240	16
4981.732	60	5429.139	6	6336.104	8
4991.067	50	5477.695	8	6366.354	8
4997.099	8	5481.426	6	6546.276	20
4999.504	45	5488.210	5	6554.226	30
5007.209	40	5490.151	12	6556.066	25
5009.652	7	5503.897	8	6743.124	10

Xenon

Meggers, Journal Optical Society of America, 1921

λ_{air}	λ_{air}	λ_{air}
4500.978	4624.275	4807.019
4524.680	4671.225	4829.705
4582.746	4697.020	4844.333
4603.028	4734.154	4923.246

Wave Lengths in the Vacuum Ultraviolet

J. C. Boyce, Rev. Med. Phys. 13, 34, (1941)

Copper (Shenstone, 1936)

λA	Intensity	P.E. in .001 A	λA	Intensity	P.E. in .001 A	λA	Intensity	P.E. in .001 A
685.139	8	2	1065.781	20	1	1393.126	10	2
685.396	2	2	1066.133	20	2	1399.355	3	2
724.487	15	2	1069.193	50	2	1402.776	15	2
735.519	20	2	1088.393	20	2	1442.136	15	2
736.031	25	2	1106 446	3	2	1444.131	2	2
810.997	15	2	1109 742	1	2	1473 976	25	2
813.882	20	2	1185 899	2	2	1496 686	35	4
826.995	30	2	1214.553	1	2	1517.630	20	2
866.440	5	2	1219.332	1	2	1519.491	50	2
876 719	20	2	1241.961	2	1	1535.004	25	2
883.837	5	2	1248 790	5	2	1540.391	30	2
884.824	5	2	1250.045	10	2	1541.701	75	2
911 654	1	2	1265 504	15	1	1558.344	30	2
912.022	0	2	1266.308	10	1	1565.925	40	2
992.951	25	1	1274.069	3	2	1566.411	40	2
1001.010	8	1	1274.463	3	2	1569.216	10	2
1004.053	30	1	1275.570	30	2	1590.164	40	3
1008 568	30	1	1281.458	8	4	1593.557	60	3
1011 433	2	1	1297.549	2	2	1598 402	40	3
1012.595	25	1	1298.394	15	2	1602 387	40	3
1018 705	50	1	1299.267	10	2	1604.848	20	3
1019 652	15	1	1308.296	30	2	1606 834	40	3
1022.100	5	1	1309.463	15	2	1608.638	25	3
1027.830	50	1	1314.147	15	2	1610.298	15	3
1028 326	25	1	1314 335	30	2	1617.914	20	3
1031.764	8	1	1325.511	3	2	1621 426	60	3
1035.160	8	1	1326.394	10	2	1649.457	25	3
1036.468	60	1	1350.592	15	2	1656.326	20	3
1039.345	60	2	1351.837	25	2	1660.005	20	3
1044.742	80	1	1355 304	15	2	1663.003	30	3
1049.363	20	2	1359 010	20	2	1944.586	25	4
1049.754	50	1	1359.935	5	2	1970.489	15	4
1054.690	60	1	1362 598	20	2	1979.947	50	4
1055.795	40	2	1363.501	5	2	1989.849	30	4
1058.796	40	2	1370.558	2	2	2000.339	60	4
1059 094	60	1	1371 840	20	2			

Iron (Green, 1939)

Intensities			Intensities			Intensities		
λA	Schüler tube	Spark	λA	Schüler tube	Spark	λA	Schüler tube	Spark
1550.273	1	..	1637.398	15	2	1702 044	25	25
1559 084	20	2	1640.150	12	2	1709.551	0	..
1563 788	25	2	1643.576	15	2	1712 998	20	25
1566 821	20	1	1652.482	0	..	1718 100	2	
1568 017	8	.	1654.476	5	1	1720 611	20	20
1569.674	12	.	1658.771	15	2	1724.962	8	1
1570 244	20	1	1659.479	20	10	1726.391	12	8
1572 754	1	..	1663.220	15	2	1815 411	0	1
1573 826	5	..	1670.990	1	..	1818 516	2	1
1574.769	0	.	1674 254	2	1	1826.994	1	1
1574.921	20	1	1676.854	1	..	1833.073	0	
1577.167	1	..	1685.952	5	1	1842.283	0	..
1584.949	15	.	1686 454	8	1	1848 771	12	2
1612.805	20	8	1691 272	8	1	1851.526	1	.
1623.090	8	1	1693.475	0		1859.744	15	10
1625.520	20	8	1693 935	0		1898.535	10	2
1632 665	1	.	1696.794	8		1903.384	1	..
1633 906	15	2	1699 195	2		1904.785	15	5
						2001.025	30	30

Hydrogen

(Paschen, 1929)

λA	λA
923 148	949 739
926.222	972.532
930 745	1025.717
937 799	1215.664

Helium

(He II)(Paschen, 1929)

λA	λA	λA
234 3452	949.326	1084.940
237 3297	958.696	1215.129
243.0244	972.109	1640.409
256 3145	992.361	
303 7788	1025.270	

Carbon, Nitrogen, Oxygen (More and Rieke, 1936)

El.	λA	Int.	El.	λA	Int.	El.	λA	Int.
O II	832.764	0	N I	1176 502	1	C II	1335 703	18*d*
O II	833.332	1	N I	1199 550	7	N I	1494.670	4
O II	834.467	2	N I	1200 218	6	C I	1560.313	8*d*
O I	990 205	4*d*	N I	1200 707	5	C I	1560.702	15*d*
O I	990 794	3	O I	1217 643	2	C I	1656 271	8*d*
O I	999.493	2	O I	1302 174	8	C I	1656.994	15*d*
N II	1083.996	2	O I	1304 858	8	C I	1657.388	5*d*
N II	1084.582	3	O I	1306 023	6	C I	1657.908	8*d*
N I	1134.168	3	C I	1328.820	3	C I	1658 135	8*d*
N I	1134.417	3	C I	1329 099	5			
N I	1134.979	4	C II	1334 534	15*d*			

PERSISTENT LINES OF THE ELEMENTS

Spectra of the neutral atom, the singly ionized atom, and the doubly ionized atom are indicated by I, II, and III, respectively. The most sensitive lines are indicated by an asterisk (*). The symbol "D" preceding the intensity indicates the discharge-tube spectrum. Wave lengths are given in International Ångstrom units.

Wave lengths and intensities of lines between 2000 and 9999 Ångstroms have been given according to the M.I.T. Wavelength Tables.

ARRANGED BY ELEMENTS

Element	Wave length	Intensity	
		Arc	Spark
A I	*1048.26		
	1066.70		
	6965.430	.	D 400
	7067.217	...	D 400
	7503.867	..	D 700
	8115 311	.	D 5000
Ag I	*3280.683	2000	1000
	3382.891	1000	700
	5209.067	1500	1000
	5465.487	1000	500
Ag II	2246.412	25	300
	*2437.791	60	500
Al I	3082 155	800	800
	3092 713	1000	1000
	3944 032	2000	1000
	*3961 527	3000	2000
Al II	1671 0		
	1856.00		
	1858.13		
	1862 48		
	2631 553	.	40
	*2669.166	3	100
	2816 179	10	100
	6231 76		30
	6243.36		100
Al III	1854 67		
	1862 90		
As I	1889.9		
	*1890.5		
	1936 9		
	1972 0		
	2288 12	250	5
	2349 84	250	18
	2369.67	40	
	2370.77	50	3
	2456 53	100	8
	2780.197	75	75
	2860 452	50	50
	2898 71	25	40
Au I	*2427 95	400	100
	2675 95	250	100
	2802.19	..	200
B I	2496.778	300	300
	*2497.733	500	400
B II	1362 46		
	3451.41	5	30
	3452 33		
Ba I	3071.591	100	50
	5424 616	100	30
	5519.115	200	60
	*5535.551	1000	200
	5777.665	500	100
Ba II	2304.235	60	80
	2335.269	60	100
	3891 785	18	25
	4130.664	50	60
	*4554 042	1000	200
	4934 086	400	400
Be I	*2348 610	2000	50
	2650.781	25	
	3321.013	50	
	3321 086	100	
	3321.343	1000	30
Be II	*3130 416	200	200
	3131 072	200	150
Bi I	2061 70	300	100
	2276 578	100	40
	2780 521	200	100
	2809.625	200	100
	2897 975	500	500
	2938 298	300	300
	2989 029	250	100
	*3067 716	3000	2000
	4722 552	1000	100
Bi II	1909 41		
Br I	1540 8		
	1633.8		
Br II	*4704.86		D 250
	4785.50	..	D 400
	4816 71	. .	D 300
C I	*2478.573	400	D 400
C II	1334 54		
	1335 72		
	2836 710		200
	2837 602		40
	4267.02	...	350
	4267.27	.	500
C III	2296 89	.	200
Ca I	*4226.728	500	50
	4425 441	100	
	4434 960	150	
	4454.781	200	
	4455 880		
	4456.62		
Ca II	3158.869	100	300
	3179.332	100	400
	*3933.666	600	600
	3968 468	500	500
Cb I	*4058.938	1000	400
	4079.729	500	200
	4100.923	300	200
	4123.810	200	125
	4137.095	100	60
Cb II	*3094.183	100	1000

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY ELEMENTS (Continued)

Element	Wave length	Intensity	
		Arc	Spark
Cb II	3130 786	100	100
	3163 402	15	8
	3194 977	30	300
	3225 479	150	800
Cd I	*2288 018	1500	300
	3261 057	300	300
	3403 653	800	500
	3466 201	1000	500
	3610 510	1000	500
	6438 4696	2000	1000
Cd II	*2144 382	50	200
	2265 017	25	300
	2312 84	1	200
	2573 09	3	150
	2748 58	5	200
Ce II	4012 388	60	20
	4040 762	70	5
	4165 606	40	6
	*4186 599	80	25
Cl I	1379 6		
	1396 5		
Cl II	4794 54	...	D 250
	4810 06	. .	D 200
	4819 46		D 200
Co I	*3453 505	3000	200
	3465 800	2000	25
	3529 813	1000	30
Co II	*2286 156	40	300
	2307 857	25	50
	2363 787	25	50
	2378 622	25	50
	2388 918	10	35
	2519 822	40	200
	3405 120	2000	150
Cr I	*4254 346	5000	1000
	4274 803	4000	800
	4289 721	3000	800
	5204 518	400	100
	5206 039	500	200
	5208 436	500	100
Cr II	*2835 633	100	400
	2843 252	125	400
	2849 838	80	150
	2855 676	60	200
	2860 934	60	100
Cs I	4555 355	2000	100
	4593 177	1000	50
	*8521 10	5000	
	8943 50	2000	
Cu I	*3247 540	5000	2000
	3273 962	3000	1500
	5105 541	500	
	5153 235	600	
	5218 202	700	
Cu II	*2135 976	25	500
	2192 260	25	500
	2246 995	30	500
Dy I	4000 454	400	300
	4045 983	150	12

Element	Wave length	Intensity	
		Arc	Spark
Dy I	4077 974	150	100
	4167 966	50	12
	4211.719	200	15
Er I	3499 104	18	15
	3692 652	20	12
	3906 316	25	12
Eu I	*4594 02		
Eu II	4129 737	150	50
	*4205 046	200	50
F I	6856 02	....	D 1000
	6902 46	....	D 500
Fe I	3581 20		
	*3719 935	1000	700
	3737 133	1000	600
	3745 564	500	500
	3745 903	150	100
	3748 264	500	200
Fe II	*2382 039	40	100
	2395.625	50	100
	2404 882	50	100
	2410 517	50	70
	2413 309	60	100
Ga I	2874 244	10	15
	2943 637	10	20
	4032 982	1000	500
	*4172 056	2000	1000
Gd I	3646 196	200	150
	3768 405	20	20
Ge I	*2651.178	40	20
	2651 575	30	20
	2709 626	30	20
	3039 064	1000	1000
	3269 494	300	300
	4226 570	200	50
H I	1215.7		
	4861 327		D 500
	6562 79	.	D 3000
He I	584.4		
	*3888 646	. . .	D 1000
	5875 618	.	D 1000
He II	303 8		
	1640 5		
	4685 75	....	D 300
Hf I	2898 259	50	12
	2904.408	30	6
	2916 481	50	15
	2940 772	60	12
	3072 877	80	18
	4093 161	25	20
Hf II	2513 028	25	70
	2516 881	35	100
	*2641 406	40	125
	2773 357	25	60
	2820 224	40	100
	3134.718	80	125
Hg I	*1849 68		
	2536.519	2000	1000
	3650.146	200	500
	3654.833	. . .	D 200

PERSISTENT LINES OF THE ELEMENTS (Continued)

Arranged by Elements (Continued)

Element	Wave length	Intensity Arc	Intensity Spark	Element	Wave length	Intensity Arc	Intensity Spark
Hg I	3663 276	500	400	Mn II	*2576.104	300	2000
	4046 561	200	300		2593.729	200	1000
	4358.35	3000	500		2605.688	100	500
	5460.740	....	D 2000	Mo I	*3798.252	1000	1000
Hg II	1649 8				3864 110	1000	500
	1942 3				3902 963	1000	500
Ho I	3748.17	60	40	Mo II	*2816 154	200	300
	3891.02	200	40		2848 232	125	200
Ho II	2936.77	....	1000		2871.508	100	100
I I	1782 9				2890 994	30	50
	2062.38	....	D 900		2909 116	25	40
I II	5161.188	....	D 300	N I	1199 5		
	5464 61	....	D 900		1200.2		
In I	3039 356	1000	500		1200.7		
	3256 090	1500	600		*4099 94	....	D 150
	3258.564	500	300		4109 98	....	D 1000
	4101 773	2000	1000	N II	5666 64	.. .	D 300
	*4511.323	5000	4000		5676 02	....	D 100
Ir I	2543.97				5679 56	....	D 500
	2849.725	40	20	N III	989.8		
	2924 792	25	15		991 6		
	*3220 780	100	30		4097 31	....	D 100
	3437.015	20	15		4103 37	....	D 80
	3513 645	100	100	Na I	3302 323	600	300
K I	4044.140	800	400		3302.988	300	150
	4047.201	400	200		5682 657	80	
	*7664 907	9000			5688 224	300	
	7698.979	5000			*5889.953	9000	1000
Kr I	5570 2895	....	D 2000		5895.923	5000	500
	5870.9158	....	D 3000	Nd I	3951 154	40	30
La I	5455.146	200	1		4177 321	15	25
	5930.648	250			*4303 573	100	40
	*6249.929	300		Ne I	735 95		
La II	*3949 106	1000	800		743 73		
	4077.340	600	400		5400.562	....	D 2000
	4123.228	500	500		5832 488		
Li I	3232.61	1000	500		5852.488	....	D 2000
	4603.00	800			6402.246	....	D 2000
	6103.642	2000	300	Ni I	*3414.765	1000	50
	*6707.844	3000	200		3492.956	1000	100
Lu I	4518 57	300	40		3515 054	1000	50
Lu II	*2615 43				3524 541	1000	100
	2894 84	60	200	Ni II	2216 47		
	2911 39	100	300		2253.86	100	300
	3397 07	50	20		2264 457	150	400
	3472.48	50	150		2270.213	100	400
	3554.43	50	150		*2287.084	100	500
Mg I	*2852.129	300	100	O I	1302.27		
	3829 350	100	150		1304.96		
	3832 306	250	200		1306 12		
	3838.258	300	200		*7771.928	....	D 1000
	5167.343	100	50		7774 138	....	D 300
	5172.699	200	100		7775 433	....	D 100
	5183 618	500	300	Os I	*2909 061	500	400
Mg II	*2795 53	150	300		3058 66	500	500
	2802.695	150	300		3262 290	500	50
Mn I	*4030 755	500	20		3267 945	400	30
	4033.073	400	20		3301.56		
	4034.490	250	20		3752 54		

ARRANGED BY ELEMENTS (Continued)

Element	Wave length	Intensity Arc	Intensity Spark	Element	Wave length	Intensity Arc	Intensity Spark
Os I	3782.20			Ru I	*3498.942	500	200
	4420.468	400	100		3596.179	30	100
P I	1774.8			Ru II	2678.758	100	300
	1782.7				2692.065	8	200
	1787.5				2712.410	80	300
	2136.8				2945 668	60	300
	2149.8				2965.546	60	200
	2534.01	50	D 20		2976.586	60	200
	2535.65	100	D 30	S I	1807.4		
	2536.38				1820.5		
	2553.28	80	D 20		1826.4		
	2554.02				4694.13	....	D 500
	2554.93	60	D 20		4695.45	....	D 30
Pb I	2169.994	1000	1000		4696.25	....	D 15
	2614.178	200	80		9212.91	....	D 200
	2833.069	500	80		9228 11	....	D 200
	3639.580	300	50		9237.49	. .	D 200
	3683.471	300	50	Sb I	*2068.38	300	3
	*4057.820	2000	300		2175 890	300	40
Pb II	1682.4				2311.469	150	50
	*2203.505	50	5000		2528.535	300	200
	5608.8	....	D 40		2598.062	200	100
Pd I	*3404.580	2000	1000		2877.915	250	150
	3421 24	2000	1000		3232 499	150	250
	3516.943	1000	500		3267.502	150	150
	3609.548	1000	700	Sc I	3907.476	125	25
	3634 695	2000	1000		*3911 810	150	30
Pd II	*2296.53				4020.399	50	20
	2488.921	10	30		4023.688	100	25
	2498 784	4	150		5671.80		
	2505.739	3	30	Sc II	*3613.836	40	70
	2658.722	20	300		3630.740	50	70
	2854.581	4	500		3642.785	60	50
Pr I	4062.817	150	50	Se I	*1960.2		
Pr II	*4179 422	200	40		2039.851	....	D 1000
	4189.518	100	50		2062.788	....	D 800
	4225.327	50	40		4730.78	....	D 1000
Pt I	2659.454	2000	500		4739 03	....	D 800
	2830.295	1000	600		4742.25	...	D 500
	2929.794	800	200	Si I	2506.899	300	200
	2997.967	1000	200		2516 123	500	500
	*3064.712	2000	300		2528.516	400	500
Ra I	*4825 91	....	D 800		*2881.578	500	400
Ra II	*3814.42	....	D 2000		3905 528	20	15
	4682.28	...	D 800	Si II	1526 83		
Rb I	4201.851	2000	500		*1533.55		
	4215.556	1000	300	Sm I	*4296.75		
	*7800.227	9000		Sm II	3568.27		
	7947.60	5000			4390.865	150	150
Re I	*3460.47	1000			*4424.342	300	300
	4889.17	2000			4434.321	200	200
Rh I	3323.092	1000	200	Sn I	*2839.989	300	300
	3396.85	1000	500		2863.327	300	300
	*3434.893	1000	200		3009.147	300	200
	3657.987	500	200		3034.121	200	150
	3692.357	500	150		3175.019	500	400
Rn I	7055 42	....	D 400		3262.328	400	300
	7450.00	...	D 600		4524.741	500	50
Ru I	3436.737	300	150	Sn III	*2152.22		

ARRANGED BY ELEMENTS (Continued)

Element	Wave length	Intensity Arc	Intensity Spark
Sr I	*4607.331	1000	50
	4832 075	200	8
	4872 493	25	
	4962 263	40	
Sr II	3380 711	150	200
	3464 57	200	200
	3474 887	80	50
	*4077 714	400	500
	4215 524	300	400
	4305.447	40	
Ta I	*3311 162	300	70
	3318 840	125	35
	3406.664	70	18
Tb I	3509 17	200	200
	3561.74	200	200
	3848.75	100	200
	3874 18	200	200
Te I	*2142.75	60	
	2383.25	500	D 300
	2385 76	600	D 300
	2530.70	...	D 30
	2769.67	...	D 30
Th I	3538.75	...	50
	3601.040	8	10
	4019.137	8	8
Th II	3290.59	....	40
Ti I	3635.463	200	100
	3642.675	300	125
	3653.496	500	200
	*4981.733	300	125
	4991.066	200	100
	4999.510	200	80
	5007.213	200	40
	5014 25		
Ti II	*3349.035	125	800
	3361.213	100	600
	3372.800	80	400
	3383.761	70	300
Tl I	2767.87	400	300
	2918.32	400	200
	3229.75	2000	800
	3519.24	2000	1000
	3775.72	3000	1000
	*5350.46	5000	2000
Tm I	3462.21	200	100
	3761.333	250	150
	3761.917	200	120
Tm II	*3848.02		
U I	3552.172	8	12
	3672.579	8	15
	4241.669	40	50
V I	3183.406	200	100
	3183.982	500	400
	3185.396	500	400
	*4379.238	200	200
	4384.722	125	125
V I	4389.974	80	60
V II	*3093 108	100	400
	3102 299	70	300
	3110 706	70	300
	3118.383	70	200
	3125.284	80	200
W I	4008.753	45	45
	4294 614	50	50
	*4302.108	60	60
W II	*2204.49		
	2397.091	18	30
	2589.167	15	25
	3215.560	10	9
	3613.790	10	30
Xe I	1295 8		
	1469.9		
	4500.977	....	D 500
	4624.276	...	D 1000
	4671.226	...	D 2000
Y I	4643.695	50	100
	*4674.848	80	100
	5466.47		
Y II	3242.280	60	100
	3600.734	100	300
	3633.123	50	100
	*3710.290	80	150
	3774.332	12	100
	3788.697	30	30
Yb I	3289.37	500	1000
	*3987.994	1000	500
Yb II	*3694.203	500	1000
Zn I	*2138.56	800	500
	3282.333	500	300
	3302.588	800	300
	3345.020	800	300
	4680.138	300	200
	4722 159	400	300
	4810.534	400	300
	6362.347	1000	500
Zn II	*2025.51	200	200
	2061.91	100	100
	2502.001	20	400
	2557.958	10	300
Zr I	3519.605	100	10
	3547.682	200	12
	*3601.193	400	15
	4687.803	125	
	4710.075	60	
	4739.478	100	
	4772.312	100	
	4815.62		
Zr II	*3891.975	300	400
	3438.230	250	200
	3496.210	100	100
	3572.473	60	80

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY WAVE LENGTHS

Wave length	Element	Intensity Arc	Intensity Spark
303 8	He II		
584 4	He I		
735 95	Ne I		
743 73	Ne I		
989 8	N III		
991 6	N III		
*1048 26	A I		
1066 70	A I		
1199 5	N I		
1200 2	N I		
1200 7	N I		
1215 7	H I		
1295 8	Xe I		
1302 27	O I		
1304 96	O I		
1306 12	O I		
1334 54	C II		
1335 72	C II		
1362 46	B II		
1379 6	Cl I		
1396 5	Cl I		
1469 9	Xe I		
1526 83	Si II		
*1533 55	Si II		
1540.8	Br I		
1633 8	Br I		
1640 5	He II		
1649 8	Hg II		
1671 0	Al II		
1682 4	Pb II		
1774 8	P I		
1782.7	P I		
1782 9	I I		
1787 5	P I		
1807 4	S I		
1820 5	S I		
1826 4	S I		
*1849 6	Hg I		
1854 67	Al III		
1856 00	Al II		
1858 13	Al II		
1862 48	Al II		
1862 90	Al III		
1889 9	As I		
*1890 5	As I		
1909 41	Bi II		
1936.9	As I		
1942 3	Hg II		
*1960 2	Se I		
1972 0	As I		
*2025 51	Zn II	200	200
2039 851	Se I	.	D 1000
2061 70	Bi I	300	100
2061 91	Zn II	100	100
2062 38	I I	....	D 900
2062 788	Se I	...	D 800
*2068 38	Sb I	300	3
*2135 976	Cu II	25	500
2136 8	P I		
*2138 56	Zn I	800	500
*2142 75	Te I	60	
*2144 382	Cd II	50	200
2149 8	P I		
*2152 22	Sn II		
2169 994	Pb I	1000	1000
2175 890	Sb I	300	40
2192.260	Cu II	25	500
*2203.505	Pb II	50	5000
*2204 49	W II		
2216 47	Ni II		
2246 412	Ag II	25	300
2246.995	Cu II	30	500
2253.86	Ni II	100	300
2264.457	Ni II	150	400
2265 017	Cd II	25	300
2270 213	Ni II	100	400
2276 578	Bi I	100	40
*2286.156	Co II	40	300
*2287 084	Ni II	100	500
*2288 018	Cd I	1500	300
2288 12	As I	250	5
*2296.53	Pd II		
2296 89	C III	....	200
2304 235	Ba II	60	80
2307 857	Co II	25	50
2311.469	Sb I	150	50
2312 84	Cd II	1	200
2335 269	Ba II	60	100
*2348 610	Be I	2000	50
2349 84	As I	250	18
2363.787	Co II	25	50
2369 67	As I	40	
2370 77	As I	50	3
2378.622	Co II	25	50
*2382 039	Fe II	40	100
2383 25	Te I	500	D 300
2385 76	Te I	600	D 300
2388 918	Co II	10	35
2395.625	Fe II	50	100
2397 091	W II	18	30
2404.882	Fe II	50	100
2410.517	Fe II	50	70
2413 309	Fe II	60	100
*2427.95	Au I	400	100
*2437 791	Ag II	60	500
2456 53	As I	100	8
*2478 573	C I	400	D 400
2488 921	Pd II	10	30
2496 778	B I	300	300
*2497.733	B I	500	400
2498 784	Pd II	4	150
2502.001	Zn II	20	400
2505 739	Pd II	3	30
2506 899	Si I	300	200
2513 028	Hf II	25	70
2516.123	Si I	500	500
2516 881	Hf II	35	100
2519.822	Co II	40	200

ARRANGED BY WAVE LENGTHS (Continued)

Wave length	Element	Intensity Arc	Intensity Spark	Wave length	Element	Intensity Arc	Intensity Spark
2528.516	Si I	400	500	2860 452	As I	50	50
2528.535	Sb I	300	200	2860 934	Cr II	60	100
2530.70	Te I	....	D 30	2863.327	Sn I	300	300
2534 01	P I	50	D 20	2871 508	Mo II	100	100
2535 65	P I	100	D 30	2874 244	Ga I	10	15
2536 38	P I			2877 915	Sb I	250	150
2536 519	Hg I	2000	1000	*2881.578	Si I	500	400
2543.97	Ir I			2890 994	Mo II	30	50
2553 28	P I	80	D 20	2894.84	Lu II	60	200
2554 02	P I			2897 975	Bi I	500	500
2554.93	P I	60	D 20	2898.259	Hf I	50	12
2557.958	Zn II	10	300	2898 71	As I	25	40
2573.09	Cd II	3	150	2904.408	Hf I	30	6
*2576 104	Mn II	300	2000	*2909 061	Os I	500	400
2589.167	W II	15	25	2909.116	Mo II	25	40
2593 729	Mn II	200	1000	2911 39	Lu II	100	300
2598 062	Sb I	200	100	2916 481	Hf I	50	15
2605 688	Mn II	100	500	2918 32	Tl I	400	200
2614 178	Pb I	200	80	2924 792	Ir I	25	15
*2615 43	Lu II			2929 794	Pt I	800	200
2631 553	Al II	...	40	2936 77	Ho II	....	1000
*2641.406	Hf II	40	125	2938 298	Bi I	300	300
2650 781	Be I	25		2940 772	Hf I	60	12
*2651.178	Ge I	40	20	2943 637	Ga I	10	20
2651 575	Ge I	30	20	2945 668	Ru II	60	300
2658 722	Pd II	20	300	2965 546	Ru II	60	200
2659 454	Pt I	2000	500	2976 586	Ru II	60	200
*2669.166	Al II	3	100	2989.029	Bi I	250	100
2675 95	Au I	250	100	2997 967	Pt I	1000	200
2678 758	Ru II	100	300	3009.147	Sn I	300	200
2692 065	Ru II	8	200	3034 121	Sn I	200	150
2709 626	Ge I	30	20	3039 064	Ge I	1000	1000
2712.410	Ru II	80	300	3039 356	In I	1000	500
2748 58	Cd II	5	200	3058 66	Os I	500	500
2767 87	Tl I	400	300	*3064 712	Pt I	2000	300
2769 67	Te I	.	D 30	*3067.716	Bi I	3000	2000
2773.357	Hf II	25	60	3071.591	Ba I	100	50
2780 197	As I	75	75	3072.877	Hf I	80	18
2780.521	Bi I	200	100	3082 155	Al I	800	800
*2795.53	Mg II	150	300	3092.713	Al I	1000	1000
2802 19	Au I	....	200	*3093.108	V II	100	400
2802.695	Mg II	150	300	*3094 183	Cb II	100	1000
2809.625	Bi I	200	100	3102 299	V II	70	300
*2816 154	Mo II	200	300	3110 706	V II	70	300
2816.179	Al II	10	100	3118 383	V II	70	200
2820 224	Hf II	40	100	3125 284	V II	80	200
2830 295	Pt I	1000	600	*3130 416	Be II	200	200
2833.069	Pb I	500	80	3130 786	Cb II	100	100
*2835 633	Cr II	100	400	3131 072	Be II	200	150
2836 710	C II	....	200	3134 718	Hf II	80	125
2837.602	C II	....	40	3158.869	Ca II	100	300
*2839 989	Sn I	300	300	3163.402	Cb II	15	8
2843 252	Cr II	125	400	3175.019	Sn I	500	400
2848.232	Mo II	125	200	3179.332	Ca II	100	400
2849.725	Ir I	40	20	3183.406	V I	200	100
2849.838	Cr II	80	150	3183.982	V I	500	400
*2852.129	Mg I	300	100	3185.396	V I	500	400
2854 581	Pd II	4	500	3194.977	Cb II	30	300
2855.676	Cr II	60	200	3215 560	W I	10	9

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY WAVE LENGTHS (Continued)

Wave length	Element	Intensity		Wave length	Element	Intensity	
		Arc	Spark			Arc	Spark
*3220 780	Ir I	100	30	3474.887	Sr II	80	50
3225 479	Cb II	150	800	3492.956	Ni I	1000	100
3229 75	Tl I	2000	800	3496.210	Zr II	100	100
3232 499	Sb I	150	250	*3498.942	Ru I	500	200
3232 61	Li I	1000	500	3499 104	Er I	18	15
3242.280	Y II	60	100	3509.17	Tb I	200	200
*3247 540	Cu I	5000	2000	3513 645	Ir I	100	100
3256 090	In I	1500	600	3515.054	Ni I	1000	50
3258 564	In I	500	300	3516.943	Pd I	1000	500
3261 057	Cd I	300	300	3519.24	Tl I	2000	1000
3262.290	Os I	500	50	3519.605	Zr I	100	10
3262 328	Sn I	400	300	3524.541	Ni I	1000	100
3267.502	Sb I	150	150	3529.813	Co I	1000	30
3267 945	Os I	400	30	3538.75	Th I	....	50
3269 494	Ge I	300	300	3547.682	Zr I	200	12
3273 962	Cu I	3000	1500	3552.172	U I	8	12
*3280 683	Ag I	2000	1000	3554.43	Lu II	50	150
3282 333	Zn I	500	300	3561.74	Tb I	200	200
3289 37	Yb I	500	1000	3568.27	Sm II		
3290.59	Th II	....	40	3572.473	Zr II	60	80
3301.56	Os I			3581 20	Fe I		
3302.323	Na I	600	300	3596 179	Ru I	30	100
3302 588	Zn I	800	300	3600.734	Y II	100	300
3302.988	Na I	300	150	3601.040	Th I	8	10
*3311 162	Ta I	300	70	*3601.193	Zr I	400	15
3318 840	Ta I	125	35	3609 548	Pd I	1000	700
3321 013	Be I	50		3610.510	Cd I	1000	500
3321 086	Be I	100		3613.790	W II	10	30
3321 343	Be I	1000	30	*3613.836	Sc II	40	70
3323 092	Rh I	1000	200	3630.740	Sc II	50	70
3345 020	Zn I	800	300	3633.123	Y II	50	100
*3349 035	Ti II	125	800	3634.695	Pd I	2000	1000
3361 213	Ti II	100	600	3635.463	Ti I	200	100
3372.800	Ti II	80	400	3639 580	Pb I	300	50
3380 711	Sr II	150	200	3642 675	Ti I	300	125
3382 891	Ag I	1000	700	3642.785	Sc II	60	50
3383.761	Ti II	70	300	3646.196	Gd I	200	150
*3391 975	Zr II	300	400	3650.146	Hg I	200	500
3396 85	Rh I	1000	500	3653 496	Ti I	500	200
3397 07	Lu II	50	20	3654.833	Hg I	...	D 200
3403 653	Cd I	800	500	3657.987	Rh I	500	200
*3404.580	Pd I	2000	1000	3663.276	Hg I	500	400
3405 120	Co I	2000	150	3672.579	U I	8	15
3406 664	Ta I	70	18	3683.471	Pb I	300	50
*3414 765	Ni I	1000	50	3692.357	Rh I	500	150
3421 24	Pd I	2000	1000	3692.652	Er I	20	12
*3434 893	Rh I	1000	200	*3694.203	Yb II	500	1000
3436 737	Ru I	300	150	*3710.290	Y II	80	150
3437 015	Ir I	20	15	*3719.935	Fe I	1000	700
3438 230	Zr II	250	200	3737.133	Fe I	1000	600
3451 41	B II	5	30	3745.564	Fe I	500	500
3452 33	B II			3745.903	Fe I	150	100
*3453.505	Co I	3000	200	3748.17	Ho I	60	40
*3460.47	Re I	1000		3748.264	Fe I	500	200
3462.21	Tm I	200	100	3752.54	Os I		
3464 57	Sr II	200	200	3761.333	Tm I	250	150
3465 800	Co I	2000	25	3761.917	Tm I	200	120
3466 201	Cd I	1000	500	3768.405	Gd I	20	20
3472 48	Lu II	50	150	3774 332	Y II	12	100

PERSISTENT LINES OF THE ELEMENTS (Continued)

ARRANGED BY WAVE LENGTHS (Continued)

Wave length	Element	Intensity Arc	Intensity Spark	Wave length	Element	Intensity Arc	Intensity Spark
3775.72	Tl I	3000	1000	4130 664	Ba II	50	60
3782 20	Os I			4137.095	Cb I	100	60
3788.697	Y II	30	30	4165 606	Ce II	40	6
*3798 252	Mo I	1000	1000	4167 966	Dy I	50	12
*3814 42	Ra II	.	D 2000	*4172.056	Ga I	2000	1000
3829 350	Mg I	100	150	4177.321	Nd I	15	25
3832 306	Mg I	250	200	*4179.422	Pr II	200	40
3838 258	Mg I	300	200	*4186.599	Ce II	80	25
*3848 02	Tm II			4189.518	Pr II	100	50
3848 75	Tb I	100	200	4201 851	Rb I	2000	500
3864 110	Mo I	1000	500	*4205.046	Eu II	200	50
3874 18	Tb I	200	200	4211.719	Dy I	200	15
*3888.646	He I	.	D 1000	4215.524	Sr II	300	400
3891 02	Ho I	200	40	4215.556	Rb I	1000	300
3891.785	Ba II	18	25	4225.327	Pr II	50	40
3902.963	Mo I	1000	500	4226.570	Ge I	200	50
3905 528	Si I	20	15	*4226.728	Ca I	500	50
3906 316	Er I	25	12	4241.669	U I	40	50
3907.476	Sc I	125	25	*4254 346	Cr I	5000	1000
*3911.810	Sc I	150	30	4267.02	C II	. . .	350
*3933 666	Ca II	600	600	4267 27	C II	. . .	500
3944 032	Al I	2000	1000	4274 803	Cr I	4000	800
*3949.106	La II	1000	800	4289.721	Cr I	3000	800
3951 154	Nd I	40	30	4294.614	W I	50	50
*3961 527	Al I	3000	2000	*4296.75	Sm I		
3968 468	Ca II	500	500	*4302.108	W I	60	60
*3987.994	Yb I	1000	500	*4303 573	Nd I	100	40
4000 454	Dy I	400	300	4305 447	Sr II	40	
4008 753	W I	45	45	4358 35	Hg I	3000	500
4012.388	Ce II	60	20	*4379.238	V I	200	200
4019.137	Th I	8	8	4384.722	V I	125	125
4020.399	Sc I	50	20	4389 974	V I	80	60
4023 688	Sc I	100	25	4390.865	Sm II	150	150
*4030 755	Mn I	500	20	4420 468	Os I	400	100
4032 982	Ga I	1000	500	*4424 342	Sm II	300	300
4033 073	Mn I	400	20	4425 441	Ca I	100	
4034 490	Mn I	250	20	4434 321	Sm II	200	200
4040.762	Ce II	70	5	4434.960	Ca I	150	
4044 140	K I	800	400	4454 781	Ca I	200	
4045 983	Dy I	150	12	4455 880	Ca I		
4046 561	Hg I	200	300	4456.62	Ca I		
4047.201	K I	400	200	4500.977	Xe I	. .	D 500
*4057 820	Pb I	2000	300	*4511.323	In I	5000	4000
*4058.938	Cb I	1000	400	4518.57	Lu I	300	40
4062 817	Pr I	150	50	4524.741	Sn I	500	50
4077 340	La II	600	400	*4554.042	Ba II	1000	200
*4077.714	Sr II	400	500	4555.355	Cs I	2000	100
4077 974	Dy I	150	100	4593.177	Cs I	1000	50
4079 729	Cb I	500	200	*4594.02	Eu I		
4093.161	Hf II	25	20	4603.00	Li I	800	
4097 31	N III	. . .	D 100	*4607.331	Sr I	1000	50
*4099.94	N I	. .	D 150	4624.276	Xe I	. . .	D 1000
4100.923	Cb I	300	200	4643.695	Y I	50	100
4101.773	In I	2000	1000	4671.226	Xe I	. . . .	D 2000
4103.37	N III	. . . .	D 80	*4674.848	Y I	80	100
4109 98	N I	. .	D 1000	4680.138	Zn I	300	200
4123.228	La II	500	500	4682.28	Ra II	. .	D 800
4123.810	Cb I	200	125	4685.75	He II	.	D 300
4129.737	Eu II	150	50	4687.803	Zr I	125	

PERSISTENT LINES OF THE ELEMENTS (Continued)

Arranged by Wave Lengths (Continued)

Wave length	Element	Intensity Arc	Intensity Spark
4694.13	S I	....	D 500
4695.45	S I	....	D 30
4696 25	S I	....	D 15
*4704.86	Br II	....	D 250
4710 075	Zr I	60	
4722 159	Zn I	400	300
4722.552	Bi I	1000	100
4730.78	Se I	....	D 1000
4739.03	Se I	....	D 800
4739 478	Zr I	100	
4742 25	Se I	...	D 500
4772 312	Zr I	100	
4785.50	Br II	....	D 400
4794.54	Cl II	....	D 250
4810 06	Cl II	...	D 200
4810.534	Zn I	400	300
4815 62	Zr I		
4816 71	Br II	....	D 300
4819 46	Cl II	....	D 200
*4825.91	Ra I	....	D 800
4832 075	Sr I	200	8
4861 327	H I	....	D 500
4872 493	Sr I	25	
4889 17	Re I	2000	
4934 086	Ba II	400	400
4962 263	Sr I	40	
*4981.733	Ti I	300	125
4991.066	Ti I	200	100
4999 510	Ti I	200	80
5007.213	Ti I	200	40
5014 25	Ti I		
5105 541	Cu I	500	
5153.235	Cu I	600	
5161.188	I II	...	D 300
5167 343	Mg I	100	50
5172 699	Mg I	200	100
5183.618	Mg I	500	300
5204 518	Cr I	400	100
5206 039	Cr I	500	200
5208 436	Cr I	500	100
5209 067	Ag I	1500	1000
5218.202	Cu I	700	
*5350.46	Tl I	5000	2000
5400.562	Ne I	...	D 2000
5424 616	Ba I	100	30
5455 146	La I	200	1
5460.740	Hg I	....	D 2000
5464 61	I II	...	D 900
5465.487	Ag I	1000	500
5466 47	Y I		
5519.115	Ba I	200	60
*5535.551	Ba I	1000	200
5570.2895	Kr I	....	D 2000
5608.8	Pb II	....	D 40
5666.64	N II	....	D 300
5671.80	Sc I		
5676.02	N II	....	D 100
5679.56	N II	....	D 500
5682.657	Na I	80	
5688 224	Na I	300	
5777.665	Ba I	500	100
5832.488	Ne I		
5852.488	Ne I	....	D 2000
5870 9158	Kr I	....	D 3000
5875.618	He I	...	D 1000
*5889 953	Na I	9000	1000
5895.923	Na I	5000	500
5930.648	La I	250	
6103.642	Li I	2000	300
6231.76	Al II	...	30
6243 36	Al II	...	100
*6249.929	La I	300	
6362.347	Zn I	1000	500
6402.246	Ne I	...	D 2000
6438 4696	Cd I	2000	1000
6562 79	H I	...	D 3000
*6707 844	Li I	3000	200
6856 02	F I	....	D 1000
6902.46	F I	....	D 500
6965 430	A I	....	D 400
7055.42	Rn I	....	D 400
7067.217	A I	....	D 400
7450 00	Rn I	....	D 600
7503.867	A I	....	D 700
*7664 907	K I	9000	
7698.979	K I	5000	
*7771.928	O I	....	D 1000
7774.138	O I	....	D 300
7775.433	O I	....	D 100
*7800.227	Rb I	9000	
7947.60	Rb I	5000	
8115.311	A I	....	D 5000
*8521.10	Cs I	5000	
8943.50	Cs I	2000	
9212.91	S I	....	D 200
9228.11	S I	....	D 200
9237.49	S I	....	D 200

INDEX OF REFRACTION

Indices of refraction for elements, inorganic, metal-organic and organic compounds and minerals will be found in the tables of physical constants for the various classes of substances in the section Properties and Physical Constants.

Values for compounds not there listed and data subsequently collected are given below.

Indices not otherwise indicated are for sodium light, $\lambda = 589.3$ mμ. Other wave lengths are indicated by the value in millimicrons or symbol in parentheses which follows the index. Wave lengths are indicated as follows. He, $\lambda = 587.6$ mμ; Li, $\lambda = 670.8$ mμ; Hg, $\lambda = 579.1$ mμ; A, $\lambda = 759.4$ mμ; C, $\lambda = 656.3$ mμ; D, $\lambda = 589.3$ mμ; F, $\lambda = 486.1$ mμ.

Temperatures are understood to be 20°C for liquids, or ordinary room temperatures in the case of solids. Other temperatures appear as superior figures with the index.

Indices for the elements and inorganic compounds will be understood to be for the solid form except as indicated by the abbreviation liq.

Elements

See also under Physical Constants of Inorganic Compounds and Index of Refraction of Gases.

Name	Formula	Index
Bromine (liq.)	Br_2	1.661^{15}
Cadmium (liq.)	Cd	0.82 (579 mμ)
(sol.)		1.13
Chlorine (liq.)	Cl_2	1.385
" (gas)		1.000768
Hydrogen (liq.)	H_2	$1.0974^{-252.83}$(579 mμ)
Iodine (sol.)	I_2	3.34
(gas)		1.001920
Lead	Pb	2.6 (579 mμ)
Mercury (liq.)	Hg	1.6–1.9
Nitrogen (liq.)	N_2	1.2053^{-190}
Oxygen (liq.)	O_2	1.221^{-181}
Phosphorus (yel.) (sol.)		2.1442^{25}
Selenium	Se_8	3.00, 4.04
" (amor.) (sol.)		2.92
Sodium (liq.)	Na	0.0045
(sol.)		4.22
Sulfur (liq.)	S_8	1.929^{110}
" (amor.) (sol.)		1.998
" (rhombic, α)		1.957, 2.0377, 2.2454
Tin (liq.)	Sn	2.1

Inorganic Compounds

See also under Physical Constants of Inorganic Compounds

Aluminum carbide	Al_4C_3	2.7, 2.75 (700 mμ)
chloride	$AlCl_3.6H_2O$	1.560, 1.507
oxide	Al_2O_3	1.665–1.680, 1.63–1.65
Alums. See under appropriate ele	ment.	
Ammonium antimonyl tartrate	$2(NH_4.SbO.C_4H_4O_6).H_2O$	β1.6229 (C)
*ortho*arsenate, di-H	$NH_4H_2AsO_4$	1.5766, 1.5217
bromide	NH_4Br	1.7108
perchlorate	NH_4ClO_4	1.4818, 1.4833, 1.4881
chloroplatinate	$(NH_4)_2PtCl_6$	1.8
fluoride	NH_4F	ω<1.328
" acid	NH_4HF_2	1.385, 1.390, 1.394
hydrogen malate (*d*)	$NH_4C_4H_5O_5$	β1.503
nitrate	NH_4NO_3	1.413, 1.611(He), 1.637

INORGANIC COMPOUNDS (Continued)

Name	Formula	Index
Ammonium sulfate, acid.	NH_4HSO_4	1.463, 1.473, 1.510
tartrate (*dl*)...........	$(NH_4)_2C_4H_4O_6.2H_2O$	β1.564
thiocyanate	NH_4CNS	1.546, 1.685, 1.692
uranyl acetate	$NH_4C_2H_3O_2.UO_2(C_2H_3O_2)_2$	1.4808, 1.4933
Antimony bromide... .	$SbBr_3$	>1.74+
iodide, tri-........	SbI_3	2.78 (Li), 2.36
Barium cadmium bromide .. .	$BaCdBr_4.4H_2O$	β1.702
cadmium chloride.......	$BaCdCl_4.4H_2O$	β1.651
calcium propionate	$BaCa_2(C_3H_5O_2)_6$	1.4442
fluochloride..	$BaCl_2.BaF_2$	1.640, 1.633
fluoride...... . .	BaF_2	1.475 also 1.4741
Barium oxide...	BaO	1.980
*ortho*phosphate, di-	$BaHPO_4$	1.617, 1.63±, 1.635
propionate. ...	$Ba(C_2H_5CO_2)_2.H_2O$	β1.5175
sulfide, mono-	BaS	2.155
Cadmium ammonium chloride	$CdCl_2.4NH_4Cl$	1.6038, 1.6042
cesium sulfate.	$CdSO_4.Cs_2SO_4.6H_2O$	1.498, 1.500, 1.506
fluoride.	CdF_2	1.56
magnesium chloride	$(CdCl_2)_2.MgCl_2.12H_2O$	1.49, 1.5331, 1.5769
oxide	CdO	2.49 (Li)
potassium chloride...	$CdCl_2.4KCl$	1.5906, 1.5907
" cyanide .	$Cd(CN)_2.2KCN$	1.4213
rubidium sulfate....	$CdSO_4.Rb_2SO_4.6H_2O$	1.4798, 1.4848, 1.4948
Calcium aluminate .	$Ca_3Al_2O_6$	1.710
borate............ .	$CaO.B_2O_3$	1.540, 1.656, 1.682
carbide.	CaC_2	>1.75
copper acetate. .	$CaCu(C_2H_3O_2)_4.6H_2O$	1.436, 1.478
cyanamide... .	$CaCN_2$	1.60, >1.95
dithionate	$CaS_2O_6.4H_2O$	1.5516, 1.5414
*pyro*phosphate	$Ca_2P_2O_7$	1.585, 1.60±, 1.605
platinocyanide .	$CaPt(CN)_4.5H_2O$	1.623, 1 644, 1.767
strontium propionate	$Ca_2Sr(C_3H_5O_2)_6$	1.4871, 1.4956
sulfide (oldhamite)...	CaS	2.137
sulfite	$CaSO_3.2H_2O$	1.590, 1.595, 1.628
thiosulfate.	$CaS_2O_3.6H_2O$	1.545, 1.560, 1.605
Carbon dioxide (liq.) .	CO_2	1.195^{15}
Cerium dithionate . .	$Ce_2(S_2O_6)_3.15H_2O$	β1.507
Cesium *per*chlorate .	$CsClO_4$	1.4752, 1.4788, 1.4804
nitrate..........	$CsNO_3$	1.55, 1.56
selenate.....	Cs_2SeO_4	1.5989, 1.5999, 1.6003
thallium chloride ..	$Cs_3Tl_2Cl_9$	1.784, 1.774
Chromium cesium sulfate .	$CrCs(SO_4)_2.12H_2O$	1.4810
oxide (ic)..	Cr_2O_3	2.5
potassium cyanide (ic).	$CrK_3(CN)_6$	1.5221, 1.5244, 1.5373
sulfate (ic).	$Cr_2(SO_4)_3.18H_2O$	1.564
thallium sulfate	$CrTl(SO_4)_2.12H_2O$	1.5228
Cobalt acetate	$Co(C_2H_3O_2)_2.4H_2O$	β1.542
aluminate (Thenard's Blue).	$Co(AlO_2)_2$	>1.78 (red), 1.74 (blue)
ammonium selenate	$CoSeO_4.(NH_4)_2SeO_4.6H_2O$	1.5246, 1.5311, 1.5398
cesium sulfate........ .	$CoCs_2(SO_4)_2.6H_2O$	1.5057, 1.5085, 1.5132
chloride (ous).. . .	$CoCl_2.2H_2O$	<1.625, <1.671, >1.67
potassium selenate .. .	$CoSeO_4.K_2SeO_4.6H_2O$	1.5135, 1.5195, 1.5358
rubidium sulfate. ...	$CoSO_4.Rb_2SO_4.6H_2O$	1.4859, 1.4916, 1.5014
selenate . . .	$CoSeO_4.6H_2O$	β1.5225, γ1.5227
Copper ammonium selenate.. .	$CuSeO_4.(NH_4)_2SeO_4.6H_2O$	1.5213, 1.5355, 1.5395
ammonium sulfate.... ..	$CuSO_4.(NH_4)_2SO_4.6H_2O$	1.4910, 1.5007, 1.5054
cesium sulfate.	$CuSO_4.Cs_2SO_4.6H_2O$	1.5048, 1.5061, 1.5153
chloride (ic).... . .	$CuCl_2.2H_2O$	1.644, 1.684, 1.742
formate........ . . .	$Cu(CHO_2)_2.4H_2O$	1.4133, 1.5423, 1.5571

Inorganic Compounds (Continued)

Name	Formula	Index
Copper oxide (ous) (cuprite)	Cu_2O	2.705
potassium chloride	$CuCl_2.2KCl.2H_2O$	1.6365, 1.6148
" cyanide (ous)	$CuK_3(CN)_4$	1.5215
" selenate	$CuSeO_4.K_2SeO_4.6H_2O$	1.5096, 1.5235, 1.5387
" sulfate	$CuSO_4.K_2SO_4.6H_2O$	1.4836, 1.4864, 1.5020
strontium formate	$Cu(HCO_2)_2.2[Sr(HCO_2)_2]8H_2O$	1.4995, 1.5199, 1.5801
sulfate (ic)	$CuSO_4$	1.724, 1.733, 1.739
Cyanogen	C_2N_2	1.327^{18} (liq.)
Germanium bromide, tetra-	$GeBr_4$	1.6269
Gold sodium chloride	$AuNaCl_4.2H_2O$	α1.545, γ1.75+
Hafnium oxychloride	$HfOCl_2.8H_2O$	1.557, 1.543
Ice	H_2O	1.3049, 1.3062 (A), 1.3091, 1.3104 (D), 1.3133, 1.3147 (F)
Iron ammonium chloride	$Fe(NH_4)_2Cl_4$	1.6439
ammonium selenate	$FeSeO_4.(NH_4)_2SeO_4.6H_2O$	1.5201, 1.5260, 1.5356
cesium sulfate (ic)	$FeCs(SO_4)_2.12H_2O$	1.4839
" " (ous)	$FeSO_4.Cs_2SO_4.6H_2O$	1.5003, 1.5035, 1.5094
rubidium sulfate	$FeRb(SO_4)_2.12H_2O$	1.48234
sulfate (ic)	$Fe_2(SO_4)_3$	1.802, 1.814, 1.818
thallium sulfate	$FeTl(SO_4)_2.12H_2O$	1.52365
Lanthanum sulfate	$La_2(SO_4)_3.9H_2O$	1.564, 1.569
Lead *ortho*arsenate, di-	$PbHAsO_4$	1.8903, 1.9097, 1.9765
nitrate	$Pb(NO_3)_2$	1.782
Lithium ammonium sulfate	$LiNH_4SO_4$	β1.437 (Li)
ammonium tartrate (*d*)	$LiNH_4(C_4H_4O_6).H_2O$	β1.567, γ1.5673
" " (*dl*)	$LiNH_4(C_4H_4O_6).H_2O$	β1.5287
bromide	$LiBr$	1.784
chloride	$LiCl$	1.662
dithionate	$Li_2S_2O_6.2H_2O$	1.5487, 1.5602, 1.5788
oxide	Li_2O	1.644
potassium sulfate	$LiKSO_4$	1.4723, 1.4717
" tartrate	$LiK(C_4H_4O_6).H_2O$	β1.5226 (red)
rubidium tartrate (*d*)	$LiRb(C_4H_4O_6).H_2O$	β1.552
sodium tartrate (*dl*)	$LiNa(C_4H_4O_6).2H_2O$	β1.4904
Magnesium ammonium selenate	$MgSeO_4.(NH_4)_2SeO_4.6H_2O$	1.5070, 1.5093, 1.5169
ammonium sulfate	$Mg(NH_4)_2.(SO_4)_2.6H_2O$	1.4716, 1.4730, 1.4786
*ortho*borate	$3MgO.B_2O_3$	1.6527, 1.6537, 1.6748
cesium sulfate	$MgCs_2(SO_4)_2.6H_2O$	1.4857, 1.4858, 1.4916
chlorostannate	$MgSnCl_6.6H_2O$	1.5885, 1.5970
fluosilicate	$MgSiF_6.6H_2O$	1.3439, 1.3602
platinocyanide	$MgPt(CN)_4.7H_2O$	1.5608, 1.91
Magnesium potassium selenate	$MgK_2(SeO_4)_2.6H_2O$	1.4969, 1.4991, 1.5139
potassium sulfate	$MgK_2(SO_4)_2.6H_2O$	1.4607, 1.4629, 1.4755
rubidium sulfate	$MgRb_2(SO_4)_2.6H_2O$	1.4672, 1.4689, 1.4779
silicate	$MgSiO_3$	1.651, 1.654 (calc.), 1.660
sulfide	MgS	2.271 also 2.268
Manganese borate	$Mn_3B_4O_9$	1.617, 1.738, 1.776
cesium sulfate	$MnCs_2(SO_4)_2.6H_2O$	1.4946, 1.4966, 1.5025
chloride	$MnCl_2.4H_2O$	1.555, 1.575, 1.607
rubidium sulfate	$MnRb_2(SO_4)_2.6H_2O$	1.4767, 1.4807, 1.4907
sulfate (ous)	$MnSO_4.4H_2O$	1.508, 1.518, 1.522
" "	$MnSO_4.5H_2O$	1.495, 1.508, 1.514
Mercury chloride (ic)	$HgCl_2$	1.725, 1.859, 1.965
cyanide (ic)	$Hg(CN)_2$	1.645, 1.492
iodide (ic) (red)	HgI_2	2.748, 2.455
Nickel ammonium selenate	$Ni(NH_4)_2.(SeO_4)_2.6H_2O$	1.5291, 1.5372, 1.5466
cesium sulfate	$NiCs_2(SO_4)_2.6H_2O$	1.5087, 1.5129, 1.5162

INDEX OF REFRACTION (Continued)

Inorganic Compounds (Continued)

Name	Formula	Index
Nickel chloride	$NiCl_2.6H_2O$	α1.535, γ1.61
fluoride, acid	$NiF_2.5HF.6H_2O$	1.392, 1.408
potassium selenate	$NiK_2(SeO_4)_2.6H_2O$	1.5199, 1.5248, 1.5339
rubidium sulfate	$NiRb_2(SO_4)_2.6H_2O$	1.4895, 1.4961, 1.5052
selenate	$NiSeO_4.6H_2O$	1.5393, 1.5125
Platinum potassium dibromonitrite	$PtK_2(NO_2)_2Br_2.H_2O$	1.626, 1.6684, 1.757
Potassium carbonate	K_2CO_3	1.426, 1.531, 1.541
carbonate, acid	$KHCO_3$	1.380, 1.482, 1.578
*per*chlorate	$KClO_4$	1.4731, 1.4737, 1.4769
chloroplatinate	K_2PtCl_6	1.827 (577 mμ)
chloroplatinite	K_2PtCl_4	1.64, 1.67
*di*chromate	$K_2Cr_2O_7$	1.7202, 1.7380, 1.8197
cyanide	KCN	1.410
fluoborate	KBF_4	1.3239, 1.3245, 1.3247
fluoride	KF	1.352 (1.361)
"	$KF.2H_2O$	1.345, 1.352, 1.363
fluosilicate	K_2SiF_6	1.3391
*per*iodate	KIO_4	1.6205, 1.6479
lithium ferrocyanide	$K_2Li_2Fe(CN)_6.3H_2O$	1.5883, 1.6007, 1.6316
*hypo*phosphate	$K_2H_2P_2O_6.2H_2O$	1.4893, 1.5314, 1.5363
"	$K_2H_2P_2O_6.3H_2O$	1.4768, 1.4843, 1.4870
ruthenium cyanide	$K_4Ru(CN)_6.3H_2O$	β1.5837
silicate	K_2SiO_3	1.520, 1.521, 1.528
thiocyanate	$KCNS$	1.532, 1.660, 1.730
thionate, tetra-	$K_2S_4O_6$	1.5896, 1.6057, 1.6435
" penta-	$2K_2S_5O_6.3H_2O$	1.565, 1.63, 1.655
Rhodium cesium sulfate	$RhCs(SO_4)_2.12H_2O$	1.5077
Rubidium *per*chlorate	$RbClO_4$	1.4692, 1.4701, 1.4731
chromate	Rb_2CrO_4	β1.71, γ1.72
dithionate	$Rb_2S_2O_6$	1.4574, 1.5078
fluoride	RbF	1.396
selenate	Rb_2SeO_4	1.5515, 1.5537, 1.5582
Ruthenium sodium nitrate	$RuNa_2(NO_2)_5.2H_2O$	1.5889, 1.5943, 1.7163
Selenium oxide	SeO_2	>1.76
Silver cyanide	$AgCN$	1.685, 1.94
nitrate	$AgNO_3$	1.729, 1.744, 1.788
phosphate	Ag_2HPO_4	1.8036, 1.7983
potassium cyanide	$AgK(CN)_2$	1.625, 1.63
Sodium ammonium tartrate (*d*)	$NaNH_4(C_4H_4O_6).4H_2O$	1.495, 1.498, 1.499
ammonium tartrate (*dl*)	$NaNH_4(C_4H_4O_6).H_2O$	β1.473 (red)
*ortho*arsenate	$NaH_2AsO_4.H_2O$	1.5382, 1.5535, 1.5607
"	$NaH_2AsO_4.2H_2O$	1.4794, 1.5021, 1.5265
bromide	$NaBr$	1.6412
carbonate	Na_2CO_3	1.415, 1.535, 1.546
Sodium carbonate, acid	$NaHCO_3$	1.376, 1.500, 1.582
cyanide	$NaCN$	1.452
iodide	NaI	1.7745
molybdate	$3Na_2O.7MoO_3.22H_2O$	β1.627
nitrate	$NaNO_3$	1.5874, 1.3361
phosphate	$NaH_2PO_4.2H_2O$	1.4401, 1.4629, 1.4815
"	$Na_2HPO_4.7H_2O$	1.4412, 1.4424, 1.4526
*hypo*phosphate	$Na_3HP_2O_6.9H_2O$	1.4653, 1.4738, 1.4804
silicate	Na_2SiO_3	1.513, 1.520, 1.528
sulfate, acid	$NaHSO_4.H_2O$	1.43, 1.46, 1.47
sulfite	Na_2SO_3	1.565, 1.515
" acid	$NaHSO_3$	1.474, 1.526, 1.685
tartrate, acid (*d*)	$NaH(C_4H_4O_6).H_2O$	β1.533
thiocyanate	$NaCNS$	1.545, 1.625, 1.695

INDEX OF REFRACTION (Continued)

INORGANIC COMPOUNDS (Continued)

Name	Formula	Index
Sodium tungstate	$Na_2WO_4.2H_2O$	1.5526, 1.5533, 1.5695
vanadate	$Na_3VO_4.10H_2O$	1.5305, ω1.5398, ϵ1.5475
"	$Na_3VO_4.12H_2O$	1.5095, 1.5232
Strontium dichromate	$SrCr_2O_7.3H_2O$	1.7146, 1.7174, 1.812
fluoride	SrF_2	1.442 (1.438)
oxide	SrO	1.870
*ortho*phosphate, acid	$SrHPO_4$	1.608, 1.62±, 1.625
sulfide, mono-	SrS	2.107
Sulfur nitride	S_4N_4	α1.908, β2.046
Thallium chloride, mono-	$TlCl$	2.247
iodide, mono-	TlI	2.78
Tin iodide (ic)	SnI_4	2.106
Uranyl potassium sulfate	$UO_2.SO_4.K_2SO_4.2H_2O$	1.5144, 1.5266, 1.5705 (580 mμ)
Vanadium ammonium sulfate	$VNH_4(SO_4)_2.12H_2O$	1.475
Zinc ammonium selenate	$Zn(SeO_4).(NH_4)_2SeO_4.6H_2O$	1.5240, 1.5300, 1.5385
bromate	$Zn(BrO_3)_2.6H_2O$	1.5452
cesium sulfate	$ZnCs_2(SO_4)_2.6H_2O$	1.5022, 1.5048, 1.5093
chloride	$ZnCl_2$	1.687, 1.713
fluosilicate	$ZnSiF_6.6H_2O$	1.3824, 1.3956
potassium cyanide	$ZnK_2(CN)_4$	1.4115
" selenate	$ZnK_2(SeO_4)_2.6H_2O$	1.5121, 1.5181, 1.5335
" sulfate	$ZnK_2(SO_4)_2.6H_2O$	1.4775, 1.4833, 1.4969
rubidium sulfate	$ZnRb_2(SO_4)_2.6H_2O$	1.4833, 1.4884, 1.4975
silicate	$ZnSiO_3$	1.616, 1.62±, 1.623
Zirconium ammonium fluoride	$Zr(NH_4)_3F_7$	1.433

ORGANIC COMPOUNDS

See also under Physical Constants of Organic Compounds.

Name	Index
Allontoin, solid	α1.579, γ1.660
Dimethyl thiophene (α, α'), liq	1.51693$^{13.4}$ (He)
" " (β, β'), liq	1.52217^{15} (He)
Ethyl carbylamine, liq	1.3659^{24}
Ethylidene cyanhydrin, liq	1.40582$^{18.4}$
Hexyl acetylene (n), liq	1.4208$^{12.5}$

MISCELLANEOUS

Albite glass	1.4890	Magdala red	1.90
Amber	1.546	Obsidian	1.482–1.496
Anorthite glass	1.5755	Paraffin	1.43295$^{38.3}$ (C)
Asphalt	1.635	Quartz, fused	1.45640 (656 mμ)
Bell metal	1.0052		1.45843 (589 mμ)
Borax, amorphous, fused	1.4630		1.46190 (509 mμ)
Canada balsam	1.530		1.47503 (361 mμ)
Ebonite	1.66 (red)		1.49634 (275 mμ)
Fuchsin	2.70		1.53386 (214 mμ)
Gelatin, Nelson's No. 1	1.530		1.57464 (185 mμ)
Gelatin, various	1.516–1.534	Resin, aloes	1.619 (red)
Gum Arabic	1.480 (1.514) (red)	colophony	1.548 (red)
		copal	1.528 (red)
Hoffman's violet	2.20	mastic	1.535 (red)
Ivory	1.539, 1.541	Peru balsam	1.593

MOLECULAR REFRACTION

The molecular refraction of a substance may be computed by the following relation,—

$$N = \frac{M(n^2 - 1)}{d(n^2 + 2)}$$

where N is the molecular refraction for a specified wave length and temperature, M, the molecular weight, d, the density and n the refractive index for the specified conditions.

LIQUIDS FOR INDEX BY IMMERSION METHOD

Liquid	N_D 24° C
Trimethylene chloride	1 446
Cineole	1 456
Hexahydrophenol	1 466
Decahydronaphthalene	1 477
Isoamylphthalate	1 486
Tetrachloroethane	1 492
Pentachloroethane	1 501
Trimethylene bromide	1 513
Chlorobenzene	1 523
Ethylene bromide + Chlorobenzene	1 533
o-Nitrotoluene	1 544
Xylidine	1 557
o-Toluidine	1 570
Aniline	1 584
Bromoform	1 595
Iodobenzene + Bromobenzene	1 603
Iodobenzene + Bromobenzene	1 613
Quinoline	1 622
α-Chloronaphthalene	1 633
α-Bromonaphthalene + α-Chloronaphthalene	1 640–1 650
α-Bromonaphthalene + α-Iodonaphthalene	1 660–1 690
Methylene iodide + Iodobenzene	1 700–1 730
Methylene iodide	1 738
Methylene iodide saturated with sulfur	1 78
Yellow phosphorus, sulfur and methylene iodide (8.1 1 by weight)	2 06
Can be diluted with methylene iodide to cover range 1.74–2.06. For precautions in use, cf. West, Am Mineral, **21**, p. 245-9 (1936).	

HEAVY LIQUIDS FOR MINERAL SEPARATION

Liquid	Density
Tetrabromethane (sym.) Can be diluted with carbon tetrachloride (1.595) or benzene (0.894).	2 964, 20°/4°
Methylene iodide Can be diluted with carbon tetrachloride or benzene.	3 325, 20° 4°
Thallium formate, aq Can be diluted with water	3 5
Thallium malonate-thallium formate, aq Can be diluted with water.	4 9

For preparation and recovery of these liquids, cf. U. S. Bureau Mines, Rept. Inv. #2897 (1928).

INDEX OF REFRACTION OF WATER

Alcohol and Carbon Bisulfide

For sodium light, λ = .5893

Temp. °C	Water, pure relative to air	Ethyl Alcohol 99.8 relative to air	Carbon Bisulfide relative to air
14	1.33348	....	....
15	1.33341	....	1.62935
16	1.33333	1.36210	1.62858
18	1 33317	1 36129	1.62704
20	1.33299	1 36048	1.62546
22	1.33281	1 35967	1 62387
24	1 33262	1.35885	1.62226
26	1 33241	1 35803	1 62064
28	1.33219	1 35721	1 61902
30	1 33192	1.35639	1.61740
32	1.33164	1.35557	1.61577
34	1.33136	1.35474	1.61413
36	1 33107	1.35390	1.61247
38	1.33079	1.35306	1 61080
40	1 33051	1 35222	1 60914
42	1 33023	1 35138	1 60748
44	1 32992	1 35054	1 60582
46	1 32959	1 34969	....
48	1 32927	1 34885	....
50	1 32894	1 34800	....
52	1.32860	1 34715	....
54	1 32827	1 34629	....
56	1 32792	1 34543	....
58	1 32755	1.34456	....
60	1.32718	1 34368	....
62	1 32678	1 34279	....
64	1 32636	1.34189	....
66	1 32596	1.34096	....
68	1.32555	1 34004	....
70	1.32511	1 33912	....
72	1 32466	1 33820	....
74	1 32421	1 33728	....
76	1.32376	1 33626	....
78	1 32332	....	....
80	1 32287	....	....
82	1 32241	....	....
84	1 32195	....	....
86	1 32148	....	....
88	1 32100	....	....
90	1 32050	....	....
92	1 32000	....	....
94	1 31949	....	....
96	1 31897	....	....
98	1 31842	....	....
100	1 31783	....	....

ABSOLUTE INDEX FOR PURE WATER FOR SODIUM LIGHT

Temperature	Index	Temperature	Index
15° C.	1.33377	60° C.	1.32754
20	1.33335	65	1.32652
25	1.33287	70	1.32547
30	1.33228	75	1.32434
35	1.33157	80	1.32323
40	1.33087	85	1.32208
45	1.33011	90	1.32086
50	1.32930	95	1.31959
55	1.32846	100	1.31819

INDEX OF REFRACTION OF GLASS

RELATIVE TO AIR

Variety.	Wave length in microns.							
	.361	.434	.486	.589 (Na)	.656	.768	1.20	2.00
Zinc crown...........	1 539	1.528	1.523	1.517	1.514	1.511	1.505	1.497
Higher dispersion crown	1 546	1.533	1.527	1.520	1.517	1.514	1.507	1.497
Light flint...........	1.614	1.594	1.585	1.575	1.571	1.567	1.559	1.549
Heavy flint..........	1.705	1.675	1.664	1.650	1.644	1.638	1.628	1.617
Heaviest flint........	...	1.945	1.919	1.890	1.879	1.867	1.848	1.832

INDEX OF REFRACTION OF ROCK SALT, SYLVINE, CALCITE, FLUORITE AND QUARTZ

(Compiled from data of Martens, Paschen, and others.)

Wave length.	Rock salt.	Sylvine, KCl.	Fluorite.	Calcspar, ordinary ray.	Calcspar, extraordinary ray.	Quartz, ordinary ray.	Quartz, extraordinary ray.
0.185	1.893	1.827	.. ..	......	......	1.676	1 690
0.198	.....	......	1.496	......	1.578	1.651	1 664
0.340	.....	......	..	1.701	1.506	1.567	1 577
0.589	1.544	1.490	1.434	1.658	1.486	1.544	1.553
0.760	.....	......	1 431	1.650	1.483	1.539	1.548
0.884	1.534	1.481	1 430				
1.179	1.530	1.478	1.428				
1.229	.....	......	......	1.639	1.479		
2.324	.....	......	......	......	1.474	1.516	
2.357	1.526	1.475	1.421				
3.536	1.523	1.473	1 414				
5.893	1.516	1.469	1 387				
8.840	1.502	1.461	1.331				

INDEX OF REFRACTION OF GLASS

Index of refraction of optical glass made at the Bureau of Standards.
Composition refers to the raw material combined, not to the finished glass.

Composition	Ordinary Crown	Borosilicate Crown	Barium flint	Light Barium flint	Light flint	Dense barium flint	Medium flint	Dense flint
				(Composition percentage)				
SiO_2	67 0	64 2	53.7	48.0	53.9	37.0	45.6	39.0
Na_2O	12 0	9.4	1 7	2 0	1.0	....	3.4	3.0
K_2O	5 0	8 3	8 3	6 1	7.6	2 7	4.1	4.0
B_2O_3	3.5	11 0	2 7	4 0	....	5 0	....	....
BaO	10.6	6.1	14 3	29 5	....	47 0	....	....
ZnO	1 5	....	2 5	10.0	....	7.7	....	....
As_2O_3	0 4	0.4	....	1.4	0 3	....	....	....
CaO	....	1.0	....	....	2 0	....	3 0	4.0
PbO	.	....	16 7	....	35 2	..	44.0	49.0
Sb_2O_3	.	....	....	...	.	. .	....	1 0
Wave length, Å				(Index of Refraction)				
Hg 4046 8	1 53189	1 53817	1 58851	1 59137	1 60507	1 63675	1 65788	1.69005
Hg 4047.1	1 53147	1 53775	1.58791	1 59084	1 60430	1 63619	1 65692	1.68894
H 4340.7	1 52818	1 53468	1.58327	1.58698	1 59860	1.63189	1.64973	1.68079
Hg 4358 6	1 52798	1 53450	1.58299	1 58674	1 59826	1 63163	1 64931	1 68030
H 4861.5	1 52326	1 53008	1 57646	1 58121	1 59029	1 62548	1 63941	1 66911
Hg 4916 4	1 52283	1 52967	1 57587	1 58071	1 58958	1 62492	1 63854	1.66814
Hg 5461.0	1 51929	1 52633	1 57105	1 57657	1 58380	1 62033	1.63143	1 66016
Hg 5769 6	1 51771	1 52484	1 56894	1.57473	1 58128	1 61829	1.62834	1 65671
Hg 5790.5	1.51760	1.52475	1.56881	1 57460	1.58112	1 61817	1 62815	1.65650

INDEX OF REFRACTION OF GLASS (Continued)

Index of refraction of optical glass made at the Bureau of Standards.
Composition refers to the raw material combined, not to the finished glass.

(Index of Refraction) Continued

Wave Length, Å	Ordinary Crown	Borosilicate Crown	Barium flint	Light Barium flint	Light flint	Dense barium flint	Medium flint	Dense flint
Na 5893 2	1 51714	1.52430	1 56819	1 57406	1 58038	1.61756	1.62725	1.65548
Hg 6234 6	1 51573	1 52297	1 56634	1 57242	1 57818	1 61576	1 62458	1 65250
H 6563 0	1 51458	1.52188	1 56482	1 57107	1 57638	1 61427	1.62241	1.65007
Li 6708 2	1 51412	1 52145	1 56423	1 57054	1 57567	1.61369	1 62157	1 64913
K 7682 0	1 51160	1 51908	1 56100	1 56762	1 57183	1 61047	1 61701	1.64405
Dispersion								
n_D	1 51714	1 52430	1 56819	1 57406	1 58038	1 61756	1 62725	1 65548
$n_F - n_C$	0 00868	0 00820	0 01164	0 01014	0 01391	0 01121	0 01700	0.01904
$\frac{n_D - 1}{n_F - n_C} = \nu$	59 6	63 9	48 8	56.6	41 7	55 1	36 9	34 4
$n_D - n_F$	0.00612	0.00578	0 00827	0 00715	0 00991	0 00792	0 01216	0 01363
$n_F - n_{G'}$	0 00492	0 00460	0 00681	0.00577	0 00831	0.00641	0.01032	0 01168
$n_D - n_C$	0 00256	0 00242	0 00337	0.00299	0 00400	0.00329	0 00484	0.00541

*

OPTICAL CONSTANTS OF METALS

The following table gives the refractive index n, the absorption index k, the angle of principle incidence $\bar{\phi}$, the angle of principle azimuth $\bar{\psi}$ and the percent of light reflected R.

The reduction of amplitude of the wave of the wave length λ after traveling any distance d in the medium is given by the ratio $1 : e^{\frac{2\pi dk}{\lambda}}$. $\bar{\phi}$ is the angle of incidence for which the phase change between the two rectangular components vibrating in and normal to the plane of incidence is 90°. $\bar{\psi}$ is the azimuth at which circularly polarized light results. These quantities are connected by the following relations

$$k = \tan 2\bar{\psi}(1 - \cot^2 \bar{\phi}), \qquad n = \frac{\sin \bar{\phi} \tan \bar{\phi}}{(1+k^2)^{\frac{1}{2}}} (1 + \tfrac{1}{2} \cot^2 \bar{\phi})$$

Metal	λ	$\bar{\phi}$	$\bar{\psi}$	Computed n	Computed k	Computed nk	Computed R	Authority
	μ	° ′	° ′					
Aluminum	0 589	. . .	. . . .	1.44	. . . . .	5 32	83.	Drude
Antimony	.589	. . .	. . . .	3 04	.	4 94	70	"
Bismuth (prism)	white	. . . .	. . . . .	2 26	.	. . . .	.	Kundt 1889
Bronze	.527	. . .	. . .	1 18		. .	. . .	Jamin
	.589	. . .	. .	1 12			.	"
Cadmium	.589	. . . .	. . . .	1 13	.	5 01	85	Drude
Chromium	.579	. . . .	. . . . .	2.97		4 85	70	Wartenburg, 1910
Cobalt	0.231	64 31	29 39	1.10	1 30	1 43	32	Minor
	.275	70 22	29 59	1.41	1 52	2 14	46.	"
	.500	77 5	31 53	1 93	1 93	3 72	66	"
	.650	79 0	31 25	2.35	1 87	4 40	69.	Ingersoll
	1.00	81 45	29 6	3 63.	1 58	5 73	73.	"
	1.50	83 21	26 18	5.22	1 29	6 73	75.	"
	2.25	83 48	26 5	5 65	1 27	7 18	76.	"
Columbium	.579	. . . .	. . . .	1.80		2 11	41.	Wartenburg, 1910
Copper	.231	65 57	26 14	1 39	1 05	1 45	29	Minor
	.347	65 6	28 16	1 19	1 23	1 47	32.	"
	.500	70 44	33 46	1.10	2 13	2 34	56.	"
	.650	74 16	41 30	0 44	7 4	3 26	86.	Ingersoll
	.870	78 40	42 30	0 35	11 0	3 85	91.	"
	1.75	84 4	42 30	0 83	11 4	9 46	96.	"
	2.25	85 13	42 30	1 03	11 4	11 7	97.	"
	4.00	87 20	42 30	1 87	11 4	21 3	. . .	Först-Freed
	5.50	88.00	41 50	3.16	9 0	28 4	. . .	" "
Gold	.257	. . .	. . . . .	0 92		1 14	28.	Meier, 1903
Electrolytic	.441	. .	. . . . .	1 18	.	1 85	42.	"
	.589		. .	0 47		2 83	82.	"
	1 00	81 45	44 00	0.24	28 0	6 7	. . . .	Först-Freed
	2 00	85 30	43 56	0 47	26 7	12 5	. .	" "
	3 00	87 05	43 50	0 80	24 5	19 6	. . .	" "
	5.00	88 15	43 25	1 81	18 1	33	. . .	" "
Iodine	.589	. . . .	. . .	3.34	.	0 57	30	Meier, 1903
Iridium	.579	. . .	. . . .	2.13		4 87	75.	Wartenburg, 1916
	1.00	82 10	29 15	3.85	1 60	6 2	. . . .	Forst-Freed
	2.00	83 10	29 40	4.30	1 66	7 1	. . . .	" "
	3.00	81 40	30 40	3.33	1 79	6 0	. . .	" "
	5.00	79 00	32 20	2 27	2 03	4 6	. . .	" "
Iron	.257	. . .	. . . . .	1.01	0 88	. . . .	16.	Meier, 1908
	.441	. . . . .	. . . . .	1.28	1 37	. . . .	28.	"
	.589	. . . . .	. . . . .	1.51	1.63	. . . . .	33.	"

OPTICAL CONSTANTS OF METALS
(Continued)

Metal	λ	Φ	Ψ	Computed n	k	nk	R	Authority
	μ	° ′	° ′					
Lead	.589	.....	.....	2.01	.....	3.48	62.	Drude
Magnesium	.589	....	.....	0.37	....	4 42	93.	"
Manganese.	.579	.....	.....	2.49	....	3.89	64.	Wartenburg, 1910
Mercury (liq.)	.326	...	.....	0.68	.....	2 26	66.	Meier, 1903
	.441	...	.....	1.01	..	3 42	74.	"
	.589	...	....	1.62		4.41	75.	"
	.668	..	....	1.72	....	4 70	77.	"
Nickel.	0.420	72 20	31 42	1 41	1.79	2 53	54.	Tool
	0.589	76 1	31 41	1.79	1.86	3 33	62.	Drude
	0 750	78 45	32 6	2.19	1 99	4 36	70.	Ingersoll
	1 00	80 33	32 2	2.63	2 00	5 26	74.	"
	2.25	84 21	33 30	3.95	2.33	9 20	85.	"
	.275	..	...	1.09	1.16	. .	24.	Meier, 1903
	.441	.	...	1.16	1.23	. .	25.	"
	.589	.	. ..	1.30	1 97		43.	"
Platinum........	1.00	75 30	37 00	1.14	3 25	3 7	....	Forst-Fréed
	2 00	74 30	39 50	0 70	5 06	3 5	....	" "
	3.00	73 50	41 00	0 52	6 52	3 4	....	" "
	5 00	72 00	42 10	0.34	9 01	3 1	...	" "
Electrolytic....	.257	....	....	1.17	1 65	. .	37.	Meier, 1903
	.441	.	...	1 84	.. .	3 16	58.	"
	.589	.		2 63	.	3 54	59.	"
	.668	.	.	2 91	.	3 66	59.	"
Potassium.......	.665	65 27	43 56	.066	26.8	....	93.8	Duncan, 1913
	.589	62 58	43 42	.068	22 1	....	92.	"
	.472	57 9	43 0	.070	14.3	.....	86 9	"
	.546	.	..	1 09	1.16	.....	24.	Morgan, 1922
Rhodium.......	.579		....	1.54	.....	4.67	78.	Wartenburg, 1910
Selenium.......	.400	.	...	2.94	2 31	...	44.	Wood
	.490	..	....	3 12	1.49	...	35.	"
	.589	..	....	2 93	0.45	....	25.	"
	.760	...	..	2.60	0.06	.....	20.	"
Silicon, 95%..... pure	.579	75 38	....	3.87	0.116	.....	35.7	Wartenburg, 1910
	.589	. .	.....	4.18	0 09	.....	38.	Ingersoll
	1 25	...	.....	3.67	0 08	...	33.	"
	2.25	.	....	3 53	0 08	...	31.	"
99.75% pure...	0 589	76 45	...	4.24	0 118	....	37.8	Littleton, 1912
Silver..........	0.226	62 41	22 16	1.41	0.75	1.11	18.	Minor
	.293	63 14	18 56	1 57	0 62	0.97	17.	"
	.316	52 28	15 38	1 13	0.38	0.43	4	"
	.332	52 1	37 2	0 41	1 61	0 65	32.	"
	.395	66 36	43 6	0 16	12.32	1 91	87.	"
	.500	72 31	43 29	0 17	17.1	2 94	93.	"
	.589	75 35	43 47	0 18	20.6	3 64	95.	"
	.750	79 26	44 6	0.17	30 7	5 16	97.	Ingersoll
	1.00	82 0	44 2	0.24	29.0	6 96	98.	"
	1 50	84 42	43 48	0.45	23.7	10 7	98.	"
	2.25	86 18	43 34	0 77	19 9	15.4	99.	"
	3.00	87 10	42 40	1 65	12.2	20.1	...	Först-Fréed
	4.50	88 20	41 10	4.49	7.42	33.3	..	" "
Sodium.........	.665	72 11	44 29	.051	55 0	.....	97.7	Duncan, 1913
	.589	68 51	44 29	.044	55.0	.....	97.1	"
	.546	68 48	44 20	.052	42.6	.....	96.5	"

OPTICAL CONSTANTS OF METALS

(Continued)

Metal	λ	$\bar{\phi}$	$\bar{\psi}$	Computed n	Computed k	Computed nk	Computed R	Authority
	μ	° ′	° ′					
Sodium	.472	66 29	44 9	057	33.3	.....	95 2	Duncan, 1913
	.435	66 0	44 6	.058	31.7	...	94 8	"
(liq.).........	.589	.....	....	.004	. .	2 61	99.	Drude
(solid).	.546	.....	.....	.047	47 3	....	96 9	Morgan, 1922
Sodium-Potassium								
17.3% K......	.546	.....	.....	081	27 2	....	94 6	"
45. % K.. .	.546	...	....	1 08	16 8	....	90 4	"
66. % K.....	.546	.....	...	.137	12 5	.....	87 0	"
74.2% K.....	.546	..	..	.124	12 8	....	86 9	"
84.3% K......	.546	...	....	.088	17.6	....	90 2	"
Steel								
0 44% C.. ...	589	77 15	..	2 50	1.30	...	57.4	Littleton, 1912
1.28% C......	.589	77 22	..	2 66	1 28	..	57 5	"
3.5 % C......	.589	77 35	..	2 77	1 23	.	57.0	"
	0.226	66 51	28 17	1 30	1.26	1.64	35.	Minor
	.257	68 35	28 45	1 38	1 35	1.86	40.	"
	325	69 57	30 9	1 37	1.53	2 09	45.	"
	.500	75 47	29 2	2 09	1 50	3.14	57.	"
	650	77 48	27 9	2 70	1 33	3 59	59	Ingersoll
	1.50	81 48	28 51	3 71	1 55	5 75	73	"
	2.25	83 22	30 36	1 14	1 79	7 41	80	"
Tantalum......	.579	..	. .	2 05	.....	2 31	44.	Wartenburg
Tellurium								
axis horizontal	.590	..	...	3 07	.563	.	34	Van Dyke, 1922
axis vertical...	.590	...	..	2 68	632		30.	Van Dyke, 1922
Tin.	.589	.	..	1 48		5 25	82	Drude
Tungsten.......	.579	76 0		2 76	0 98		18 6	Wartenburg
	.589	78 31	..	3 46	0 94		54 5	Littleton, 1912
Vanadium	.579	..	.	3 03		3 51	58	"
Zinc....	.257	.	.	0 55		0 61	20	Meier, 1903
	.441	.		0 93		3 19	73	"
	.589	..	..	1 93	. .	4 66	74	"
	.668	...		2.62	.....	5.08	73	"

DISPERSION

The dispersion for various types of optical glass is shown in the following table. n_D =index of refraction for the *D* line (of the solar spectrum) and n_F and n_C the index for the *F* and *C* lines respectively ($n_F - n_C$) shows the dispersion for these two wave lengths.

Glass.	n_D	$(n_F - n_C)$
Light phosphate crown................	1.5159	.00737
Barium-silicate crown................	1.5399	.00909
High-dispersion crown................	1.5262	01026
Borate flint..........................	1.5686	.01102
Extra light flint.....................	1.5398	.01142
Heavy flint.......	1.7174	.02434
Heaviest flint........................	1.9626	.04882

INDEX OF REFRACTION, AQUEOUS SOLUTIONS

Substance	Density	Temp. °C	Index for λ = .5893 (Na)	Observer
Ammonium chloride	1 067	27 05	1 379	Willigen
Ammonium chloride	1 025	29 75	1 351	Willigen
Calcium chloride	1.398	25 65	1 443	Willigen
Calcium chloride	1.215	22 9	1 397	Willigen
Calcium chloride	1.143	25 8	1.374	Willigen
Hydrochloric acid	1.166	20 75	1.411	Willigen
Nitric acid	1 359	18.75	1.402	Willigen
Potash (caustic)	1 416	11 0	1.403	Frauenhofer
Potassium chloride	Normal	solution	1 343	Bender
Potassium chloride	Double	normal	1 352	Bender
Potassium chloride	Triple	normal	1 360	Bender
Soda (caustic)	1.376	21 6	1 413	Willigen
Sodium chloride	1.189	18 07	1 378	Schutt
Sodium chloride	1.109	18 07	1 360	Schutt
Sodium chloride	1.035	18 07	1 342	Schutt
Sodium nitrate	1.358	22.8	1 385	Willigen
Sulfuric acid	1.811	18.3	1 437	Willigen
Sulfuric acid	1 632	18.3	1 425	Willigen
Sulfuric acid	1 221	18 3	1 370	Willigen
Sulfuric acid	1 028	18.3	1 339	Willigen
Zinc chloride	1 359	26 6	1 402	Willigen
Zinc chloride	1 209	26 4	1 375	Willigen

INDEX OF REFRACTION OF FUSED QUARTZ

λ mμ, 15° C	n, 18° C	λ mμ, 15° C	n, 18° C
185 467	1 57436	434 047	1 46690
193 583	1 55999	435 834	1 46675
202 55	1 54727	467 815	1 46435
214.439	1 53386	479 991	1 46355
219.462	1 52907	486 133	1 46318
226.503	1 52308	508 582	1 46191
231.288	1 51941	533 85	1 46067
250.329	1 50745	546 072	1 46013
257.304	1.50379	589 29	1 45845
274.867	1.49617	643 847	1.45674
303 412	1 48594	656 278	1 45640
340 365	1 47867	706 520	1 45517
396 848	1 47061	794 763	1 45340
404 656	1 46968		

INDEX OF REFRACTION, GASES

Values are relative to a vacuum and for a temp. of 0° C. and 760 mm. pressure.

(From Smithsonian Tables.)

Substance.	Kind of light.	Indices of refraction	Observer
Acetone	*D*	1.001079–1.001100	
Air	*D*	1.0002926	Perreau
Ammonia	white	1.000381–1.000385	
Ammonia	*D*	1.000373–1.000379	
Argon	*D*	1.000281	Rayleigh
Benzene	*D*	1.001700–1.001823	
Bromine	*D*	1.001132	Mascart
Carbon dioxide	white	1.000449–1.000450	
dioxide	*D*	1.000448–1.000454	
disulphide	white	1.001500	Dulong
disulphide	*D*	1.001478–1.001485	
monoxide	white	1.000340	Dulong
monoxide	white	1.000335	Mascart
Chlorine	white	1.000772	Dulong
Chlorine	*D*	1.000773	Mascart
Chloroform	*D*	1.001436–1.001464	
Cyanogen	white	1.000834	Dulong
Cyanogen	*D*	1.000784–1.000825	
Ethyl alcohol	*D*	1.000871–1.000885	
ether	*D*	1.001521–1.001544	
Helium	*D*	1.000036	Ramsay
Hydrochloric acid	white	1.000449	Mascart
Hydrochloric acid	*D*	1.000447	Mascart
Hydrogen	white	1.000138–1.000143	
Hydrogen	*D*	1.000132	Burton
sulphide	*D*	1.000644	Dulong
sulphide	*D*	1.000623	Mascart
Methane	white	1.000443	Dulong
Methane	*D*	1.000444	Mascart
Methyl alcohol	*D*	1.000549–1.000623	
Methyl ether	*D*	1.000891	Mascart
Nitric oxide	white	1.000303	Dulong
Nitric oxide	*D*	1.000297	Mascart
Nitrogen	white	1.000295–1.000300	
Nitrogen	*D*	1.000296–1.000298	
Nitrous oxide	white	1.000503–1.000507	
Nitrous oxide	*D*	1.000516	Mascart
Oxygen	white	1.000272–1.000280	
Oxygen	*D*	1.000271–1.000272	
Pentane	*D*	1.001711	Mascart
Sulphur dioxide	white	1.000665	Dulong
Sulphur dioxide	*D*	1.000686	Ketteler
Water	white	1.000261	Jamin
Water	*D*	1.000249–1.000259	

COEFFICIENT OF TRANSPARENCY OF UVIOL GLASS FOR THE ULTRA-VIOLET

For a thickness of 1 mm.

Wave length, microns	0.280	0.309	0.325	0.346	0.361	0.383	0.397
Uviol crown	0.56	0.95	0.990	0.996	0.999	1.000	1.000

REFLECTION OF LIGHT BY GLASS IN AIR

The table gives the percentage R of light reflected by one surface of glass having a refractive index of 1.55 relative to air. The angle of incidence is i, and the angle of refraction is r. The two components of the polarized light are marked $\parallel$ and $\perp$ according to the electric vector of the vibration. (Computed according to Fresnel's formula.)

i	r	$\parallel$	$\perp$	R
0	0° 0′	4.65	4.65	4.65
10	6° 26′	4.84	4.47	4.66
20	12° 45′	5.45	3.92	4.68
30	18° 49′	6.64	3.00	4.82
40	24° 30′	8.77	1.75	5.26
50	29° 37′	12.54	0.46	6.50
60	33° 58′	19.35	0.12	9.73
70	37° 19′	31.99	4.00	18.00
80	39° 27′	55.74	23.34	39.54
90	40° 11′	100.00	100.00	100.00

REFLECTION BY TRANSPARENT MEDIA IN AIR

For Normal Incidence

The table gives the per cent of the normally incident light which is reflected by transparent media of various indices of refraction. n = index of refraction, R = reflected light, i = angle of incidence = 0.

(Computed from Fresnel's formula.)

n	R	n	R	n	R
1.0	0.00	1.7	6.72	2.4	17.0
1.1	0.23	1.8	8.16	2.5	18.4
1.2	0.83	1.9	9.63	2.6	19.8
1.3	1.70	2.0	11.11	2.7	21.1
1.4	2.78	2.1	12.6	2.8	22.5
1.5	4.00	2.2	14.1	2.9	23.8
1.6	5.33	2.3	15.5	3.0	25.0

COEFFICIENT OF TRANSPARENCY OF GLASS FOR THE INFRA-RED

Normal incidence, thickness 1 cm.

Wave length, microns	0.7	1.1	1.7	2.3	2.7	3.1
Crown, borate	1.00	.55	.21	.025	.04	
borosilicate		.74	.61	.33	.034	.021
Flint, light	1.00	.91	.82	.45	.083	.019
heavy	1.00	1.00	1.00	1.00	.45	.019

INDEX OF REFRACTION OF AQUEOUS SOLUTIONS OF SUCROSE (CANE SUGAR)

The table gives the index of refraction for $\lambda = 0.5893$ of aqueous sugar solutions at 20°C from 0 – 85% sugar. Corrections for temperatures other than 20° are given at the end of the table.

Per cent sugar		0	.1	.2	3	4	.5	6	7	8	9
00.	1 3	330	331	333	334	336	337	338	340	341	342
1.		344	345	347	348	350	351	353	355	356	357
2.		359	361	362	363	365	367	368	369	371	373
3.		374	375	377	378	380	381	382	384	385	387
4		388	389	391	393	394	395	397	399	400	401
5.		403	405	406	407	409	411	412	413	415	417
6		418	419	421	423	424	425	427	429	430	431
7.		433	435	436	437	439	441	442	443	445	447
8		448	450	451	453	454	456	458	459	461	462
9		464	465	467	469	470	471	473	475	476	477
10.		479	481	482	483	485	487	488	489	491	493
11		494	496	497	499	500	502	504	505	507	508
12.		510	512	513	515	516	518	520	521	523	524
13		526	527	529	531	532	533	535	537	538	539
14		541	543	544	546	547	549	551	552	554	555
15.		557	559	560	562	563	565	567	568	570	571
16		573	575	576	578	580	582	583	585	587	588
17		590	592	593	595	596	598	600	601	603	604
18		606	608	609	611	612	614	616	617	619	620
19		622	624	625	627	629	631	632	634	636	637
20.		639	641	642	644	645	647	649	650	652	653
21		655	657	658	660	662	663	665	667	669	670
22		672	674	675	677	679	681	682	684	686	687
23		689	691	692	694	696	698	699	701	703	704
24		706	708	709	711	713	715	716	718	720	721
25.		723	725	726	728	730	731	733	735	737	738
26		740	742	744	745	747	749	751	753	754	756
27		758	760	761	763	765	767	768	770	772	773
28		775	777	779	780	782	784	786	788	789	791
29		793	795	797	798	800	802	804	806	807	809
30.		811	813	815	816	818	820	822	824	825	827
31		829	831	833	834	836	838	840	842	843	845
32		847	849	851	852	854	856	858	860	861	863
33		865	867	869	870	872	874	876	878	879	881
34		883	885	887	889	891	893	894	896	898	900
35.		902	904	906	907	909	911	913	915	916	918
36		920	922	924	926	928	929	931	933	935	937
37		939	941	943	945	947	949	950	952	954	956
38		958	960	962	964	966	968	970	972	974	976
39		978	980	982	984	986	987	989	991	993	995
40.		997	999	*001	*003	*005	*007	*008	*010	*012	*014
41	1 4	016	018	020	022	024	026	028	030	032	034
42		036	038	040	042	044	046	048	050	052	054
43		056	058	060	062	064	066	068	070	072	074
44		076	078	080	082	084	086	088	090	092	094
45.		096	098	100	102	104	107	109	111	113	115
46		117	119	121	123	125	127	129	131	133	135
47		137	139	141	143	145	147	150	152	154	156
48		158	160	162	164	166	169	171	173	175	177
49		179	181	183	185	187	189	192	194	196	198
50.		200	202	204	206	208	211	213	215	217	219
51		221	223	225	227	229	231	234	236	238	240
52		242	244	246	249	251	253	255	257	260	262
53		264	266	268	270	272	275	277	279	281	283
54		285	287	289	292	294	296	298	300	303	305
55.		307	309	311	313	316	318	320	322	325	327

INDEX OF REFRACTION OF AQUEOUS SOLUTIONS OF SUCROSE (CANE SUGAR) (Continued)

Per cent sugar		0	1	2	.3	4	5	6	7	.8	9
55.	1 4	307	309	311	313	316	318	320	322	325	327
56		329	331	333	336	338	340	342	344	347	349
57		351	353	355	358	360	362	364	366	369	371
58		373	375	378	380	382	385	387	389	391	394
59		396	398	400	403	405	407	409	411	414	416
60.		418	420	423	425	427	429	432	434	436	439
61		441	443	446	448	450	453	455	457	459	462
62		464	466	468	471	473	475	477	479	482	484
63.		486	488	491	493	495	497	500	502	504	507
64		509	511	514	516	518	521	523	525	527	530
65.		532	534	537	539	541	544	546	548	550	553
66		558	561	563	565	567	570	572	574	577	579
67		581	584	586	588	591	593	595	598	600	602
68		605	607	609	612	614	616	619	621	623	625
69		628	630	632	635	637	639	642	644	646	649
70.		651	653	656	658	661	663	666	668	671	673
71		676	678	681	683	685	688	690	693	695	698
72		700	703	705	708	710	713	715	717	720	722
73		725	727	730	732	735	737	740	742	744	747
74		749	752	754	757	759	762	764	767	769	772
75		774	777	779	782	784	787	789	792	794	797
76		799	802	804	807	810	812	815	817	820	822
77		825	827	830	832	835	838	840	843	845	848
78		850	853	855	858	860	863	865	868	871	873
79		876	878	881	883	886	888	891	893	896	898
80.		901	904	906	909	912	914	917	919	922	925
81		927	930	933	935	938	941	943	946	949	951
82		954	956	959	962	964	967	970	972	975	978
83		980	983	985	988	991	993	996	999	*001	*004
84	1 5	007	009	012	015	017	020	022	025	028	030
85.		033									

Temperature Corrections

Below 20°C the correction should be subtracted from the per cent sugar. Above 20°C the correction is to be added to the per cent sugar.

Temp. °C	Approximate per cent sugar									
	5	10	15	20	30	40	50	60	70	75
15	0 25	0 27	0 31	0 31	0 34	0 35	0 36	0.37	0 36	0 36
16	0 21	0 23	0 26	0 27	0 29	0 31	0 31	0 32	0.31	0 29
17	0 16	0 18	0 20	0 20	0 22	0 23	0 23	0 23	0.20	0 17
18	0 11	0 12	0 14	0 14	0 15	0 16	0 16	0 15	0.12	0 09
19	0 06	0 07	0 08	0 08	0 08	0 09	0.09	0.08	0.07	0.05
21	0 06	0 07	0 07	0 07	0 07	0 07	0 07	0 07	0 07	0.07
22	0 12	0 14	0 14	0 14	0 14	0 14	0 15	0 14	0 14	0.14
23	0 18	0 20	0 20	0 21	0 21	0 21	0 23	0.21	0.22	0 22
24	0 24	0 26	0 26	0 27	0 28	0 28	0 30	0.28	0 29	0.29
25	0 30	0 32	0 32	0 34	0 36	0 36	0.38	0.36	0 36	0.37
26	0 36	0 39	0 39	0 41	0 43	0 43	0 46	0.44	0.43	0 44
27	0 43	0 46	0.46	0 48	0 50	0 51	0 55	0 52	0 50	0 51
28	0 50	0 53	0 53	0 55	0 58	0 59	0 63	0.60	0 57	0 59
29	0 57	0 60	0 61	0 62	0 66	0 67	0 71	0 68	0 65	0 67
30	0 64	0 67	0 70	0 71	0 74	0 75	0 80	0.76	0.73	0 75

REFLECTION OF LIGHT BY METALS

The table gives the per cent of normally incident light which is reflected by the polished surface of various metals.

Wave length.	Antimony.	Bronze (68 Cu, 32 Sn).	Copper, commercial.	Gold, electrolytic.	Iron.	Magnalium, Mach's.	Magnesium.	Mercury, backed glass.
251	....	.30	25.9	38.8	....	67.0		
288	....	....	24.3	34.0	....	70.6		
.305	....	....	25.3	31.8	....	72.2		
.326	....	....	24.9	28.6	....	75.5		
.357	....	....	27.3	27.9	....	81.2		
.385	....	.53	28.6	27.1	....	83.9		
.420	....	....	32.7	29.3	....	83.3		
.450	....	....	37.0	33.1	....	83.4	....	72.8
.500	....	.63	43.7	47.0	.55	83.3	.72	70.9
.550	....	....	47.7	74.0	....	82.7	....	71.2
.600	.53	.64	71.8	84.4	.57	83.0	.73	69.9
.650	....	....	80.0	88.9	....	82.7	....	71 5
.700	....	....	83.1	92.3	.59	83.3	....	72 8
.800	....	....	88.6	94.9	..	84.3		
1.00	.55	.70	90.1	......	.65	84.1	.74	
2.0	.60	.80	95.5	96.8	.78	86.7	.77	
3.0	.65	.86	97.1	......	.84	87.4	.80	
4.0	.68	.88	97.3	96.9	.89	88 7	.83	
9.0	.72	.93	98.4	98.0	94	90 6	93	

Wave length.	Nickel, electrolytic.	Platinum, electrolytic.	Silver, chemically deposited.	Silver-backed glass.	Speculum metal.	Steel.	Tungsten.
.251	37.8	33.8	34.1	......	29.9	32 9	
.288	42.7	38.8	21 2	......	37.7	35.0	
.305	44.2	39.8	9.1	......	41.7	37.2	
326	45 2	41.4	14 6	......	.....	40 3	
.357	48.8	43.4	74.5	......	51.0	45.0	
.385	49.6	45.4	81 4	......	53 1	47.8	
.420	56 6	51.8	86.6	.... ..	56 4	51 9	
.450	59 4	54.7	90.5	85.7	60 0	54.4	
.500	60 8	58.4	91.3	86.6	63.2	54.8	49
.550	62 6	61.1	92.7	88.2	64.0	54.9	
.600	64.9	64.2	92.6	88.1	64.3	55.4	.51
.650	66.6	66.5	94 7	89 1	65.4	56.4	
.700	68.8	69.0	95.4	89.6	66.8	57 6	.54
.800	69 6	70 3	96 8	......	......	58 0	
1.00	72.0	72.9	97.0	......	70.5	63.1	.62
2 0	83.5	80.6	97.8	......	80.4	76.7	.85
3 0	88.7	88.8	98.1	......	86 2	83 0	.90
4 0'	91.1	91.5	98 5	......	88.5	87.8	.93
9 0	95.6	95.4	98.7	......	92.2	92 9	.95

REFLECTION OF LIGHT BY METALS

The table gives the percent of normally incident light which is reflected by the polished surface of various metals.

Coblentz, 1906, 1911.

Wave length	Aluminum	Cadmium	Cobalt	Graphite	Iridium	Molybdenum	Palladium	Rhodium	Silicon
.5	..	..	..	22	..	46	..	76	34
.6	..	..	...	24	..	48	..	77	32
.8	..	..	..	25	..	52	..	81	29
1.0	71	72	67	27	78	58	72	84	28
2.0	82	87	72	35	87	82	81	91	28
4.0	92	96	81	48	94	90	88	92	28
7.0	96	98	93	54	95	93	94	94	28
10.0	98	98	97	59	96	94	97	95	28
12.0	98	99	97	..	96	95	97	..	..

Wave length	Tantalum	Tellurium	Tin	Vanadium	Zinc
.5	38	..	..	57	..
.6	45	49	..	58	..
.8	64	48	..	60	..
1.0	78	50	54	61	80
2.0	90	52	61	69	92
4.0	93	57	72	79	97
7.0	94	68	81	88	98
10.0	..	..	84	..	98
12.0	95	..	85	..	99

Wave length	Tungsten*	Stellite*
15	....	.32
20	....	.42
.30	....	.50
.50	.50	.64
.75	.52	.67
1.00	.576	.689
2.00	.900	.747
3 00	.943	.792
4.00	.948	825
5 00	.953	.848
9 00	....	.880

* Coblentz, Emerson, 1917

RELATIVE STIMULATION OF THE THREE PRIMARY COLOR SENSATIONS BY DIFFERENT WAVE LENGTHS

Wave length...	0.36μ	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.52	0.54
Red......	0.0	0.0	2.0	1.0	1.0	1.0	3.0	9.0	23.0	39.0
Green.....	0.0	0.0	0.0	0.0	0.0	2.0	7.0	23.0	61.0	87.0
Blue......	0.0	10.5	29.0	52 0	76.0	78.0	68.0	46.0	16.0	7.0

Wave length...	0.56μ	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74
Red......	56.0	69.0	71.5	59 0	30 0	12.0	5 0	2.0	1.0	0.0
Green.....	86 0	67.0	37.0	10.0	2 5	1.0	0.0	0.0	0.0	0.0
Blue......	4.0	1.5	0 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

REFLECTION OF LIGHT BY METALS (Continued)

Coblentz, Bulletin 379, Bureau of Standards 1920

Wave-length in $\mu - 0.001$mm.	Silver	Monel metal	Stellite	Zinc
0.45	88 0	56 5	63.5	54 0
0.50	90 0	57.8	65.8	55 0
0.55	91.5	59.0	68.3	56.0
0.60	92.7	60.2	70.1	57.5
0.65	93.5	61.8	71 0	60.0
0.70	94.1	63.7	71.8	61.0
0.75	94.7	65.6	72 4	61 5
0.80	95 1	67.2	73.0	61.5
0.90	96.0	70.0	73.5	55.5
0.95	96.3	71.1	...	51 0
1.00	96 5	72.3	74 0	49.0
1.05	96.7	73.0	....	53 5
1.10	96.9	73 6	..	62 5
1.20	97.2	74 8	74.5	74.7
1.40	97 4	77 0	75 0	85 8
1.50	97.6	78.2	75 3	88 4
1.75	97.8	81.2	76 0	92 0
2.00	97.9	83.8	76.8	94 0
2 50	98 0	87.0	78 6	95.3
3.00	98 0	88 7	80.0	95 5
3.50	98.0	89.5	81 4	95.8
4.00	98 0	91 0	82 8	96 2

TRANSMISSION FACTORS FOR "GROUND" GLASS

Luckiesch

	Side toward light	Transmission Factor	
		Narrow beam	Diffuse
Sand blasted	Rough	0 783	0 702
	Smooth	.739	.695
Etched, fine	Rough	.794	.709
	Smooth	.758	.704

DIFFUSE REFLECTING POWER

The diffuse reflecting power, or ratio of total luminous flux reflected to that received, measured for the various regions of the spectrum. The wave lengths given are those of maximum energy. — Coblentz, Bulletin, 196, Bureau of Standards 1912.

Material	Reflecting power %					
	0.54 μ	0.60	0.95	4.4	8.8	24.0
Lampblacks						
paint	...	3.2	3.4	3.2	3.8	4.4
paraffin-candle	...	...	0.97	...	...	...
rosin	...	...	1.3	1.3	...	3.0
sperm candle	...	...	1.1	.9	1.3	4.0
camphor	...	...	1.3	1.2	1.6	5.7
acetylene	...	...	0.6	.8	1.2	2.1
Platinum black						
electrolytic	...	...	1.1	1.4	2.1	4.2
Pigments						
cobalt oxide, Co_2O_3	...	3.02	3.92 4.04 2.49	13.9	14.6 11.8 ...	5.9 ... ...
copper oxide, CuO	...	...	23.5	15.2	...	4.4
chromium oxide, Cr_2O_3	24.1	27.0	44.6	32.9	5.0	8.2
lead oxide, PbO	...	51.8	...	50.6	25.6	9.5
red iron oxide, Fe_2O_3	...	26.3	41.0	29.9	3.7	9.1
yttrium oxide, Y_2O_3	...	73.8	...	34.4	11.1	10.0
lead chromate, $PbCrO_4$	61.2	70.2	...	41.2	4.74	7.4
aluminum oxide, Al_2O_3	...	84.1	87.7	20.8	2.34 1.64	6.5 ...
thorium oxide, ThO_2	...	86.0	...	46.9	7.11	10.0
zinc oxide, ZnO	...	82.2	86.4	8.5	3.2 2.1	5.1
magnesium oxide, MgO	...	86.3	...	16.0	2.5	9.1
calcium oxide, CaO	...	85.4	...	22.3	3.6	6.2
zirconium oxide, ZrO_2	82.2	85.8	84.1	23.2	5.1	5.4
lead carbonate, $PbCO_3$	...	86.8 89.9 ...	90.8 92.8 94.5	29.2	9.3 ... 13.2	6.9 ... ...
magnesium carbonate, $MgCO_3$	...	85.2	89.4	10.8	4.1	8.8
Paints						
white lead No. 103	...	76.2	79.3	...	...	...
" " " 102	...	74.3	...	...	...	...
zinc lead white No 107	...	69.6	...	...	...	...
" oxide No. 104	...	68.1	72.1	...	...	...
white lead 50% / zinc oxide 50% } No. 209	...	70.8	...	...	...	...
Miscellaneous						
asphalt (pavement)		14.8	...	...	...	...
black felt	...	13.9 22.5	21.2 25.6	...	...	...
black velvet	...	1.75	...	3.66	2.7	...
bluestone (sandstone) SiO_2	...	18.4	8.1	17.6	11.0	...
blue flannel	...	17.5	...	...	...	...
Brick:						
light buff	...	48.4	...	...	...	...
darker	...	40.0	...	...	...	...
red brick	...	30.1	...	...	12.4	...
darker & glazed	...	23.4	...	...	...	...
Cotton cloth:						
diamine fast red 8 B L	...	43.8	...	...	...	...
diamine fast black C B —	...	33.1	...	...	...	...
columbia fast black R	...	28.7	...	...	...	...
diamine aldehyde black	...	29.5	...	...	...	...
sulphur black A W L —	...	2.43	2.57	...	...	...

DIFFUSE REFLECTING POWER (Continued)

The diffuse reflecting power, or ratio of total luminous flux reflected to that received, measured for the various regions of the spectrum. The wave lengths given are those of maximum energy. — Coblentz, Bulletin, 196, Bureau of Standards 1912.

Material	Reflecting power %					
	0.54 μ	0.60	0.95	4.4	8.8	24.0
Woolen Cloth:						
lanacyl blue B N —	....	25.1	.	..	.....	...
salacine blue black A E —	...	14.6	17.8	..	.....	....
" black PB —	....	11.8	15.1	..	.....	....
Linen:						
starched, dull finish	....	81.2	.	..	......	....
deep blue cloth (Navy Dept.)	....	17.0	.	...	......	....
lighter shade	....	18.2		..	......	...
Feldspar, $KAlSi_3O_8$	....	...	86.7	38.2	10.3	9.7
cleavage surface	....	39.4	..	.	14.6	...
Granolith (pavement)	....	16.9	.		....	...
Green Leaf (tulip tree)	....	21.9	38.0	5.6	.	....
Indiana limestone, $CaCO_3$	...	42.9	..	20.3	5.0	..
Quartz (powder, French Flint) SiO_2	....	81.0	41.5	7.9	9.0	..
Slate (dark clay)	....	6.7	....	13.4	20.0	.
White marble $CaCO_3$ ground, unpolished	....	53.5	..	6.4	5.1	...
cleavage, surface	....	40.8			..	...
White paper	....	71.7	74.7	18.2	5.0	....
two thicknesses	...	73.4	..	.	...	...
White paper, (Bond)	...	75.2	...	..	....	...

DIFFUSED REFLECTION

Albedo

Giving the percent of diffused reflection of "white light" for various surfaces. *Sumpner, Zollner* and others.

Material	Reflections	Material	Reflections
Wood, pine	40	Parchment	
Cardboard		1 sheet	22
yellow	30	2 sheets	35
white	60–70	Cloth	
Painted surface,		black	1
yellow	40	tracing	35
white washed	50	white	60–70
Paper		Velvet	
tracing	22	black	0.4
ordinary white	60–70		
blotting	70–80	Loam, sandy	24
chocolate color	4		
brown	13	Earth, moist	8
blue	25		
yellow	25	Marl, argillaceous	16

REFLECTION COEFFICIENTS

Coefficients of Reflection of Miscellaneous Surfaces for Monochromatic Radiation in the Visible Spectrum
(J. L. Michaelson)

Material	Wave lengths (μ)			
	0.400	0.500	0.600	0.700
Carbon Black in Oil	0.003	0.003	0.003	0.003
Clay,				
Kaolin (treated)	0.82	0.81	0.82	0.82
Kaolin (untreated)	0.75	0.79	0.85	0.86
White Georgia	0.94	0.92	0.93	0.94
Magnesium oxide	0.97	0.98	0.98	0.98
Paint,				
Lithopone	0.95	0.98	0.98	0.98
$MgCO_3$-Vynal Acetate Lacquer	0.90	88	0.88	0.88
ZnO-Milk	0.74	0.84	0.85	0.86
Paper,				
Blotting	0.64	0.72	0.79	0.79
Calendered	0.64	0.69	0.73	0.76
Crepe, green	0.23	0.49	0.19	0.48
Crepe, red	0.03	0.02	0.21	0.69
Crepe, yellow	0.17	0.44	0.75	0.79
News Print Stock	0.38	0.61	0.63	0.78
Peach,				
Green	0.18	0.17	0.62	0.63
Ripe	0.10	0.10	0.41	0.42
Pear,				
Green	0.04	0.12	0.29	0.41
Ripe	0.08	0.19	0.46	0.53
Pigment,				
Chrome Yellow	0.05	0.13	0.70	0.77
French Ochre	0.06	0.14	0.50	0.56
Porcelain Enamel,				
Blue	0.44	0.10	0.05	0.23
Orange	0.09	0.09	0.59	0.69
Red	0.05	0.03	0.08	0.62
White	0.77	0.73	0.72	0.70
Yellow	0.11	0.46	0.62	0.62
Talcum, Italian	0.94	0.89	0.88	0.88
Wheat Flour	0.75	0.87	0.94	0.97

REFLECTION COEFFICIENTS OF SURFACES FOR "INCANDESCENT" LIGHT

Material	Nature of Surface	Coefficient	Authority
Aluminum, "Alzak"	Diffusing	0.77–0.81	3
"Alzak"	Specular	0.79–0.83	3
on Glass	First Surface	0.82–0.86	4
Polished	Specular	0.69	3
Black Paper	Diffusing	0.05–0.06	4
Chromium	Specular	0.62	4
Copper	Specular	0.63	4
Gold	Specular	0.75	1
Magnesium oxide	Diffusing	0.98	5
Nickel	Specular	0.62–0.64	1, 3
Platinum	Specular	0.62	1
Porcelain Enamel	Glossy	0.76–0.79	3
Porcelain Enamel	Ground	0.81	3
Porcelain Enamel	Matt.	0.72–0.76	3
Silver	Polished	0.93	1
Silvered Glass	Second Surface	0.88–0.93	3
Snow	Diffusing	0.93	2
Steel	Specular	0.55	1
Stellite	Specular	0.58–0.65	4

(1) Hagen and Rubens. (2) Nutting, Jones, and Elliot. (3) J. E. Bock. (4) Frank Benford. (5) J. L. Michaelson.

EMISSIVITY AND ABSORPTION

These data are the result of investigations made by the Bureau of Standards, the British National Physical Laboratory, General Electric Research Laboratories, and several eastern universities, and were collected by W. J. King of the General Electric Company.

Low Temperature Total Emissivities

Silver, highly polished	0.02	Brass, polished	0.60
Platinum " "	0.05	Oxidized copper	0.60
Zinc " "	0.05	Oxidized steel	0.70
Aluminum, " "	0.08	Bronze paint	0.80
*Monel metal, polished	0.09	Black gloss paint	0.90
Nickel "	0.12	White lacquer	0.95
Copper "	0.15	White vitreous enamel	0.95
Stellite "	0.18	Asbestos paper	0.95
Cast iron "	0.25	Green paint	0.95
Monel metal, oxidized	0.43	Gray paint	0.95
Aluminum paint	0.55	Lamp black	0.95

Coefficient of Absorption of Solar Radiation

Silver, highly polished	0.07	Stellite, polished	0.30
Platinum " "	0.10	Light cream paint	0.35
Nickel " "	0.15	Monel metal, polished	0.40
*Aluminum	0.15	Light yellow paint	0.45
Magnesium carbonate	0.15	Light green paint	0.50
Zinc oxide	0.15	Aluminum paint	0.55
*Steel	0.20	Zinc, polished metal	0.55
Copper	0.25	Gray paint	0.75
White lead paint	0.25	Black matte	0.97
Zinc oxide paint	0.30		

* Questionable because of scant or inconsistent data.

TOTAL EMISSIVITY

ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

Material	Temp. °C	Emissivity	Material	Temp. °C	Emissivity
Alloys			Iron, rusted	25	0.65
20Ni-25Cr-55Fe, oxidized	200	0.90	wrought, dull	25	0.94
	500	0.97	oxidized	350	0.94
60Ni-12Cr-28Fe, oxidized	270	0.89	Lead, unoxidized.	100	0.05
	560	0.82	oxidized	200	0.63
80Ni-20Cr, oxidized	100	0.87	Mercury, unoxidized	25	0.10
	600	0.87		100	0.12
	1300	0.89	Molybdenum, unoxidized	1000	0.13
Aluminum, unoxidized	25	0.022		1500	0.19
	100	0.028		2000	0.24
	500	0.060	Monel metal, oxidized	200	0.43
oxidized	200	0.11		600	0.43
	600	0.19	Nickel, unoxidized	25	0.045
Bismuth, unoxidized	25	0.048		100	0.06
	100	0.061		500	0.12
Brass, oxidized	200	0.61		1000	0.19
	600	0.59	oxidized	200	0.37
unoxidized	25	0.035		1200	0.85
	100	0.035	Platinum, unoxidized	25	0.037
Carbon, unoxidized	25	0.081		100	0.047
	100	0.081		500	0.096
	500	0.079		1000	0.152
Chromium, unoxidized	100	0.08		1500	0.191
Cobalt, unoxidized	500	0.13	Silica brick	1000	0.80
	1000	0.23		1100	0.85
Columbium, unoxidized	1500	0.19	Silver, unoxidized	100	0.02
	2000	0.24		500	0.035
Copper, unoxidized	100	0.02	Steel, unoxidized	100	0.08
	liquid	0.15		liquid	0.28
oxidized	200	0.6	oxidized	25	0.80
	1000	0.6		200	0.79
calorized	100	0.26		600	0.79
	500	0.26	Steel plate, rough	40	0.94
calorized, oxidized	200	0.18		400	0.97
	600	0.19	calorized oxidized	200	0.52
Fire brick	1000	0.75		600	0.57
Gold, unoxidized	100	0.02	Tantalum, unoxidized	1500	0.21
	500	0.03		2000	0.26
Gold enamel	100	0.37	Tin, unoxidized	25	0.043
Iron, unoxidized	100	0.05		100	0.05
oxidized	100	0.74	Tungsten, unoxidized	25	0.024
	500	0.84		100	0.032
	1200	0.89		500	0.071
cast, unoxidized	100	0.21		1000	0.15
	liquid	0.29		1500	0.23
cast, oxidized	200	0.64		2000	0.28
	600	0.78	Zinc, unoxidized ...	300	0.05
cast, strongly oxidized	40	0.95			
	250	0.95			

SPECTRAL EMISSIVITY

Prepared by Roeser and Wensel, National Bureau of Standards

Spectral Emissivity of Materials, Surface Unoxidized for 0.65μ

Element	Solid	Liquid	Element	Solid	Liquid
Beryllium	0.61	0.61	Thorium	0.36	0.40
Carbon	0.80–0.93	....	Titanium	0.63	0.65
Chromium	0.34	0.39	Tungsten	0.43	
Cobalt	0.36	0.37	Uranium	0.54	0.34
Columbium	0.37	0.40	Vanadium	0.35	0.32
Copper	0.10	0.15	Yttrium	0.35	0.35
Erbium	0.55	0.38	Zirconium	0.32	0.30
Gold	0.14	0.22	Steel	0.35	0.37
Iridium	0.30	....	Cast Iron	0.37	0.40
Iron	0.35	0.37	Constantan	0.35	
Manganese	0.59	0.59	Monel	0.37	
Molybdenum	0.37	0.40	Chromel P (90Ni-10Cr)	0.35	
Nickel	0.36	0.37	80Ni-20Cr	0.35	
Palladium	0.33	0.37	60Ni-24Fe-16Cr	0.36	
Platinum	0.30	0.38	Alumel (95Ni; Bal. Al, Mn, Si)	0.37	
Rhodium	0.24	0.30	90Pt-10Rh	0.27	
Silver	0.07	0.07			
Tantalum	0.49	...			

Spectral Emissivity of Oxides

The emissivity of oxides and oxidized metals depends to a large extent upon the roughness of the surface. In general, higher values of emissivity are obtained on the rougher surfaces

Material	Range of observed values	Probable value for oxide formed on smooth metal	Material	Range of observed values	Probable value for oxide formed on smooth metal
Aluminum oxide	0.22–0.40	0.30	Alumel (oxidized)	..	0.87
Beryllium oxide	0.07–0.37	0.35	Cast Iron (oxidized)		0.70
Cerium oxide	0.58–0.80	..	Chromel P (90Ni-10Cr) (oxidized)		0.87
Chromium oxide	0.60–0.80	0.70	80Ni-20Cr (oxidized)	..	0.90
Cobalt oxide		0.75	60Ni-24Fe-16Cr (oxidized)		0.83
Columbium oxide	0.55–0.71	0.70	55Fe-37.5Cr-7.5 Al (oxidized)		0.78
Copper oxide	0.60–0.80	0.70	70Fe-23Cr-5Al-2Co (oxidized)		0.75
Iron oxide	0.63–0.98	0.70	Constantan (55Cu-45Ni) (oxidized)		0.84
Magnesium oxide	0.10–0.43	0.20	Carbon Steel (oxidized)		0.80
Nickel oxide	0.85–0.96	0.90	Stainless Steel (18-8) (oxidized)		0.85
Thorium oxide	0.20–0.57	0.50	Porcelain	0.25–0.50	
Tin oxide	0.32–0.60	..			
Titanium oxide		0.50			
Uranium oxide		0.30			
Vanadium oxide		0.70			
Yttrium oxide		0.60			
Zirconium oxide	0.18–0.43	0.40			

PROPERTIES OF TUNGSTEN

JONES AND LANGMUIR, GENERAL ELECTRIC REVIEW

Temp. °K	Resistivity microhm cm	Electron emission amp./cm²	Evaporation g/cm² sec	Vapor pressure dynes/cm²	Thermal expansion per cent l_0 at 293°	Atomic heat cal./g. atom./°C.
300	5.65				.003	6.0
400	8.06				.044	6 0
500	10 56				.086	6.1
600	13 23				.130	6 1
700	16.09				.175	6 2
800	19.00				.222	6 2
900	21.94				.270	6 3
1000	24 93	1 07 $\times 10^{15}$	5.32 $\times 10^{34}$	1 98 $\times 10^{-29}$	320	6 4
1100	27.94	1 52 $\times 10^{-13}$	2.17 $\times 10^{-30}$	1 22 $\times 10^{-25}$	.371	6 4
1200	30 98	9 73 $\times 10^{-12}$	3 21 $\times 10^{-27}$	1 87 $\times 10^{-22}$	424	6 5
1300	34 08	3 21 $\times 10^{10}$	1 35 $\times 10^{-24}$	8 18 $\times 10^{-20}$	.479	6.7
1400	37 19	6.62 $\times 10^{9}$	2 51 $\times 10^{-22}$	1 62 $\times 10^{17}$	.535	6.8
1500	40.36	9 14 $\times 10^{8}$	2 37 $\times 10^{-20}$	1 54 $\times 10^{15}$	.593	7 0
1600	43 55	9 27 $\times 10^{7}$	1 25 $\times 10^{-18}$	8.43 $\times 10^{14}$	652	7.1
1700	46 78	7 08 $\times 10^{6}$	4 17 $\times 10^{-17}$	2 82 $\times 10^{12}$	713	7 2
1800	50 05	4 47 $\times 10^{-5}$	8 81 $\times 10^{-16}$	6 31 $\times 10^{11}$	775	7 4
1900	53.35	2 28 $\times 10^{-4}$	1 41 $\times 10^{-14}$	1 01 $\times 10^{-9}$	.839	7 6
2000	56 67	1 00 $\times 10^{-3}$	1 76 $\times 10^{-13}$	1 33 $\times 10^{-8}$	.904	7 7
2100	60 06	3 93 $\times 10^{-3}$	1.66 $\times 10^{-12}$	1 28 $\times 10^{-7}$	971	7 8
2200	63 48	1 33 $\times 10^{-2}$	1 25 $\times 10^{-11}$	9 88 $\times 10^{-7}$	1 039	8 0
2300	66 91	4 07 $\times 10^{-2}$	8 00 $\times 10^{-11}$	6 47 $\times 10^{6}$	1 109	8 2
2400	70 39	1 16 $\times 10^{1}$	4 26 $\times 10^{-10}$	3 52 $\times 10^{5}$	1 180	8 3
2500	73 91	2 98 $\times 10^{1}$	2 03 $\times 10^{-9}$	1 71 $\times 10^{4}$	1 253	8 4
2600	77.49	7 16 $\times 10^{1}$	8 41 $\times 10^{-9}$	7 24 $\times 10^{4}$	1 328	8 6
2700	81 04	1 63	3 19 $\times 10^{-8}$	2 86 $\times 10^{-3}$	1 404	8 7
2800	84 70	3 54	1 10 $\times 10^{-7}$	9 84 $\times 10^{3}$	1 479	8 9
2900	88.33	7 31	3 30 $\times 10^{7}$	3 00 $\times 10^{2}$	1 561	9 0
3000	92 04	1 42 $\times$ 10	9 95 $\times 10^{7}$	9 20 $\times 10^{-2}$	1 642	9 2
3100	95 76	2 64 $\times$ 10	2 60 $\times 10^{6}$	2 50 $\times 10^{-1}$	1 724	9 4
3200	99 54	4 78 $\times$ 10	6 38 $\times 10^{6}$	6 13 $\times 10^{-1}$	1 808	9 5
3300	103 3	8 44 $\times$ 10	1 56 $\times 10^{5}$	1 51	1 893	9 6
3400	107 2	1 42 $\times 10^{2}$	3 47 $\times 10^{5}$	3 41	1 980	9 8
3500	111 1	2 33 $\times 10^{2}$	7 54 $\times 10^{-5}$	7 52	2 068	9 9
3600	115 0	3 73 $\times 10^{2}$	1 51 $\times 10^{-4}$	1 53 $\times$ 10	2 158	10 1
3655	117 1	4 79 $\times 10^{2}$	2 28 $\times 10^{-4}$	2 33 $\times$ 10	2 209	10 2

PROPERTIES OF TUNGSTEN

ROESER AND WENSEL, NATIONAL BUREAU OF STANDARDS

Temp. °K	Normal brightness new candles per cm²	Spectral emissivity 0.65μ	Spectral emissivity 0.467μ	Color emissivity	Total emissivity	Brightness temp. 0.65μ	Color temp.
300	. . .	0.472	0.505	.	0.032		
400	. . . .			.	042		
500	.				053		
600					064		
700					076		
800					.088		
900	. .				101		
1000	0.0001	458	486	395	114	966	1007
1100	0.001	456	484	392	128	1059	1108
1200	0.006	454	482	390	143	1151	1210
1300	0.029	452	480	387	158	1242	1312
1400	0.11	450	478	385	175	1332	1414
1500	0.33	448	476	382	192	1422	1516
1600	0.92	446	475	380	207	1511	1619
1700	2.3	444	473	377	222	1599	1722
1800	5.1	442	472	374	236	1687	1825
1900	10.4	440	470	371	249	1774	1928
2000	20.0	438	469	368	260	1861	2032
2100	36	436	467	365	270	1946	2136
2200	61	.434	466	362	279	2031	2241
2300	101	432	464	359	288	2115	2345
2400	157	430	463	356	296	2198	2451
2500	240	428	462	353	303	2280	2556
2600	350	426	460	349	311	2362	2662
2700	500	424	459	346	318	2443	2769
2800	690	422	458	343	323	2523	2876
2900	950	420	456	340	329	2602	2984
3000	1260	418	455	336	334	2681	3092
3100	1650	416	454	333	337	2759	3200
3200	2100	414	.452	330	341	2837	3310
3300	2700	412	451	.326	344	2913	3420
3400	3400	410	.450	323	.348	2989	3530
3500	4200	408	449	320	.351	3063	3642
3600	5200	406	447	317	354	3137	3754

PIGMENTS AND DYES

The tables which follow give the fraction of incident light reflected by pigments or transmitted by dyes. The pigments were in dry powdered form and the dye solutions, except where indicated, in distilled water. Wave lengths are given in microns.

(*Luckiesch, 1917*)

Pigment	0 44	.46	48	50	52	.54	.56	58	60	.62	.64	.66	.68	.70
American vermilion	0 08	0.06	0 05	0 05	0 06	0 06	0 09	0 11	0 24	0.39	0.53	0.61	0.66	0.65
Venetian red	05	05	05	.05	05	06	07	.12	.19	.24	.28	.30	.32	.32
Tuscan red	07	07	07	08	.08	.08	.08	.12	.16	.18	.20	.22	.23	.24
Indian red	08	07	07	07	.07	07	.07	.11	.15	.18	.20	.22	.23	.24
Burnt sienna	04	04	04	.04	.05	.06	.09	.14	.18	.20	.21	.23	.24	.25
Raw sienne	12	.13	13	.13	.18	.26	.35	.43	.46	.46	.45	.44	.45	.43
Golden ochre	22	22	23	.27	.40	.53	.63	.71	.75	.74	.73	.73	.73	.72
Chrome yellow, ochre	.08	.09	07	.07	10	.19	.30	.46	.60	.62	.66	.82	.81	.80
Yellow ochre	20	20	21	24	.32	.42	.53	.63	64	.61	.60	.59	.59	.59
Chrome yellow (medium)	.05	05	06	.08	.18	.48	.66	.75	78	.79	.81	.81	.81	.81
Chrome yellow (light)	.13	13	18	.30	56	82	.88	89	.90	.89	.88	.87	.85	.84
Chrome green (light)	.10	10	.14	.23	.26	.23	.20	.17	.14	.11	.09	.08	.07	.06
Chrome green (medium)	.07	07	.10	.21	.21	.17	.13	.11	.09	07	06	06	.06	.05
Cobalt blue	.59	58	49	35	23	.15	.11	.10	.10	.10	11	.15	.20	.25
Ultramarine blue	.67	.54	.38	.21	10	.06	04	03	03	.04	.05	.07	.10	.17

PIGMENTS AND DYES (Continued)

Red Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	70
Carmen ruby opt.	...	...	...	...	...	...	...	...	...	0.04	0 18	0.37	0.49	0.60
Amido naphthol red	...	...	...	...	...	...	...	...	0 04	.38	.75	.92	.96	.96
Coccinine	...	...	...	...	...	...	...	0.04	.56	.96	.98	.98	.98	.98
Erythrosine	0 06	...	...	...	...	...	0 10	.53	.90	.95	.96	.96	.96	.96
Hematoxyline	.01	0.03	0 07	0 13	0 14	0 12	.13	.25	.44	.54	.63	.73	.78	.82
"	...	...	...	...	...	...	...	01	.02	.04	.09	.15	.21	.25
Alizarine red	01	.01	.02	.03	04	.06	.11	.22	.39	.54	.65	.72	.77	.79
Acid rosolic (pure)	.04	.03	.01	...	...	...	.02	.38	.78	.88	.90	.91	.92	.92
Rapid filter red	...	...	...	...	...	01	.10	.47	.86	.95	.96	.96	.96	.96
Aniline red fast extra A	...	...	...	...	...	.02	.12	.34	.55	.72	.84	.88	90	.92
Pinatype red fast	...	...	...	...	...	...	...	...	.11	.35	.55	.65	68	.69
Eosine (yellowish)	...	...	...	...	...	...	...	...	.06	.40	63	.74	.82	.85
Eosine	...	...	...	...	...	...	.01	.54	.87	.93	.92	.92	.92	.92
Naphthalinrot in absolute alcohol	...	...	...	...	...	...	...	...	.06	.28	43	.50	.57	.61
Rose bengal	80	.70	.34	.06	.01	...	14	.82	.96	.97	.98	.98	.98	.98
Rose bengal	01	...	...	...	...	...	...	.09	57	.83	89	.92	.94	.96
Cobalt ammonium sulphate	.60	56	48	.37	38	.53	70	.82	.86	.90	90	90	.90	.89
Cobalt nitrate	69	.51	.40	.31	.32	48	.67	82	87	.90	.90	90	.90	.90

PIGMENTS AND DYES (Continued)

Yellow Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Tartrazine	....	....	....	....	0.07	0.52	0.75	0.86	0.91	0.95	0.96	0.97	0.98	0.98
Chrysoidin	....	....	....	....	....	....	....	....	.02	.23	.50	.71	.79	.79
Aurantia	....	....	....	....	...	.03	.23	.53	.82	.92	.96	.96	.96	.96
Aniline yellow phosphine	....	...	....	....	.02	.20	.43	.60	.67	.75	.81	.85	.86	.87
Fluorescein	0.15	0.01	...	...	.48	.91	.97	.98	.98	.98	.98	.98	.98	.98
Aniline yellow fast, S	....	...	0.01	0 07	.43	.84	.96	.96	.96	.96	.96	.96	.96	.96
Methyl orange, indicator	....	...	...	...	...	...	.01	.31	.70	.79	.80	.81	.81	.81
Auramin	...	...	.01	.39	.77	.83	.84	.86	.87	.88	.90	.92	.93	.93
Uranine	.15	.01	....	.01	.58	.96	.97	.97	.97	.97	.97	.97	.97	.97
Uranine naphthaline	....	...	....	.04	.53	.77	.82	.83	.84	.85	.86	.86	.87	.87
Orange B Naphthol	....	...	....	....	....	.01	.43	.88	.95	.96	.97	.97	.97	.97
Safranine	....	....	....	....	....	....	....	....	.03	.27	.64	.85	.93	.93
Martius gelb	....	....	...	.01	.43	.84	.91	.94	.95	.95	.95	.95	.95	.95
Naphthol yellow	....	....	.01	.18	.74	.91	.96	.97	.98	.98	.98	.98	.98	.98
Potassium bechromate, sat. sol.	...	...	...	...	....	.10	.60	.84	.88	.89	.89	.89	.89	.88
Cobalt chromate	.17	.36	.62	.82	.88	.90	.92	.93	.95	.96	.96	.96	.96	.95

*

PIGMENTS AND DYES (Continued)

Green Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Naphthol green	0 02	0 04	0.07	0.21	0.30	0.36	0 29	0.16	0.07	0.02	0.01	....	....	....
Brilliant green	.04	.39	.69	.52	.23	.04	....	....	....	....	....	0.02	0.23	0.64
Filter blue green	.35	.49	.64	.70	.60	.37	.13	.02	....	....	....	....	....	....
Filter blue green	.06	.14	.23	.40	.26	.08	.01	....	....	....	....	....	....	....
Malachite green	....	.12	.20	.08	.01	....	....	....	....	....	....	....	.12	.50
Malachite green	....	.01	.04	.01	....	....	....	....	....	....	....	....	.02	.23
Malachite green	....	....	.01	....	....	....	....	....	....	....	....	....	....	.10
Saurgrun	.03	.29	.57	.57	.39	.19	.04	.01	....	....	....	....	.04	.30
Methylengrun	.28	.31	.32	.26	.17	.07	.02	.01	....	....	....	....	.03	.28
Methylengrun	.14	.16	.17	.13	.06	.01	....	....	....	....	....	....	.02	.14
Aniline green naphthol B	.02	.06	.14	.24	.34	.40	.32	.14	.04	.01	....	....	....	....
Aniline green naphthol B	....	....	.02	.06	.10	.15	.09	.02	....	....	....	....	....	....
Neptune green	..	.40	.63	.41	.13	.01	....	....	....	....	....	....	....	.05
Neptune green	..	19	.36	.18	.02	....	....	....	....	....	....	....	....	.02
Cupric chloride	.77	84	.89	.92	.92	.89	.80	.67	.52	.36	.19	.06	.02	....

PIGMENTS AND DYES (Continued)

PIGMENTS AND DYES (Continued)

Blue Dyes

Dye-Solution	0 44	.46	48	.50	.52	.54	.56	.58	.60	62	.64	.66	.68	.70
Turnbull's blue	0 58	0 60	0 56	0 51	0 38	0 28	0 18	0 09	0 05	0 03	0 01			
Victoria blau	52	23	09	01						01	.04	0 21	0 49	0.73
Prussian blue (soluble)	.66	.71	.76	69	60	.46	.32	.20	.12	.07	.05	.03	.03	....
" " "	06	.09	.09	.05	.02	.01								
Wasser blau	.89	.75	.51	.26	.07	.01			.01	.02	.06	.18	37	.60
" "	85	66	.42	.17	03	.01				.01	.03	.10	.26	.48
Resorcine blue	.25	18	.06	.02	01				01	.02	.14	.41	64	.72
Toluidin blau	.66	31	13	03	01						.01	.04	.16	.40
Patent blue	.83	.91	.84	76	65	.46	.24	08	.02			.06	.42	.78
" "	.15	.25	.17	.05										.12
Dianil "	77	69	.59	.48	.35	.24	.15	.09	.05	.05	.07	.14	.29	.53
" "	38	.30	.18	.10	.04	.01							02	.12
Filter "	84	.79	66	.44	.27	.17	.14	.19	36	.56	.74	.81	.88	.92
" "	35	.29	.18	.04					02	.08	.23	.44	.62	.71
Aniline blue, methyl	.92	.88	.78	.52	27	.09	.03	.02	.02	.04	.08	.16	.25	.45
" " "	.44	.31	.13	....	....	....	....	....	....	..	....	....	....	....

Purple Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Ethyl violet in gelatine (dry)...	0.97	0.87	0.67	0.28	0 04	....	....	...	...	0.05	0.33	0.73	0.88	.91
Ethyl violet in gelatine (wet)...	.83	.79	.45	.07	01	....	0.01	0.03	0 05	15	.42	.76	.91	.93
Magenta..................	.21	.08	.02	.01	...	....	.01	.22	.73	.93	.97	.97	.97	.97
"	....	....	....	..	...	....	....	....	.07	.48	.81	.92	.95	.95
Gentian violet..............	.89	.83	.64	.44	.26	0.19	.15	.10	.13	.42	.75	.92	.93	.94
" "	.11	.01	...	....	....	....	....	....	....	...	.01	.15	.48	.66
Rosazeine...............	.50	.28	.02	....	....	....	....	.06	.55	.90	.98	.98	.98	.98
"	...	....	....	....	....	....	....	...	....	.07	.54	.90	.95	.95
Iodine (dense).............	...	...	....	....	...	....	....	...	....	...	.01	.03	.11	.23
Rhodamine B	.81	.71	.45	.13	.02	....	....	.23	.83	.96	.96	.96	.95	.94
Acid violet...............	.84	.76	.68	.50	.33	.26	.27	.34	49	.70	.84	.96	.96	.96
" "	.29	.08	.01	....	....	...	....	.01	09	.32	.63	.84	.94	.94
Cyanine in alcohol	07	.01	....	....	....	....	....	..	.	....	....	.01	.13	.23
Xylene red	.39	.23	.01	...	....	....	....	.01	.27	.79	.97	.97	.97	.96
" "	...	....	....	....	....	....	....	...	.01	.31	.79	.96	.96	.95
Methyl violet B.............	.25	.04	....	....	....	....	....	....	....	....	.03	.26	.63	.89

PIGMENTS AND DYES (Continued)

TRANSMISSION OF COLORED GLASSES

If I_o is the intensity of radiation entering a layer of some medium and I the intensity reaching the opposite surface, the ratio I/I_o is called the transmittance. In practice the ratio of intensity of radiation passing through a glass sample to that incident on its surface is often measured and plotted as transmission. The transmission is the result of two factors, the transmittance of the glass and the losses by reflection. These losses amount to about 4% for each glass-air surface; the transmission of a sample is about 92% of its transmittance. Since the reflection losses differ slightly with different samples, the correction is often determined and applied when the transmission is measured. Values which are thus corrected are marked * at the head of the column.

In order to obtain the transmittance for thicknesses other than those listed it is convenient to transform the tabular values to terms of βt in the equation $I/I_o = e^{\beta t}$ where t is the thickness (in millimeters) and β a constant for a particular sample. The base 10 is conveniently used in place of e so that βt becomes the common logarithm of the transmittance, or $\beta t = \log I/I_o$ Using the corrected value of the transmittance for a specific thickness, found in the table, the value of βt may be found, changed to the value for the new thickness and the transmittance for the second thickness computed

For example: The tabular value of transmission for sample **CG** 396 at $\lambda = .46\mu$ is given as 0 80 for a thickness of 2 mm. It is desired to find the transmittance for 5 mm.

The corrected value of the transmittance for 2 mm is 0.80/.92 or about 0.871. Log 871 = 9.94002–10 Writing this as a wholly negative number the equation becomes $\beta t = -\ 05998$ For $t = 5$ $\beta t = -\ 05998 \times 5/2 = -.14995$ or changing to the more familiar form gives 9.85005–10 which is the logarithm of the new transmittance which is found to be .708: The transmission will be .92 × .708 or .651.

In order to identify the glasses listed, the manufacturer's number is given preceded by an abbreviation of the maker's name, as follows: **AO**, American Optical Co.; **BL**, Bausch & Lomb Optical Co , **CE**, Chicago Eye Shield Co.; **CG**, Corning Glass Works Data for Jena glasses are given separately in section II of the table.

This table has been compiled with the assistance of: Mr. H. P Gage, Corning Glass Works; Mr. J. Liautaud, Chicago Eye Shield Co.; Mr W. B. Rayton, Bausch & Lomb Optical Co ; Mr A. J. Weinstein of the Fish-Shurman Corporation

Abbreviations Used

abs., absorbing	lant , lantern	sext , sextant
bl., blue	lt., light	sig., signal
col., colorless	med , medium	tr., transmitting
didym , didymium	neut . neutral	u v., ultra-violet
dk., dark	purp , purple	v , very
fl , fluorescent	pyrom , pyrometer	viol . violet
grn., green	rd red	yel., yellow
ht , heat		

TRANSMISSION OF COLORED GLASSES

Section I.—Glasses of American Manufacture

Wave-length μ	AO Crown 1.50 neut 1.68 mm	BL Crookes 1 neut 2 mm	BL Crookes 2 neut 2 mm	BL Crookes 3 neut 2 mm	BL Smoke A neut. 2 mm	BL Smoke B neut 2 mm	BL Smoke C neut. 2 mm	CG 254 black ht. tr. 1 mm	CG 255 sext. red 1 mm	CG 241 Se red pyrom. 38%
0 22	. .	*	*	*	*	*	*	.		. . .
.24	. .			.	.		. .	. .		. .
.26					.	.	. . .	. .		. . .
.28	0	. .		.	. .	.	.	.		. .
.30	10	.00	00	.00	00	00	.00	.		.
.32	.56	00	00	.00	.00	.00	.00	.		.
.34	83	00	00	.00	.44	.14	.00	. .	.	.
.36	.89	.06	22	20	83	60	.32	. . .	. .	.
.38	.91	.72	70	65	.89	74	.61	. . .	. . . .	. . .
.40	92	86	80	74	.90	.76	.64	. .	0	. .
.42	92	89	75	54	.85	70	.43		07	. .
.44	92	.91	77	46	.82	54	.28	.	05	. .
.46	92	.93	80	.47	83	.53	.28		.015	. .
.48	92	94	82	51	.84	55	.33		005	.
.50	92	.95	83	55	.85	.59	.35	.	005	. .
.52	92	96	85	57	.85	59	34	.	000	. .
54	.92	97	86	.58	.85	.59	.33		005	.
.56	.92	97	84	57	85	.60	33		005	.
58	.92	80	69	.49	85	60	.33		015	.
.60	92	99	85	58	85	59	32		030	.
.62	92	1 00	89	61	.85	.58	32		040	. . . .
.64	92	1 00	90	63	.85	.60	33		060	0
66	.92	1 00	92	66	.87	65	.39	0	070	067
68	92	1 00	94	73	.90	73	.52	006	090	508
70		99	97	90	.95	.88	75	012	120	660
72				.	.	. .	. . .	018	.150	.667
1 0		98	92	.85	.93	75	74	724	200	.660
1 5		95	89	.87	.91	82	.74	845	860	. .
2 0		94	89	.83	90	81	.72	812	920	.
2 5	.	89	82	.80	.88	.80	.74	818	920	.
3 0		55	53	.53	.59	.61	.56	.672	915	. .
3 5		31	25	33	35	33	31	549	.743	.
4 0		26	34	32	31	28	28	325	.670	
4 5		23	.20	.21	.22	22	.23	030	390	.
5.0		11	09	09	10	12	10			.

TRANSMISSION OF COLORED GLASSES (Continued)

Section I.—Glasses of American Manufacture (Continued)

Wave-length μ	CG 242 Se red dark 100 %	CG 244 Se red lant. 225 %	CG 245 Se red traffic 300 %	CG 246 Se red lt house 125 %	CG 346 amber A 2 5 mm	BL Kali-chrome A yellow 2 mm	BL Kali-chrome C yellow 2 mm	CG 348 yel. lant. Y 4	CG 351 yel. traffic Y 3	CG 338 yel. noviol C
0 22						*	*			
.24										
.26										
.28										
.30						00	00			
.32						00	00			
.34						00	00			
.36						00	00	0		
.38					0	21	00	0008		
.40					.045	50	00	0010		
.42					.105	65	00	0020		
.44					.200	74	00	0039		
.46					.330	81	00	0075		000
.48					465	.85	02	.0137		380
.50					585	.90	.46	0289	0	650
.52					680	93	.87	0826	0003	765
.54					750	94	93	.157	.289	813
.56	0	0			795	.94	.97	544	784	820
.58	.0001	.0001	.000	100	835	.95	98	848	844	825
.60	0005	024	148	730	855	96	98	882	864	825
.62	.019	680	722	828	.875	97	97	890	874	
.64	.630	832	832	844	865	97	.97	893	883	
.66	.828	855	.850	850	869	97	.97	894	889	
.68	847	863		847	879	97	97	894	891	
.70	853	862	850	835	889	97	97	892	891	
.72	854	.859		825	900			888	890	
1.0	.605					.96	.87			
1.5	.703					95	.89			
2.0	.805					.95	.90			
2.5	.730					.89	.85			
3.0	.330					.59	.60			
3.5	.275					30	34			
4.0	230					.22	.27			
4 5	.023					16	.17			
5.0						08	.10			

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

Wave-length μ	CG 038 lt. yel. noviol A	CG 306 lt. yel. noviol O 2 mm	CG 330 sig. yel. 210 % 2.5 mm	CG 375 U yel. fluor. 5 mm	BL Fieuzal A green 2 mm	BL Fieuzal B green 2 mm	BL Fieuzal C green 2 mm	BL Anti-glare green 2 mm	BL Green 19 green 2 mm	BL Ht. abs. green 2 mm
0.22	...	. .		.	*	*	*	*	*	*
24	. .	. .			...		.	...	...	.
26		.			.		.	...	.	
28	.				.			...		
.30					.00	.00	.00	.00	00	00
32	. .		.		.00	.00	.00	.00	.00	00
.34				0	00	.00	.00	.00	.00	03
.36	.	0	0	190	.00	.00	.00	.00	.00	.22
38	. .	120	008	323	11	.00	.00	.02	.00	.43
40		473	0075	0622	30	.02	00	.14	.00	.51
.42	0	635	0076	0367	.40	05	01	.27	.00	.55
.44	.550	745	0113	.184	.49	.14	05	.29	.00	.58
.46	.702	795	0271	.407	.64	29	.13	.43	.01	.61
.48	.765	825	.0636	518	.70	.38	19	.50	03	.65
.50	.787	855	1324	581	.77	48	25	.55	05	.66
.52	.802	875	241	833	82	57	33	57	.14	67
.54	813	880	367	858	.86	65	40	58	19	67
56	820	885	492	863	.86	67	43	.57	17	65
58	825	885	589	868	.86	46	43	56	09	62
60	825	880	654	878	85	64	41	53	04	58
62		883	693	878	84	61	39	50	01	53
64			713	880	83	59	31	45	01	.48
66			721	884	82	56	35	40	01	.43
68			723	893	81	.54	.33	36	01	.38
.70			720	900	80	53	.31	.31	01	.33
72			712	902						
1.0				910	.58	29	12	11	19	09
1.5				880	61	.40	.20	15	.50	.15
2.0	...		.	862	73	.52	.32	27	.71	.25
2.5	...	.	.	.705	73	.51	.37	.34	.85	32
3.0	...	.		090	51	35	27	27	.70	20
3 5				010	34	25	21	17	43	.15
4.0		.			.24	.24	21	15	41	09
4.5					16	11	.11	11	32	07
5 0		...	...	. .	.08	06	07	05	06	06

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

Wave-length μ	BL red free green 2 mm	CG 396 green 2 mm	CG 428 bl. grn 2 mm	CG 440 sig. grn. 150% 5.78 mm	CG 401 sext green 1 mm	CG 502 blue 2 mm	CG 503 dk blue 2 mm	CG 556 sig. blue 100% 5 mm	CG 554 blue 101% 2 8 mm	CG 590 lt. bl. 4.6 mm
0.22	*									
.24										
.26										
.28										
.30	00	0	0							
.32	00	020	004					0		
.34	00	280	.266					060		
.36	00	.530	652	0				370		
.38	00	670	780	.073				650		417
.40	00	735	830	237	0	631	766	780	700	650
.42	04	760	845	.366	0494	782	.832	800	730	653
.44	.10	.785	860	480	124	825	830	795	700	.550
.46	.17	800	865	.588	252	822	791	.727	635	462
.48	.23	.815	860	.638	429	.787	.698	458	400	.380
.50	.25	820	835	.618	592	703	.547	205	.175	.316
.52	.22	.820	770	.526	670	578	380	.049	050	.258
.54	.13	.805	660	366	.653	.441	236	012	.015	.200
.56	.06	790	.515	205	.538	.281	.105	.022	030	.205
.58	.02	.760	375	.0952	397	.171	050	005	005	.170
.60	.01	.720	255	0375	260	088	.018	0008	0	.121
.62	00	670	.175	.0134	.161	038	005	.0006	0	.099
.64	00	.610	105	0051	107	035	.005	0003	0	.080
.66	.00	.555	075	.0019	0762	024	003	0003	0	082
.68	.00	.495	050		.0632	082	.005	.002	.015	.095
.70	00	430	040		.0508	054	015	008	060	.103
.72		.370	030		.049	269	173	009	080	
1.0	.07	068			050					
1.5	.10	.172			180					
2.0	.35	.279			525					
2.5	.54	.400			.780					
3.0	.46				.250					
3.5	.29				.150					
4.0	28				110					
4.5	.20				0					
5.0	.08									

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

Wave-length μ	BL Blue O blue 2 mm	BL Blue A blue 2 mm	BL Blue B blue 2 mm	BL Blue C blue 2 mm	CG 511 violet 2.15 mm	CG 557 lt purp. 6 2 mm	CG 555 purp 4 8 mm	CG 512 didym. 5 mm	CG 507 purp 3 mm	CG 227 gold ruby 3 mm
0 22	*	*	*	*	. . .			.	.	. . .
24			.	.	.	.			.	.
.26	. .			.				. .	.	. . .
28			. .		.			. .	.	. . .
.30	020	11	08	.11				.		. . .
.32	450	.68	65	.60	0		. .		.	. . . .
.34	79	88	87	.87	0018			. . .	212	. . .
.36	88	94	93	.97	082	.		. . . .	552	. . .
.38	94	97	96	.98	326	795	783	. . . .	.728	. . . .
.40	98	98	.97	.98	502	861	845	731	726	090
.42	1 00	.99	98	.97	.462	834	786	731	490	.100
.44	1 00	99	98	.95	326	810	705	530	225	.105
.46	99	99	98	.92	138	781	589	548	092	100
.48	.99	.97	.93	.81	014	665	318	530	045	090
.50	99	94	.83	66	0003	497	1015	652	028	055
.52	99	91	.73	.52		302	0163	.601	0299	015
.54	98	89	.69	45		185	0028	790	033	005
.56	97	88	67	43		257	0092	811	050	005
.58	96	.87	64	40		160	0017	0082	0727	045
.60	96	86	62	.37		095	0002	.184	100	185
62	96	.84	61	35		109	0004	849	128	365
64	96	.85	60	36		0935	0002	851	156	515
.66	96	87	64	39		132	0008	849	177	615
68	97	91	75	52		360	035	736	201	695
.70	98	97	.93	81		710	400	804	.230	740
72	.		. .			852	795	845	.267	740
1 0	99	98	99	99					793	.
1 5	.96	95	89	83	0				902	
2 0	97	94	92	87	100				863	. . .
2 5	.95	87	87	.91	.387		.	. . . .	.732	. . . .
3 0	.81	.50	.55	.72	320		.	. .	.155	. . . .
3 5	49	33	35	41	250		.	. . . .	.007	. . . . .
4 0	39	31	31	.33	.305			. .	015	. . . .
4.5	31	21	19	29	156			. . . .	0	. . . .
5.0	11	09	.12	.11	0	. . . . .	. . . .	. . . . .	. . . . .	. . . .

TRANSMISSION OF COLORED GLASSES (Continued)

Section I.—Glasses of American Manufacture (Continued)

Wave-length μ	CG G 984 B green	CG G 985 B blue	CG 585 bl. purp. tr u v 1 mm	CG 597 rd. purp. tr u v 1 mm	CG 587 rd purp tr u.v 2 mm	CG 586 violet tr u v. 5 mm	CG 584 red tr. u.v 1 mm	CG 774 neut. pyrex 2 mm	CG 970 neut. corex D 2 mm	CG 980 neut. corex A 2 mm
0.22	.	0	. .	.	.	.	.	. . . .	0	.0115
.24	0	.02		.	.	.		. .	0027	237
.26	38	18		. .	.		.		039	531
.28	34	46	0	0	0		.	0	305	.753
.30	12	68	153	.116	.039	0	129	120	700	.840
.32	.36	.78	650	.570	342	0004	555	610	860	.879
.34	.73	84	860	850	.640	097	791	830	.902	.884
.36	79	86	910	913	795	290	.830	900	. .	885
.38	.75	86	925	890	700	080	714	913	.	. . . .
.40	.45	81	900	714	265	0	115	913	.	.887
.42	11	67	840	.260	.045		0	.		. . .
.44	02	.41	765	065	010			913	.	.893
.46	01	16	620	.025	010			.		. . . .
.48	03	04	390	025	005			917	.	.897
.50		.	199	026	000			. .	. .	. .
.52			090	026	005			918		900
.54	.		053	028	005			.	.	. . . .
.56	.		104	027	010			918	.	900
.58			029	030	005				.	. . . .
.60			014	065	000			919		900
.62	.	.	020	034	000				. . .	. . .
.64			018	045	000		0	919	. .	.900
.66			033	160	005		010	.	. .	. . . .
.68			146	350	035		080	919		.900
.70			505	505	255		290	919	. .	. . . .
.72			760	595	520		405	.		.900
1.0			.850	450			.	.915	. .	.900
1.5			425	610		.	.	.914	. . .	.898
2.0	.	.	.645	415	.		. .	.904	. . .	.857
2.5		.	805	.450	. .		. .	. . .	. . .	.744
3.0	. . .	. . .	595	485	. . .	.		. . .	. . .	.018
3.5	.	. . .	520	.393	.		. . .	. . . .	. . .	.017
4.0	. .	. . .	.580	.422	. . .	. . .	. . . .	. . . .	. . . .	. . . . .
4.5	. . .	. . .	.310	. . . .	. . . .	. . . . .	. . . .	. . . .	. . . .	. . .

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION I.—GLASSES OF AMERICAN MANUFACTURE (Continued)

Wave-length μ	CG 986 rd. purp. corex A 3 mm	BL Weld. 3 yel. grn. 1 mm	BL Weld. 4 yel. grn. 1 mm	BL Weld. 5 yel. grn. 0.5 mm	BL Weld. 8 yel. grn. 0.5 mm	BL Weld 12 yel. grn. 0.5 mm	CE Cesco-weld no. 3 ht. abs.	CE Cesco-weld no. 4 ht. abs.	CE Cesco-weld no. 5 ht. abs.	CE Cesco-weld no. 6 ht. abs.
0.22	...	*	*	*	*	*	...	...	....	....
.24	0	...	...	.	..	. .		.	...	...
.26	.135	...	.	.			.	.	....	....
28	.412							.	.	....
30	.625	00	.00	00	.00	.00		.	.	....
32	793	00	.00	.00	.00	00			.	....
34	.814	.00	.00	.00	.00	00			.	....
.36	.797	03	.03	.06	.11	.00		. .	. .	....
.38	.430	06	.09	.13	.18	.01		.000	000	....
40	.075	.09	.12	14	.21	03		.001	001	....
.42	.023	10	.13	14	.16	.02	0	.002	.001	...
.44	.000	09	.14	.15	.15	.02	001	.004	.000	....
.46	000	13	.19	.21	.17	03	013	.009	001	.000
.48	000	22	.27	.27	.20	.05	032	.025	005	.001
.50	.000	31	25	.25	.25	07	.070	.047	010	.003
.52	000	40	42	41	.29	.08	160	.082	.031	.008
54	000	46	44	45	31	09	180	.094	032	.013
56	000	46	43	.45	32	10	174	087	030	012
58	000	43	39	43	31	09	157	.063	026	.010
60	001	36	.31	.38	27	08	120	.037	014	.006
62	003	29	.25	31	.23	07	068	.020	007	.002
64	010	24	20	26	.20	06	042	010	.004	001
66	025	19	15	.21	.19	05	025	004	.001	.000
68	128	15	12	.18	.17	05	016	001	000	.000
.70	231	12	09	.16	15	04	009	001	000	.000
72	.240				.	.	008	. .	001	.000
1 0	.095	.07	04	.09	.04	.03	.002	000	.000	.000
1.5	.009	03	02	04	07	.02	.000	000	.000	000
2.0	.026	.07	04	10	12	04	002	000	.000	000
2.5	.081	11	10	15	19	.07	010	002	.000	.000
3.0	0	14	11	20	22	11	.012	.001	.001	.000
3 5		16	13	14	28	14	014	003	002	000
4 0		20	17	30	33	21	024	008	007	001
4 5		21	.17	37	.29	.26	022	.005	012	004
5 0		06	05	20	15	30	000	000	001	000

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION II.—JENA GLASSES*

Wave-length μ	UG 1 dk. viol. tr. u.v. 1 mm	UG 2 dk. viol. tr. u v. 1 mm	UG 3 violet 1 mm	UG 4 dark violet 1 mm	BG 1 blue tr u v. 1 mm	BG 2 blue tr. u.v. 1 mm	BG 3 blue tr. u.v. 1 mm	BG 5 dk. blue abs. red 1 mm	BG 6 dk. blue 1 mm
.281	....	0 01	..	....	0.04	....	0 13	....	. ..
.302	0 17	.27	. .	0 09	.40	0 04	69	. ..	..
.312	.37	.50	0 04	22	64	.16	77	....	..
.334	.69	.80	55	.59	.93	.63	92	.	.
.366	85	84	91	77	97	84	96	0 09	0 06
.405	.08	02	85	.07	97	70	86	33	.34
.436		.	50	01	86	42	63	47	48
.480			17	.02	.44	02	10	39	33
.509	. .		12	01	14	.	01	19	.12
.546	.. .	.	15	.02	.04	.		06	.02
.578	. .	.	21	. .	05	.		04	02
.644	....	...	35		.01	. .	. .	01	01
.700	.01	.12	46	21	.51	.32	06	13	08
.775	.34	.30	64	52	94	84	90	13	.14
.85	.22	19	79	39	97	83	98	10	10
.95	.11	12	93	39	93	.74	94	12	.12
1.05	.07	09	97	.37	86	.61	81	15	15
1.15	05	.07	98	.32	.76	.50	64	.19	.18
1.30	04	.06	.99	28	58	41	39	24	23
1.45	.04	.06	99	.27	45	38	27	29	27
1.60	.03	.06	.99	.26	40	.37	.19	.34	31
1.80	.04	.06	.99	.25	44	38	.20	.42	38
2.00	.04	.06	.99	.32	.50	41	28	49	46
2.40	.11	.11	.98	.51	.69	.51	.47	.68	.66
3.00	17	19	.86	.35	.55	.35	49	37	36

* Data furnished by courtesy of the Fish-Schurman Corp., New York, Importers of Jena Glasses. All values are corrected for reflection losses.

TRANSMISSION OF COLORED GLASSES (Continued)

Section II.—Jena Glasses (Continued)

Wave-length μ	BG 7 dk. blue abs red 1 mm	BG 9 blue-green 1 mm	BG 10 blue-green 1 mm	BG 11 lt blue (Nd) 1 mm	BG 12 blue abs red 1 mm	BG 13 med blue 1 mm	BG 14 bright blue 1 mm	BG 15 blue 1 mm	BG 16 blue 1 mm
.281				0 02					
302				21					
.312		0 01		38	0 02		0 13	0 03	
.334	0 02	21	0 12	80	39		71	33	0 04
.366	26	67	60	95	75	0 35	92	73	57
.405	.51	90	78	97	86	77	98	86	80
.436	.70	.94	84	96	85	87	98	89	84
.480	79	96	88	93	48	87	98	.90	86
.509	.73	96	88	95	12	85	96	90	86
.546	.50	95	87	99	02	77	.90	.90	84
.578	.26	93	86	70	01	64	75	89	81
.644	03	86	74	1 00		35	46	80	68
.700		74	63	0 99	.04	21	30	65	54
.775	...	56	42	90	08	.14	24	.47	.36
85	01	46	31	92	08	14	27	.36	25
.95	02	38	25	98	12	19	.35	.28	20
1 05	04	34	.24	99	18	24	.45	24	18
1 15	08	33	26	99	18	30	.55	.24	17
1 30	15	36	31	98	16	43	.69	30	21
1 45	.24	.42	.39	97	.19	52	.78	.41	.28
1 60	.35	49	47	96	22	.61	.84	45	38
1.80	48	56	53	97	27	73	.90	49	44
2 00	.58	.59	.55	97	.53	.81	.93	.54	.44
2 40	.74	64	58	93	79	88	.94	.61	55
3.00	56	.50	46	54	55	.59	.63	.51	44

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION II.—JENA GLASSES (Continued)

Wave-length μ	BG 17 col. abs. heat 1 mm	VG 2 yellow-green 1 mm	VG 3 green (Nd) 1 mm	GG 1 col. abs. u.v 1 mm	GG 2 col. abs u.v. 1 mm	GG 3 light yellow 1 mm	GG 4 light green 1 mm	GG 5 bright yellow 1 mm	GG 6 medium yellow 1 mm
281	. .	.		. .		.	.	.	. .
.302	0 03	.		0 02		0 03	.	0 01	0 02
312	11		.	13		05		02	.05
334	46		0 01	47		09	0 03	03	.11
366	89		49	86	0 64	16	01	09	.14
405	97	.	27	98	97	.21	40	14	21
436	98	0 05	06	99	99	85	67	40	36
480	98	37	02	1 00	1 00	99	92	99	.73
.509	98	59	38	1 00	1 00	1 00	95	1 00	98
.546	98	.61	06	1 00	1 00	1 00	97	1 00	1 00
.578	98	44	69	1 00	1 00	1 00	.96	1 00	1 00
644	97	.10		1 00	1 00	1 00	94	1 00	1 00
700	93	08	85	1 00	1 00	1 00	96	1 00	0 99
775	78	07	59	1 00	1 00	0 99	99	0 99	.98
85	61	.06	32	1 00	1 00	98	99	99	97
95	.42	09	36	1 00	1 00	98	99	98	96
1 05	.32	.13	22	1 00	1 00	97	99	98	95
1 15	.30	.18	20	1 00	1 00	97	99	98	.95
1 30	33	.27	39	1 00	1 00	97	.99	97	95
1 45	.36	.37	.34	1 00	1 00	.98	.99	.97	.96
1 60	.43	47	22	1 00	1.00	.98	.99	.98	.96
1 80	.46	.57	.38	1 00	1.00	.98	.99	.98	.97
2 00	42	65	47	1 00	0 99	.98	.99	98	.97
2 40	.39	75	.30	0 96	.98	.96	98	97	94
3.00	.27	54	12	.50	70	62	.64	62	.62

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION II.—JENA GLASSES (Continued)

Wave-length μ	GG 7 medium yellow 1 mm	GG 8 greenish-yellow 1 mm	GG 9 greenish-yellow 1 mm	GG 10 dk. grn.-yellow 1 mm	GG 11 deep yellow 1 mm	GG 12 yellow, grn. fl. 1 mm	OG 1 yellow-orange 1 mm	OG 2 orange 1 mm	OG 3 red-orange 1 mm
281	.	.							
302			0 01					.	. .
312	0 01		01	.			.		.
334	04					0 03		.	.
366	.05					74	.		. . . .
405	12	0 05	01		.	.53		.	. . .
.436	16	26	14	0 09	0 01	71	.		.
.480	65	75	78	59	24	90			. .
.509	99	88	88	85	97	96	0 01	.	. . . .
.546	99	99	93	97	99	99	91	0 14	. . .
.578	1 00	99	92	95	99	1 00	99	94	0 48
.644	1 00	92	89	83	99	1 00	99	99	1 00
700	1 00	92	91	86	99	1 00	99	99	1 00
775	0 99	98	95	96	98	1 00	.99	99	0.99
85	.99	98	98	99	97	1 00	.99	99	.99
95	98	99	99	99	96	1 00	.99	99	.98
1 05	98	1 00	99	99	96	1 00	.99	.99	98
1 15	97	1 00	99	1 00	96	1 00	99	99	98
1 30	96	1 00	99	1 00	96	1 00	.99	99	.98
1 45	.96	1 00	.99	0 99	96	1 00	.99	.99	.98
1 60	.97	1.00	99	.99	96	0 99	.99	.99	.98
1 80	.98	.99	.99	99	.97	99	.98	99	.98
2 00	.98	99	99	99	97	99	98	99	.99
2 40	95	96	97	94	95	.98	97	97	.97
3 00	65	68	69	44	66	67	62	.60	.63

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION II.—JENA GLASSES (Continued)

Wave-length μ	RG 1 bright red 1 mm	RG 2 pure red 1 mm	RG 3 dark red 1 mm	RG 4 dark red 1 mm	RG 5 dark red 1 mm	RG 6 blood color 1 mm	RG 7 infra-red 1 mm	RG 8 v. dk red. 1 mm	RG 9 infra-red 1 mm
.281		.	. .	. . .	. . .	. .	.	. . . .	. . .
.302				.		0.12		. . .	. .
.312				. . .	.	.20		.	. . .
.334				.		.34		. . .	.
.366	.		.			.44		.	
405						.49			
436			.		.	50		. . .	.
.480	.			. .	.	44		.	
.509	.		. . .	0.02	.	31		. .	
.546	. .	.	.	.05	. . .	.18	. .	. .	
.578	.	. .	. .	.10	. . .	.40	.	. .	. .
.644	0.96	0.92	0.54	.55	0.02	93		0.01	. .
.700	.98	.98	70	.73	.96	98	0.02	.71	0.20
.775	.98	.98	81	.82	98	99	.18	.99	0.98
.85	.98	.98	.88	.87	.98	.99	.41	.99	.97
.95	.98	.98	.92	.91	.98	99	74	.99	.92
1.05	.98	98	.94	93	.98	.99	.91	.99	.80
1.15	.98	.98	95	94	.99	.99	96	.99	.62
1.30	.98	.98	.97	.96	.99	99	.97	.99	38
1.45	.98	.98	.97	.97	99	.99	.98	.99	.25
1.60	.98	.98	98	.98	.99	.99	.99	.99	.19
1.80	98	98	.98	.98	.99	.99	.99	.99	.20
2.00	.98	98	.98	.99	99	99	.99	.99	.27
2.40	96	.95	.94	.97	.97	.96	.99	97	.45
3.00	.65	.65	.56	67	.58	.63	.85	.58	. .

TRANSMISSION OF COLORED GLASSES (Continued)

SECTION II.—JENA GLASSES (Continued)

Wave-length μ	NG 1 v. dk neut. 0.1 mm	NG 2 med. dk neut. 0 1 mm	NG 3 dk. neut. 1 mm	NG 4 med. neut. 1 mm	NG 5 neut. 1 mm	NG 6 light neut. 1 mm	NG 7 blue-gray 1 mm
.281	...	0.05	.	..	.	...	.
.302	...	30		.	..	.	.
.312	...	.36		.	...	...	..
.334	...	.46		..	0 02	0 07	0 01
.366	0.21	.47	0 02	0 07	.22	.53	17
.405	29	.45	08	.18	.37	89	.37
.436	.32	46	12	.23	43	.92	44
.480	36	.50	15	.29	.46	.89	.34
.509	36	52	.17	.30	.46	.89	29
.546	36	.56	17	31	46	.89	.33
.578	.36	58	.17	31	46	.89	26
.644	37	62	.17	30	46	.87	19
.700	45	77	16	28	.43	.86	34
.775	.50	80	12	.21	34	.85	.34
.85	49	80	08	.17	27	86	29
.95	48	81	07	.14	21	.87	.24
1.05	50	85	07	.14	.19	.89	.21
1 15	54	85	06	.16	19	.91	21
1.30	.59	.86	.09	.21	.22	.93	.21
1.45	.63	.88	.15	.26	26	95	.22
1 60	67	.89	20	30	31	.96	.26
1 80	71	.90	.22	.34	38	96	.34
2.00	73	.91	26	.37	43	.97	40
2.40	.78	93	.34	.39	.48	.96	.44
3 00	72	87	.20	19	21	72	.25

TRANSMISSION OF WRATTEN FILTERS

Data condensed from Wratten Light Filters, published by Eastman Kodak Co., manufacturers of the filters.

The following pages give the percent transmission for the dyed gelatin only, unless otherwise indicated. Values for the transmission for wave lengths less than 0.40μ and greater than 0.70μ are computed from density curves while the values for the visible spectrum are taken directly from transmission tables. The values thus computed for the transmission in the ultraviolet and infrared are necessarily less accurate and are intended only as a general guide to the characteristics of the filters. These values are printed in italics.

In case the gelatin filters are cemented between sheets of glass the transmission at any wave length will be the product of the filter transmission and the transmission of glass for that wave length. See No. 00.

To save space the name, use and stability of the filters are indicated in the list below. The following abbreviations are used:

abs., absorbs	neut., neutral	sl., slightly
compl., complementary	ortho., orthochromatic	trans., transmits
exp., experimental	phot., photography	uns., unstable
ir., infrared	s., stable	uv., ultraviolet
m.s., moderately stable	sens., sensitive	v.s., very stable

No.	Name, use and stability
	Colorless
00	Two pieces of "B" glass cemented together, such as ordinarily used for mounting gelatin filters.
0	Plain gelatin, focusing, s
1	β-Naphtholdisulfonic acid, abs. uv., m s.
2	Aesculine, abs. uv, uns. (turns brown).
2A	———, abs. uv., s.
	Yellow
3	Aero No. 1, aerial phot, v.s.
3N5	———, ortho, Aero No 1 with neut. density, v s
4	Kodak color filter, ortho, v.s
5	Aero No. 2, aerial phot, v.s.
5N5	———, ortho., Aero No. 2 with neut. density, v.s.
6	K1, ortho., v.s
7	K1½, ortho., v.s.
8	K2, ortho., v.s.
9	K3, ortho., v s.
11	X1, ortho, v.s.
12	Minus blue, compl., v.s.
13	X2, ortho., v.s.
15	G, contrast, v.s.
16	Flavazine T, contrast, v.s.
17	Quinoline yellow, trans. uv, abs. violet, s.
18A	Ultraviolet, trans uv and ir. only, s. Glass filter
	Orange and Red
21	Monobromofluoresceine, contrast, m.s.
22	E2, contrast, m.s.
23	E red, contrast, m.s.
23A	E red (light), exp. tricolor projection, m.s.
23B	Two-color red, additive projection, m.s.
24	Projection red, additive tricolor projection, m.s.
24A	Projection red (light), projection, m.s.
25	A (tricolor red), contrast, m.s.
26	Stereo red, for anaglyphs, m.s.
27	Stage red, exp. tricolor, s.
27A	Stage red (light), exp. tricolor, s.
28	Ciné red, two-color taking, s.
29	F, contrast, m.s. (darkens sl.).
	Magenta and Violet
	Transmitting both red and blue
30	Rose bengal, absorption, uns.
30A	Q, absorption, m s.
31	Minus green 1, absorption, sl. uns.
32	Minus green 3, compl., m.s.
33	Xylene red, absorption, s.
34	D (light), absorption, sl. uns.
35	D, contrast, m.s.
36	Methyl violet B.B.R., absorption, m.s.
	Blue and Blue Green
38	Toluidine blue, absorption, v.s.
38A	Dark toluidine blue, absorption, v.s.
39	Duplicating, contrast, s. Glass filter

TRANSMISSION OF WRATTEN FILTERS (Continued)

No.	Name, use and stability
40	Ciné green 1, two-color taking (tungsten source), m.s.
40A	Ciné green 2, two-color taking, m.s.
43	Minus red 2, absorption, sens. to heat.
44	Minus red 4, compl., m.s (not sens. to heat).
44A	Minus red 5, compl., m.s. (not sens. to heat).
45	H, contrast, m s. (darkens).
45A	Blue green, contrast, m.s. (darkens).
46	η-Blue, contrast, m.s. (darkens).
47	C5 projection blue, projection tricolor (standard tricolor), s.
47A	Stage blue, exp. tricolor, s.
48	C2, absorption, s.
48A	C3, absorption, s.
49	C4, contrast, s.
49A	C4 (light), exp. tricolor, s.
49B	C4 (dark), exp. tricolor, s.
49C	C4 (extra dark), exp. tricolor, s.
50	L, contrast, m.s.
	Green
51	Naphthol green 1, absorption, v s.
52	Naphthol green 2, absorption, v s.
53	Naphthol green 3, absorption, v s.
54	Naphthol green 4, absorption, v s.
55	Stereo green, viewing for anaglyphs, s.
56	B3, absorption, s.
57	B2 (light), absorption, s
57A	B2 (extra light), exp. tricolor, s.
58	B2, contrast, s.
58A	B2 (dark), s.
59	Projection green, tricolor for additive projection, s.
59A	Projection green (light), exp tricolor, s.
60	P, contrast, s.
61	N, contrast, s.
62	Mercury green, mercury monochromat, s.
63	ϵ-Green, absorption, s.
64	Minus red 3 (light), absorption, s.
65	Minus red 3, absorption, s.
65A	Minus red 3 (intermediate), absorption, s.
66	Rapid filter green, absorption, s.

No.	Name, use and stability
67	Filter blue green, absorption, s.
68	Fast green blue shade, absorption, s.
69	Two-color blue green, additive projection, s.
	Monochromatic
70	α-(contrast R), deep red monochromat, m.s.
71A	β, orange red monochromat, m s.
72	γ, orange yellow monochromat, m.s.
73	δ, yellow green monochromat, s.
74	ϵ, pure green monochromat, s
75	η, blue green monochromat, m.s.
76	θ, violet monochromat, m s
77	Mercury vapor monochromat, v.s. Cemented in glass.
77A	Mercury vapor monochromat, v.s. Cemented in glass.
	Photometric
78	Bluish, photometric, s.
78AA	———, photometric, s.
78A	———, photometric, s.
78B	———, photometric, s.
78C	———, photometric, s.
79	———, photographic compensator, m.s.
80	———, kodachrome for photoflood, s.
86	Yellowish, photometric, m s
86A	———, photometric, m.s.
86B	———, photometric, m.s
86C	———, photometric, m s
	Miscellaneous
87	Extra dark infrared, absorption, v.s.
88	Infrared (R. W. Wood), absorption, v s.
88A	Infrared, absorption, v s.
89	Signaling red (light), absorption, s.
89A	Signaling red (dark), absorption, s.
90	Monochromatic viewing, s.
91	Z (infrared), absorption, m s.
96	Neutral, m s.
97	Dichroic, absorption, m.s.
97A	Dichroic (light), absorption, m.s.
97B	Dichroic (extra light), absorption, m s.

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	00	0	1	2	2A	3	3N5	4	5	5N5	6	7	8
0.24μ		*3*											
.26		*3.2*				*1*					*2*		
.28		*5.2*									*1.0*		
.30		*43*									*13*	*4.2*	
.32	*2.5*	*58*									*22*	*5.2*	
.34	*30*	*69*				*3*	*2*				*17*	*1.4*	
.36	*65*	*79*	*27*			*2*	*3*				*11*	*.6*	
.38	*85*	*83*	*78*	*4.0*							*9.3*	*.3*	
.40	92	85.0	85.0	30.0							8.91	.24	
.42	92	86.0	86.0	62.8	54.3						12.3	.62	
.44	92	87.0	87.0	79.5	83.0		.10				20.9	2.40	
.46	92	87.8	87.8	84.5	86.0	39.9	15.7	2.50			38.0	11.5	1.58
.48	92	88.5	88.5	86.5	87.5	82.2	33.9	70.4	8.81	1.57	63.0	42.5	25.1
.50	92	88.9	88.9	87.5	88.4	86.2	29.5	81.0	47.9	15.8	81.5	70.5	58.8
.52	92	89.3	89.3	88.3	89.1	87.5	27.0	85.5	74.1	25.7	85.0	82.5	79.0
.54	92	89.5	89.5	88.9	89.5	88.2	28.9	87.2	82.1	28.8	87.4	85.5	84.5
.56	92	89.7	89.7	89.3	89.7	89.2	32.4	88.0	84.8	32.3	88.2	86.6	86.0
.58	92	89.9	89.9	89.6	89.9	89.5	33.2	88.8	86.0	33.1	88.9	87.4	87.2
.60	92	90.0	90.0	89.8	90.0	89.7	32.3	89.3	87.0	32.3	89.4	88.2	88.2
.62	92	90.0	90.0	90.0	90.0	89.9	29.5	89.7	87.6	30.2	89.7	88.7	88.9
.64	92	90.0	90.0	90.0	90.0	90.0	28.8	89.9	88.0	28.8	89.9	89.3	89.5
.66	92	90.0	90.0	90.0	90.0	90.0	28.2	90.0	88.4	28.8	90.0	89.8	89.8
.68	92	90.0	90.0	90.0	90.0	90.0	28.2	90.0	88.8	28.8	90.0	90.0	90.0
.70	92	90.0	90.0	90.0	90.0	90.0	28.8	90.0	89.0	30.1	90.0	90.0	90.0
.72													
.74													
.76													
.78													
.80													
.82													
.84													
.86													
.88													
.90	*92*												

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	9	11	12	13	15	16	17	18A	21	22	23	23A	23B
0.24μ													
.26							*5*						
.28							*1.5*						
.30		*.3*	*6*				*.2*						
.32		*.5*	*2 0*	*.4*	*9*		*4.8*	*3.0*					
.34		*.1*					*35*	*20*					
.36							*50*	*36*					
.38							*17*	*25*					
.40							1 59						
.42		.20					12						
.44		1 00		45			07						
.46		7 00		3 62			1 97						
.48	10 0	26 9		25 2			80 0						
.50	33 3	52.5	2 50	50 0			85 0						
.52	58 8	61 6	50 1	57 5	29 0	10	87 2						
.54	76 6	51 4	81 5	51 5	76 0	52.4	88 7		4 44				
.56	82 5	41 6	85 5	39 9	84 0	82 0	89 5		60 2	23 4		10	
.58	85 7	31 6	88 4	25 2	86 5	85 5	89 9		84 0	72 3	34 7	56 4	20.2
.60	88 0	21 9	89 2	13 8	88 2	87 5	90 0		87 5	85 0	76 0	80 8	60 0
.62	88 9	14 7	89 8	6 60	89 2	88 7	90 0		89 0	87 2	82 0	86.2	66 0
.64	89 5	10 5	90 0	2 69	89 8	89 6	90 0		89.6	88 7	85 0	87 8	69.0
.66	89 8	9 12	90 0	1 57	90 0	90 0	90 0		90 0	89 5	87 0	88 8	70 8
.68	90 0	8 72	90 0	4 07	90 0	90 0	90 0		90 0	90 0	87 7	89 0	71 8
.70	90 0	8 72	90 0	5 64	90 0	90.0	90 0	*.3*	90 0	90 0	88 0	89 0	72 0
.72								*4 3*					
.74								*8 3*					
.76								*5 9*					
.78								*2 6*					
.80								*1.0*					
.82								*.3*					
.84													
.86													
.88													
.90	. . .	. . . . .	. . . .	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . .	. . .	.		

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	24	24A	25	26	27	27A	28	29	30	30A	31	32	33
0.24μ													
.26									.4				
.28									1.9	4		1 0	
.30									3 1	2 1		4 0	
.32									5 0	1 2		17	
.34									14	7	6 2	30	.1
.36									32	7	3.1	32	.6
.38									54	3 0	16	35	5 0
.40									63 3	4 50	16 2	42 8	1.80
.42									57 6	4 20	20 8	53 6	1 40
.44									45 8	2 90	38 9	65 1	10 0
.46									29 5	99	39 7	63 1	10 0
.48									7 95		6 60	40 0	10
.50												13 8	
.52												62	
.54							10						
.56						40	38		4 00	1 00			
.58	3 90	15.1	.16		10.2	27 6	10 9		63 1	33 0			
.60	60 2	68 7	50 1	33 1	61 9	66 0	54 8	39	81 2	68 0	23 0	31 6	
.62	80 0	82 7	80 5	76.8	81.5	84 0	80 0	31 6	86 0	82 0	75 8	78 0	39 6
.64	84 2	85.5	85 5	84 6	86 0	87 0	85 5	71 0	87 4	86 2	84 5	84 2	80 0
.66	86 5	87 0	87 0	87 0	87 7	88 0	87 5	82 0	88 0	87 5	87 2	86 5	84 5
.68	87 5	87 2	87 0	87 0	88 0	88 0	88 0	84 5	88 0	88 0	88 0	87 7	86 5
.70	88 0	88 0	87 0	87 0	88 0	88 0	88 0	85 0	88 0	88 0	88 0	88.0	87.0
.72													
.74													
.76													
.78													
.80													
.82													
.84													
.86													
.88													
.90													

λ	34	35	36	38	38A	39	40	40A	43	44	44A	45	45A
0.24μ													
.26				*6*	*2*								
.28	*.5*			*1 7*	*.4*								
.30		*.1*		*3.5*	*.5*	*.2*			*.6*	*3*			
.32	*2.5*	*.8*		*6 3*	*7*	*32*			*10*	*.8*	*.3*		
.34	*16*	*17*	*3*	*12*	*1 4*	*72*			*26*	*3 1*	*2 1*	*1 9*	
.36	*31*	*30*	*7*	*25*	*10*	*87*			*48*	*5 8*	*10*	*2 9*	*.6*
.38	*42*	*39*	*2 5*	*44*	*21*	*89*			*68*	*6.2*	*10*	*1.0*	*.3*
.40	54.9	56.4	18.7	57.6	33 8	85 2			74.0	5.00	5 98		
.42	63.0	51.3	15 0	66.0	43 5	70 5			70 4	6 05	5.00		
.44	53 4	27.6	4 45	70 2	49.0	53.6			64 2	27 3	30.2	18 2	7.10
.46	28 2	6.25	.35	71 5	50.1	35 3	5.24	.80	57 6	42 5	48.6	34.7	20 7
.48	7 08			69 4	46 9	10 2	54 9	18 2	51.2	52 4	50 0	41.5	22.5
.50				65 0	39 7	1.33	72 5	49 0	44.3	56 4	42 5	34 9	14 4
.52				60 2	31 6		71 8	60 2	35 4	46.9	29 5	16 9	4 40
.54				53 6	23 8		60 0	57 6	21 9	26 8	16.0	2 40	.12
.56				42 5	15 0		36 1	37 9	9 56	9 32	5 00		
.58				31 6	8.31		11 8	19 5	2.95	.27	.16		
.60				21 7	3 62		1.95	7 08	.35				
.62				14 1	1.50		.28	2 18					
.64	57			10 0	.62			.33					
.66	14 7	14 1		8 80	42								
.68	49 0	47 9	6.30	8 31	.39	50	1 97	3 17					
.70	79.4	63 1	33 0	7.95	37	17 8	15 7	10 0	10 0		1.00	*.5*	
.72											*4.9*	*1.5*	
.74											*10*	*2 3*	
.76											*18*	*2.9*	
.78											*29*	*4 3*	
.80											*42*	*10*	
.82											*54*	*21*	
.84											*65*	*36*	
.86											*72*	*52*	
.88											*76*	*69*	
.90											*79*	*74*	

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	46	47	47A	48	48A	49	49A	49B	49C	50	51	52	53
0.24μ													
26											*1.1*		
28											*3 0*		
.30											*5.1*		
.32	*.1*			*4*							*8 9*		
.34	*7*			*1 2*			*2*				*15*		
.36	*2 2*	*1 5*	*4*	*2 3*	*3*	*4*	*1 8*			*1*	*26*	*.2*	
.38	*3.5*	*10*	*3 0*	*6 0*	*5 0*	*3.9*	*9 1*	*1 7*	*1*	*1 5*	*45*	*1.3*	
40	2 09	25 1	12 3	2 69	8 31	5 76	12 0	2 29	65	46	55 1	1 83	
.42	2 50	49 0	28 2	3 32	15 5	9 75	16 5	3 99	1 42	77	45 8	.80	
44	13 8	48 0	31.6	19 1	25 5	20 0	36 2	10 0	6 03	8 71	36 1	37	
.46	31 0	43 7	26 2	36 9	25 0	26 2	41 6	15 1	8.28	14 4	39 6	.80	
.48	28 7	30 3	13 5	26 2	12 0	10 4	27.6	3 99	1.97	1.97	49 4	5 24	.93
.50	10 7	12 5	3 30	9 10	2 23	.49	7 75	10			60.1	14 4	5 25
.52	1 58	1 30	.10				18				70 0	25 1	12 0
.54											75.6	31 6	18 9
.56											74 2	31 6	14 4
.58											71 0	18 2	6 45
.60											60 6	6 61	1 30
.62											52 4	2 09	.15
.64											45 8	83	
.66											40 2	44	
.68											37 8	22	
.70							31				36 9		
.72		*2.5*											
.74		*11*											
.76		*31*											
.78		*55*											
.80		*72*											
.82		*83*											
.84		*89*											
.86		*91*											
.88		*91*											
.90		*91*											

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	54	55	56	57	57A	58	58A	59	59A	60	61	62	63
0 24μ													
.26													
.28			2										
.30			.3		7			1 0	2 6	.2			
.32				.1	7			1 1	2 7	.3			
.34								8	1 2	.2			
.36								3	.6				
.38									.4				
.40									.37				.22
.42								11	.62				
.44								37	1 69				
.46			1 00	51	2 40			3 63	6 92	2 50			
.48		10.7	21 7	15 8	22 9	1 97		24 6	28 0	19 1			5 89
.50		52.4	52 4	53 9	57 6	30 3	18 2	60 2	63 1	49 0	17.8		15 2
.52	31	72 4	68 9	60 0	69 4	60 2	39 4	68 9	74 5	58 8	47 9	8 00	17 3
.54	89	54 7	63 1	55 6	56 4	39 0	31 6	57 6	66 0	49 6	47 9	10 9	7.25
.56	62	33 0	51 3	41 8	34 7	25 1	14 9	39 4	52 4	25 1	25 7	1.46	.77
.58		12 0	37 3	19 6	15 8	10.0	3 32	20 4	36 4	6 75	6 30		
.60		1 83	25 1	6 30	6 45	2.82	.16	8 52	21 4	.77	.51		
.62		.18	11 5	1 38	2.09	.57		2 24	9 35				
.64			1 97		31			10	1 42				
.66			1 21		20				1 26				
.68		1.97	13 8	5 00	2 86			5 36	10 0				
.70		26 2	50 1	31 0	7 48	1 97	73	19 8	30 2	2 50			
.72													
.74													
.76													
.78													
.80													
.82													
.84													
.86													
.88													
.90													

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	64	65	65A	66	67	68	69	70	71A	72	73	74	75
0 24μ													
.26				*2*									
.28	*2*			*1 2*		*1*							
.30	*6*			*10*		*3*	*3*						
.32	*1 1*		*2*	*15*		*1 0*	*1 2*						
.34	*2 1*	*1*	*1 5*	*16*	*.1*	*12*	*1 9*						
.36	*4 4*	*1 0*	*1 9*	*13*	*5*	*26*	*2 2*						
.38	*7 6*	*2 4*	*1 0*	*11*	*1 3*	*19*	*1 9*						
.40	11 7	2 98	36	10 4	2 86	6 64	1 34						
.42	15 1	1 83	39	11 9	5 00	4 57	1 60						
.44	19 9	3 57	5 00	18 2	10 0	10 7	11 5						
.46	31 6	9 40	20 4	36 4	22 3	28 3	25 7						.80
.48	50 1	22.3	37 9	58 8	35 5	38 0	45 7						17.3
.50	60 2	33 0	45 5	76 1	44 6	35 3	62 9						14.1
.52	52 4	25 9	30 7	84 5	41 5	24 0	62 9					8.00	1.26
.54	36 2	11 5	11 7	82 8	28 8	10 0	40 7					10.1	
.56	20 4	3 63	1 18	70 6	13 4	1 35	15 4				2 50	1.14	
.58	8 17	.44		56 0	4 16		3 11				5 68		
.60	2 40			37 8	70		.33			3.78	1 15		
.62	44			19 1					7 05	2.86	.15		
.64				4 44					10.0	.78			
.66				3 17				10 0	7 95	.37			
.68				26 8		1 26	2 23	39 8	6.60	1.24	.15		
.70			2 10	57 6		25 0	6 05	74.5	7.95	11.5	6.30		.24
.72												*.2*	*.3*
.74												*7*	*.4*
.76												*2.1*	*.6*
.78												*5.1*	*1.3*
.80												*16*	*3.8*
.82												*30*	*9.6*
.84												*49*	*21*
.86												*68*	*34*
.88												*74*	*46*
.90												*79*	*62*

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	76	77	77A	78	78AA	78A	78B	78C	79	80	86	86A	86B
0.24μ							2						
.26						1 1	1 8	2 1		4 8		1	1 3
.28				.1	5	3 4	5 2	5 9		10	2	1.9	4 2
.30				.4	2 0	7.9	13	16		16	9	8 1	21
.32				1 0	4 4	14	21	27	2	22	1 0	11	29
.34	5			3 0	8 1	24	34	38	8	31	3	6 2	26
.36	1 2			16	21	35	46	47	5 1	49		3 2	21
.38	1 9			32	41	48	54	58	15	68		3 5	22
.40	2 29			43 5	51 3	55 0	60 6	66 0	23 4	72 6	48	10 0	34.7
.42	2 79			50 0	58 0	59 0	64 5	69 0	28 0	74.5	3 60	25 7	47.6
.44	9 15			49 0	58 0	59 5	64 5	70 0	29 9	75 5	9.30	37 3	55 0
.46	4 46			42.7	51.3	57 0	63 2	70 0	29 7	75 4	15 8	43 8	61.9
.48				33 0	40.7	52.5	60 0	69 5	26 8	72 5	21.6	48.5	66 8
.50				25 1	31.5	47.9	56 4	69 0	22 3	67 7	27 1	52 4	71.0
.52		12 5	4 36	17 8	24 0	43 8	52 8	66 0	17 8	64 0	33 0	57 6	74 5
.54		55 8	46 9	12 5	19 0	39 0	50 0	63 0	14 4	57 5	42 5	64 0	77.6
.56		72 4	57 6	9 10	15 9	35 5	47 9	59 5	11 5	52 0	55 2	70.5	80.5
.58		42		7 00	13 7	31 6	45 5	56 4	8 70	46 5	65 5	77 8	83.0
.60		14 4	1 26	6 30	12 3	28.8	43 8	54 8	6 40	40 6	77 0	82 7	85.0
.62		66.1	63 2	4.90	11.0	26 3	41 8	52 8	4 10	37 5	84.2	85 3	86 4
.64		79 4	74 0	4 00	9 10	24 6	40 7	51 6	3 00	35 5	86 2	86 8	87 5
.66		83 0	77 7	3 60	7 43	22 9	39 8	51 7	2 68	34 5	87 4	87 7	88 3
.68		83 0	79 4	3 70	7.43	21 9	39 6	54 8	2 82	34 5	88 0	88 0	88 9
.70	46	83 0	79 4	4 50	8 59	25 8	39 6	59 7	3 15	34 5	88 0	88 0	89.0
.72	8			10									
.74	1 0			30									
.76	1.4			59									
.78	2.6			72									
.80	7 9			74									
.82	19			74									
.84	34			74									
.86	46			74									
.88	56			74									
.90	65			76									

TRANSMISSION OF WRATTEN FILTERS (Continued)

λ	86C	87	88	88A	89	89A	90	91	96	97	97A	97B
0 24μ												
.26	*3 9*											
.28	*9 6*											
.30	*28*						*4*					
.32	*41*						*1 0*		*1*			
.34	*44*						*1 1*		*5*			
.36	*36*						*7*		*2 2*			
.38	*39*								*4 6*			
.40	52 4								6 72			
.42	63.3								7.96			
.44	71 9								8 12			
.46	77 7								7.85			
.48	80.5								7 43	1 00	1 80	3.50
.50	82.6								7 23	1 00	1.59	3.50
.52	84.2								7 23	16	.40	1.69
.54	85.2								7 85			.72
.56	86 1						12 5		8 12		.12	.67
.58	86 8						33 0		8.12			.31
.60	87 3						15 8		7 58			
.62	87 9						6 70		7.08			
.64	88.3						1 00		6 93			
.66	88 7				5 00		64		6 93		.44	.59
.68	89.0				33 0	62	11 2	3 17	7 30	5 00	5.00	5 60
.70	89.0		5.00		64 6	20 2	57 6	14 4	7.85	41 5	20.2	26.9
.72			*28*	*1*					*10*			
.74		*1*	*69*	*38*					*11*			
.76		*8.5*	*91*	*69*					*13*			
.78		*31*	*91*	*72*					*16*			
.80		*54*	*93*	*74*					*21*			
.82		*68*	*94*	*76*					*28*			
.84		*76*	*96*	*78*					*37*			
.86		*81*	*96*	*79*					*45*			
.88		*84*	*96*	*81*					*47*			
.90		*85*	*96*	*83*					*49*			

TRANSMISSIBILITY FOR RADIATIONS

Ratio of the transmitted light to the incident light for a definite thickness of the substance, usually 1 cm.

Glass.

Glass in general is opaque to the ultra-violet and infra-red. Uviol glass is transparent to the longer radiations of the ultra-violet.

Coefficient of transparency of glass for visible and ultra-violet radiations.

	Normal incidence, thickness 1 cm.								
Wave length microns	0.309	0.330	0.347	0.357	0.361	0.375	0.384	0.388	0.396
Crown, ordinary	...	...	...	...	...	.947			
Crown, borosilicate	0.08	0.65	0.88	...	0.95	...	0.972	0.975	0.986
Flint, ordinary	...	...	...	0.72	...	...	...	0.904	
Flint, heavy	...	...	0.01	...	0.16	...	0.58		

	Normal incidence, thickness 1 cm.								
Wave length, microns	0.400	0.415	0.419	0.425	0.434	0.455	0.500	0.580	0.677
Crown, ordinary	0.964	...	0.952	...	0.960	0.981	...	0.986	0.990
Crown, borosilicate	...	0.985	...	0.993	...	...	0.993		
Flint, ordinary	...	0.959	...	...	...	...	1.00		
Flint, heavy	...	...	...	0.905					

Quartz

Quartz is very transparent to the ultra-violet and to the visible spectrum, but opaque for the infra-red beyond 7.0μ.

(Pflüger.)

Wave length, microns	0.19	0.20	0.21	0.22
Transmission for 1 mm	.67	.84	.92	.94

Fluorite

Fluorite is very transparent to the ultra-violet, nearly to 0.10μ. Coefficient of transparency at $\lambda = 186$ is found by Pflüger to be 0.80.

For the infra-red the values are given in a table below.

TRANSMISSIBILITY FOR RADIATIONS (Continued)

Rock Salt and Sylvine and Fluorite

Transparency for the Infra-red.

Thickness 1 cm.

Wave length, microns.	Rock salt.	Sylvine KCl.	Fluorite.
8.	....	....	.844
9.	0.995	1.000	.543
10.	.995	.988	.164
12.	.993	.995	.010
14.	.931	.975	.000
16.	.661	.936	
18.	.275	.862	
19.	.096	.758	
20.7	.006	.585	
23.7	.000	.155	

PHOSPHORESCENCE BY CATHODE RAYS

Substances Luminous under Excitation by Cathode Rays.

Substance (with calcium oxide).	Wave lengths of principal bands in microns (Urbain, 1909.)
Dysprosium oxide........	0.480, 0 489, 0.585, 0.675
Europium oxide.........	0.416–0.426, 0.469
Europium oxide.........	0.589–0.593, 0.613, 0.625
Neodymium oxide......	0.392, 0.419–0.429, 0.458
Praesodymium oxide......	0.488, 0.604, 0.606, 0.626, 0.634

One part.	100 parts.	Wave length.	Color.	Observer.
Antimony oxide..	calcium oxide	0.560	yellow	Bruninghaus, 1910
Antimony trisulphide	calcium sulphide	0.569	yellow	Bruninghaus, 1910
Bismuth oxide..	calcium oxide	0.522	blue	Bruninghaus, 1910
Bismuth sulphate.	calcium sulphate	0.640	red	Bruninghaus, 1910
Manganous carbonate.. ...	magnesium carbonate	0.620	red	Bruninghaus, 1910
oxide.	calcium oxide	0.589	yellow	Lecoq & Boisbaudran, 1886
phosphate...	calcium phosphate $Ca_3(PO_4)_2$	0.633	red	Bruninghaus, 1910
sulphate......	calcium sulphate	0.540	green	Lecoq & Boisbaudran, 1886
sulphide.......	calcium sulphide	0.589	yellow	Bruninghaus, 1910

FLUORESCENCE OF ORGANIC SUBSTANCES IN SOLUTION

Excitation by White Light.

Substance.	Solvent.	Wave length microns.	Observer.
Anthracene	alcohol	0.400 0.430 0.436	Stark & Meyer, 1907
Eosine	alcohol or water	0.589	Nichols & Merritt, 1907
Esculine	alcohol	0.460	Nichols & Merritt, 1907
Fluorescein	water (alkaline)	0.542	Nichols & Merritt, 1907
Naphthalin, red	alcohol	0.632	Nichols & Merritt, 1907
Quinine sulphate	water	0.437	Nichols & Merritt, 1907
Resorcin blue	water	0.65	Nichols & Merritt, 1907
Rhodamin	water	0.554	Nichols & Merritt, 1907

FLUORESCENCE

Gases and Vapors.

Gas or vapor.	Condition.	Excitation.	Color or wave length of emitted light.	Observer.
Iodine	Vapor at ordinary temperature.	Mercury arc $\lambda = .546\mu$	Strongest bands $\lambda = .5460\mu, .5774\mu$ .5730, .5796	Wood, 1911
Mercury	Vapor at ordinary temperature	Spark between aluminum electrodes	Broad band $\lambda = .5900-.3000$	Wood, 1909
Oxygen	. . . .	Mercury arc in quartz tube	Strongest lines $\lambda = .1849, .1851$ (ultra-violet)	Streubing, 1910
Potassium	Vapor, 300°–400° C.	White light	Many strong lines from .6416–.6768, strongest .6544 and .6584	Wood & Carter, 1908
Rubidium	Vapor, at 270° C.	White light (elec. arc)	Strong red band $\lambda = .6900-.6620$.	Dunoyer, 1912
Sodium	Vapor at 350° C.	White light (elec. arc)	D, $\lambda = .5893$ (mean)	Dunoyer, 1912

FLUORESCENT SUBSTANCES

By Jack De Ment

The emission of light from matter under the influence of an exciting agent is termed fluorescence. When emission persists after removal of the exciting agent the process is termed phosphorescence. Both are practically identical, except in the duration of light emission, and may harmoniously be explained on the same basis. Luminescence is the term covering both phenomena, although candoluminescence, emission due to incandescent heat, may also be included. Fluorescence is classified according to the exciting agent(s) and special terms are derived therefrom.

Excitation includes over 30 processes by which energy is introduced into, and/or released from, the luminescent system; visible light (photoluminescence); low temperature heat (thermoluminescence); friction (triboluminescence); cold (baroluminescence); ion streams (ionoluminescence); cathode rays (cathodoluminescence); crystallization (crystalloluminescence); sound waves (sonoluminescence); Hertzian waves; radioelement radiations, e.g., alpha, beta (positrons), and gamma rays (radio-luminescence, etc.); neutrons; metabolic processes (bioluminescence); and a large number and wide variety of chemical reactions (chemiluminescence); etc. Terms such as radiophotoluminescence and tribothermoluminescence denote the exciting action of more than one agent.

Ultraviolet light is used with most success in ordinary studies on luminescent substances. Most effectively suited for general excitation of inorganic chemicals, phosphors, certain minerals, etc., whose exact absorption characteristics are unknown, is short wavelength ultraviolet light (Hg = 2537A, resonance radiation) filtered through a medium (usually glass) possessing peak transmission in this region and minimal transmission elsewhere, especially in the visible. For general excitation of organic and metal-organic compounds, and a few minerals, as well as tissues, long wavelength (Hg = 3650A) radiation is employed. All ultraviolet light must be filtered before adequate results are obtained.

Slight discordance is noted in the fluorescence of certain substances, especially in minerals and impure inorganic chemicals. Fluorescence may be affected by purity, age and source of the compound, particle size, water-content, and the solvent and concentration of solute. A great many substances, however, emit characteristic fluorescence which serves for detection and estimation in extremely small amounts, particularly after treatment with solvents, acids, or alkalis. The science of fluorochemistry embraces the applications of fluorescence and ultraviolet light to chemistry. The references should be consulted for additional details on fluorescent chemicals and fluorochemical analysis.

The following table gives the character of fluorescence for various substances when excited by radiation of wave length 3650 angstrom units, except where otherwise noted.

Key to Abbreviations

acet.	acetone	KOH..	potassium hydroxide
alk	alkalis, alkaline	l....	light
al	ethyl alcohol	m..	medium
	bright	oxid.	oxidation
bz	benzene	oxy	oxyacids
d	dark	p..	pale
dil.	dilute	s..	strong
dl	dull	sl	slight
dp	deep	soln.	solutions
H_2O..	water	xyl..	xylene

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Abietic acid	green	—	4, 6
Acetaldehyde	blue-green	—	4
Acetanilid	bluish-violet	—	4
Acetoacetanilid	b. blue-white	—	4, 6
Acetophenone	brownish	—	2, 4
p-Acetylaminophenol	whitish	—	4
Acetyl homoumbelliferone	blue	KOH	7
2-Acetyl purpurin	yellowish	—	7
Acetylsalicylic acid	p. blue	—	4
Acridine	green	H_2O	4
Acridine picrate	yellow-green	H_2O	4, 6
Acridone	s. blue	al.	4
Acrylic aldehyde	bluish	—	4
Adenine sulfate	blue-white	—	4, 8
Ajacine	blue	al.	6
β-Alanine	purple-blue	—	4
dl-Alanine	rose-white	—	4
Alizarin	yellow	—	1
Aloin	red-yellow	—	4
Alloxan	violet	—	4
Allylamine picrate	crimson	—	4
Aluminum distearate	b. blue	—, xyl.	4
Aluminum monstearate	b. blue	—, xyl.	4
Aluminum palmitate	blue-white	—	4
Aluminum tristearate	b. blue	—, xyl.	4
Ambergris	m. blue	al.	4
Aminoacetal picrate	b. red-orange	—	4
p-Aminobenzoic acid	blue	—	4
2-Amino-5-chlorobenzoic acid	b. blue-white	—	4
Aminohydrastin	s. blue	—	1
Aminophyllin	s. blue-green	—	4
Aminopyrine	s. blue	—	4
Ammonium acetate	blue	—	4
Ammonium benzoate	blue	—	4
Ammonium mandelate	b. blue-white	—	4
Ammonium salicylate*	s. blue	—	1, 4
Amyl salicylate	purple	—	4
Anemonine	yellowish	—	4
Anisic aldehyde	p. brown	—	4
Anthracene	l. blue	—	4
Anthracene [+ chrysene]	brilliant green	—	4
Anthracene-1-carboxylic acid	blue	alk.	7
Anthracene-2-carboxylic acid	blue	alk.	7
Anthracene-1, 9-dicarboxylic acid	bluish	acids	6
Anthralin	green	NaOH soln.	7
Anthraquinone	orange	—	4
Apoharmine	green	H_2SO_4 + formalin	7
Apomorphine	b. blue	—	4
Apoquinine	violet	—	4
Arecoline	purplish	—	4
Arecoline hydrobromide	lavender	—	4
l (+)-Arginine monohydrochloride	s. lavender	—	4
Ascorbic acid	lavender	—	4
dl-Aspartic acid	purplish-white	—	4
l(+)-Aspartic acid	purple-blue	—	4
Asterin hydrochloride	bluish	—	6
Atropine	bluish-white	—	4
Atropine sulfate	p. bluish	—	4

* Exciting wave length not given.

Name	Character of fluorescence	Solvent or treatment	References
Auramine	b. yellow	H_2O, etc.	1, 2, 3, 4, 5
Azulmic acid	green	KOH soln.	7
Barium citrate*	bluish	—	4
Barium formate	blue-violet	—	1
Barium platinocyanide	b. green	with H_2O xln.	1
Barium salicylate	s. blue	—	1
Barium stearate	blue-white	—	4
Barium succinate	violet	—	1
4,5-Benzisocoumarancne	green	H_2S_4O soln.	7
Benzocain	blue	—	4
Benzyl acetate	b. violet	—	2
Benzyl ether	greenish-purple	—	4
Benzyl salicylate	violet	—	4
Berberine	yellow	—	1, 5
Berberine hydrochloride	yellow-green	—	4
Beryllium salicylate	s. blue	—	4
Bismuth subgallate	crimson	—	4
Bismuth subsalicylate	sl. lavender	—	4
Boldine	bluish	—	4
Borneol	whitish	—	2
5-Bromosalicylic acid	white	—	4
Butyl acetyl ricinoleate	d. blue-green	—	4
Butyl borate	p. bluish	—	4
Butyl chloride	p. bluish	—	4
Butyl lactate	sl. bluish	—	4
N-Butyl-2-naphthylamine	violet	—	7
Butyl oleate	green-yellow	—	4
Butyl ricinoleate	yellow-green	—	4
Butyl stearate	p. blue	—	4
Butyrone	bluish	—	4
Cadmium 8-hydroxyquinolinate	yellow-green	al.	4
Calcium benzoate	lavender	—	4
Calcium *p*-caseinate	yellow-blue	—	4
Calcium 8-hydroxyquinolinate	dk. green	al.	4
Calcium iodo-di (triethanolamine) theobromine	b. blue-green	—	4
Calcium *o*-iodoxybenzoate	b. blue		4
Calcium linoleate	blue-purple	—	6
Calcium mandelate	blue	—	4
Calcium pantothenate	d. lavender	—	4
Calcium salicylate	blue	—	1, 4
Calcium stearate	s. blue	—	4
Calcium uranyl acetate	greenish-blue	—	9
Campherol	blue	H_2SO_4	6
Carbon dioxide (solid)	blue to violet	—	4
Chlorophyll A	red	—	1, 4
Chlorophyll B	brown-red	—	1, 4
Chromium stearate	lavender-blue	—	4
Cobalt resinate	d. blue	—	10
Cobaltous linoleate	brown-green	—	10
Cobaltous stearate	b. blue	—	4
Cupric salicylate†	green-blue	—	4
Cyanomaclurin	bluish	KOH fusion	6
Decacyclene	green	—	1
Decyl naphthalene	s. blue	—	4
Dehydrocholic acid	violet-blue	—	4
Delphinine	p. green	—	4
Diallyl barbituric acid	violet	—	4

* Exciting wave length not given.
† Exciting wave length 2537.

Name	Character of fluorescence	Solvent or treatment	References
4, 4'-Dibromodiphenyl	white	—	4
Didymium salicylate	lavender	—	4
6, 4'-Dihydroxyflavone diethyl ether*	green	—	7
7, 2'-Dihydroxyflavone diethyl ether	blue	H_2SO_4 soln.	7
3, 6-Dihydroxyxanthone	blue-violet	—	4
1 (−)-Diiodotyrosine dihydrate	purple	—	4
Dilantin	purplish	—	6
Dimethyl phthalate	green	—	4
2, 4-Dimethylpyrrole	blue	—	6, 7
3, 5-Dimethylpyrrole-2, 4-dicarboxylic acid	blue	260°C	6
Di-1-Naphthastilbene	violet	—	7
1', 2', 8', 9'-Dinaphthazine	blue	al., bz.	7
1', 2', 7', 8'-Dinaphthazine	yellow-green	bz	7
2, 2'-Dinaphthyl	blue	—	6
2, 2'-Dinaphthylamine	blue	—	6
1, 1'-Dinaphthyl ether	bluish	—	7
1, 2-Di(2-Xenoxy) ethane	white	—	4
Dodecacyclene	olive green	—	1
Emetine	yellow	—	4
Enanthic aldehyde	b. yellow-blue	—	4
Esculetin	dp. violet	—	1
Erbium salicylate	sky blue	—	4
Ergometrine	blue	—	2
Ergotine	yellow-brown	—	4
Ergotoxine	blue	—	2
Erythrosine	greenish	—, H_2O	2
Erythritol tetranitrate	dp. violet	—	4
Ethanolamine hydrochloride	violet	—	4
Ethyl acetate	p. bluish	—	4
Ethylene glycol monoethyl ether laurate	b. bluish	—	4
Ethylene glycol monoethyl ether ricinoleate	s. green-blue	—	4
Ethylene glycol monoethyl ether stearate	s. yellow-blue	—	4
Ethylene glycol monolaurate	b. blue	—	4
Ethylene glycol monooleate	bluish	—	4
Ethylene glycol monoricinoleate	green-blue	—	4
4-Ethoxyacridone	green	H_2O	4
Ethyl β-naphtholate	violet	—	2
Ethyl salicylate	greenish	—	1, 4
Eucaine	gray	—	4
Ferric 8-hydroxyquinolinate	bluish-black	al.	4
Ferrous 8-hydroxyquinolinate	blue-brown	al.	4
Ferrous stearate	b. crimson	—	4
Flavazin S	b. orange	H_2O	1
Fluorene-2-sulfonic acid	dp. yellow	—	1
Fluorescein	b. green	alk. soln.	1, 2, 4, 5
Fluorescin	b. green	oxid. then KOH	4, 6
Fraxetin	blue-green	—	1
Fraxin	blue-green	—	1
Fumaric acid	l. yellow	—	1
Furfuryl alcohol	d. yellow	—	4
Furfuraldehyde	reddish	—	4
Gallium gluconate	p. blue	—	4

* Exciting wave length not given.

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Gallium 8-hydroxyquinolinate	yellowish	al.	4
Gallium salicylate	b. blue	—	4
Germanium salicylate	b. blue	—	4
l (+)-Glutamic acid	violet-white	—	4
Glutathione	b. lavender	—	4
Glyceric aldehyde	p. blue	—	4
Glyceryl citrate	bluish	—	4
Glyceryl α, γ-diphenyl ether	lavender-blue	—	4
Glyceryl furfural	violet-blue	—	4
Glyceryl α,-mono-*n*-butyl ether	p. blue-green	—	4
Glyceryl monohydroxystearate	p. bluish	—	4
Glyceryl monooleate	b. yellow-blue	—	4
Glyceryl monoricinoleate	blue-green	—	4
Glyceryl monostearate	b. yellow-blue	—	4
Glyceryl phthalate	yellow-blue	—	4
Glyceryl tartrate	b. blue	—	4
Glyceryl tristearate	b. violet-blue	—	4
Glycine	purplish-blue	—	4
Glycol dilaurate	yellow-blue	—	4
Glycollic acid	blue	—	4
Glycol monolaurate [polymerized]	b. blue	—	4
Glycol maleate [polymerized]	blue-yellow	—	4
Glycol monooleate [polymerized]	b. blue-brown	—	4
Glycol monostearate [polymerized]	brown-yellow	—	4
Glycol phthalate [polymerized]	b. bluish	—	4
Glycylglycine	purple-white	—	4
Glycyl-l (−)-leucine	purplish-white	—	4
Glyoxal	blue	—	4
Guanine [free base]	purple	—	8
Guanine hydrochloride	purple	—	8
Harmine	blue	—	3, 4
sym-Hemimellitenol	bluish	—	7
Heroin	yellow-grey	—	4
Heroin sulfate	yellowish	—	4
Hematoporphyrin	red	al, CCl_4, etc	1
Hexaeikosicyclene	olive-green	—	1
Hexamethylenetetramine	l. purple	—	4
Homatropine methyl bromide	lavender	—	4
Homoumbelliferone methyl ether	blue	H_2SO_4	7
Hydrastin	b. greenish	—	1
Hydrastine salicylate	greenish-white	—	4
Hydrastine chloride	b. blue	—	1
Hydrofuramide	b. pink	—	4
Hydroquinone	blue-violet	—	4
Hydroxyperylene	green	—	7
2-Hydroxyphenanthrene methyl ether	blue	—	7
p-Hydroxyphenyl glycocoll	violet	—	4
3-Hydroxyquinoline	bluish	—	6, 7
7-Hydroxyquinoline	green	alk. soln.	7
6-Hydroxyquinoline methyl ether	blue	acids	7
Hyoscyamin	red-violet	—	1
Hypoxanthine	violet	—	8
Indium *o*-iodoxybenzoate	p. lavender	—	4
Indium salicylate	b. blue-green	—	4
α-Ionone	greenish	—	2, 4
β-Ionone	green-brown	—	2, 4

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Isocytosine	violet-white	—	8
Isodibenzanthrone	brown	$PhNO_2$	7
Isoharman	blue-violet	H_2SO_4 soln.	7
Isoguanine	purple-white	—	8
Lanthanum 8-hydroxyquinolinate	yellow-green	al.	4
Lanthanum o-iodoxybenzoate	p. violet	—	4
Lanthanum salicylate	s. blue	—	4
Lead linoleate	d. green	—	10
Lead naphthenate	b. blue-green	—	4
Lead sebacate	b. lavender-white	—	4
Lead stearate	b. blue	—	4
Lithium benzoate	whitish-violet	—	4
Lithium salicylate	b. blue-green	—	4
Lithium stearate	bluish	—	4
Lotoflavin	bluish	KOH fusion	6
Luteolin	bluish	KOH fusion	6
Luteolinidium chloride	green	H_2SO_4	7
l (+)-Lysine dihydrochloride	purple-white	—	4
Lysine hydrochloride	p. purple	—	4
l (+)-Lysine hydrochloride	b. blue	—	4
Magnesium 8-hydroxyquinolinate	golden-yellow	al., H_2O, etc.	4
Magnesium salicylate	purple-green	—	4
Magnesium stearate	blue-white	—	4
Magnesium uranyl acetate*	emerald green	—	9
Malonic acid	bluish-white	—	1
Manganous 8-hydroxyquinolinate	s. green	al.	4
Manganous stearate	dp. rose	—	4
Manganese resinate	d. violet	—	10
Mannitol glyceryl monolaurate	dp. green-brown	—	4
Mannitol glyceryl monooleate	b. brown-blue		4
Mannitol glyceryl monostearate	blue-gray	—	4
Mannitol triricinoleate	dp. green		4
Menthol	greenish		2
2-Mercaptobenzothiazole	reddish-brown	—	4
Mercuric salicylate	greenish	—	1
Mercurochrome	b. green	alk. soln.	5
Mercurophen	s. crimson	—	4
Mercurous benzoate	purple	—	4
Mercury dibromofluorescein	yellow-green	alk. soln.	4
Merieyl alcohol	blue-yellow	—	4
Mesobilirubin	reddish		1
Mesobilirubinogen	reddish		1
dl-Methionine	b. lavender		4
Methyl acetophenone	grey-brown		4
Methyl acridine*	green		11
N-Methyl anthranilic acid	blue	alk. soln.	7
N-Methyl anthranilic acid phenyl ester	blue	—	7
2-Methyl benzanthrone sulfonic acid	yellow		4
Methyl benzyl ether	blue-green		4
5-Methyl chromone	blue	H_2SO_4 soln.	7
6-Methyl chromone	blue	H_2SO_4 soln.	7
7-Methyl chromone	blue	H_2SO_4 soln.	7
β-Methyl esculin	blue	H_2O, etc.	4
2-Methylgenistein	blue-green	H_2SO_4	7

* Exciting wave length not given.

Name	Character of fluorescence	Solvent or treatment	References
Methyl glycolphenetidin	violet	—	4
Methyl hexalin	green-blue	—	4
Methyl hydrastin	blue-green	—	1
Methyl hydrastinine hydrochloride	blue	—	6
4-Methyl indole	blue-green	—	1
7-Methyl indole	yellow-green	—	1
Methyl pentadecyl ketone	blue-brown	—	4
Methyl terephthalic acid	l. blue	—	1
Methyl tridecyl ketone	blue-yellow	—	4
β-Methyl umbelliferone	b. blue	H_2O, al.	4, 6
Methyl undecyl ketone	yellow-blue	—	4
Monoamyl naphthalene	dp. blue	—	4
Monobromoisovaleryl barbiturate	lavender	—	4
Monoethyl glycol ether	blue-yellow	—	4
Morin	blue-green	H_2SO_4	3, 4, 6
Morindin chloride	greenish	H_2SO_4 soln.	7
Morphenol	green	acids	7
Munjistin	green	AcOH	7
Musk ambrette	yellow-brown	—	2
Musk ketone	yellow-brown	—	2
Musk xylol	yellow-brown	—	2
Mycolic acid	blue	—	4
Myosalvarsan	green	alk. soln.	2
Myristic aldehyde	brownish-yellow	—	4
Myristone	yellowish	—	4
Naphthalene	l. blue	—	1
1,8-Naphthalenediamine-3,6-disulfonic acid	green	alk. soln	7
Naphthastyril	green	al	7
β-Naphthol	blue		4
2-Naphthol-1,3,6,7-tetrasulfonic acid	blue-green	alk. soln.	7
2-Naphthol-1,3-7-trisulfonic acid	blue-green	alk. soln.	7
2-Naphthol-3,6,7-trisulfonic acid	blue-green	alk soln	7
2-Naphthol-3,6-8-trisulfonic acid	green	NaOH soln.	7
1-Naphthylamine-2,5-disulfonic acid	blue-green	acids and alk.	7
1-Naphthylamine-2,7-disulfonic acid	bluish	alk soln.	7
1-Naphythylamine-2,8-disulfonic acid	green	alk soln.	7
1-Naphthylamine-3,7-disulfonic acid	blue	acids and alk.	7
1-Naphthylamine-4,6-disulfonic acid	blue	acids and alk	7
1-Naphthylamine-4,7-disulfonic acid	blue	acids and alk	7
2-Naphthylamine-1,6-disulfonic acid	bluish	—	7
2-Naphthylamine-1,7-disulfonic acid	violet-blue	KOH soln.	7
2-Naphthylamine-3,6-disulfonic acid	violet-blue	—	7
2-Naphthylamine-4,7-disulfonic acid	blue	KOH soln.	7
2-Naphthylamine-4,8-disulfonic acid	blue	alk. soln.	7

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
2-Naphthylamine-5, 7-disulfonic acid	green	alk.	7
2-Naphthylamine-6, 8-disulfonic acid	blue	alk	7
1-Naphthylamine-5-sulfonic acid	green	alk.	7
2-Naphthylamine-5-sulfonic acid	red-blue	alk	7
2-Naphthylamine-6-sulfonic acid	blue	alk.	7
2-Naphthylamine-8-sulfonic acid	blue	acids and alk	7
2-Naphthylamine-1,3,6, 7-tetrasulfonic acid	violet-blue	alk. soln	7
1-Naphthylamine-2,4, 6-trisulfonic acid	blue	—	7
1-Naphthylamine-3,5, 7-trisulfonic acid	green	alk soln	7
1-Naphthylamine-2,5, 7-trisulfonic acid	green	—	7
2-Naphthylamine-1,3, 7-trisulfonic acid	violet-blue	-	7
2-Naphthylamine-1,5, 7-trisulfonic acid	blue	alk	7
2-Naphthylamine-3,5, 7-trisulfonic acid	green	alk soln	7
2-Naphthylamine-3,6, 7-trisulfonic acid	blue	alk	7
2-Naphthylamine-3,6, 8-trisulfonic acid	sky blue	alk	7
2-Naphthylamine-4,6, 8-trisulfonic acid	b. blue		7
N-α-Naphthylanthranilic acid	blue-green	H_2SO_4 soln	7
Naringenin	bluish	KOH fusion	6
Neodymium citrate	blue	—	4
Neodymium salicylate	b. blue-green		4
Neosynephrine hydrochloride	p. violet		4
Nickel formate	carmine red		1
Nickel stearate	grey-purple		4
Nicotinamide	b. blue		4
Nicotinic acid	purple-white		4
Nicotine	azure blue		2
2-Nitro-2-methyl-1, 3-propanediol	p. violet		4
2-Nitro-2-methyl-1-propanol	p. lavender		4
α-Nitro-β-naphthol	scarlet		4
2-*o*-Nitrophenylhydrazone	green	amyl al	7
α-Nitroso-β-naphthol	reddish		4
6-Nitrothymol	bluish	bz	7
3-Nitroxanthone	green	H_2SO_4 soln.	7
Norharman	blue	acids	7
Norharmine hydrocloride	b. blue	-	7
Norleucine	purple-blue	-	4
dl-Norvaline	purple		4
Nucleic acid	lavender-rose		4
Nupercaine	violet		4
Octodecacyclene	green		1
Octohydrodecacyclene	olive-green		1
Orcin	yellow-green	-	1
Orcinaurine	green	H_2O	4
dl-Ornithine hydrochloride	purple-white	-	4
p-Oxybenzoic acid	l. violet		1
2-Oxy-6,8-diaminopurine	green-blue	-	8

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
β-Oxynaphthionic acid	green-yellow	—	4
Oxypeucedanine	bluish	KOH fusion	6
Palmitic aldehyde	blue-white	—	4
Parabanic acid	blue	—	4
Paraldehyde	b. bluish	—	4
Pentacene	blue	—	4
Pentachloroethane	green-blue	—	2
Pentamethylenetetrazol	blue-violet	H_2O	4
Percaine	b. blue	—	7
Perlatolic acid	green	$CHCl_3$ + alk.	7
Perylene	blue	—	7
Perylene-3,10-dicarboxylic acid	green	alk	7
Perylene-3,9-dicarboxylic acid dichloride	yellow-green	—	7
Phaetophytin	red	—	2
Phenanthrene	l. blue	—	1
o-Phenoxyphenyl benzoate	lavender-blue	—	4
N-Phenylacridone	blue	AcOH	7
dl-Phenylalanine	lavender-white	—	4
N-Phenyl-2-amino-5-naphthol-7-sulfonic acid	violet	Na_2CO_3 soln	7
9-Phenylanthracene	blue	—	7
N-Phenylanthranil	green-blue	—	7
1-Phenylbenzanthrone	orange-red	H_2SO_4 soln.	7
10-Phenylbenzanthrone	golden-yellow	H_2SO_4 soln.	7
5-Phenylbenzpyrene	green-yellow	—	1
6-Phenyl-10-benzyl-1,2-dibenzanthracene	greenish-yellow	—	1
2-Phenylcoumarone	blue	H_2SO_4 soln.	7
3-Phenylcoumarone	blue	Hot H_2SO_4	7
3-Phenylcyclohexanone	green	al.-H_2SO_4	7
10-Phenyl-5,* 10-dihydroacridine	blue	al	7
o-Phenylenediamine	b. violet	—	4
p-Phenylenediamine	b. blue	—	4
Phenyl mercuric acetate	violet	—	4
Phenyl mercuric chloride	p. lavender	—	4
Phenyl mercuric nitrate	white	—	4
Phenyl mercuric nitrite	bluish	—	4
Phenyl mercuric sulfate	violet	—	4
2-Phenylnaphthalene	blue	—	7
Phenyl-α-naphthylamine	l. blue	—	4
Phenyl-β-naphthylamine	l. blue	—	4
4-Phenylquinaldine	blue	dil. acids	7
4-Phenylquinoline	blue	dil. acids	7
8-Phenylquinoline	yellow-green	—	7
Phenyl salicylate	strong blue		4
Phenyl-o-tolylguanidine	l. bluish-purple	-	4
Phloroglucinol	b. blue	-	1, 4, 6
Phloxine	yellow	water	4
Phycoerythrin	orange	-	2
Picrotoxine	yellow	—	4
Podophyllin	green	-	2
Polyamyl naphthalene	d. blue		4
Potassium ammonium platinocyanide*	green	- -	1
Potassium benzoate	bluish	—	4
Potassium opianate	blue	—	4
Potassium platinocyanide*	green	-	1
Potassium salicylate	violet-blue		4
Potassium stearate	blue-white	-	4

* Exciting wave length not given.

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Potassium succinate	bluish-white	—	1
Proflavine	green	H_2O	4, 5
Protoporphyrin	red	—	2
Psychotrine	blue	—	7
Pyocyanine	green-yellow	CCl_4	2
Pyramidon	s. blue	—	4
Pyrene	blue	—	1
Pyridanthrone	yellow	H_2SO_4 soln.	7
Pyridoxine hydrochloride	b. blue	—	4
Quinetine	blue	H_2SO_4 soln	7
Quinidine	p. blue	—	4
Quinine	b. blue	dil. oxy	1, 2, 3, 4, 5
Quinine bisulfate	b. blue-green	dil. oxy.	4
Quinine hydrochloride	l. blue	dil. oxy.	4
Quinine monosulfate	blue	dil. oxy	4
Quinine salicylate	b. blue-green	—	4
Quinoline	green	—	1
Rhamnetin	greenish-blue	H_2SO_4 soln.	4, 6
Rhodacene	red	—	7
Rhodamine	b. red-orange	H_2O, al., etc.	1, 2, 3, 4, 5
Rhodium salicylate	b. purple	—	4
Riboflavin	b. orange	—	4
Rose bengal	green	al. etc.	2
Saccharin	whitish	—	2
Salicylic acid	blue	—	4
Samarium gluconate	m. blue	—	4
Samarium 8-hydroxyquinolinate	yellow-red	—	4
Samarium salicylate	b. blue	—	4
Santonin	violet	—	4
Saponarin	blue	H_2SO_4 soln	7
dl-Serine	purplish-white	—	4
Silver 8-hydroxyquinolinate	yellow	—	4
Silver succinate	b. yellow	—	1
Sodium barbiturate	violet		4
Sodium benzoate	violet		1
Sodium benzyl morrhuate	b. yellow-green		4
Sodium 5-ethyl (1-methyl-1-butenyl) barbiturate	b. light blue	—	4
Sodium isoamyl barbiturate	bluish		4
Sodium isoamylethyl barbiturate	bluish		4
Sodium methyl salicylate	b. blue-green		4
Sodium *o*-nitrophenolate	red		4
Sodium oleate	blue-green		1
Sodium salicylate	b. blue-green		4
Sodium selenocyanide	bluish	H_2O	4
Sodium stearate	p. blue		4
Sorbitol lactate	dp. blue-green		4
Sorbitol tartrate	b. yellow-blue		4
Sorbitol tricinoleate	green		4
Stearic aldehyde	blue		4
trans-Stilbene	blue		7
Strontium benzoate	lavender	—	4
Strontium 8-hydroxyquinolinate	l. green	al.	4
Strontium lactate	yellow	—	1
Strontium stearate	blue-white	—	4
Strychnine	blue-white	—	4
Styrene	p. blue		6

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Sulfanilamide	violet	—	4
Sulforicinic acid	b. yellow-blue	—	4
Syntropin	lavender	—	4
Syringetin	green	H_2SO_4 soln.	7
Tartrazin	b. orange	al.	1
Thallium carbonate	blue	—	1
Thalloperazine	red-green	H_2SO_4 soln.	7
Theobromine	b. blue-green	—	4
Theobromine calcium salicylate	b. blue-green	—	4
Thiamine hydrochloride	dl. lavender-white	—	4
Thiochrome	blue	in soln.	3
Thioflavin S	yellow	H_2O	1, 4
Thioindigo	red-yellow	xyl.	7
Thioxanthone	green	H_2SO_4 son.	1
Thorium cyanide	pink	—	4
Thorium formate	b. blue	—	1
Thorium 8-hydroxyquinolinate	d. green	al.	4
Thorium *o*-iodoxybenzoate	m. blue	—	4
Thorium salicylate	b. blue	—	4
Thymol iodide	s. crimson	—	4
Tin stearate	cream	—	4
Titanium 8-hydroxyquinolinate	yellowish	—	4
Titanium stearate	grey-blue	—	4
Tetrahydrofurfuryl alcohol	blue	—	4
Tetradihydroxydesoxy-yohimbine	b. blue	—	1
5,7,2′,4′-Tetrahydroxyflavone-2′4′-dimethyl ether	blue	H_2SO_4 soln.	7
7,2′,4′,6′-Tetrahydroxyflavone	green	H_2SO_4 soln.	7
7,3′,4′,5′-Tetrahydroxyflavone	green-yellow	—	7
1 4,5,8-Tetrahydroxy-2-methyl anthraquinone	red	H_2SO_4 soln.	7
6 3′,4′,5′-Tetrahydroxyflavone-3′,4′,5′-trimethyl ether	green	H_2SO_4 soln.	7
7,3′,4′5′-Tetrahydroxyflavone tetramethyl ether	violet	al	7
5 6,7,8-Tetramethylalloxazin	yellow-violet	—	1
1,3,6,8-Tetramethylanthracene	green	AcOH	7
2 4,5,8-Tetramethyl quinoline	blue-violet	acids	7
2,3,5,6-Tetraphenyl pyridine	blue	H_2SO_4 soln.	8
α-Tocopherol	bl blue-green	—	4
N-*p*-Tolyl-1-naphthylamine	blue	—	7
N-*m*-Tolyl-2-naphthylamine	blue	—	7
Transentin	b. yellow-green	H_2O	4, 6
Triethyl trimethylene triamine	d. yellow-green	—	4
6 7,4′-Trihydroxyflavone	green	H_2SO_4 soln.	7
5,6,7-Trimethylalloxazin	greenish-yellow	—	1
6,7,8-Trimethylalloxazin	greenish-yellow	—	1
Tris(hydroxymethyl)aminomethane	green-blue	—	4
Tris(hydroxymethyl)nitromethane	dp. pink	—	4
Umbelliferone	blue-violet	—	1
Uracil	violet	—	4, 8
Uranine	b. yellow	H_2O, al., etc.	1, 2, 3, 4, 5, 6
Uranyl compounds*	usually b. yellow	—	9, 2, 3, 4, 6
Uric acid	m. violet	—	2

* Exciting wave length not given.

FLUORESCENT SUBSTANCES (Continued)

Name	Character of fluorescence	Solvent or treatment	References
Urobilin	reddish	—	1
Vanadic 8-hydroxyquinolinate	dp. green	al.	4
Vanadic *o*-iodoxybenzoate	orange-red	—	4
Vanadous salicylate	lavender	—	4
Vanadyl cyanide	green	—	4
Vanillin	b. pink	—	4
Veronal	yellow-grey	—	2
Xanthanol	green	H_2SO_4 soln.	6
Xanthone	b. blue	H_2SO_4 soln.	4
Yangonin	blue	acet., MeOH	7
Yttrium gluconate	b blue	—	4
Yttrium 8-hydroxyquinolinate	orange-red	al.	4
Yttrium *o*-iodoxybenzoate	bluish	—	4
Yttrium salicylate	b dp blue	—	4
Zinc butyl xanthate	dp. purple	—	6
Zinc dimethyldithiocarbamate	purple	—	4
Zinc fluoresceinate	b green	alk soln.	6
Zinc 8-hydroxyquinolinate	b. green	al.	4
Zinc hydroxyquinoline sulfonate	b yellow	—	2
Zinc palmitate	blue-white	—	4
Zinc resinate	cream-white	—	10 2
Zinc salicylate	b blue	—	1
Zinc sebacate	white	—	4
Zinc stearate	b blue	—	4
Zinc sulfanilate	blue-purple	—	4
Zinc uranyl acetate*	greenish	—	9
Zinc urobilinate	b. dp green	—	2, 3, 4
Zinc valerate	lavender	—	4
Zirconium 8-hydroxyquinolinate	yellowish	al	4

* Exciting wave length not given.

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COLORIMETRY

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Recommendations of the International Commission on Illumination

Standard Illuminants

A. Gas-filled tungsten incandescent lamp of color temperature 2848° K.

B. Noon Sunlight. Lamp as above in combination with the Davis-Gibson filter for converting color temperature 2848° to 4800° K.

The filter is to be composed of a layer one centimeter thick of each of two separate solutions B_1 and B_2, contained in a double cell of colorless optical glass.

Solution B_1

Copper sulphate ($CuSO_4{\cdot}5H_2O$)	2.452	g
Mannite ($C_6H_8(OH)_6$)	2 452	g
Pyridine (C_5H_5N)	30.0	cc
Distilled water to make	1000	cc

Solution B_2

Cobalt ammonium sulphate ($CoSO_4{\cdot}(NH_4)_2SO_4{\cdot}6H_2O$)	21 71	g
Copper sulphate ($CuSO_4{\cdot}5H_2O$)	16 11	g
Sulphuric acid (density 1.835)	10 0	cc
Distilled water to make	1000	cc

C. Average Daylight. Lamp as in **A** in combination with Davis-Gibson filter for converting color temperature 2848° to 6500° K.

The filter is composed of a layer one centimeter thick of each of two separate solutions C_1 and C_2, contained in a double cell made of colorless optical glass.

Solution C_1

Copper sulphate ($CuSO_4{\cdot}5H_2O$)	3 412	g
Mannite ($C_6H_8(OH)_6$)	3 412	g
Pyridine (C_5H_5N)	30.0	cc
Distilled water to make	1000	cc

Solution C_2

Cobalt ammonium sulphate ($CoSO_4{\cdot}(NH_4)_2SO_4{\cdot}6H_2O$)	30 580	g
Copper sulphate ($CuSO_4{\cdot}5H_2O$)	22 520	g
Sulphuric acid (density 1.835)	10.0	cc
Distilled water to make	1000	cc

See R Davis and K S. Gibson Bur Stds. Misc. Pub. No. 114, Jan 1931 or Bur. Stds. Jour. Research **7,** 796 (1931).

Standard Coordinate System

The tristimulus system of color specification is based on four chosen stimuli consisting of homogeneous radiant energy of wave lengths

700.0 **546.1** **435.8**

mμ and of standard illuminant B (see above).

To establish the system of specification coordinates are assigned as follows:

Stimulus	x	y	z
700 0 mμ	0 73467	0.26533	0.00000
546 1 mμ	0 27376	0.71741	0.00883
435 8 mμ	0 16658	0.00886	0.82456
Standard illuminant B:	0.34842	0 35161	0.29997

The Standard Observer

The "standard observer" is determined below by the specification for the equal energy spectrum both in fractions, x, y, z of the total amount for each wave length interval of 5 mμ and directly $\bar{x}$, $\bar{y}$, $\bar{z}$. The fractional values are known as the **trilinear coordinates** or **trichromatic coefficients** of the spectrum; the direct values as the **distribution functions** or coefficients.
The sum of the trichromatic coefficients is unity, that is $x + y + z = 1$
Therefore the value of z may be and often is omitted from a specification.

Relative Visibility

The value of $\bar{y}$ given in the table is the standard visibility function or relative visibility

Wave length mμ	Trichromatic coefficients			Distribution coefficients for equal energy			Wave length mμ
	x	y	z	$\bar{x}$	$\bar{y}$ (Rel. Vis.)	$\bar{z}$	
380	0 1741	0 0050	0 8209	0 0014	0 0000	0 0065	380
385	0 1740	0 0050	0 8210	0 0022	0 0001	0 0105	385
390	0 1738	0 0049	0 8213	0 0042	0 0001	0 0201	390
395	0 1736	0 0049	0.8215	0 0076	0 0002	0.0362	395
400	0 1733	0 0048	0 8219	0 0143	0 0004	0 0679	400
405	0 1730	0 0048	0 8222	0 0232	0 0006	0.1102	405
410	0 1726	0 0048	0 8226	0 0435	0 0012	0 2074	410
415	0 1721	0 0048	0 8231	0 0776	0 0022	0 3713	415
420	0.1714	0 0051	0.8235	0 1344	0 0040	0 6456	420
425	0 1703	0 0058	0 8239	0 2148	0 0073	1 0391	425
430	0 1689	0 0069	0 8242	0 2839	0 0116	1 3856	430
435	0 1669	0 0086	0 8245	0 3285	0 0168	1 6230	435
440	0 1644	0 0109	0 8247	0 3483	0 0230	1 7471	440
445	0 1611	0 0138	0 8251	0 3481	0 0298	1 7826	445
450	0 1566	0 0177	0 8257	0 3362	0 0380	1 7721	450
455	0 1510	0 0227	0 8263	0 3187	0 0480	1 7441	455
460	0 1440	0 0297	0 8263	0 2908	0 0600	1 6692	460
465	0 1355	0 0399	0 8246	0 2511	0 0739	1 5281	465
470	0 1241	0 0578	0 8181	0 1954	0 0910	1 2876	470
475	0 1096	0 0868	0 8036	0 1421	0 1126	1 0419	475
480	0 0913	0 1327	0 7760	0 0956	0 1390	0 8130	480
485	0 0687	0 2007	0 7306	0 0580	0 1693	0 6162	485
490	0 0454	0 2950	0 6596	0 0320	0 2080	0 4652	490
495	0 0235	0 4127	0 5638	0 0147	0 2586	0 3533	495
500	0 0082	0 5384	0 4534	0 0049	0 3230	0.2720	500
505	0 0039	0 6548	0.3413	0 0024	0 4073	0 2123	505
510	0 0139	0 7502	0 2359	0 0093	0 5030	0 1582	510
515	0 0389	0 8120	0 1491	0 0291	0 6082	0 1117	515
520	0 0743	0.8338	0 0919	0 0633	0 7100	0 0782	520
525	0 1142	0 8262	0 0596	0 1096	0 7932	0.0573	525
530	0 1547	0 8059	0 0394	0 1655	0 8620	0 0422	530
535	0 1929	0 7816	0 0255	0 2257	0 9149	0 0298	535
540	0 2296	0 7543	0 0161	0 2904	0 9540	0 0203	540
545	0 2658	0 7243	0 0099	0 3597	0 9803	0 0134	545
550	0 3016	0 6923	0 0061	0 4334	0 9950	0 0087	550
555	0 3373	0 6589	0 0038	0 5121	1 0002	0 0057	555
560	0 3731	0 6245	0 0024	0 5945	0 9950	0 0039	560
565	0 4087	0 5896	0 0017	0 6784	0 9786	0 0027	565
570	0 4441	0 5547	0 0012	0.7621	0 9520	0 0021	570

The Standard Observer (Continued)

Wave length mμ	Trichromatic coefficients			Distribution coefficients for equal energy			Wave length mμ
	x	y	z	$\bar{x}$	$\bar{y}$ (Rel. Vis.)	$\bar{z}$	
575	0.4788	0 5202	0 0010	0 8425	0 9154	0 0018	575
580	0 5125	0 4866	0 0009	0 9163	0 8700	0.0017	580
585	0 5448	0 4544	0 0008	0 9786	0 8163	0 0014	585
590	0 5752	0 4242	0 0006	1 0263	0 7570	0 0011	590
595	0 6029	0.3965	0 0006	1 0567	0.6949	0.0010	595
600	0 6270	0 3725	0 0005	1 0622	0 6310	0.0008	600
605	0 6482	0 3514	0 0004	1 0456	0 5668	0 0006	605
610	0 6658	0 3340	0 0002	1 0026	0.5030	0 0003	610
615	0 6801	0 3197	0 0002	0 9384	0.4412	0 0002	615
620	0 6915	0 3083	0 0002	0.8544	0 3810	0 0002	620
625	0 7006	0 2993	0 0001	0.7514	0 3210	0 0001	625
630	0 7079	0 2920	0 0001	0.6424	0 2650	0 0000	630
635	0 7140	0 2859	0 0001	0 5419	0 2170	0 0000	635
640	0 7190	0 2809	0 0001	0 4479	0 1750	0 0000	640
645	0 7230	0 2770	0 0000	0 3608	0 1382	0 0000	645
650	0 7260	0 2740	0 0000	0 2835	0 1070	0 0000	650
655	0 7283	0 2717	0 0000	0 2187	0 0816	0 0000	655
660	0 7300	0 2700	0 0000	0 1649	0 0610	0 0000	660
665	0 7311	0 2689	0 0000	0 1212	0 0446	0 0000	665
670	0 7320	0 2680	0 0000	0 0874	0 0320	0 0000	670
675	0 7327	0 2673	0 0000	0 0636	0 0232	0 0000	675
680	0 7334	0 2666	0 0000	0 0468	0 0170	0 0000	680
685	0 7340	0.2660	0 0000	0 0329	0 0119	0 0000	685
690	0 7344	0.2656	0 0000	0 0227	0 0082	0 0000	690
695	0 7346	0.2654	0 0000	0 0158	0.0057	0 0000	695
700	0 7347	0.2653	0 0000	0 0114	0 0041	0 0000	700
705	0 7347	0.2653	0 0000	0 0081	0 0029	0 0000	705
710	0 7347	0.2653	0 0000	0.0058	0 0021	0 0000	710
715	7347	0.2653	0 0000	0.0041	0 0015	0 0000	715
720	0 7347	0.2653	0 0000	0.0029	0 0010	0 0000	720
725	0 7347	0.2653	0 0000	0 0020	0 0007	0 0000	725
730	0 7347	0 2653	0 0000	0.0014	0 0005	0 0000	730
735	0 7347	0 2653	0 0000	0.0010	0 0004	0 0000	735
740	0 7347	0 2653	0 0000	0 0007	0 0003	0 0000	740
745	0 7347	0.2653	0 0000	0.0005	0 0002	0 0000	745
750	0 7347	0 2653	0 0000	0 0003	0 0001	0 0000	750
755	0 7347	0 2653	0 0000	0.0002	0.0001	0 0000	755
760	0 7347	0 2653	0.0000	0 0002	0 0001	0 0000	760
765	0 7347	0 2653	0 0000	0 0001	0 0000	0 0000	765
770	0 7347	0.2653	0 0000	0 0001	0.0000	0.0000	770
775	0 7347	0 2653	0 0000	0 0000	0.0000	0.0000	775
780	0 7347	0.2653	0 0000	0 0000	0.0000	0.0000	780
			Totals	21 3713	21.3714	21 3715	

SPECIFIC ROTATION

Specific rotation or rotatory power is given in degrees per decimeter for liquids and solutions and in degrees per millimeter for solids; + signifies right handed rotation, − left. Specific rotation varies with the wave length of light used, with temperature and, in the case of solutions, with the concentration. When sodium light is used, indicated by D in the wave length column, a value of λ = 0.5893 may be assumed.

Optical rotatory power for a large number of organic compounds will be found in the International Critical Tables, Vol. VII, for sugars, Vol. II.

SOLIDS

Substance	Wave length μ	Rotation deg mm	Substance	Wave length μ	Rotation deg./mm
Cinnabar (HgS)	D	+32.5	Quartz (continued)		
Lead hyposulfate.	D	5.5		0.3609	+63.628
Potassium hyposulphate	D	8.4		0.3582	64.459
Quartz	0.7604	12.668		0.3466	69.454
	0.7184	14.304		0.3441	70.587
	0.6867	15.746		0.3402	72.448
	0.6562	17.318		0.3360	74.571
	0.5895	21.684		0.3286	78.579
	0.5889	21.727		0.3247	80.459
	0.5269	27.543		0.3180	84.972
	0.4861	32.773		0.2747	121.052
	0.4307	42.604		0.2571	143.266
	0.4101	47.481		0.2313	190.426
	0.3968	51.193		0.2265	201.824
	0.3933	52.155		0.2194	220.731
	0.3820	55.625		0.2143	235.972
	0.3726	58.894	Sodium bromate	D	2.8
			Sodium chlorate	D	3.13

LIQUID

Liquid	Temp. °C	Wave length μ	Specific rotation deg. dm
Amyl alcohol		D	− 5.7
Camphor	204	D	+ 70.33
Cedar oil	15	D	− 30 to − 40
Citron oil	15	D	+ 62
Ethyl malate $(C_2H_5)_2C_4H_4O_5$	11	D	− 10.3 to − 12.4
Menthol.	35.2	D	− 49.7
Nicotine $C_{10}H_{14}N_2$	10–30	D	− 162
	20	0.6563	− 126
	20	0.5351	− 207.5
	20	0.4861	− 253.5
Turpentine $C_{10}H_{16}$	20	D	− 37
	20	0.6563	− 29.5
	20	0.5351	− 45
	20	0.4861	− 54.5

SPECIFIC ROTATION (Continued)

Solutions

Corrections for values of the specific rotation for concentration are given in the last column. c indicates concentration in grams per 100 milliliters of solution; d indicates the concentration in grams per 100 grams of solution.

Substance	Solvent	Temp. °C	Wave length μ	Specific rotation deg./dm	Correction for concentration or temperature
Albumen	water		D	− 25 to −38	
Arabinose	water	20	D	− 105 0	
Camphor	alcohol	20	D	+ 54 4	− .135d for d = 45–91
	benzene	20	D	+ 56	− .166d for d = 47–90
	ether		D	+ 57	
Dextrose d-glucose $C_6H_{12}O_6$	water	20	D	+ 52 5	+ .025d for d = 1–18
			5461	+ 62 03	+ 04257c for c = 6–32
Galactose	water	.	D	+ 83 9	+ .078d − .21t for d = 4–36 and t = 10–30°C
l-Glucose (β)	water	20	D	− 51 4	
Invert sugar $C_6H_{12}O_6$	water	20	D	− 19 7	− .036c for c = 9–35; $\alpha_t = \alpha_{20}$ + .304(t − 20) + .00165 $(t-20)^2$ for t = 3–30°C
		25	5461	− 21 5	
Lactose	water	20	D	+ 52 4	+ .072 (20° − t) for c = 5
			5461	+ 61 9	+ .085(20° − t) for c = 5
Levulose fruit sugar	water	25	D	− 88 5	− .145d for d = 2.6–18.6
		25	5461	− 105 30	
Maltose	water	20	D	+ 138 48	− .01837d for d = 5–35
		25	5461	+ 153 75	
Mannose	water	20	D	+ 14 1	c = 10 2
Nicotine	water	20	D	− 77	for d = 1–16
	benzene	20	D	− 164	for d = 8–100
Potassium tartrate	water	20	D	+ 27 14	+ .0992c − .00094c^2 for c = 8–50
Quinine sulfate	water	17	D	− 214	
Santonin	alcohol	20	D	− 161 0	c = 1 78
		20	D	+ 693	c = 4 05
	chloroform	20	D	− 202.7	+ .309d for d = 75–96.5
	alcohol	20	6867	+ 442	c = 4 05
			.5269	+ 991	c = 4 05
			4861	+1323	c = 4.05
Sodium potassium tartrate (Rochelle salt)	water	20	D	+ 29 75	− .0078c
Sucrose (cane sugar) $C_{12}H_{22}O_{11}$	water	20	D	+ 66 412	+ .01267d − .000376d^2 for d = 0–50; $\alpha_t = \alpha_{20}[1 - .00037(t-20)]$ for t = 14–30°C

SPECIFIC ROTATION (Continued)

Sucrose dissolved in water, 20°C.

μ	Spec. rot.	μ	Spec. rot.	μ	Spec. rot.
670.8 (Li)	+50.51	510.6 (Cu)	+90.46	435.3 (Fe)	+128.5
643.8 (Cd)	55.04	508.6 (Cd)	91.16	433.7 (Fe)	129.8
636.2 (Zn)	56.51	481.1 (Zn)	103.07	431.5 (Fe)	130.7
589.3 (Na)	66.45	480.0 (Cd)	103.62	428.2 (Fe)	133.6
578.2 (Cu)	69.10	472.2 (Zn)	107.38	427.2 (Fe)	134.2
578.0 (Hg)	69.22	468.0 (Zn)	109.49	426.1 (Fe)	134.9
570.0 (Cu)	71.24	467.8 (Cd)	109.69	419.1 (Fe)	140.0
546.1 (Hg)	78.16	438.4 (Fe)	126.5	414.4 (Fe)	144.2
521.8 (Cu)	86.21	437.6 (Fe)	127.2	388.9 (Fe)	166.7
515.3 (Cu)	88.68	435.8 (Hg)	128.49	383.3 (Fe)	171.8
				382.6 (Fe)	173.1

Substance	Solvent	°C	μ	Spec. rot.	Correct.
Tartaric acid (ord.)	water	20	D	+15.06	− .131c
		20	6563	7.75	for d = 41
		20	D	8.86	for d = 41
		20	5351	9.65	for d = 41
		20	4861	9.37	for d = 41
Turpentine	alcohol	20	D	−37	− .00482d − .00013d^2 for d = 0–90
	benzene	20	D	−37	− .0265d for d = 0–91
Xylose	water	20	D	+19.13	d = 2.7

OPTICAL ROTATION OF ACIDS AND BASES

Optical rotation of acids and bases commonly used in the resolution of racemic substances. Compiled by F. L. Ray

Name	Formula	Solvent	Conc. %	α_D
Bromocamphor-sulfonic acid. K salt	$C_{10}H_{15}O_4BrS$	H_2O		72.1
Camphorsulfonic acid	$C_{10}H_{16}O_4S$	H_2O	..	23.9
Chlorocamphor-sulfonic acid	$C_{10}H_{15}ClO_4S$	H_2O		49.6
Codeinesulfonic acid	$C_{18}H_{21}NO_6S$	H_2O	3	−190.1
Hydroxybutyric acid	$C_4H_8O_3$	H_2O	3.3	−24.8
Lactic acid	$C_3H_6O_3$	H_2O	10.5	3.8
Malic acid	$C_4H_6O_5$	H_2O	.	2.4
Mandelic acid	$C_8H_8O_3$	H_2O	2.01	155.5
Methylene-camphor	$C_{11}H_{16}O$	C_2H_5OH		127
Phenylsuccinic acid	$C_{10}H_{10}O_4$	C_2H_5OH	1.5	148
Tartaric acid	$C_4H_6O_6$	C_2H_5OH and H_2O	.	3 to 25*
Brucine	$C_{23}H_{26}N_2O_4$	C_2H_5OH	5.4	−85
Cinchonidine	$C_{19}H_{22}N_2O$	C_2H_5OH	1.0	−111.0
Cinchonine	$C_{19}H_{22}N_2O$	$CHCl_3$	0.6	+209.6
Cocaine	$C_{17}H_{21}NO_4$	50% C_2H_5OH	1.1	−35.4
Coniine	$C_8H_{17}N$	$CHCl_3$	4	8.0
Codeine	$C_{18}H_{21}NO_3$	C_2H_5OH	5	−135.8
Hydrastine	$C_{21}H_{21}NO_6$	50% C_2H_5OH	0.2	115
Menthol	$C_{10}H_{20}O$	C_2H_5OH	9.6	−50.6
Menthylamine	$C_{10}H_{21}N$	C_2H_5OH	11.3	−31.9
Narcotine	$C_{22}H_{23}NO_7$	$CHCl_3$	2.6	+200.0
Quinidine	$C_{20}H_{24}N_2O_2$	C_2H_5OH	1.0	+233.6
Quinine	$C_{20}H_{24}N_2O_2$	C_6H_6	0.6	−136
Thebaine	$C_{19}H_{21}NO_3$	$CHCl_3$	5	−229.5
Strychnine	$C_{21}H_{22}N_2O_2$	C_2H_5OH	0.9	−128

* Varies greatly with temperature, solvent, and conc.

MAGNETO-OPTIC ROTATION

Revised by Park L. Turrill

$$\text{Verdet's Constant: } \rho = \frac{\alpha}{tH \cos \theta}$$

The specific power of magnetic rotation ρ, is expressed in the above formula, where α is the total angle of rotation in minutes, t the thickness of the substance in centimeters through which the light beam passes, H the magnetic field intensity in gauss, and θ the angle between the direction of the magnetic field and the path of light. Determinations made with sodium light. $\lambda D = 5893$ Å.

Values from the Smithsonian Tables, the International Critical Tables, and the literature.

Gases

Substance	Pressure (atmospheres)	Temp. °C.	Verdet's Constant (minutes) $\rho \times 10^6$	Observer	Year
Atmospheric air	1	20	6.83	Becquerel	1880
Carbon dioxide	1.1	6.5	8.61	Siertsema	1895
Carbon disulfide	0.98	70	23.49	Bichat	1879
Ethylene	1	20	34.48	Becquerel	1880
Nitrogen	1	20	6.92	Becquerel	1880
Nitrous oxide	1	20	6.28	Becquerel	1880
Oxygen	1	20	31.39	Becquerel	1880
Sulfur dioxide	3.3	20	38.40	Bichat	1880

Liquids, Organic

Substance	Temp. °C.	$\rho \times 10^3$	Observer	Year
Acetic acid	15.1	11.09	Schwers	1912
Acetic acid	31.5	10.86	Schwers	1912
Acetone	15.2	10.35	Schwers	1912
Acetone	32.0	10.19	Schwers	1912
Amyl alcohol	15	13.1	Becquerel	1880
Benzine	20	29.7	Jahn	
Carbon disulfide	0	43.41	Becquerel	1885
	15.6	42.4	Schwers	1912
	18.0	43.0	Chaudier	1913
	20	42.26	Bichat	1880
	34	41.1	Schwers	1912
Carbon tetrachloride	15	16.03	Schwers	1912
Carvane	14.9	18.4	Herngrist	1914
Chloroform	20	16.4	Jahn	
Citranellal	16.4	15.1	Herngrist	1914
Diethyl malate	15.3	12.4	Herngrist	1914
Diethyl tartrate	15.2	12.3	Herngrist	1914
Dimethyl malate	15.3	11.8	Herngrist	1914
Dipropyl tartrate	15.4	12.6	Herngrist	1914
Ethanol	25.0	11.12	Theuvenet	1910
Isobutyl alcohol	16.1	12.66	Schwers	1912
Isobutyric acid	15.3	11.35	Schwers	1912
Isovaleric acid	15.0	12.08	Schwers	1912
Limonene	15.6	16.5	Herngrist	1914
Menthone	16.7	13.7	Herngrist	1914
Methyl chloride	18	12.9	Chaudier	1913
Pulegone	14.9	16.4	Herngrist	1914
n-Propanol	17.3	11.81	Schwers	1912
Toluene	28.4	26.9	Becquerel	1880
Xylene	15	22.1	Becquerel	1880

MAGNETO-OPTIC ROTATION (Continued)

Liquids, Inorganic

Substance	Temp. °C.	Verdet's Constant (minutes) $\rho \times 10^3$	Observer	Year
Antimony pentachloride	16	70.4	Becquerel	1885
Arsenic trichloride	16	42.53	Becquerel	1885
Hydrogen peroxide	10	11.5	Giguère and Feeny	 1943
Nitric acid, fuming	16	8.75	Becquerel	1885
Nitrogen	−195.5	4.15	Chaudier	1913
Nitrous oxide	−92	5.54	Siertsema	1904
Oxygen	−182.5	7.82	Chaudier	1913
Phosphorus, fused	33	132.6	Becquerel	1877
Phosphorus, trichloride	16	27.7	Becquerel	1885
Silicon tetrachloride	16	18.9	Becquerel	1885
Sulfur, fused	114	80.9	Becquerel	1877
Sulfur dioxide	−10	18	Chaudier	1913
Sulfur monochloride	16	41.8	Becquerel	1885
Titanium tetrachloride	13.4	14.71	Siertsema	1915
Water (λ = 5956 Å)	0	13.11	Rodger and Watson	1895
	20	13.08		
	30	13.06		
	40	13.02		
	60	12.94		
	80	12.82		
	90	12.74		

Solutions, Aqueous

Substance	Density	Temp. °C	Verdet's Constant (minutes) $\rho \times 10^3$	Observer	Year
Ammonium hydroxide	0.8918	..	15.3	Perkin	1884
Antimony trichloride	.....	.	29.9	Becquerel	1885
Barium bromide	1.5399	20	21.5	Jahn	
Barium chloride	1.2897	20	16.8	Jahn	
Bismuth nitrate	.....	.	19.22	Becquerel	1885
Cadmium chloride	1.3179	20	16.5	Jahn	
Calcium chloride	1.1504	20	16.5	Humburg	1893
Ferric chloride	1.6933	15	−202.6	Becquerel	1885
Ferrous chloride	1.4331	15	2.5	Becquerel	1885
Hydriodic acid	1.2966	15	25.8	Perkin	1884
Hydrobromic acid	1.2039	15	19.4	Perkin	1884
Hydrochloric acid	1.0758	20	16.71	Schwers	1912
Lithium chloride	1.0619	20	14.5	Jahn	..
Magnesium sulfate	1.1147	16	3.6	Schonrock	1893
Manganous sulfate	1.1212	16	4.0	Schonrock	1893
Mercuric chloride	1.0381	16	13.7	Schonrock	1893
Mercuric cyanide	1.0638	16	7.1	Schonrock	1893
Nickelous chloride	1.4685	. .	27.3	Becquerel	1885
Nitric acid	1.3366	15	10.5	Perkin	1884
Potassium bicarbonate	1.1906	20	14.0	Humburg	1893
Potassium bichromate	1.0786	15	12.6	Verdet	1863
Potassium bromide	1.1424	20	16.3	Humburg	1893
Potassium carbonate	1.1960	20	14.0	Jahn	.
Potassium chloride	1.6000	15	16.3	Becquerel	1885

MAGNETO-OPTIC ROTATION (Continued)

Solutions, Aqueous (Continued)

Substance	Density	Temp. °C.	Verdet's Constant (minutes) $\rho \times 10^3$	Observer	Year
Potassium iodide.	1.6743	15	34.1	Becquerel	1885
Potassium nitrate	1.0634	20	13.0	Humburg	1893
Potassium sulfate.	1.0475	20	13.3	Jahn	. . . .
Silver nitrate	. . . . .	. . . .	18.03	Becquerel	1885
Sodium bromide . . .	1.1351	20	16.5	Jahn	. . . .
Sodium carbonate. .	1.1006	20	14.0	Humburg	1893
Sodium chloride. .	1.2051	16	18.2	Becquerel	1885
Sodium sulfate. . . .	1.0061	20	13.5	Humburg	1893
Stannous chloride.	1.3280	15	26.6	Verdet	1863
Sulfuric acid	1.5507	15	12.18	Schwers	1912
Zinc chloride.	1.2851	16	19.6	Verdet	1863

Solutions, in Ethyl Alcohol

Substance	Density	Temp. °C.	Verdet's Constant (minutes) $\rho \times 10^3$	Observer	Year
Cadmium bromide	1.0446	20	15.9	Humburg	1893
Cadmium chloride	0.8303	20	11.8	Humburg	1893
Cadmium iodide	1.0988	20	19.9	Humburg	1893
Calcium bromide .	0.9966	20	15.4	Humburg	1893
Mercuric chloride	0.9988	16	10.9	Schonrock	1893
Mercuric chloride	0.8857	16	12.1	Schonrock	1893
Mercuric cyanide	0.8527	16	6.4	Schonrock	1893
Mercuric cyanide	0.8348	16	5.3	Schonrock	1893
Mercuric iodide . . .	0.8072	16	24.4	Schonrock	1893
Strontium bromide. .	0.9636	20	14.0	Humburg	1893
Strontium chloride	0.8313	20	11.8	Humburg	1893

Solids

Substance	Density	Temp. °C.	Verdet's Constant (minutes) $\rho \times 10^3$	Observer	Year
Amber		19	−9.60	Quincke	1885
Calcium fluoride (fluorite)		16	8.83	Becquerel	1885
Carbon (diamond) .		16	12.8	Becquerel	1877
Carbon dioxide .		26	2.07	Chaudier	1913
Glass, Jena (barium crown)		18	22.0	duBois	1894
(phosphate crown)		18	16.1	duBois	1894
(light flint).		18	31.7	duBois	1894
(heavy flint). . . .		18	60.8	duBois	1894
(very heavy flint)		18	88.8	duBois	1894
Potassium chloride (sylvite) .		16	28.58	Becquerel	1885
Sodium chloride (rock salt) .		16	35.85	Becquerel	1885
Sodium tetraborate (borax) .		16	17.2	Becquerel	1885
Silicon (quartz)		20	16.64	Borel	1903
Stannous chloride.		16	44.	Becquerel	1885
Zinc sulfide, β.		16	225.	Becquerel	1885

QUANTITIES AND UNITS

MISCELLANEOUS

DEFINITIONS AND FORMULAE

The chemical terms have been compiled with the collaboration of B. Clifford Hendricks

A compilation of chemical and physical terms including **quantities, units, laws, theories** and **effects,** with their expression as **formulae** or **equations.**

Abegg's rule.—For use in regard to a helical periodic system If the maximum positive valence exhibited by an element be numerically added to its maximum negative valence, there is evidently a tendency for the sum to equal 8. This tendency is exhibited especially by the elements of the 4th, 5th, 6th and 7th groups and is known as Abegg's rule.

Absolute humidity.—See *Humidity*

Absolute pressure.—See *Pressure*

Absolute temperature.—Temperature reckoned from the absolute zero See *Temperature*

Absolute units.—A system of units based on the smallest possible number of independent units. Specifically, units of force, work, energy and power not derived from or dependent on gravitation

Absolute zero.—The temperature at which a gas would show no pressure if the general law for gases would hold for all temperatures It is equal to −273 18°C or −459.72°F

Absorption.—1 Penetration of a substance into the body of another 2 Transformation into other forms suffered by radiant energy passing through a material substance

Absorption coefficient.—See *Absorption factor*

Absorption factor.—The ratio of the intensity loss by absorption to the total original intensity of radiation If I_o represents the original intensity, I_r, the intensity of reflected radiation, I_t, the intensity of the transmitted radiation, the absorption factor is given by the expression

$$\frac{I_o - (I_r + I_t)}{I_o}$$

Also called coefficient of absorption

Absorption, Lambert's law.—If I_o is the original intensity, I the intensity after passing through a thickness x of a material whose absorption coefficient is k,

$$I = I_o e^{-kx}$$

The **index of absorption** k' is given by the relation $k = (4\pi k'n)/\lambda$ where n is the index of refraction and λ the wave length in vacuo. The **mass absorption** is given by k/d when d is the density The transmission factor is given by I/I_o

Absorption spectrum.—The spectrum obtained by the examination of light from a source, itself giving a continuous spectrum, after this light has passed through an absorbing medium in the gaseous state. The absorption spectrum will

consist of dark lines or bands, being the reverse of the emission spectrum of the absorbing substance.

When the absorbing medium is in the solid or liquid state the spectrum of the transmitted light shows broad dark regions which are not resolvable into lines and have no sharp or distinct edges

Absorptive power or absorptivity for any body is measured by the fraction of the radiant energy falling upon the body which is absorbed or transformed into heat This ratio varies with the character of the surface and the wave length of the incident energy It is the ratio of the radiation absorbed by any substance to that absorbed under the same conditions by a black body

Acceleration.—The time rate of change of velocity in either speed or direction Cgs unit,—one centimeter per second per second Dimensions,—$[l\ t^{-2}]$ See also under *Angular acceleration*

Acceleration due to gravity.—The acceleration of a body freely falling in a vacuum The International Committee on Weights and Measures has adopted as a standard or accepted value, 980 665 cm/sec^2 or 32 174 ft /sec^2

Acceleration due to gravity at any latitude and elevation.—If ϕ is the latitude and H the elevation in centimeters the acceleration in cgs units is, $g = 980.616 - 2\ 5928 \cos 2\phi + 0\ 0069 \cos^2 2\phi - 3\ 086 \times 10^{-6}\ H$ (Helmert's equation)

Achromatic.—A term applied to lenses signifying their more or less complete correction for chromatic aberration

Acids are substances whose molecules ionize in water solution to give the hydrogen ion from their constituent elements The strength of an acid is proportional to the concentration of hydrogen ions present

Action is measured by the product of work by time. Cgs units of action are the erg-second and the joule-second Dimensions,—$[m\ l^2\ t^{-1}]$ Planck's quantum or constant of action is 6.554×10^{-27} erg-seconds

Active mass of a substance is the number of gram molecular weights per liter in solution, or in gaseous form

Adiabatic.—A body is said to undergo an adiabatic change when its condition is altered without gain or loss of heat The line on the pressure volume diagram representing the above change is called an adiabatic line

Adsorption.—The condensation of gases, liquids, or dissolved substances on the surfaces of solids is called adsorption

Air columns, frequency of vibration in —See *Organ pipes*

Allotropy.—The property shown by certain elements of being capable of existence in more than one form, due to differences in the arrangement of atoms or molecules (See *Monotropic* and *Enantiotropic*)

DEFINITIONS AND FORMULAE (Continued)

Alpha (α)-particle.—A helium nucleus—that is, a helium atom which has lost two electrons and has therefore a double positive charge.

Alpha (α)-rays are strongly ionizing and weakly penetrating radiations, deflected by magnetic and electric fields as positively charged particles. The particles are doubly charged helium atoms (ions) and are called α-particles.

Alternating current in circuits including resistance and inductance,

$$I = \frac{E}{\sqrt{R^2 + (2\pi fL)^2}}$$

where f is the frequency in cycles per second, L the inductance in henry. I will be given in effective amperes if R is in ohms and E in effective volts. The denominator is known as the impedance of the circuit.

For circuits involving also a capacitance C in farads, the impedance becomes,

$$\sqrt{R^2 + \left(2\pi fL - \frac{1}{2\pi fC}\right)^2}$$

Altitudes with the barometer.—If b_1 and b_2 denote the corrected barometer readings at two stations, t the mean of the temperatures, t_1 and t_2 of the air at the two stations, e_1 and e_2 the tension of water vapor at the two stations, h the mean height above sea level, ϕ the latitude; then the difference in elevation in centimeters is $H = 1{,}843{,}000\ (\log b_1 - \log b_2)\ (1 + 0.00367t)\ (1 + 0.0026 \cos 2\phi + 0.00002h + \frac{3}{8}k)$, where

$$k = \frac{1}{2}\left(\frac{e_1}{b_1} + \frac{e_2}{b_2}\right)$$

An approximate formula, sufficient for differences not over 1000 meters is

$$H = 1{,}600{,}000\ \frac{b_1 - b_2}{b_1 + b_2}\ (1 + 0.004t).$$

Amorphous.—Without definite form, not crystallized.

Ampere's rule.—To determine the direction in which the magnetic needle is deflected by a conductor carrying a current in a given direction.

If a man is imagined to be swimming in the direction in which the current is flowing, and facing the magnetic needle; then the north pole will be deflected toward his left hand, the south pole being deflected in the opposite direction.

Amplitude.—The maximum value of the displacement in an oscillatory motion.

Angle.—The ratio between the arc and the radius of the arc. Units of angle,—the radian, the angle subtended by an arc equal to the radius; the degree, $\frac{1}{360}$ part of the total angle about a point. Dimensions,—a numeric.

DEFINITIONS AND FORMULAE (Continued)

Angular acceleration.—The time rate of change of angular velocity either in angular speed or in direction of the axis of rotation (precession). Cgs unit,—one radian per second per second. Dimensions,—$[t^{-2}]$.

If the initial angular velocity is ω_0, and the velocity after time t is ω_t, the angular acceleration,

$$\alpha = \frac{\omega_t - \omega_0}{t}$$

The angular velocity after time t,

$$\omega_t = \omega_0 + \alpha t$$

The angle swept out in time t,

$$\theta = \omega_0 t + \tfrac{1}{2}\alpha t^2$$

The angular velocity after movement through the arc θ,

$$\omega = \sqrt{\omega_0^2 + 2\alpha\theta}$$

In the above equations, for angular displacement in radians, angular velocity will be in radians per second and angular acceleration in radians per second per second.

Angular aperture of an objective is the largest angular extent of wave surface which it can transmit.

Angular harmonic motion or harmonic motion of rotation.—Periodic, oscillatory angular motion in which the restoring torque is proportional to the angular displacement. Torsional vibration.

Angular momentum or moment of momentum.—Quantity of angular motion measured by the product of the angular velocity and the moment of inertia. Cgs unit,—unnamed, its nature is expressed by g-cm^2/sec. Dimensions,—$[m\, l^2\, t^{-1}]$.

The angular momentum of a mass whose moment of inertia is I, rotating with angular velocity ω, is $I\omega$.

Angular velocity.—Time rate of angular motion about an axis. Cgs unit,—one radian per second. Dimensions,—$[t^{-1}]$.

If the angle described in time t is θ, the angular velocity,

$$\omega = \frac{\theta}{t}$$

θ in radians and t in seconds gives ω in radians per second.

Anhydride (of acid or base).—An oxide which when combined with water gives an acid or base.

Anion.—A negatively charged ion.

Apochromat.—A term applied to photographic and microscope objectives indicating the highest degree of color correction.

Archimedes principle.—A body wholly or partly immersed in a fluid is buoyed up by a force equal to the weight of the

fluid displaced. A body of volume V cm³ immersed in a fluid f density ρ grams per cm³ is buoyed up by a force in dynes,

$$F = \rho g V.$$

where g is the acceleration due to gravity.

A floating body displaces its own weight of liquid.

Area, unit of.—The square centimeter. The area of a square whose sides are one centimeter in length. Other units of area are similarly derived. Dimensions,—$[l^2]$.

Arrhenius theory of electrolytic dissociation states that the molecule of an electrolyte can give rise to two or more electrically charged atoms or ions.

Astigmatism is an error of spherical lenses peculiar to the formation of images by oblique pencils. The image of a point when astigmatism is present will consist of two focal lines at right angles to each other and separated by a measurable distance along the axis of the pencil. The error is not eliminated by reduction of aperture as is spherical aberration.

Atom.—The smallest part of an element which can participate in ordinary chemical changes. The atoms of a given element are unvarying in average mass, but are different in such mass from atoms of all other elements.

Atomic number.—The number of excess positive charges on the atomic nucleus. This charge of the nucleus is the essential feature which distinguishes one element from another and determines the position of the element in the periodic table.

Atomic theory.—All elementary forms of matter are composed of very small unit quantities called atoms. The atoms of a given element all have the same size and weight. The atoms of different elements have different sizes and weights. Atoms of the same or different elements unite with each other to form very small unit quantities of compound substances called molecules.

Atomic weight is the relative weight of the atom, on the basis of oxygen as 16. If these weights are expressed in grams they are called gram atomic weights.

Avogadro's law.—Equal volumes of different gases at the same pressure and temperature contain the same number of molecules.

Avogadro's number.—The number of molecules in a mole or in a mass in grams of substance equal numerically to its molecular weight, i.e., 6.02×10^{23} molecules.

Avogadro's principle (or theory).—The numbers of molecules present in equal volumes of gases at the same temperature and pressure are equal.

Babo's law.—The addition of a non-volatile solid to a liquid in which it is soluble lowers the vapor pressure of the solvent in proportion to the amount of substance dissolved.

Balanced or reversible action.—One which can be caused to proceed in either direction by suitable variation in the conditions of temperature, volume, pressure or of the quantities of reacting substances.

Balmer series of spectral lines. The wave lengths of a series of lines in the spectrum of hydrogen are given in angstroms by the equation

$$\lambda = 3646 \frac{N^2}{N^2 - 4}$$

where N is an integer having values greater than 2.

Bases are substances which ionize in water to give the hydroxyl ion from their constituent elements. The strength of a base is proportional to the concentration of hydroxyl ions.

Beats.—Two tones of slightly different frequencies sounded together interfere to give a sound of regularly varying intensity. The number of beats per second is the difference in frequency of the two tones.

Beer's law (1852).—If two solutions of the same salt be made in the same solvent, one of which is, say, twice the concentration of the other, the absorption due to a given thickness of the first solution should be equal to that of twice the thickness of the second.

Bernoulli's theorem.—At any point in a tube through which a liquid is flowing the sum of the pressure energy, potential energy, and kinetic energy is constant. If p is pressure; h, height above a reference plane; d, density of the liquid, and v, velocity of flow,

$$p + hdg + \tfrac{1}{2}\, dv^2 = \text{a constant.}$$

Berthelot principle of maximum work.—Of all possible chemical processes which can proceed without the aid of external energy, that process always takes place which is accompanied by the greatest evolution of heat. This law holds good for low temperatures only and does not account for endothermic reactions.

Beta (β)-particle.—One of the products emitted from the atomic nuclei of radioactive substances during their spontaneous disintegration. A negatively charged particle, which at rest has a mass about $\frac{1}{1845}$ that of a hydrogen atom. An electron.

Beta (β)-rays.—A radiation, more penetrating but less ionizing than α-rays. The rays are deflected by electric and magnetic fields as negatively charged particles. The particles consist of high speed electrons.

Black body.—If, for all values of the wave length of the incident radiant energy, all of the energy is absorbed the body is called a black body.

Boyle's law for gases.—At a constant temperature the volume of a given quantity of any gas varies inversely as the pressure to which the gas is subjected. For a perfect gas,

changing from pressure p and volume v to pressure p' and volume v' without change of temperature,

$$pv = p'v'$$

Bulk modulus.—The modulus of volume elasticity,

$$M_B = \frac{p_2 - p_1}{\frac{v_1 - v_2}{v_1}}$$

where p_1, p_2; v_1, v_2 are the initial and final pressure and volume respectively.

Brewster's law.—The tangent of the polarizing angle for a substance is equal to the index of refraction. The polarizing angle is that angle of incidence for which the reflected polarized ray is at right angles to the refracted ray. If n is the index of refraction and θ the polarizing angle, $n = \tan \theta$.

Brightness is measured by the flux emitted per unit emissive area as projected on a plane normal to the line of sight. The unit of brightness is that of a perfectly diffusing surface giving out one lumen per square centimeter of projected surface and is called the lambert. The millilambert (0.001 lambert) is a more convenient unit. **Candle per square centimeter** is the brightness of a surface which has, in the direction considered, a luminous intensity of one candle per cm².

Brownian movement.—A continuous agitation of particles in a colloidal solution caused by unbalanced impacts with molecules of the surrounding medium. The motion may be observed with a microscope when a strong beam of light is caused to traverse the solution across the line of sight.

Capacitance is measured by the charge which must be communicated to a body to raise its potential one unit. Electrostatic unit capacitance is that which requires one electrostatic unit of charge to raise the potential one electrostatic unit. The farad $= 9 \times 10^{11}$ electrostatic units. A capacitance of one farad requires one coulomb of electricity to raise its potential one volt. Dimensions,—$[\epsilon\, l]$; $[\mu^{-1}\, l^{-1}\, t^2]$.

A conductor charged with a quantity Q to a potential V has a capacitance,

$$C = \frac{Q}{V}$$

Capacitance of a spherical conductor of radius r,

$$C = Kr$$

Capacitance of two concentric spheres of radii r and r'

$$C = K\frac{rr'}{r - r'}$$

Capacitance of a parallel plate condenser, the area of whose plates is A and the distance between them d,

$$C = \frac{KA}{4\pi d}$$

Capacitances will be given in electrostatic units if the dimensions of condensers are substituted in cm. K is the dielectric constant of the medium.

Capillary constant or specific cohesion,

$$a^2 = \frac{2T}{(d_1 - d_2)g} = hr$$

where T is surface tension, d_1 and d_2, the densities of the two fluids, g the acceleration due to gravity, h the height of rise in a capillary tube of radius r. See *Surface tension.*

Carnot cycle.—A sequence of operations forming the working cycle of an ideal heat engine of maximum thermal efficiency. It consists of isothermal expansion, adiabatic expansion, isothermal compression, and adiabatic compression to the initial state.

Catalytic agent.—A substance which by its mere presence alters the velocity of a reaction, and may be recovered unaltered in nature or amount at the end of the reaction.

Cation.—A positively charged ion.

Cauchy's dispersion formula.

$$n = A + \frac{B}{\lambda^2} + \frac{C}{\lambda^4} + \cdots$$

An empirical expression giving an approximate relation between the refractive index n of a medium and the wavelength λ of the light, A, B, and C being constants for a given medium.

Centripetal force.—The force required to keep a moving mass in a circular path. Centrifugal force is the name given to the reaction against centripetal force.

Charles' law or Gay-Lussac's law.—The volumes assumed by a given mass of a gas at different temperatures, the pressure remaining constant, are, within moderate ranges of temperature, directly proportional to the corresponding absolute temperatures.

Chromatic aberration.—Due to the difference in the index of refraction for different wave lengths, light of various wave lengths from the same source cannot be focused at a point by a simple lens. This is called chromatic aberration.

Chemiluminescence.—Emission of light during a chemical reaction.

Christiansen effect.—When finely powdered substances, such as glass or quartz, are immersed in a liquid of the same index of refraction complete transparency can only be obtained for monochromatic light. If white light is employed the transmitted color corresponds to the particular wave-length for which the two substances, solid and liquid have exactly the same index of refraction. Due to differences in dispersion the indices of refraction will match for only a narrow band of the spectrum.

Colligative property.—A property numerically the same for a group of substances, independent of their chemical nature.

Colloid.—A phase dispersed to such a degree that the surface forces become an important factor in determining its properties.

Coma.—An aberration of spherical lenses, occurring in the case of oblique incidence, when the bundle of rays forming the image is unsymmetrical. The image of a point is comet shaped, hence the name.

Combining volumes.—Under comparable conditions of pressure and temperature the volume ratios of gases involved in chemical reactions are simple whole numbers.

Combining weight of an element or radical is its atomic weight divided by its valence.

Combining weights, law of.—If the weights of elements which combine with each other be called their "combining weights," then elements always combine either in the ratio of their combining weights or of simple multiples of these weights.

Component substances, law of.—Every material consists of one substance, or is a mixture of two or more substances, each of which exhibits a specific set of properties, independent of the other substances.

Compounds are substances containing more than one constituent element and having properties, on the whole, different from those which their constituents had as elementary substances. The composition of a given pure compound is perfectly definite, and is always the same no matter how that compound may have been formed.

Compressibility.—Reciprocal of the bulk modulus.

Concentration.—The amount of a substance in weight, moles, or equivalents contained in unit volume.

Condensers in parallel and series.—If c_1, c_2, c_3, etc. represent the capacitances of a series of condensers and C their combined capacitance,—

when in parallel, $C = c_1 + c_2 + c_3 \cdots$

when in series, $\dfrac{1}{C} = \dfrac{1}{c_1} + \dfrac{1}{c_2} + \dfrac{1}{c_3} \cdots$

Conductance, the reciprocal of resistance, is measured by the ratio of the current flowing through a conductor to the difference of potential between its ends. The practical unit of conductance, the mho, the conductance of a body through which one ampere of current flows when the potential difference is one volt. The conductance of a body in mho is the reciprocal of the value of its resistance in ohms. Dimensions,—$[\epsilon\, l\, t^{-1}]$; $[\mu^{-1}\, l^{-1}\, t]$.

Conductivity, electrical, is measured by the quantity of electricity transferred across unit area, per unit potential gradient per unit time. Reciprocal of resistivity. **Volume conductivity** or specific conductance, $k = 1/\rho$ where ρ is the volume resistivity. **Mass conductivity** $= k/d$ where d is density. **Equivalent conductivity** $\Lambda = k/c$ where c is the number of equivalents per unit volume of solution. **Molecular conductivity** $\mu = k/m$ where m is the number of moles per unit volume of solution. Dimensions: volume conductivity,—$[\epsilon\, t^{-1}]$; $[\mu^{-1}\, l^{-2}\, t]$,—mass conductivity,—$[\epsilon\, m^{-1}\, l^3\, t^{-1}]$; $[\mu^{-1}\, m^{-1}\, lt]$.

Conductivity, thermal.—Time rate of transfer of heat by conduction, through unit thickness, across unit area for unit difference of temperature. It is measured as calories per second per square centimeter for a thickness of one centimeter and a difference of temperature of 1°C. Dimensions,—$[m\, l\, t^{-3}\, \theta^{-1}]$.

If the two opposite faces of a rectangular solid are maintained at temperatures t_1 and t_2 the heat conducted across the solid of section a and thickness d in a time T will be,

$$Q = \frac{K(t_2 - t_1)aT}{d}$$

K is a constant depending on the nature of the substance, designated as the specific heat conductivity. K is usually given for Q in calories, t_1 and t_2 in °C, a in cm², T in sec, and d in cm. See table *Heat conductivity*.

Conductors.—A class of bodies which are incapable of supporting electric strain. A charge given to a conductor spreads to all parts of the body.

Conjugate foci.—Under proper conditions light divergent from a point on or near the axis of a lens or spherical mirror is focused at another point. The point of convergence and the position of the source are interchangeable and are called conjugate foci.

Conservation of energy. (Chem).—In a chemical change there is no loss or gain but merely a transformation of energy from one form to another.

Conservation of energy, law of.—Energy can neither be created nor destroyed and therefore the total amount of energy in the universe remains constant.

Conservation of momentum, law of.—For any collision, the vector sum of the momenta of the colliding bodies after collision equals the vector sum of their momenta before collision. If two bodies of masses m_1 and m_2 have, before impact velocities v_1 and v_2 and after impact velocities u_1 and u_2.

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

Conservation of mass.—In all ordinary chemical changes, the total of the reactants is always equal to the total mass of the products.

Constitutive property.—A property which depends on the constitution or structure of the molecule.

Couple.—Two equal and oppositely directed parallel but not colinear forces acting upon a body form a couple. The moment of the couple or torque is given by the product of one of the forces by the perpendicular distance between them. Dimension,—$[m\, l^2\, t^{-2}]$.

Couple acting on a magnet of magnetic moment ml in a field of strength H. If the magnet is perpendicular to the direction of the field

$$C = Hml = HM$$

If the angle between the magnet and the field is θ

$$C = Hml \sin \theta$$

The couple will be in dyne-cm for cgs electromagnetic units of H, m and l.

Cryohydrate.—The solid which separates when a saturated solution freezes. It contains the solvent and the solute in the same proportions as they were in the saturated solution.

Crystal.—A homogeneous portion of a substance bounded by plane surfaces making definite angles with each other, giving a regular geometrical form.

Critical temperature is that temperature above which a gas cannot be liquefied by pressure alone. The pressure under which a substance may exist as a gas in equilibrium with the liquid at the critical temperature is the **critical pressure.**

Curie's law.—The intensity of magnetization,

$$I = \frac{AH}{T},$$

where H, is the magnetic field strength, T the absolute temperature and A Curie's constant. Used for paramagnetic substances.

Curie point.—All ferro-magnetic substances have a definite temperature of transition at which the phenomena of ferromagnetism disappear and the substances becomes merely paramagnetic. This temperature is called the "Curie Point" and is usually lower than the melting point.

Current (electric).—The rate of transfer of electricity. The transfer at the rate of one electrostatic unit of electricity in one second is the electrostatic unit of current. The electromagnetic unit of current is a current of such strength that one centimeter of the wire in which it flows is pushed sideways with a force of one dyne when the wire is at right angles to a magnetic field of unit intensity. The practical unit of current is the **ampere,** a transfer of one coulomb per second, which is one tenth the electromagnetic unit. The **international ampere** is the unvarying electric current which, when passed through a solution of silver nitrate in accordance with certain specifications, deposits silver at the rate of 0.00111800 gram per second. The international ampere is equivalent to 0.99991 absolute ampere. The **ampere-turn** is the magnetic potential

produced between the two faces of a coil of one turn carrying one ampere. Dimensions,—$[\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2}]$; $[\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$.

Current in a simple circuit.—The current in a circuit including an external resistance R and a cell of electromotive force E and internal resistance r,

$$I = \frac{E}{R + r}$$

If E is in volts and r and R in ohms the current will be in amperes.

For two cells in parallel,

$$I = \frac{E}{R + \frac{r}{2}}$$

For two cells in series,

$$I = \frac{2E}{R + 2r}$$

Dalton's law of partial pressures.—The pressure exerted by a mixture of gases is equal to the sum of the separate pressures which each gas would exert if it alone occupied the whole volume. This fact is expressed in the following formula:

$$PV = V(p_1 + p_2 + p_3, \text{etc.})$$

Declination.—The angle between the vertical plane containing the direction of the earth's field at any point and a plane containing the geographic north and south meridian.

Decomposition is the chemical separation of a substance into two or more substances, which may differ from each other and from the original substances.

Definite proportions, law of.—In every sample of each compound substance the proportions by weight of the constituent elements are always the same.

Degree of freedom.—The number of the variables determining the state of a system (usually pressure, temperature, and concentrations of the components) to which arbitrary values can be assigned.

Density.—Concentration of matter, measured by the mass per unit volume. Dimensions,—$[m\, l^{-3}]$.

Dew point.—The temperature at which condensation of water vapor in the air takes place.

Diamagnetic bodies tend to set the longest dimension across the magnetic field. The permeability of a diamagnetic substance is less than unity.

Dielectric constant of a medium is defined by ϵ in the equation

$$F = \frac{QQ'}{\epsilon r^2}$$

where F is the force of attraction between two charges Q and Q' separated by a distance r in a uniform medium.

Dielectrics or insulators or non-conductors.—A class of bodies supporting an electric strain. A charge on one part of a non-conductor is not communicated to any other part.

Diffraction.—If the light source were a point, the shadow of any object would have its maximum sharpness; a certain amount of illumination, however, would be found within the geometrical shadow due to the diffraction of the light at the edge of the object.

Diffraction grating.—If s is the distance between the rulings, d the angle of diffraction, then the wave length where the angle of incidence is 90° is (for the nth order spectrum),

$$\lambda = \frac{s \sin d}{n}$$

If i is the angle of incidence, d the angle of diffraction, s the distance between the rulings, n the order of the spectrum, the wave length is, $\lambda = \frac{s}{n} (\sin i + \sin d)$.

Diffusion.—If the concentration (mass of solid per unit volume of solution) at one surface of a layer of liquid is d_1 and at the other surface d_2, the thickness of the layer h and the area under consideration A, then the mass of the substance which diffuses through the cross-section A in time t is,

$$m = \Delta A \frac{(d_2 - d_1)t}{h}$$

where Δ is the coefficient of diffusion.

Diffusivity or coefficient of diffusion is also given by Δ in the equation

$$\frac{dQ}{dt} = -\Delta \left(\frac{dc}{dx}\right) dy\, dz$$

where dQ is the amount passing through an area $dy\, dz$ in the direction of x in a time dt where dc/dx is the rate of increase of volume concentration in the direction of x. Dimensions,—$[l^2 t^{-1}]$.

Diffusivity of heat is given by Δ in the equation

$$\frac{dH}{dt} = -\Delta s d \frac{dT}{dx} dy\, dz$$

where dH is the quantity of heat passing through the area $dy\, dz$ in the direction of x in a time dt. The rate of variation of temperature along x is given by dT/dx, s is specific heat and d, density. Dimensions,—$[l^2 t^{-1}]$.

Dimensional formulae.—If mass, length, and time are considered fundamental quantities, the relation of other physical quantities and their units to these three may be expressed by a formula involving the symbols l, m and t respectively, with appropriate exponents. For example: the dimensional formula

for volume would be expressed,—$[l^3]$; velocity,—$[lt^{-1}]$; force— $[m\, lt^{-2}]$. Other fundamental quantities used in dimensiona' formulae may be indicated as follows: θ, temperature; ϵ the dielectric constant of a vacuum; μ, the magnetic permeability of a vacuum.

Diminution of pressure at the side of a moving stream. If a fluid of density d moves with a velocity v, the diminution of pressure due to the motion is (neglecting viscosity),

$$p = \tfrac{1}{2}\, dv^2$$

Dip.—The angle measured in a vertical plane between the direction of the earth's magnetic field and the horizontal.

Dispersion.—The difference between the index of refraction of any substance for any two wave lengths is a measure of the dispersion for these wave lengths, called the coefficient of dispersion.

Dispersive power.—If n_1 and n_2 are the indices of refraction for wave lengths λ_1 and λ_2 and n the mean index or that for sodium light, the dispersive power for the specified wave length is,

$$\omega = \frac{n_2 - n_1}{n - 1}$$

Displacement is a reaction in which an elementary substance displaces and sets free a constituent element from a compound.

Displacement or elongation at any instant. The distance of a vibrating or oscillating particle from its position of equilibrium.

Distribution law.—A substance distributes itself between two immiscible solvents so that the ratio of its concentrations in the two solvents is approximately a constant (and equal to the ratio of the solubilities of the substance in each solvent). Requires modification if more than one molecular species is formed.

Doppler effect. (Light).—The apparent change in the wave-length of light produced by the motion in the line of sight of either the observer or the source of light.

Doppler's principle.—The apparent frequency of a sound as affected by motion of the hearer, the source and the medium is given by the following expression,

$$n = n_o \frac{V + w - v_o}{V + w - v}$$

where n_o is the original frequency of the source, V the velocity of sound, w that of the medium, v_o that of the observer and v that of the source. Only the components of motion parallel to the line connecting the source and observer are to be considered. All velocities are taken in the direction from the source to observer; if the motion is in the opposite direction the sign of the velocity substituted in the formula should be changed.

Double decomposition consists of a simple exchange of the parts of two substances to form two new substances.

Dulong and Petite, law of.—The specific heats of the several elements are inversely proportional to their atomic weights. The atomic heats of solid elements are constant and approximately equal to 6.3. Certain elements of low atomic weight and high melting point have, however, much lower atomic heats at ordinary temperatures.

Eddy current.—A current induced in a mass of conducting material by a varying magnetic field. Also called *Foucault current.*

Edison effect.—The name first given (after its discoverer) to the phenomenon of electrical conduction between an incandescent filament and an independent cold electrode contained in the same envelope, when the second electrode is made positive with respect to the filament.

Elasticity.—The property by virtue of which a body resists and recovers from deformation produced by force.

Elastic limit.—The smallest value of the stress producing permanent alteration.

Elastic moduli.

Young's modulus by stretching.—If an elongation s is produced by the weight of the mass m, in a wire of length l, and radius r, the modulus,

$$M = \frac{mgl}{\pi r^2 s}$$

Young's modulus by bending, bar supported at both ends. If a flexure s is produced by the weight of mass m, added midway between the supports separated by a distance l, for a rectangular bar with vertical dimensions of cross-section a and horizontal dimension b, the modulus is,

$$M = \frac{mgl^3}{4sa^3b}$$

For a cylindrical bar of radius r,

$$M = \frac{mgl^3}{12\pi r^4 s}$$

For a bar supported at one end. In the case of a rectangular bar as described above,

$$M = \frac{4mgl^3}{sa^3b}$$

For a round bar supported at one end,

$$M = \frac{4mgl^3}{3\pi r^4 s}$$

Modulus of rigidity.—If a couple C ($= mgx$) produces a twist of θ radians in a bar of length l and radius r, the modulus is

$$M = \frac{2Cl}{\pi r^4 \theta}$$

DEFINITIONS AND FORMULAE (Continued)

The substitution in the above formulae for the elastic coefficients of m in grams, g in cm per sec^2, l, a, b, and r in cm, s in cm, and C in dyne-cm will give moduli in dynes per cm^2. The dimensions of elastic moduli are the same as of stress,—$[m\, l^{-1}\, t^{-2}]$.

Coefficient of restitution.—Two bodies moving in the same straight line, with velocities v_1 and v_2 respectively, collide and after impact move with velocities v_3 and v_4. The coefficient of restitution is

$$C = \frac{v_4 - v_3}{v_2 - v_1}$$

Electric field intensity is measured by the force exerted on unit charge. Unit field intensity is the field which exerts the force of one dyne on unit positive charge. Dimensions,—$[\epsilon^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^{-1}]$; $[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{1}{2}}\, t^{-2}]$.

The field intensity or force exerted on unit charge at a point distant r from a charge q in a vacuum

$$H = \frac{q}{r^2}$$

If the dielectric in the above cases is not a vacuum the dielectric constant ϵ must be introduced. The formula becomes

$$H = \frac{q}{\epsilon r^2}$$

The value of ϵ is frequently considered unity for air. If the dielectric constant of a vacuum is considered unity the value for air at 0°C and 760 mm pressure is 1 000576.

Electrolysis.—If a current i flows for a time t and deposits a metal whose electrochemical equivalent is e, the mass deposited is

$$m = eit$$

The value of e is usually given for mass in grams, i in amperes and t in seconds.

Electrochemical equivalent of an ion is the mass liberated by the passage of unit quantity of electricity.

Electromotive force is defined as that which causes a flow of current. The electromotive force of a cell is measured by the maximum difference of potential between its plates. The electromagnetic unit of potential difference is that against which one erg of work is done in the transfer of electromagnetic unit quantity. The **volt** is that potential difference against which one joule of work is done in the transfer of one coulomb. One volt is equivalent to 10^8 electromagnetic units of potential. The **international** volt is the electrical potential which when steadily applied to a conductor whose resistance is one international ohm will cause a current of one international ampere to flow. The international volt = 1.00043 absolute volts. The electromotive force of a Weston standard cell is 1.0183 int. volts at 20°C. Dimensions,—$[\epsilon^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{1}{2}}\, t^{-1}]$; $[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{3}{2}}\, t^{-2}]$

Electrolytic dissociation or ionization theory.—When an acid, base or salt is dissolved in water or any other dissociating solvent, a part or all of the molecules of the dissolved substance are broken up into parts called ions, some of which are charged with positive electricity and are called cations, and an equivalent number of which are charged with negative electricity and are called anions.

Electrolytic solution tension theory (**or the Helmholtz double layer theory**).—When a metal, or any other substance capable of existing in solution as ions, is placed in water or any other dissociating solvent, a part of the metal or other substances passes into solution in the form of ions, thus leaving the remainder of the metal or substances charged with an equivalent amount of electricity of opposite sign from that carried by the ions. This establishes a difference in potential between the metal and the solvent in which it is immersed.

Electromotive series is a list of the metals arranged in the decreasing order of their tendencies to pass into ionic form by losing electrons.

Electron.—A very small negatively charged particle. Electrons appear to be uniform in mass and charge and to be one of the basic elements of which atoms are made. The charge of the electron is accepted as 4.80×10^{-10} absolute electrostatic unit.

Electron theory of matter.—An atom is believed to consist of a nucleus bearing a positive charge, different for each sort of atom, surrounded by electrons or negative charges equal in total charge to the positive charge of the nucleus. The nucleus may consist of a certain number of protons and neutrons. The electrons revolve as satellites around the nucleus.

The nucleus contains practically all of the mass of the atom, the number of protons and neutrons determining the atomic weight. The number and arrangement of satellite electrons determines the chemical properties of the atom.

Elements are substances which cannot be decomposed by the ordinary types of chemical change, or made by chemical union.

Emissive power or emissivity is measured by the energy radiated from unit area of a surface in unit time for unit difference of temperature between the surface in question and surrounding bodies. For the cgs system the emissive power is given in ergs per second per square centimeter with the radiating surface at 1° absolute and the surroundings at absolute zero. See *Radiation formula*.

Enantiotropic.—Crystal forms capable of existing in reversible equilibrium with each other.

Energy.—The capability of doing work. **Potential energy** is energy due to position of one body with respect to another or to the relative parts of the same body. **Kinetic energy**

is energy due to motion. Cgs units,—the erg, the energy expended when a force of one dyne acts through a distance of one centimeter; the joule is 1×10^7 ergs. Dimensions,—$[m\, l^2\, t^{-2}]$.

The potential energy of a mass m, raised through a distance h, where g is the acceleration due to gravity is

$$E = mgh.$$

The kinetic energy of mass m, moving with a velocity v, is

$$E = \tfrac{1}{2}mv^2.$$

Energy will be given in ergs if m is in grams, g in cm per sec^2, h in cm and v in cm per sec.

Energy of a charge in ergs where Q is the charge and V the potential in electrostatic units.

$$E = \tfrac{1}{2}QV.$$

Energy of the electric field.—If H is the electric field intensity in electrostatic units and K the specific inductive capacity, the energy of the field in ergs per cm^3 is

$$E = \frac{KH^2}{8\pi}$$

Energy of rotation.—If a mass whose moment of inertia about an axis is I, rotates with angular velocity ω about this axis, the kinetic energy of rotation will be,

$$E = \tfrac{1}{2}I\omega^2$$

Energy will be given in ergs if I is in g-cm^2 and ω in radians per sec.

Entropy.—A quantity depending on the quantity of heat in a body and on its temperature, which, when multiplied by any lower temperature (minimum available), gives the unavailable energy, or unavoidable waste when mechanical work is derived from the heat energy of the body. Dimensions,—$[m\, l^2\, t^{-2}\, \theta^{-1}]$.

Equilibrium, chemical.—A state of affairs in which a chemical reaction and its reverse reaction are taking place at equal velocities, so that the concentrations of reacting substances remain constant.

Equilibrium constant.—The product of the concentrations (or activities) of the substances produced at equilibrium in a chemical reaction divided by the product of concentrations of the reacting substances, each concentration raised to that power which is the coefficient of the substance in the chemical equation.

Equivalent weight or combining weight of an element or ion is its atomic or formula weight divided by its valence. Elements entering into combination always do so in quantities proportional to their equivalent weights.

Ettinghausen's effect (Von Ettinghausen's).—When an electric current flows across the lines of force of a magnetic

field an electromotive force is observed which is at right angles to both the primary current and the magnetic field: a temperature gradient is observed which has the opposite direction to the Hall electromotive force.

Eutectic.—A term applied to the mixture of two or more substances which has the lowest melting point.

Expansion of gases.

Charles' law or Gay-Lussac's law.—The volume of a gas at constant pressure increases proportionately to the absolute temperature. If V_1 and V_2 are volumes of the same mass of gas at absolute temperatures, T_1 and T_2,

$$\frac{V_1}{V_2} = \frac{T}{T_2}$$

For an original volume V_o at 0°C the volume at t°C (at constant pressure) is

$$V_t = V_o(1 + 0.00367t).$$

General law for gases.

$$p_t v_t = p_o v_o \left(1 + \frac{t}{273}\right)$$

where p_o, v_o, p_t, v_t represent the pressure and value at 0° and t°C. or

$$\frac{p_1 v_1}{T_1} = \frac{p_2 v_2}{T_2}$$

where p_1, v_1 and T_1 represent pressure volume and absolute temperature in one case and p_2, v_2 and T_2 the same quantities for the same mass of gas in another.

The law may also be expressed:

$$pv = RmT$$

where m is the mass of gas at absolute temperature T. R is the **gas constant** which depends on the units used. **Boltzmann's molecular gas constant** is obtained by expressing m in terms of the number of molecules.

For volume in cm^3, pressure in dynes per cm^2 and temperature in Centigrade degrees on the absolute scale $R = 8.3136 \times 10^7$.

Reduction of a gas volume to 0°C, 760 mm pressure.—If V is the original volume of a gas at temperature t and pressure H, the volume at 0°C and 760 mm pressure will be,

$$V_o = \frac{V}{(1 + \alpha t)} \frac{H}{760}$$

if d is the original density the density at 0°C and 760 mm pressure will be

$$d_o = d(1 + \alpha t) \frac{760}{H}$$

$$\alpha = 0.00367 \text{ approximately.}$$

Falling bodies.—For bodies falling from rest conditions are as for uniformly accelerated motion except that $v_o = O$ and

g is the acceleration due to gravity. The formulae become,—air resistance neglected,

$$v_t = gt,\ s = \tfrac{1}{2}gt^2,\ v_s = \sqrt{2gs}.$$

For bodies projected vertically upward,—if v is the velocity of projection, the time to reach greatest height, neglecting the resistance of the air,

$$t = \frac{v}{g}$$

Greatest height,

$$h = \frac{v^2}{2g}$$

See also under *Projectiles*.

Faraday's laws.—In the process of electrolytic changes equal quantities of electricity charge or discharge equivalent quantities of ions at each electrode.

One gram equivalent weight of matter is chemically altered at each electrode for 96,500 coulombs, or one faraday, of electricity passed through the electrolyte.

Faraday effect.—The rotation of the plane of polarization produced when plane-polarized light is passed through a substance in a magnetic field, the light traveling in a direction parallel to the lines of force. For a given substance, the rotation is proportional to the thickness traversed by the light and to the magnetic field strength.

Fermat's principle of least time.—The path chosen by a ray joining two points is that which can be travelled over in the least possible time.

Fleming's rule.—A simple rule for relating the directions of the flux, motion, and e.m.f. in an electric machine. The forefinger, second finger and thumb, placed at right-angles to each other, represent respectively the directions of flux, e.m.f., and motion or torque. If the right hand is used the conditions are those obtaining in a generator and if the left hand is used the conditions are those obtaining in a motor.

Fluidity.—The reciprocal of viscosity. The cgs unit is the rho, the reciprocal of the poise. Dimensions,—$[m^{-1}\,lt]$.

Force.—That which changes the state of rest or motion in matter, measured by the rate of change of momentum. Absolute unit,—the **dyne,** the force which will produce an acceleration of one centimeter per second per second in a gram mass. The gram weight or weight of a gram mass is the cgs gravitational unit. The poundal is that force which will give an acceleration of one foot per second to a pound mass. Dimensions,—$[m\,lt^{-2}]$.

The force F required to produce an acceleration a in a mass m is given by

$$F = ma.$$

If m is substituted in grams and a in cm per sec^2, F will be given in dynes.

Force between two charges, Coulomb's law.—If two charges q and q' are at a distance r in a vacuum, the force between them is,

$$F = \frac{qq'}{r^2}$$

The force will be given in dynes if q and q' are in electrostatic units and r in cm.

Force between two magnetic poles.—If two poles of strength m and m' are separated by a distance r in a medium whose permeability is μ (unity for a vacuum), the force between them is,

$$F = \frac{mm'}{\mu r^2}$$

Force will be given in dynes if r is in cm and m and m' are in cgs units of pole strength.

The strength of a magnetic field at a point distance r from an isolated pole of strength m is

$$H = \frac{m}{\mu r^2}$$

The field will be given in gauss if m and r are in cgs units.

Formula, chemical.—A combination of symbols with their subscripts representing the constituents of a substance and their proportions by weight.

Foucault's pendulum.—The rate of rotation in degrees per hour of a line on the surface of the earth relative to the plane of a Foucault's pendulum at latitude ϕ is,

$$\omega = 15 \sin \phi$$

Fraunhofer's lines.—When sunlight is examined through a spectroscope it is found that the spectrum is traversed by an enormous number of dark lines parallel to the length of the slit. These dark lines are known as Fraunhofer's lines. Kirchoff conceived the idea that the sun is surrounded by layers of vapors which act as filters of the white light arising from incandescent solids within and which abstract those rays which correspond in their periods of vibration to those of the components of the vapors. Thus reversed or dark lines are obtained due to the absorption by the vapor envelop, in place of the bright lines found in the emission spectrum.

Frequency in uniform circular motion or in any periodic motion is the number of revolutions or cycles completed in unit time. Cgs units,—cycles per second. Dimension,—$[t^{-1}]$.

Frequency of vibrating strings.—The fundamental frequency of a stretched string is given by

$$n = \frac{1}{2l}\sqrt{\frac{T}{m}}$$

where l is the length; T, the tension and m the mass per unit length.

For a string or wire of circular section of length, l, tension T, density d, and radius r, the frequency of the fundamental is

$$n = \frac{1}{2rl}\sqrt{\frac{T}{\pi d}}$$

The frequency in vibrations per second will be given if T is in dynes, r and l in cm and d in g per cm^3.

Friction, coefficient of.—The coefficient of friction between two surfaces is the ratio of the force required to move one over the other to the total force pressing the two together.

If F is the force required to move one surface over another and W, the force pressing the surfaces together, the coefficient of friction,

$$k = \frac{F}{W}.$$

Fundamental units.—See under *Mass, Length and Time.*

Gamma (γ) **rays.**—Highly penetrating radiations from radioactive substances, undeflected by electric or magnetic fields, representing a high frequency electromagnetic radiation They have the same nature as X-rays but are of higher frequency.

Gas.—A state of matter in which the molecules are practically unrestricted by cohesive forces. A gas has neither definite shape nor volume.

Gas thermometer.—Where P_o, P_s and P_x represent the total pressure with the bulb at 0°C, at the boiling-point of water and at the unknown temperature respectively, t_s the temperature of steam and t_x the unknown temperature,

$$t_x = t_s \frac{P_x - P_o}{P_s - P_o}$$

(approximately). The total pressure on the gas in the bulb is the algebraic sum of barometric pressure at the time and that measured by the manometer.

Gay-Lussac's law.—See *Charles' law.*

Gay-Lussac's law of combining volumes.—If gases interact and form a gaseous product, the volumes of the reacting gases and the volumes of the gaseous products are to each other in simple proportions, which can be expressed by small whole numbers.

Gibbs' phase rule.—$F = C + 2 - P$. F, the number of degrees of freedom of a system, is the number of variable

factors (temperature, pressure and concentration) of the components, which must be arbitrarily fixed in order that the condition of the system may be perfectly defined. C, the number of the components of the system, is chosen equal to the smallest number of independently variable constituents by means of which the composition of each phase participating in the state of equilibrium can be expressed in the form of a chemical equation; the components must be chosen from among the constituents which are present when the system is in a state of true equilibrium and which take part in that equilibrium; as components are chosen the smallest number of such constituents necessary to express the composition of each phase participating in the equilibrium, zero and negative quantities of components being permissible; in any system the number of components is definite, but may alter with changes in conditions of experiment; a qualitative but not quantitative freedom of selection of components is allowed, the choice being influenced by suitability and simplicity of application. P, the number of phases of the system, are the homogeneous, mechanically separable and physically distinct portions of a heterogeneous system; the number of phases capable of existence varies greatly in different systems; there can never be more than one gas or vapor phase since all gases are miscible in all proportions, a heterogeneous mixture of solid substances forms as many phases as there are substances present.

Graham's law.—The relative rates of diffusion of gases under the same conditions are inversely proportional to the square roots of the densities of those gases.

Gram atom or gram atomic weight.—The mass in grams numerically equal to the atomic weight.

Gram equivalent of a substance is the weight of a substance displacing or otherwise reacting with 1.008 grams of hydrogen or combining with one-half of a gram atomic weight (8.00 grams) of oxygen.

Gram mole, gram formula weight, gram equivalent.—Mass in grams numerically equal to the molecular weight, formula weight or chemical equivalent, respectively.

Gram molecular weight or gram molecule.—A mass in grams of a substance numerically equal to its molecular weight. Gram mole.

Gravitation.—The universal attraction existing between all material bodies. The force of attraction between two masses m and m', separated by a distance r, k being the constant of gravitation,

$$F = k\frac{mm'}{r^2}$$

(If m and m' are given in grams, and r in centimeters, F will be in dynes if $k = 6.670 \times 10^{-8}$.)

Hall effect.—When a steady current is flowing in a steady magnetic field, electromotive forces are developed which are at right angles both to the magnetic force and to the current and are proportional to the product of the intensity of the current, the magnetic force and the sine of the angle between the directions of these quantities.

Hardness.—Property of substances determined by their ability to abrade or indent one another. An arbitrary scale of hardness is based upon ten selected minerals. For metals the diameter of the indentation made by a hardened steel sphere (Brinnell) or the height of rebound of a small drop hammer (Shore Scleroscope) serve to measure hardness.

Harmonic motion.—See *Simple harmonic motion and Angular harmonic motion.*

Heat effect.—The heat in calories developed in a circuit by an electric current of I amperes flowing through a resistance of R ohms, with a difference of potential E volts for a time t seconds.

$$H = \frac{RI^2t}{4.18} = \frac{EIt}{4.18}$$

Heat equivalent, or latent heat, of fusion.—The quantity of heat necessary to change one gram of solid to a liquid with no temperature change. Dimensions,—[$l^2\ t^{-2}$].

Heat quantity is measured by the change of temperature produced. The cgs unit of heat is the **calorie,** the quantity of heat necessary to change the temperature of one gram of water from 3.5°C to 4.5°C (called a small calorie). If the temperature change involved is from 14.5 to 15.5°C, the unit is the normal calorie. The mean calorie is $\frac{1}{100}$ the quantity of heat necessary to raise one gram of water from 0°C to 100°C. The large calorie is equal to 1000 small calories. The British thermal unit is the heat required to raise the temperature of one pound of water at its maximum density, 1°F. It is equal to about 252 calories. Dimensions of energy,—[$m\ l^2\ t^{-2}$].

Heat of combustion of a substance is the amount of heat evolved by the combustion of 1 gram molecular weight of the substance.

Henry's law.—The mass of a slightly soluble gas that dissolves in a definite mass of a liquid at a given temperature is very nearly directly proportional to the partial pressure of that gas. This holds for gases which do not unite chemically with the solvent.

Hess' law of constant heat summation.—The amount of heat generated by a chemical reaction is the same whether reaction takes place in one step or in several steps, or all chemical reactions which start with the same original substances and end with the same final substances liberate the same amounts of heat, irrespective of the process by which the final state is reached.

Hooke's law.—Within the elastic limit of any body the ratio of the stress to the strain produced is constant.

Humidity, absolute.—Mass of water vapor present in unit volume of the atmosphere, usually measured as grams per cubic meter. It may also be expressed in terms of the actual pressure of the water vapor present.

Huygens' theory of light.—This theory states that light is a disturbance traveling through some medium, such as the ether. Thus light is due to wave motion in ether.

Every vibrating point on the wave-front is regarded as the center of a new disturbance. These secondary disturbances traveling with equal velocity, are enveloped by a surface identical in its properties with the surface from which the secondary disturbances start and this surface forms the new wave-front.

Hydrogen equivalent of a substance is the number of replaceable hydrogen atoms in 1 molecule or the number of atoms of hydrogen with which 1 molecule could react.

Hydrogen ion concentration or pH value is the logarithm of the reciprocal of the gram ionic hydrogen equivalents per liter; i.e., $pH = \log \frac{1}{(H^+)}$ per liter. Water has a concentration of H^+ ion of 10^{-7} and of OH^- ion of 10^{-7} moles per liter or a pH value of 7. Due to hydrolysis the composition of a weak acid solution titrated against a strong base is basic and of a weak base against a strong acid is acid. A truly neutral titrated solution of a strong acid or base has the same concentration of H^+ and OH^- ions as water.

Hydrolysis is a double decomposition reaction involving the splitting of water into its ions and the formation of a weak acid or base or both.

Hydrostatic pressure at a distance h from the surface of a liquid of density d,

$$P = hdg.$$

The total force on an area A due to hydrostatic pressure,

$$F = PA = Ahdg.$$

Force in dynes and pressure in dynes per cm² will be given if h is in cm, d in g per cm³ and g in cm per sec².

Hysteresis.—The magnetization of a sample of iron or steel due to a magnetic field which is made to vary through a cycle of values, lags behind the field. This phenomenon is called hysteresis.

Steinmetz' equation for hysteresis gives the loss of energy in ergs per cycle per cm³,

$$W = \eta B^{1.6}$$

where B is the maximum induction in maxwells per cm² and η the coefficient of hysteresis.

Illumination on any surface is measured by the luminous flux incident on unit area. The units in use are: the **lux,** one lumen per square meter; the **phot,** one lumen per square centimeter and the lumen per square foot. Since at unit distance from a point source of unit intensity the illumination is unity, unit illumination may be defined as that produced by a unit source at unit distance, hence the **meter-candle** or **candle-meter** which is equal to the lux and the **foot-candle** equivalent to one lumen per square foot.

Index of refraction for any substance is the ratio of the velocity of light in a vacuum to its velocity in the substance. It is also the ratio of the sine of the angle of incidence to the sine of the angle of refraction. In general, the index of refraction for any substance varies with the wave length of the refracted light.

Induced electromotive force in a circuit is proportional to the rate of change of magnetic flux through the circuit.

$$E = -\frac{d\phi}{dt}.$$

where $d\phi$ is the change of magnetic flux in a time dt. The induced current will be given by

$$I = \frac{d\phi}{Rdt}$$

where R is the resistance of the circuit.

Inertia.—The resistance offered by a body to a change of its state of rest or motion, a fundamental property of matter. Dimension,—$[m]$.

Indicators are substances which change from one color to another when the hydrogen ion concentration reaches a certain value, different for each indicator.

Inductance.—The change in magnetic field due to the variation of a current in a conducting circuit causes an induced counter electromotive force in the circuit itself. This phenomenon is known as **self-induction.** If an electromotive force is induced in a neighboring circuit the term mutual induction is used. Inductance may thus be distinguished as self- or mutual and is measured by the electromotive force produced in a conductor by unit rate of variation of the current. Units of inductance are the centimeter (absolute electromagnetic) and the henry, which is equal to 10^9 centimeters of inductance. The **henry** is that inductance in which an induced electromotive force of one volt is produced when the inducing current is changed at the rate of one ampere per second. Dimensions,—$[\epsilon^{-1} l^{-1} t^2]$; $[\mu l]$.

Induction.—Any change in the intensity or direction of a magnetic field causes an electromotive force in any conductor in the field. The induced electromotive force generates an induced current if the conductor forms a closed circuit.

Intensity of illumination in candle meters of a screen illuminated by a source of illuminating power P candles at a distance r meters, for normal incidence,

$$I = \frac{P}{r^2}$$

If two sources of illuminating power P_1 and P_2 produce equal illumination on a screen when at distances r_1 and r_2 respectively,

$$\frac{P_1}{r_1^2} = \frac{P_2}{r_2^2} \quad \text{or} \quad \frac{P_1}{P_2} = \frac{r_1^2}{r_2^2}$$

If I_o is the intensity of illumination when the screen is normal to the incident light, I the intensity when an angle θ

$$I = I_o \cos \theta$$

Intensity of magnetization is given by the quotient of the magnetic moment of a magnet by its volume. Unit intensity of magnetization is the intensity of a magnet which has unit magnetic moment per cubic centimeter. Dimensions,—$[\epsilon^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{3}{2}}]$; $[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^{-1}]$.

Intensity of radiation is the radiant energy emitted in a specified direction per unit time, per unit area of surface, per unit solid angle.

Intensity of sound depends upon the energy of the wave motion. The intensity is measured by the energy in ergs transmitted per second through one square centimeter of surface. The energy in ergs per cm^3 in a sound wave is given by

$$E = 2^2\pi d n^2 a^2$$

where d is density in g per cm^3, n is frequency in vib. per sec and a is amplitude in cm. The energy reaching the ear in unit time will also be proportional to the velocity of propagation.

Ion.—Acids, bases and salts (electrolytes) when dissolved in certain solvents are more or less dissociated into electrically charged units, or parts of the molecules, called ions.

Some electrolytes dissociate into ions when fused.

Ions carry charges of electricity, and in consequence have different properties from the uncharged radicals.

Positive ions are atoms or group of atoms which have lost valence electrons; negative ions are those to which additional electrons have been added.

Ionization potential.—The potential required to transfer an electron from its normal quantum level to infinity.

Isomerism.—Existence of molecules having the same number and kinds of atoms but in different configurations.

Isothermal.—When a gas passes through a series of pressure and volume variations without change of temperature the changes are called isothermal. A line on a pressure-volume diagram representing these changes is called an isothermal line.

Isotopes are elements occupying the same place in the periodic system, having the same nuclear charge, but differing

somewhat in atomic weight. Most of the ordinary inactive elements have been shown to consist of a mixture of isotopes.

Joule-Thomson effect.—The cooling which occurs when a highly compressed gas is allowed to expand in such a way that no external work is done is known as the Joule-Thomson effect. This cooling is inversely proportional to the square of the absolute temperature.

Kepler's laws.

I. The planets move about the sun in ellipses, at one focus of which the sun is situated.

II. The radius vector joining each planet with the sun describes equal areas in equal times.

III. The cubes of the mean distances of the planets from the sun are proportional to the squares of their times of revolution about the sun.

Kerr effect.—When plane polarized light is incident on the pole of an electromagnet, polished so as to act like a mirror, the plane of polarization of the reflected light is not the same when the magnet is "on" as when it is "off." It was found that the direction of rotation was opposite to that of the currents exciting the pole from which the light was reflected.

Kinetic theory, expression for pressure.

$$P = \tfrac{1}{3}Nmv^2$$

where N is the number of molecules in unit volume, m the mass of each molecule and v^2 the mean square of the velocity of the molecules.

Kinetic theory of gases.—1738.—Gases are considered to be made up of minute, perfectly elastic particles which are ceaselessly moving about with high velocities, colliding with each other and with the walls of the containing vessel. The pressure exerted by a gas is due to the combined effect of the impacts of the moving molecules upon the walls of the containing vessel, the magnitude of the pressure being dependent upon the kinetic energy of the molecules and their number.

Kirchhoff's laws.

I. The algebraic sum of the currents which meet at any point is zero.

II. In any closed circuit the algebraic sum of the products of the current and the resistance in each conductor in the circuit is equal to the electromotive force in the circuit.

Kirchhoff's laws of radiation.—The relation between the powers of emission and the powers of absorption for rays of the same wave-length is constant for all bodies at the same temperature. First, a substance when excited by some means or other possess a certain power of emission; it tends to emit definite rays, whose wave-lengths depend upon the nature of the substance and upon the temperature. Second, the substance exerts a definite absorptive power, which is a maximum for the rays it tends to emit. Third, at a given temperature the ratio between the emissive and the absorptive power

for a given wave-length is the same for all bodies, and is equal to the emissive power of a perfectly black body.

Kohlrausch's law.—When ionization is complete, the conductivity of an electrolyte is equal to the sum of the conductivities of the ions into which the substance dissociates.

Kundt's law.—On approaching an absorption band from the red side of the spectrum the refractive index is abnormally increased by the presence of the band, while the approach is from the blue side and the index is abnormally decreased.

Lambert's law of absorption.—Each layer of equal thickness absorbs an equal fraction of the light which traverses it.

Lambert's law of illumination.—The illumination of a surface on which the light falls normally from a point source is inversely proportional to the square of the distance of the surface from the source. If the normal to the surface makes an angle with the direction of the rays, the illumination is proportional to the cosine of that angle.

Latent heat of vaporization.—The quantity of heat necessary to change one gram of liquid to vapor without change of temperature, measured as calories per gram. Dimensions,—$[l^2\, t^{-2}]$.

Lattice energy.—The energy required to separate the ions of a crystal to an infinite distance from each other.

LeChatelier's principle.—If some stress is brought to bear upon a system in equilibrium, a change occurs, such that the equilibrium is displaced in a direction which tends to undo the effect of the stress.

Length, units of.—The centimeter, one of the three fundamental units of the cgs system, is one one-hundredth the length of the International Prototype Meter, at Paris, at zero degrees centigrade. The meter is 1,533,164.13 times the wave length of the red cadmium line in air, 760 mm pressure, 15°C. The standard in the British system is the yard, the prototype of which is kept by the British government. The United States standard yard is defined as $\frac{3600}{3937}$ meter.

Lenses.—For a single thin lens whose surfaces have radii of curvature r_1 and r_2 whose principal focus is F, the index of refraction n, and conjugate focal distances f_1 and f_2,

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} = (n - 1)\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$$

For a thick lens, of thickness t,

$$F = \frac{nr_1r_2}{(n - 1)[n(r_1 + r_2) - t(n - 1)]}$$

Combinations of lenses.—If f_1 and f_2 are the focal lengths of two thin lenses separated by a distance d the focal length of the system,

$$F = \frac{f_1 f_2}{f_1 + f_2 - d}$$

Lenz's law.—When an electromotive force is induced in a conductor by any change in the relation between the conductor and the magnetic field, the direction of the electromotive force is such as to produce a current whose magnetic field will oppose the change.

Line of force.—A term employed in the description of an electric or magnetic field. A line such that its direction at every point is the same as the direction of the force which would act on a small positive charge (or pole) placed at that point. A line of force is defined as starting from a positive charge (or pole) and ending on a negative charge (or pole).

The line (of force) is also used as a unit of magnetic flux, equivalent to the maxwell.

Lissajous figures.—The path described by a particle which is simultaneously displaced by two simple harmonic motions at right angles, when the periods of the two motions are in the ratio of two small whole numbers, shows a variety of characteristic curves called Lissajous figures.

Liquid.—A state of matter in which the molecules are relatively free to change their positions with respect to each other but restricted by cohesive forces so as to maintain a relatively fixed volume.

Loschmidt's number.—The number of molecules per unit volume of an ideal gas at 0°C and normal atmospheric pressure.

$$n_0 = 2.687 \times 10^{19} \text{ per cm}^3.$$

Luminous flux.—The total visible energy emitted by a source per unit time is called the total luminous flux from the source. The unit of flux, the **lumen,** is the flux emitted in unit solid angle (steradian) by a point source of one candle luminous intensity. A uniform point source of one candle intensity thus emits 4π lumens.

Luminous intensity or candle-power is the property of a source of emitting luminous flux and may be measured by the luminous flux emitted per unit solid angle. The accepted unit of luminous intensity is the **international candle.** The **hefner unit,** which is equivalent to 0.9 international candles, is the intensity of a lamp of specified design burning amyl acetate, called the Hefner lamp.

The mean horizontal candle-power is the average intensity measured in a horizontal plane passing through the source. The mean spherical candle-power is the average candle-power measured in all directions and is equal to the total luminous flux in lumens divided by 4π.

Magnetic field due to a current.—The intensity of the magnetic field in oersted at the center of a circular conductor of radius r in which a current I in absolute electromagnetic units if flowing,

$$H = \frac{2\pi I}{r}$$

If the circular coil has n turns the magnetic intensity at the center is,

$$H = \frac{2\pi nI}{r}$$

The magnetic field in a long solenoid of n turns per centimeter carrying a current I in absolute electromagnetic units

$$H = 4\pi nI$$

If I is given in amperes the above formulae become,—

$$H = \frac{2\pi I}{10r}, \qquad H = \frac{2\pi nI}{10r}, \qquad H = \frac{4\pi nI}{10}$$

Magnetic field due to a magnet.—At a point on the magnetic axis prolonged, at a distance r cm from the center of the magnet of length $2l$ whose poles are $+m$ and $-m$ and magnetic moment M, the field strength in oersted is,

$$H = \frac{4mlr}{(r^2 - l^2)^2}$$

If r is large compared with l,

$$H = \frac{2M}{r^3}$$

At a point on a line bisecting the magnet at right angles, with corresponding symbols,

$$H = \frac{2ml}{(r^2 + l^2)^{\frac{3}{2}}}$$

For large value of r,

$$H = \frac{M}{r^3}$$

Magnetic field intensity or magnetizing force.—Is measured by the force acting on unit pole. Unit field intensity, the oersted, is that field which exerts a force of one dyne on unit magnetic pole. The field intensity is also specified by the number of lines of force intersecting unit area normal to the field, equal numerically to the field strength in oersted. Magnetizing force is measured by the space rate of variation of magnetic potential and as such its unit may be the **gilbert per centimeter.** The gamma (γ) is equivalent to 0.00001 oersted. Dimensions,—$[\epsilon^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{1}{2}}\, t^{-2}]$; $[\mu^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^{-1}]$.

Magnetic flux through any area perpendicular to a magnetic field is measured as the product of the area by the field strength. The units of magnetic flux, the **maxwell** is the flux through a square centimeter normal to a field of one gauss. The line is also a unit of flux. It is equivalent to the maxwell. Dimensions,—$[\epsilon^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{1}{2}}]$; $[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{3}{2}}\, t^{-1}]$.

Magnetic induction resulting when any substance is subjected to a magnetic field is measured as the magnetic flux per unit area taken perpendicular to the direction of the

flux. The unit is the maxwell per square centimeter or its equivalent, the gauss. Dimensions,—$[\epsilon^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{3}{2}}]$; $[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^{-1}]$.

If a substance of permeability μ is placed in a magnetic field H the magnetic induction in the substance,

$$B = \mu H.$$

If I is the magnetic moment for unit volume, or intensity of magnetization,

$$B = H + 4\pi I.$$

The susceptibility,

$$\kappa = \frac{I}{H}, \qquad \mu = 1 + 4\pi\kappa.$$

Magnetic moment of a magnet is measured by the torque experienced when it is at right angles to a uniform field of unit intensity. The value of the magnetic moment is given by the product of the magnetic pole strength by the distance between the poles. Unit magnetic moment is that possessed by a magnet formed by two poles of opposite sign and of unit strength, one centimeter apart. Dimensions,—$[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{5}{2}}\, t^{-1}]$; $[\epsilon^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{3}{2}}]$.

If the poles are separated by a distance which is great compared with the dimensions of the magnet, the magnetic moment of a magnet of length 1 whose poles have values of $+m$ and $-m$ is,

$$M = ml.$$

Magnetic permeability is a property of materials modifying the action of magnetic poles placed therein and modifying the magnetic induction resulting when the material is subjected to a magnetic field or magnetizing force. The permeability of a substance may be defined as the ratio of the magnetic induction in the substance to the magnetizing field to which it is subjected. The permeability of a vacuum is unity. Dimensions,—$[\epsilon^{-1}\, l^{-2}\, t^{2}]$; $[\mu]$.

Magnetic pole or quantity of magnetism.—Two unit quantities of magnetism concentrated at points unit distance apart in a vacuum repel each other with unit force. If the distance involved is one centimeter and the force one dyne, the quantity of magnetism at each point is one cgs unit of magnetism. Dimensions,—$[\epsilon^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{1}{2}}]$; $[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{3}{2}}\, t^{-1}]$.

Magnetic potential or magnetomotive force at a point is measured by the work required to bring unit positive pole from an infinite distance (zero potential) to the point. The unit is the *gilbert*, that magnetic potential against which an erg of work is done when unit magnetic pole is transferred. Dimensions,—$[\epsilon^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{3}{2}}\, t^{-2}]$; $[\mu^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{1}{2}}\, t^{-1}]$.

Magnifying power of an optical instrument is the ratio of the angle subtended by the image of the object seen through the instrument to the angle subtended by the object when seen by the unaided eye. In the case of the microscope or simple magnifier the object as viewed by the unaided eye is supposed to be a distance of 25 cm (10 in.).

Mass.—Quantity of matter. **Units of mass**—the gram is $\frac{1}{1000}$ the quantity of matter in the International Prototype Kilogram; one of the three fundamental units of the cgs system. The British standard of mass is the pound, of which a standard is preserved by the government. The United States standard mass is the avoirdupois pound defined as 1/2.20462 kilogram.

Mass action, law of.—At a constant temperature the product of the active masses on one side of a chemical equation when divided by the product of the active masses on the other side of the chemical equation is a constant, regardless of the amounts of each substance present at the beginning of the action.

Mass by weighing on a balance with unequal arms.—If W_1 is the value for one side, W_2 the value for the other, the true mass,

$$W = \sqrt{W_1 W_2}.$$

Maxwell's rule.—A law stating that every part of an electric circuit is acted upon by a force tending to move it in such a direction as to enclose the maximum amount of magnetic flux.

Mechanical equivalent of heat is the quantity of energy which, when transformed into heat, is equivalent to unit quantity of heat; 4.18×10^7 ergs = 1 calorie (20°C).

Metallic elements in general are distinguished from the non-metallic elements by their lustre, malleability, conductivity and usual ability to form positive ions. **Non-metallic** elements are not malleable, have low conductivity and never form positive ions.

Minimum deviation.—The deviation or change of direction of light passing through a prism is a minimum when the angle of incidence is equal to the angle of emergence. If D is the angle of minimum deviation and A the angle of the prism, the index of refraction of the prism for the wave length used is,

$$n = \frac{\sin \frac{1}{2}(A + D)}{\sin \frac{1}{2}A}$$

Mixtures consist of two or more substances intermingled with no constant percentage composition, and with each component retaining its essential original properties.

Modulus of elasticity.—The stress required to produce unit strain, which may be a change of length (Young's modulus): a twist or shear (modulus of rigidity or modulus of torsion) or a change of volume (bulk modulus), expressed in dynes per square centimeter. Dimensions,—the same as of stress, $[m\, l^{-1}\, t^{-2}]$.

A **molal solution** contains one mole per 1000 grams of solvent.

A **molar solution** contains one mole or gram molecular weight of the solute in one liter of solution.

Mole.—A mass numerically equal to the molecular weight.

Molecule.—The smallest unit quantity of matter which can exist by itself and retain all the properties of the original substance.

Molecular volume.—Volume occupied by one mole. Numerically equal to the molecular weight divided by the density.

Molecular weight.—The sum of the atomic weights of all the atoms in a molecule.

Mol volume.—The volume occupied by a mol or a gram molecular weight of any gas measured at standard conditions is 22.414 liters.

Moment of force or torque.—The effectiveness of a force to produce rotation about an axis, measured by the product of the force and the perpendicular distance from the line of action of the force to the axis. Cgs unit—the dyne-centimeter. Dimensions,—$[m\, l^2\, t^{-2}]$. If a force F acts to produce rotation about a center at a distance d from the line in which the force acts, the force has a torque,

$$L = Fd.$$

Moment of inertia.—A measure of the effectiveness of mass in rotation. In the rotation of a rigid body not only the body's mass, but the distribution of the mass about the axis of rotation determines the change in the angular velocity resulting from the action of a given torque for a given time. Moment of inertia in rotation is analogous to mass (inertia) in simple translation. The cgs unit is g-cm². Dimensions,—$[m\, l^2]$.

If m_1, m_2, m_3, etc. represent the masses of infinitely small particles of a body; r_1, r_2, r_3, etc. their respective distances from an axis of rotation, the moment of inertia about this axis will be

$$I = (m_1 r_1^2 + m_2 r_2^2 + m_3 r_3^2 + \cdots)$$

or

$$I = \Sigma(mr^2)$$

Momentum.—Quantity of motion measured by the product of mass and velocity. Cgs unit—, one gram-centimeter per second. Dimensions,—$[m\, l\, t^{-1}]$.

A mass m moving with velocity v has a momentum,

$$M = mv.$$

If a mass m has its velocity changed from v_1 to v_2 by the action of a force F for a time t,

$$mv_2 - mv_1 = Ft.$$

Monochromatic emissive power is the ratio of the energy of certain defined wave lengths radiated at definite temperatures to the energy of the same wave lengths radiated by a black body at the same temperature and under the same conditions.

Monotropic.—Crystal forms one of which is always metastable with respect to the other.

Mosley's law.—The frequencies of the characterististic X-rays of the elements show a strict linear relationship with the square of the atomic number.

Motion, laws of.—See *Newton's law of motion.*

Multiple proportions, law of.—If two elements form more than one compound, the weights of the first element which combine with a fixed weight of the second element are in the ratio of integers to each other.

Nernst effect.—When heat flows across the lines of magnetic force, there is observed an electromotive force in the mutually perpendicular direction.

Neutralization is a reaction in which the hydrogen ion of an acid and the hydroxyl ion of a base unite to form water, the other product being a salt.

Neutron.—An elementary particle with approximately the mass of a hydrogen atom but without any electric charge. The neutron is one of the constituents of the atomic nucleus.

Newton's law of cooling.—The rate of cooling of a body under given conditions is proportional to the temperature difference between the body and its surroundings.

Newton's law of motion.

I. Every body continues in its state of rest or of uniform motion in a straight line except in so far as it may be compelled to change that state by the action of some outside force.

II. Change of motion is proportional to force applied and takes place in the direction of the line of action of the force

III. To every action there is always an equal and opposite reaction.

Nodal points.—Two points on the axis of a lens such that a ray entering the lens in the direction of one, leaves as if from the other and parallel to the original direction.

A **normal salt** is an ionic compound containing neither replaceable hydrogen nor hydroxyl ions.

A **normal solution** contains one gram molecular weight of the dissolved substance divided by the hydrogen equivalent of the substance (that is, one gram equivalent) per liter of solution.

Nucleus.—The heavy central part of an atom in which most of the mass and the total positive electric charge is concentrated The charge of the nucleus, an integral multiple (Z) of the electronic charge, is the essential factor which distinguishes one element from another. Z is called the atomic number.

Numerical aperture is the sine of half the angular aperture, used as a measure of the optical power of an objective.

Ohm's law.—Current in terms of electromotive force E and resistance R.

$$I = \frac{E}{R}.$$

The current is given in amperes when E is in volts and R in ohms.

Organ pipes.—The frequency of vibration of a closed pipe or other air column of length l, where V is the velocity of sound in air, for the fundamental and first three overtones respectively is,

$$n_o = \frac{V}{4l}, \qquad n_1 = \frac{3V}{4l}, \qquad n_2 = \frac{5V}{4l}, \qquad n_3 = \frac{7V}{4l}$$

For an open pipe,

$$n_o = \frac{V}{2l}, \qquad n_1 = \frac{2V}{2l}, \qquad n_2 = \frac{3V}{2l}, \qquad n_3 = \frac{4V}{2l}$$

Oxidation is any process which increases the proportion of oxygen or acid-forming element or radical in a compound.

Paramagnetic bodies are those which tend to set the longest dimension parallel to the magnetic field. The permeability of a paramagnetic substance is greater than unity.

Pascal's law.—Pressure exerted at any point upon a confined liquid is transmitted undiminished in all directions.

Peltier effect.—When a current flows across the junction of two unlike metals it gives rise to an absorption or liberation of heat. If the current flows in the same direction as the current at the hot junction in a thermoelectric circuit of the two metals, heat is absorbed; if it flows in the same direction as the current at the cold junction of the thermoelectric circuit heat is liberated.

Pendulum.—For a simple pendulum of length l, for a small amplitude, the complete period,

$$T = 2\pi\sqrt{\frac{l}{g}} \qquad \text{or} \qquad g = 4\pi^2\frac{l}{T^2}$$

T will be given in seconds if l is in cm and g in cm per sec^2. For a sphere suspended by a wire of negligible mass where d is the distance from the knife edge to the center of the sphere whose radius is r, the length of the equivalent simple pendulum,

$$l = d + \frac{2r^2}{5d}$$

If the period is P for an arc θ, the time of vibration in an infinitely small arc is approximately

$$T = \frac{P}{1 + \frac{1}{4}\sin^2\frac{\theta}{4}}$$

For a compound pendulum, if a body of mass m be suspended from a point about which its moment of inertia is I with its center of gravity a distance h below the point of suspension, the period

$$T = 2\pi\sqrt{\frac{I}{mgh}}$$

Period in uniform circular motion is the time of one complete revolution. In any oscillatory motion it is the time of a complete oscillation. Dimension,—$[t]$

Period of vibration of a magnet of magnetic moment M and moment of inertia I vibrating in a field of strength H,

$$T = 2\pi\sqrt{\frac{I}{MH}}$$

Periodic law.—Elements when arranged in the order of their atomic weights or atomic numbers show regular variations in most of their physical and chemical properties.

Permeance, the reciprocal of reluctance. Unit permeance is the permeance of a cylinder one square centimeter cross-section and one centimeter length taken in a vacuum. Dimensions,—$[\epsilon^{-1} l^{-1} t^2]$; $[\mu l]$.

Phase of oscillatory motion.—The fraction of a whole period which has elapsed since the moving particle last passed through its middle position in a positive direction.

Photographic density.—The density D of silver deposit on a photographic plate or film is defined by the relation

$$D = \log O$$

where O is the opacity. If I_o and I are the incident and transmitted intensities respectively the opacity is given by I_o/I The transparency is the reciprocal of the opacity or I/I_o.

Piezo-electric effect.—The phenomenon exhibited by certain crystals of expansion along one axis and contraction along another when subjected to an electric field. The converse effect, whereby mechanical strains produce opposite charges on different faces of the crystal, also obtains.

Pinch effect.—When an electric current, either direct or alternating, passes through a liquid conductor, that conductor tends to contract in cross-section, due to *electromagnetic* forces.

Pitch of sound is determined by the frequency or number of vibrations per second.

Planck's constant (h) when multiplied by the frequency of radiation ν, gives the quantity of energy ($= h\nu$) contained in one quantum.

Poisson's ratio is the ratio of the transverse contraction per unit dimension of a bar of uniform cross-section to its elongation per unit length, when subjected to a tensile stress.

Polarized light.—Light which exhibits different properties in different directions at right angles to the line of propagation is said to be polarized. Specific rotation is the power of liquids to rotate the plane of polarization. It is stated in terms of specific rotation or the rotation in degrees per decimeter per unit density.

Polymorphism.—The ability to exist in two or more crystalline forms.

Positron.—A particle with a mass equal to that of the electron but possessing a positive charge.

Potential (electric) at any point is measured by the work necessary to bring unit positive charge from an infinite distance. Difference of potential between two points is measured by the work necessary to carry unit positive charge from one to the other. If the work involved is one erg we have the electrostatic unit of potential. Dimensions,—$[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2}]$.

The potential at a point due to a charge q at a distance r in a medium whose dielectric constant is ϵ is,

$$V = \frac{q}{\epsilon r}$$

Power.—The time rate at which work is done. Units of power,—the watt, one joule (ten million ergs) per second; the kilowatt is equal to 1000 watts; the horse-power, 33,000 foot-pounds per minute, is equal to 746 watts. Dimensions,—$[m\, l^2\, t^{-3}]$.

If an amount of work W is done in time t the power or rate of doing work is

$$P = \frac{W}{t}$$

Power will be obtained in watts if W is expressed in joules (10^7 ergs) and t in sec.

Power in watts for alternating current,

$$P = EI \cos \phi$$

where E and I are the effective values of the electromotive force and current in volts and amperes respectively and ϕ the phase angle between the current and the impressed electromotive force.

The ratio,

$$\frac{P}{EI} = \cos \phi$$

is called the power factor.

Power developed by a direct current.—The power in watts developed by an electric current flowing in a conductor, where E is the difference of potential at its terminals in volts, R its resistance in ohms, and I the current in amperes,

$$P = EI = RI^2$$

The work done in joules in a time t sec is,

$$W = EIt{:}RI^2t.$$

Power ratios in telephone engineering are measured in **decibels.** The gain or loss of power expressed in decibels is ten times the logarithm of the power ratio. By reference to an arbitrarily chosen "power level" the actual power may be expressed in decibels. The numerical values thus used will

not be proportional to the actual power level but roughly to the sensation on the ear produced when the electrical power is converted into sound. A difference of 1 decibel in the power supply to a telephone receiver produces approximately the smallest change in volume of sound which a normal ear can detect.

Pressure.—Force applied to, or distributed, over a surface; measured as force per unit area. Cgs unit,—the barye, one dyne per square centimeter The megabarye is equal to 10^6 dynes per square centimeter. Pressure is also measured by the height of the column of mercury or water which it supports. Dimensions,—$[m\ l^{-1}\ t^{-2}]$.

The pressure due to a force F distributed over an area A,

$$P = \frac{F}{A}$$

Absolute pressure.—Pressure measured with respect to zero pressure. *Gauge pressure*—pressure measured with respect to that of the atmosphere.

Principal focus of a lens or spherical mirror is the point of convergence of light coming from a source at an infinite distance.

Projectiles.—For bodies projected with velocity v at an angle a above the horizontal, the time to highest point of flight,

$$t = \frac{v \sin a}{g}$$

Total time of flight to reach the original horizontal plane,

$$T = \frac{2v \sin a}{g}$$

Maximum height,

$$h = \frac{v^2 \sin^2 a}{2g}$$

Horizontal range,

$$R = \frac{v^2 \sin 2a}{g}$$

In the above equations the resistance of the air is neglected g is the acceleration due to gravity.

Proton.—An elementary particle having a positive charge equivalent to the negative charge of the electron but possessing a mass approximately 1845 times as great. The proton is in effect the positive nucleus of the hydrogen atom.

Purkinje effect.—A phenomenon associated with the human eye, making it more sensitive to blue light when the illumination is poor (less than about 0.1 lumen per sq. ft.) and to yellow light when the illumination is good.

Quality or timbre of a sound depends on the coexistence with the fundamental of other vibrations of various frequencies and amplitudes.

Quantity of electricity or charge.—The electrostatic unit of charge, the quantity which when concentrated at a point and placed at unit distance from an equal and similarly concentrated quantity, is repelled with unit force. If the distance is one centimeter and force of repulsion one dyne and the surrounding medium a vacuum, we have the electrostatic unit of quantity. The electrostatic unit of quantity may be defined as that transferred by electrostatic unit current in unit time. The quantity transferred by one ampere in one second is the coulomb, the practical unit. The faraday is the electrical charge carried by one gram equivalent. The coulomb = 3 × 10^9 electrostatic units. Dimensions,—

$$[\epsilon^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{3}{2}}\, t^{-1}];\ [\mu^{-2}\, m^{\frac{1}{2}}\, l^{\frac{1}{2}}]$$

Radiation.—If I_o is the intensity of normal radiation and I the intensity at an angle

$$I = I_o \cos \theta$$

This is called Lambert's law. It does not apply in all cases.

Radiation formula, Planck's.—The emissive power of a black body at wave length λ may be written

$$E_\lambda = \frac{c_1\lambda^{-5}}{\epsilon^{c_2/\lambda T} - 1}$$

where c_1 and c_2 are constants with numerical values 3.7403 × 10^8 microwatts per cm^2 per 0.01μ zone of spectrum and 14384 micron degrees, respectively and T the absolute temperature.

Radioactive substances continuously undergo a process of atomic disintegration in which energy is liberated. One or more radiations known as α-rays, β-rays or γ-rays are spontaneously emitted.

Radius of curvature from spherometer readings.—If l is is the mean length of the sides of the triangle formed by the points of the three legs, d the spherometer readings, the radius of curvature of the surface is

$$F = \frac{l^2}{6d} + \frac{d}{2}$$

Radius of gyration may be defined as the distance from the axis of rotation at which the total mass of a body might be concentrated without changing its moment of inertia. The product of total mass and the square of the radius of gyration will give (the) moment of inertia.

Rankine scale of temperature.—The absolute Fahrenheit scale.

Raoult's law.—Molar weights of non-volatile non-electrolytes when dissolved in a definite weight of a given solvent under the same conditions lower the solvent's freezing point, elevate its boiling point and reduce its vapor pressure equally for all such solutes

Reduction is any process which increases the proportion of hydrogen or base-forming elements or radicals in a compound.

Reflection coefficient or reflectivity is the ratio of the light reflected from a surface to the total incident light. The coefficient may refer to diffuse or to specular reflection. In general it varies with the angle of incidence and with the wave-length of the light.

Reflection of light by a transparent medium in air. (Fresnel's formulae).—If i is the angle of incidence, r the angle of refraction, n_1 the index of refraction for air (nearly equal to unity), n_2 index of refraction for a medium, then the ratio of the reflected light to the incident light is,

$$R = \frac{1}{2}\left(\frac{\sin^2(i-r)}{\sin^2(i+r)} + \frac{\tan^2(i-r)}{\tan^2(i+r)}\right)$$

If $i = 0$ (normal incidence), and $n_1 = l$ (approximate for air),

$$R = \left(\frac{n_2 - 1}{n_2 + 1}\right)^2$$

Refraction.—See *Index of refraction; Snell's law.*

Refraction at a spherical surface.—If u be the distance of a point source, v the distance of the point image or the intersection of the refracted ray with the axis, n_1 and n_2 the indices of refraction of the first and second medium, and r the radius of curvature of the separating surface,

$$\frac{n_2}{v} + \frac{n_1}{u} = \frac{n_2 - n_1}{r}$$

If the first medium is air the equation becomes,

$$\frac{n}{v} + \frac{1}{u} = \frac{n-1}{r}$$

Refractivity is given by $(n - 1)$ when n is the index of refraction; the **specific refractivity** is given by $\frac{n-1}{d}$ where d is the density. **Molecular refractivity** is the product of specific refractivity by the molecular weight.

Relative humidity.—The ratio of the quantity of water vapor present in the atmosphere to the quantity which would saturate at the existing temperature. It is also the ratio of the pressure of water vapor present to the pressure of saturated water vapor at the same temperature.

Reluctance is that property of a magnetic circuit which determines the total magnetic flux in the circuit when a given magnetomotive force is applied. Unit, the reluctance of one centimeter length and one square centimeter cross-section of space taken in a vacuum. Dimensions,—$[\epsilon l\, t^{-2}]$; $[\mu^{-1}\, l^{-1}]$.

Reluctivity or specific reluctance is the reciprocal of magnetic permeability. The reluctivity of empty space is taken as unity. Dimensions,—$[\epsilon l^2\, t^{-2}]$; $[\mu^{-1}]$.

DEFINITIONS AND FORMULAE (Continued)

Replacement series.—The arrangement of the metals in order of the values of their oxidation potentials.

Resistance is a property of conductors depending on their dimensions, material and temperature which determines the current produced by a given difference of potential. The practical unit of resistance, the **ohm** is that resistance through which a difference of potential of one volt will produce a current of one ampere. The **international ohm** is the resistance offered to an unvarying current by a column of mercury at 0°C, 14.4521 grams in mass, of constant cross-sectional area and 106.300 centimeters in length, sometimes called the legal ohm. Dimensions,—$[\epsilon^{-1} l^{-1} t]$; $[\mu l\, t^{-1}]$.

Resistance of a conductor at 0°C, of length l, cross-section s and specific resistance ρ

$$R_o = \rho \frac{l}{s}$$

The resistivity may be expressed as ohm-cm when R is in ohms, l in cm and s in cm^2.

Resistance of a conductor at a temperature t whose resistance at 0°C is R_o and whose temperature resistance coefficient is α.

$$R_t = R_o(1 + \alpha t)$$

Resistance of conductors in series and parallel.—The total resistance of any number of resistances joined in series is the sum of the separate resistances. The total resistance of conductors in parallel whose separate resistances are r_1, r_2, r_3 . . . r_n is given by the formula

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} \cdots + \frac{1}{r_n}$$

Where R is the total resistance. For two terms this becomes.

$$R = \frac{r_1 r_2}{r_1 + r_2}$$

Resistivity or specific resistance, the reciprocal of conductivity, is measured by the resistance of a body of the substance of unit cross-section and of unit length at 0°C also called volume resistivity The unit may be indicated as the ohm-centimeter. Dimensions,—$[\epsilon^{-1} l]$, $[\mu l^2 t^{-1}]$.

Mass resistivity is the longitudinal resistance per unit length of a uniform bar of the substance of such a sectional area that it contains one unit of mass per unit of length. Dimensions,—$[\epsilon^{-1} m\, l^{-3} t]$; $[\mu m\, l^{-1} t^{-1}]$.

Surface resistivity is the resistance of unit length and unit width of a surface.

Resolving power of a telescope or microscope is indicated by the minimum separation of two objects for which they appear distinct and separate when viewed through the instrument.

Restitution, coefficient of, for two bodies on impact.—The ratio of the difference in velocity, after impact to the difference before impact.

Reversible reactions are those in which the products of the reaction may in turn react upon each other to form the original reacting substances.

Rotatory power is the power of rotating the plane of polarized light, given in general by θ/l where θ is the total rotation which occurs in a distance l.

The **molecular** or **atomic rotatory power** is the product of the specific rotatory power by the molecular or atomic weight. Magnetic rotatory power is given by

$$\theta/e\ H \cos \alpha$$

where H the intensity of the magnetic field, and α the angle between the field and the direction of the light.

Rydberg formula.—A formula, similar to that of Balmer, for expressing the wave-numbers (ν) of the lines in a spectral series:

$$\nu = R\left[\frac{1}{(n+a)^2} - \frac{1}{(m+b)^2}\right]$$

where n and m are integers and $m > n$, a and b are constants for a particular series, and R is the *Rydberg constant,* 109677.8 cm^{-1} for hydrogen.

Salt.—Any substance which yields ions, other than hydrogen or hydroxyl ions. A salt is obtained by displacing the hydrogen of an acid by a metal.

Seebeck effect.—If a circuit consists of two metals, one junction hotter than the other, a current flows in the circuit. The direction of the flow depends on the metals and the temperature of the junctions.

Sensitiveness of a balance.—Assuming the three knife edges of a balance to lie on a straight line,—if M is the weight of the beam, h the distance of the center of gravity below the knife edge, L the length of the balance arms and m a small mass added to one pan, the deflection θ produced is given by

$$\tan\theta = \frac{mL}{Mh}.$$

Simple harmonic motion.—Periodic oscillatory motion in a straight line in which the restoring force is proportional to the displacement. If a point move uniformly in a circle, the motion of its projection on the diameter (or any straight line in the same plane) is simple harmonic motion.

If r is the radius of the reference circle, ω the angular velocity of the point in the circle, θ the angular displacement at the time t after the particle passes the mid-point of its path, the linear displacement,

$$x = r \sin\theta = r \sin \omega t.$$

The velocity at the same instant,

$$v = r\omega \cos \theta = \omega \sqrt{r^2 - x^2}$$

The acceleration,

$$a = -\omega^2 x.$$

The force for a mass m,

$$F = m\omega^2 x = -\frac{4\pi^2 mx}{T^2}$$

The period,

$$T = 2\pi \sqrt{\frac{x}{a}}$$

In the above equations the cgs system calls for x and r in cm, v in cm per sec, a in cm per sec^2, T in sec, m in grams, F in dynes, θ in radians and ω in radians per sec.

Simple machine.—A contrivance for the transfer of energy and for increased convenience in the performance of work.

Mechanical advantage is the ratio of the resistance overcome to the force applied. Velocity ratio is the ratio of the distance through which force is applied to the distance through which resistance is overcome.

Efficiency is the ratio of the work done by a machine to the work done upon it.

If a force f applied to a machine through a distance S results in a force F exerted by the machine through a distance s, neglecting friction,

$$fS = Fs.$$

The theoretical mechanical advantage or velocity ratio in the above case is, $\frac{S}{s}$.

Actually the force obtained from the machine will have a smaller value than will satisfy the equation above. If F' be the actual force obtained, the practical mechanical advantage will be, $\frac{F'}{f}$.

The efficiency of the machine,

$$E = \frac{F's}{fS}.$$

Snell's law of refraction.—If i is the angle of incidence, r the angle of refraction, v the velocity of light in the first medium, v' the velocity in the second medium, the index of refraction v,

$$n = \frac{\sin i}{\sin r} = \frac{v}{v'}.$$

Solid.—A state of matter in which the relative motion of the molecules is restricted and they tend to retain a definite fixed position relative to each other, giving rise to crystal

structure A solid may be said to have a definite shape and volume.

Solid angle.—Measured by the ratio of the surface of the portion of a sphere enclosed by the conical surface forming the angle, to the square of the radius of the sphere. Unit of solid angle,—the steradian, the solid angle which encloses a surface on the sphere equivalent to the square of the radius. Dimensions,—unity.

Solubility of one liquid or solid in another is the mass of a substance contained in a solution which is in equilibrium with an excess of the substance. Under these conditions the solution is said to be saturated. Solubility of a gas is the ratio of concentration of gas in the solution to the concentration of gas above the solution.

Solute.—That constituent of a solution which is considered to be dissolved in the other, the solvent. The solvent is usually present in larger amount than the solute.

A **solution** is **saturated** if it contains at given temperature as much of a solute as it can retain in the presence of an excess of that solute

A **true solution** is a mixture, liquid, solid or gaseous, in which the components are uniformly distributed throughout the mixture. The proportion of the constituents may be varied within certain limits.

Solubility product or precipitation value is the product of the concentrations of the ions of a substance in a saturated solution of the substance.

Solvent.—That constituent of a solution which is present in larger amount; or, the constituent which is liquid in the pure state, in the case of solutions of solids or gases in liquids.

Specific gravity.—The ratio of the mass of a body to the mass of an equal volume of water at 4°C or other specified temperature. Dimensions,—unity.

Specific heat of a substance is the ratio of its thermal capacity to that of water at 15°C. Dimensions,—unity.

If a quantity of heat H calories is necessary to raise the temperature of m grams of a substance from t_1 to t_2°C, the specific heat, or more properly, thermal capacity of the substance,

$$s = \frac{H}{m(t_1 - t_2)}.$$

Specific heat by the method of mixtures.—Where a mass m_1 of the substance is heated to a temperature t_1, then placed in a mass of water m_2 at a temperature t_2 contained in a calorimeter with stirrer (of same material) of mass m_3, specific heat of the calorimeter c, t_3 the final temperature

$$m_1 s(t_1 - t_3) = (m_3\, c + m_2)(t_3 - t_2).$$

Black's ice calorimeter.—If a body of mass m and temperature t melts a mass m' of ice, its temperature being reduced to 0°C, the specific heat of the substance is,

$$s = \frac{80.1 m'}{mt}$$

Bunsen's ice calorimeter.—A body of mass m at temperature t causes a motion of the mercury column of l centimeters in a tube whose volume per unit length is v. The specific heat is

$$s = \frac{884 lv}{mt}$$

Specific inductive capacity.—The ratio of the capacitance of a condenser with a given substance as dielectric to the capacitance of the same condenser with air or a vacuum as dielectric is called the specific inductive capacity. The ratio of the dielectric constant of a substance to that of a vacuum.

Specific rotation.—If there are n grams of active substance in v cubic centimeters of solution and the light passes through l centimeters, r being the observed rotation in degrees, the specific rotation (for 1 centimeter),

$$[\alpha] = \frac{rv}{nl}$$

Specific volume is the reciprocal of density. Dimensions,—$[m^{-1} l^3]$.

Spectral series are spectral lines or groups of lines which occur in an orderly sequence.

Speed.—Time rate of motion measured by the distance moved over in unit time. Cgs unit,—one centimeter per second. Dimension,—$[l\, t^{-1}]$.

Spherical aberration.—When large surfaces of spherical mirrors or lenses are used the light divergent from a point source is not exactly focused at a point. The phenomenon is known as spherical aberration For axial pencils the error is known as axial spherical aberration, for oblique pencils, coma.

Spherical mirrors.—If R is the radius of curvature, F principal focus, and f_1 and f_2 any two conjugate focal distances,

$$\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{F} = \frac{2}{R}$$

If the linear dimensions of the object and image be O and I respectively and u and v their distances from the mirror,

$$\frac{O}{I} = \frac{u}{v}$$

Standard conditions for gases.—Measured volumes of gases are quite generally recalculated to 0 degrees C temperature and 760 mm pressure, which have been arbitrarily chosen as standard conditions.

DEFINITIONS AND FORMULAE (Continued)

Stark effect.—A change occurs in the number of spectral lines when the emission takes place in a strong electrical field The phenomena are different for different lines and the observed effects depend upon the geometrical relation between the direction of emission and the direction of the electric field.

Stationary or standing waves are produced in a medium by the simultaneous transmission, in opposite directions of two similar wave motions. Fixed points of minimum amplitude are called **nodes.** A **segment** extends from one node to the next. An **antinode** or **loop** is the point of maximum amplitude between two nodes.

Stefan-Boltzman law of radiation.—The energy radiated in unit time by a black body is given by, $E = K(T^4 - T_o^4)$, where T is the absolute temperature of the body, T_o the absolute temperature of the surroundings, and K a constant.

Stoichiometric.—Pertaining to weight relations in chemical reactions.

Stoke's law gives the rate of fall of a small sphere in a viscous fluid. When a small sphere falls under the action of gravity through a viscous medium it ultimately acquires a constant velocity,

$$V = \frac{2ga^2(d_1 - d_2)}{9\eta}$$

where a is the radius of the sphere, d_1 and d_2 the densities of the sphere and the medium respectively, and η the coefficient of viscosity. V will be in cm per sec if g is in cm per sec^2, a in cm, d_1 and d_2 in g per cm^3 and η in dyne-sec per cm^2 or poises.

Strain.—The deformation resulting from a stress measured by the ratio of the change to the total value of the dimension in which the change occurred. Dimensions,—unity.

Stress.—The force producing or tending to produce deformation in a body measured by the force applied per unit area C gs units,—one dyne per square centimeter. Dimensions,—$[m\, l^{-1}\, t^{-2}]$.

Surface density of electricity.—Quantity of electricity per unit area. Dimensions,—$[\epsilon^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^{-1}]$; $[\mu^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{3}{2}}]$.

Surface density of magnetism.—Quantity of magnetism per unit area. Dimensions,—$[\epsilon^{-1}\, m^{\frac{1}{2}}\, l^{-\frac{3}{2}}]$, $[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^{-1}]$.

Surface tension.—Two fluids in contact exhibit phenomena, due to molecular attractions which appear to arise from a tension in the surface of separation. It may be expressed as dynes per cm or as ergs per square centimeter. Dimensions, —$[m\, t^{-2}]$.

The total force along a line of length l on the surface of a liquid whose surface tension is T,

$$F = lT.$$

Capillary tubes.—If a liquid of density d rises a height h in a tube of internal radius r the surface tension is,

$$T = \frac{rhdg}{2}$$

The tension will be in dynes per cm if r and h are in cm, d in g per cm^3 and g in cm per sec^2.

Drops and bubbles.—Pressure in dynes per cm^2 due to surface tension on a drop of radius r cm for a liquid whose surface tension is T dynes per cm,

$$P = \frac{2T}{r}$$

For a bubble of mean radius r cm,

$$P = \frac{4T}{r}.$$

Susceptibility (magnetic) is measured by the ratio of the intensity of magnetization produced in a substance to the magnetizing force or intensity of field to which it is subjected. The susceptibility of a substance will be unity when unit intensity of magnetization is produced by a field of one gauss Dimensions,—$[\epsilon^{-1} l^{-2} t^2]$; $[\mu]$.

A **chemical symbol** is not only an abbreviation of the name but represents one atom and one gram atomic weight of that element.

Tangent galvanometer.—A tangent galvanometer with n turns, of radius r, in the earth's field H, has a deflection θ. The current flowing is,

$$i = \frac{Hr}{2\pi n} \tan \theta$$

If $\frac{2\pi n}{r} = G$ (the galvanometer constant).

$$i = \frac{H}{G} \tan \theta$$

Temperature may be defined as the condition of a body which determines the transfer of heat to or from other bodies. The customary unit of temperature is the **Centigrade** degree, $\frac{1}{100}$ the difference between the temperature of melting ice and that of water boiling under standard atmospheric pressure. The degree **Fahrenheit** is $\frac{1}{180}$, and the degree **Reaumur** $\frac{1}{80}$ the same difference of temperature.

The fundamental temperature scale is the absolute, thermodynamic or **Kelvin scale** in which the temperature measure is based on the average kinetic energy per molecule of a perfect gas. The zero of the Kelvin scale is $-273.18°C$. The temperature scale adopted by the International Bureau of Weights and Measures is that of the constant volume hydrogen gas thermometer. The magnitude of the degree in both these scales is defined as $\frac{1}{100}$ the difference between the temperature of melting ice and that of boiling water at 760 mm pressure.

Temperature resistance coefficient.—The ratio of the change of resistance in a wire due to a change of temperature of 1°C to its resistance at 0°C. Dimension,—$[\theta^{-1}]$.

Thermal capacity of a substance is the quantity of heat necessary to produce unit change of temperature in unit mass. It is ordinarily expressed as calories per gram per degree Centigrade. Numerically equivalent to specific heat.

Thermal capacity or water equivalent.—The total quantity of heat necessary to raise any body or system unit temperature, measured as calories per degree centigrade in the cgs system. Dimension,—$[m]$.

Thermal expansion.—The coefficient of linear expansion or expansivity is the ratio of the change in length per degree C to the length at 0°C. The coefficient of volume expansion (for solids) is approximately three times the linear coefficient. The coefficient of volume expansion for liquids is the ratio of the change in volume per degree to the volume at 0°C. The value of the coefficient varies with temperature. The coefficient of volume expansion for a gas under constant pressure is nearly the same for all gases and temperatures and is equal to 0.00367 for 1°C. Dimension,—$[\theta^{-1}]$.

If l_0 is the length at 0°C, α the coefficient of linear expansion, the length at t_0C is,

$$l_t = l_0(1 + \alpha t).$$

General formula for thermal expansion.—The rate of thermal expansion varies with the temperature. The general equation giving the magnitude m_t (length or volume) at a temperature t, where m_0 is the magnitude at 0°C, is

$$m_t = m_0(1 + \alpha t + \beta t^2 + \gamma t^3 \cdot \cdot \cdot \cdot)$$

where α, β, γ, etc. are empirically determined coefficients.

Volume expansion.—If V represents volume and β the coefficient of expansion,

$$V_t = V_0(1 + \beta t).$$

For solids,

$$\beta = 3\alpha \text{ (approximately)}.$$

Thermodynamics, law of.

I. When mechanical work is transformed into heat or heat into work, the amount of work is always equivalent to the quantity of heat.

II. It is impossible by any continuous self-sustaining process for heat to be transferred from a colder to a hotter body.

Thermoelectric power is measured by the electromotive force produced by a thermocouple for unit difference of temperature between the two junctions. It varies with the average temperature and is usually expressed in microvolts per degree C. It is customary to list the thermoelectric power of the various metals with respect to lead. Dimensions,—$[\epsilon^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{1}{2}}\, t^{-1}\, \theta^{-1}]$; $[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, t^{-1}\, \theta^{-1}]$.

DEFINITIONS AND FORMULAE (Continued)

Thomson thermoelectric effect is the designation of the potential gradient along a conductor which accompanies a temperature gradient. The magnitude and direction of the potential varies with the substance.

The coefficient of the Thomson effect or specific heat of electricity is expressed in joules per coulomb per degree Centigrade. Dimensions,—$[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1} \theta^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2} \theta^{-1}]$.

Time, unit of.—The second, $\frac{1}{86400}$ of a mean solar day. One of the three fundamental units of the cgs system.

Torque produced by the action of one magnet on another.—The turning moment experienced by a magnet of pole strength m' and length $2l'$ placed at a distance r from another magnet of length $2l$ and pole strength m, where the center of the first magnet is on the axis (extended) of the second and the axis of the first is perpendicular to the axis of the second,

$$C = 8\frac{mm'll'}{r^3} = \frac{2MM'}{r^3}$$

If the first magnet is deflected through an angle θ, the expression becomes,

$$C = \frac{2MM'}{r^3}\cos\theta$$

Torsional vibration.—See *Angular harmonic motion.*

Total reflection.—When light passes from any medium to one in which the velocity is greater, refraction ceases and total reflection begins at a certain critical angle of incidence θ such that

$$\sin\theta = \frac{1}{n}$$

where n is the index of the first medium with respect to the second. If the second medium is air n has the ordinary value for the first medium. For any other second medium,

$$n = \frac{n_1}{n_2}$$

where n_1 and n_2 are the ordinary indices of refraction for the first and second medium respectively.

Tractive force of a magnet.—If a magnet with induction B has a pole face of area A the force, is,

$$F = \frac{B^2A}{8\pi}$$

If B and A are in cgs units, F will be in dynes.

Triangle or polygon of forces.—If three or more forces acting on the same point are in equilibrium, the vectors representing them form, when added, a closed figure.

Uniform circular motion.—If r is the radius of a circle, v the linear speed in the arc, ω the angular velocity and T the

period or time of one revolution,

$$\omega = \frac{v}{r} = \frac{2\pi}{T}$$

The acceleration toward the center is

$$a = \frac{v^2}{r} = \omega^2 r = \frac{4\pi^2 r}{T^2}$$

The centrifugal force for a mass m,

$$F = \frac{mv^2}{r} = m\omega^2 r = \frac{4\pi^2 mr}{T^2}$$

In the above equations ω will be in radians per second and a in cm per sec^2 if r is in cm, v in cm per sec and T in sec. F will be in dynes if mass is in grams and other units as above.

Application to the solar system.—If M is the mass of the sun, G the constant of gravitation, P the period of the planet and r the distance of the planet from the sun, then the mass of the sun

$$M = \frac{4\pi^2 r^3}{GP^2}, \quad (G = 6.670 \times 10^{-8} \text{ for cgs units}).$$

If P is the period and r the distance of a satellite revolving around the planet, the above expression for M gives the mass of the planet. The formula is written on the assumption that the orbit of the planet or satellite is circular, which is only approximately true.

Uniformly accelerated rectilinear motion.—If v_o is the initial velocity, v_t the velocity after time t, the acceleration,

$$a = \frac{v_t - v_o}{t}$$

The velocity after time t,

$$v_t = v_o + at$$

Space passed over in time t,

$$s = v_o t + \tfrac{1}{2}at^2$$

Velocity after passing over space s,

$$v_s = \sqrt{v_o^2 + 2as}$$

Space passed over in the nth second

$$s = v_o + \tfrac{1}{2}a(2n - 1).$$

In the above and following similar equations the values of the space, velocity, and acceleration must be substituted in the same system. For space in *cm*, velocity will be in *cm* per sec and acceleration in *cm* per sec per sec.

Unit.—Specific magnitude of a quantity, set apart by appropriate definition, which is to serve as a basis of comparison or measurement for other quantities of the same nature.

Valence of an atom of an element is that property which is measured by the number of atoms of hydrogen (or its equiva-

lent) one atom of that element can hold in combination if negative, or can displace in a reaction if it is positive.

Valence electrons of the atom are electrons which are gained, lost or shared in chemical reactions.

Van't Hoff's principle.—If the temperature of interacting substances in equilibrium is raised, the equilibrium concentrations of the reaction are changed so that the products of that reaction which absorb heat are increased in quantity, or if the temperature for such an equilibrium is lowered, the products which evolve heat in their formation are increased in amounts.

Van der Waal's variation of Boyle's law.

$$(p + \frac{a}{v^2})(v - b) = RT$$

where p and v are the pressure and volume at any constant temperature and a and b are constants R is the gas constant and T the absolute temperature. For values of R, a and b see tables.

Vectors, composition of.—If the angle between two vectors is A, and their magnitude a and b, their resultant,

$$C = \sqrt{a^2 + b^2 + 2ab \cos A}.$$

Velocity.—Time rate of motion in a fixed direction. Cgs units,—one centimeter per second. Dimensions,—$[l\,t^{-1}]$.

If s is space passed over in time t, the velocity,

$$v = \frac{s}{t}$$

Velocity of a compressional wave.—The velocity of a compressional wave in an elastic medium, in terms of elasticity E (bulk modulus) and density d,

$$V = \sqrt{\frac{E}{d}}$$

For the velocity of sound in air, where p is the pressure and d the density,

$$V = \sqrt{\frac{1.4p}{d}}$$

Velocity of efflux of a liquid.—If h is the distance from the opening to the free surface of the liquid, the velocity of efflux is

$$V = \sqrt{2gh}$$

The above is the theoretical discharge velocity disregarding friction and the shape of orifice. For water issuing through a circular opening with sharp edges of area, A, the volume discharged per second is given approximately by,

$$Q = 0.62A\sqrt{2gh}$$

Velocity of sound, variation with temperature.—The velocity in meters per sec at any temperature t in °C is given approximately by

$$V = V_o \sqrt{1 + \frac{t}{273}}$$

$$V = 331.5 + .607t$$

The **variation with humidity** is given by the equation

$$V_d = V_h \sqrt{1 - \frac{e}{p}\left(\frac{\gamma_\omega}{\gamma_a} - \frac{5}{8}\right)}$$

where V_d is the velocity in dry air, V_h that in air at barometric pressure p in which the pressure of water vapor is e. γ_ω and γ_a are the specific heat ratios for water vapor and for air respectively.

Velocity of a transverse wave in a stretched cord. If T is the tension of the cord and m the mass per unit length,

$$V = \sqrt{\frac{T}{m}}$$

Velocity of water waves.—If the depth h is small compared with the wave length, the velocity,

$$V = \sqrt{gh}$$

In deep water for a wave length λ,

$$V = \sqrt{\frac{g\lambda}{2\pi}}$$

If the wavelength is very small, less than about 1.6 cm, the velocity increases as the wave length decreases and is expressed by the following,

$$V = \sqrt{\frac{2\pi T}{\lambda d} + \frac{g\lambda}{2\pi}}$$

where T is the surface tension and d the density of the liquid. V will be given in cm per sec if h and λ are in cm, g in cm per sec^2, T in dynes per cm and d in g per cm^3.

Velocity of a wave.—The velocity of propagation in terms of wavelength λ and the period T or frequency n is,

$$V = \frac{\lambda}{T} = n\lambda$$

Viscosity.—All fluids possess a definite resistance to change of form and many solids show a gradual yielding to forces tending to change their form. This property, a sort of internal friction, is called viscosity; it is expressed in dyne-seconds per cm^2 or poises. Dimensions,—$[m\, l^{-1}\, t^{-1}]$. If the tangential force per unit area, exerted by a layer of fluid upon one adjacent is one dyne for a space rate of variation of the tangential velocity of unity, the viscosity is one poise.

Kinematic viscosity is the ratio of viscosity to density.

Flow of liquids through a tube; where l is the length of the tube, r its radius, p the difference of pressure at the ends, η the coefficient of viscosity, the volume escaping per second,

$$v = \frac{\pi p r^4}{8 l \eta} \text{ (Poiseuille).}$$

The volume will be given in cm^3 per second if l and r are in cm, p in dynes per cm^2 and η in poises per dyne-seconds per cm^2.

Visibility is measured by the ratio of the luminous flux in lumens to the total radiant energy in ergs per second or in watts.

Volume, unit of.—The cubic centimeter, the volume of a cube whose edges are one centimeter in length. Other units of volume are derived in a similar manner. Dimension,—$[l^3]$.

Wave motion.—A progressive disturbance propagated in a medium by the periodic vibration of the particles of the medium. Transverse wave motion is that in which the vibration of the particles is perpendicular to the direction of propagation. Longitudinal wave motion is that in which the vibration of the particles is parallel to the direction of propagation.

Weight.—The force with which a body is attracted toward the earth. Cgs unit,—the dyne. Dimensions,—$[m\, l\, t^{-2}]$.

Although the weight of a body varies with its location, the weights of various standards of mass are often used as units of force as,—pound weight, or pound force, gram weight, etc. The weight of mass m, where g is the acceleration due to gravity.

$$W = mg.$$

The weight will be given in dynes when m is in grams and g in cm per sec^2.

Wien's displacement law.—When the temperature of a radiating black body increases, the wave length corresponding to maximum energy decreases in such a way that the product of the absolute temperature and wave length is constant.

$$\lambda_{max} T = w$$

w is known as **Wien's displacement constant.**

Wheatstone's bridge.—If the resistances r_1, r_2, r_3, and r_4 form the arms of a Wheatstone's bridge in order as the circuit (omitting cell and galvanometer connections) is traced, when the bridge is balanced,

$$\frac{r_1}{r_2} = \frac{r_4}{r_3} \quad \text{or} \quad \frac{r_1}{r_4} = \frac{r_2}{r_3}$$

Work.—When a force acts against resistance to produce motion in a body the force is said to do work. Work is measured by the product of the force acting and the distance moved through against the resistance. Cgs units of work,—the erg, a force of one dyne acting through a distance of one centimeter. The joule is 1×10^7 ergs. Dimensions,—$[m\, l^2\, t^{-2}]$. The foot-

pound is the work required to raise a mass of one pound a vertical distance of one foot where $g = 32.174$ ft./sec^2. The foot-poundal is the work done by a force of one poundal acting through a distance of one foot. The International joule, a unit of electrical energy, is the work expended per second by a current of one International ampere flowing through one International ohm. The kilowatt-hour is the total amount of energy developed in one hour by a power of one kilowatt.

If a force F act through a space s, the work done is

$$W = Fs$$

Work will be given in ergs if F is in dynes and s in cm

Work done in rotation. If a torque L dyne-cm acts through an angle θ radians, the work done in ergs is

$$W = L\theta$$

Zeeman effect.—The splitting of a spectrum line into several symmetrically disposed components, which occurs when the source of light is placed in a strong magnetic field. The components are polarized, the directions of polarization and the appearance of the effect depending on the direction from which the source is viewed relative to the lines of force.

MEASURES AND UNITS

FUNDAMENTAL STANDARDS

The primary standard of **length** is defined as the distance between two lines at 0° C on a platinum-iridium bar known as the **International Prototype Meter** deposited at the International Bureau of Weights and Measures. The International Prototype Meter is 1553164.13 times the wave length of the red cadmium line in air, 760 mm pressure, 15° C.

The primary standard of **mass** is defined as the mass of the **International Prototype Kilogram** of platinum-iridium kept at the International Bureau of Weights and Measures at Sèvres. It is equal to the mass of 0.001000027 cubic meter of pure water at 4° C and 760 mm pressure.

The primary standard of **capacity** is the **liter** which is the volume of one kilogram of pure water at the temperature of maximum density and under normal atmospheric pressure.

The primary standard of **time** is the **mean solar second,** one eighty-six thousand four hundredth ($\frac{1}{86400}$) part of a mean solar day.

The standard scale of **temperature** adopted by the International Committee of Weights and Measures 1887 is based on the variations in pressure of hydrogen at constant volume. The hydrogen is taken at an initial pressure, at the temperature of melting ice, of one meter of mercury (0° C, sea level, latitude 45°). The scale is defined by taking the temperature of melting ice as 0° and that of condensing steam under 760 mm pressure as 100°. This is known as the Centigrade (C) scale.

The **absolute** or **thermodynamic temperature scale** proposed by Lord Kelvin is based on the average kinetic energy per molecule of a perfect gas. The temperature of melting ice is 273.18° and that of the boiling point of water 373.18°. This is frequently referred to as the Kelvin (K) scale.

WEIGHTS AND MEASURES

Metric System

Lengths

Millimeters (mm)	Centimeters (cm)	Decimeters (dm)	Meters (m)	U. S. equivalent
1	0.1	0.01	0.001	0.0393700 inch
10	1	.1	.01	0.393700 inch
100	10	1	.1	3.93700 inches 0.328083 foot
1,000	100	10	1	39.3700 inches 3.28083 feet

Meters (m)	Dekameters (dkm)	Hectometers (hm)	Kilometers (km)	U. S. equivalent
1	0.1	0.01	0.001	1.09361 yards 0.198838 rod
10	1	.1	.01	10.9361 yards 1.98838 rods
100	10	1	.1	19.8838 rods
1,000	100	10	1	0.621372 mile

Millionth microns ($\mu\mu$)	Ångstroms (Å)	Millimicrons ($m\mu$)	Microns (μ)	Centimeters (cm)	U. S. equivalent inches
1	0.01	0.001	10^{-6}	10^{-10}	3.93700×10^{-11}
100	1	.1	10^{-4}	10^{-8}	3.93700×10^{-9}
1,000	10	1	10^{-3}	10^{-7}	3.93700×10^{-8}
10^6	10^4	1,000	1	10^{-4}	3.93700×10^{-5}

1 myriameter = 10,000 meters = 6.21372 miles

Area

Sq. millimeters (mm²)	Sq. centimeters (cm²)	Sq. decimeters (dm²)	Sq. meters or centares (m², ca)	U. S. equivalent
1	0.01	0.0001	0.000001	0.00155000 sq. in.
100	1	.01	.0001	0.155000 sq. in.
10,000	100	1	.01	15.5000 sq. in.
1,000,000	10,000	100	1	10.76387 sq. ft.

Metric System (Continued)

Area (Continued)

Sq meters or centares (m^2, ca)	Sq dekameters or ares (dkm^2, a)	Sq hectometers or hectares (hm^2, ha)	Sq kilometers (km^2)	U S equivalent
1	0.01	0.0001	0.000001	0.039537 sq rod
100	1	.01	.0001	0.02471044 acre
10,000	100	1	.01	2.471044 acres
1,000,000	10,000	100	1	0.3861006 sq mile

Volume

Cu millimeters (mm^3)	Cu centimeters (cm^3, cc)	Cu decimeters (dm^3)	Cu meters (m^3)	U S equivalent
1	0.001	0.000001	0.000000001	0.0000610234 cu in
1,000	1	.001	.000001	0.0610234 cu in
1,000,000	1,000	1	.001	61.0234 cu in
1,000,000,000	1,000,000	1,000	1	35.3144 cu ft 1.30794 cu. yd.

1 stere = 1 cubic meter

Capacity

1 liter is the volume of pure water at 4° C and 760 mm pressure which weighs 1 kilogram 1 liter = 1.000027 cubic decimeter = 1000.027 cubic centimeters

Milliliters (ml)	Centiliters (cl)	Deciliters (dl)	Liters (l)	U S equivalent
1	0.1	0.01	0.001	16.2311 minims 0.0610250 cu inch
10	1	.1	.01	2.70518 fl drams
100	10	1	.1	3.38147 fl ounces
1,000	100	10	1	270.518 fl drams 33.8147 fl ounces

Liters (l)	Dekaliters (dkl)	Hectoliters (hl)	Kiloliters (kl)	U S equivalent
1	0.1	0.01	0.001	1.05671 liq quarts 0.264178 gallon 1.81620 dry pints 0.908102 dry quart
10	1	.1	.01	18.1620 dry pints 9.08102 dry quarts 1.13513 pecks
100	10	1	.1	2.83782 bushels
1,000	100	10	1	. . .

WEIGHTS AND MEASURES (Continued)

Metric System (Continued)

Mass

Milligrams (mg)	Centigrams (cg)	Decigrams (dg)	Grams (g)	U. S. equivalent
1	0.1	0.01	0.001	0.015432356 grain
10	1	.1	.01	0.15432356 grain
100	10	1	.1	1.5432356 grains
1,000	100	10	1	15.432356 grains 0.5643833 dram av. 0.03527396 ounce av.

Grams (g)	Deka-grams (dkg)	Hecto-grams (hg)	Kilo-grams (kg)	U. S. equivalent
1	0.1	0.01	0.001	0.771618 scruple 0.2572059 dram apoth. 0.03215074 ounce apoth. 0.002204622 pound av.
10	1	.1	.01	5.643833 drams av.
100	10	1	.1	3.527396 ounces av.
1,000	100	10	1	2.2046223 pounds av 2.6792285 pounds troy or apoth.

1 kilogram = 15,432.35639 grains = 0.00110231 short ton = 0.00098421 long ton.
1 metric carat = 200 milligrams = 3.0864712 grains.
1 myriagram = 10,000 grams = 10 kilograms = 22.04622 pounds avoirdupois.
1 quintal (metric) = 100 kilograms = 220.4622 pounds avoirdupois
1 millier or tonne = 1,000 kilograms = 2,204.622 pounds avoirdupois = 2,679.229 pounds troy = 0.98420640 long ton = 1.1023112 short tons

Prefixes

The prefixes mega-, meaning one million, and micro- one millionth, are used in connection with various simple and derived units of the metric system.

WEIGHTS AND MEASURES (Continued)

U. S. System

Miscellaneous Units and Equivalents

LENGTHS

The United States standard yard is defined as 3600/3937$^{\text{ths}}$ meter.

Inches (in.)	Feet (ft.)	Yards (yd.)	Rods (rd.)	Miles (mi.)	Metric equivalent
1	0.083333	0.027778	0.00505051	0.0000157828	2.54001 cm
12	1	.33333	.0606061	.000189394	0.304801 m
36	3	1	.181818	.000568182	0.914402 m
198	16.5	5.5	1	.003125	5.029210 m
63,360	5,280	1,760	320	1	1.60935 km

1 mil = 0.001 inch = 25.4001 microns = .0254001 millimeter.
1 hand = 4 inches = 10.1600 centimeters.
1 span = 9 inches = 22.86005 centimeters
1 fathom (fath.) = 6 feet = 1.828804 meters.
1 link (li.) = 0.66 foot = 7.92 inches = 20.11684 centimeters.
1 rod (rd.) = 25 links = 5.029210 meters
1 surveyor's or Gunter's chain (ch.) = 4 rods = 100 links = 66 feet = 20.11684 meters
1 engineer's or Ramsden's chain = 100 links of one foot each = 100 feet = 30.4801 meters
1 knot or nautical mile = 1.1516 statute miles = 6,080.27 feet = 1.85325 kilometers = 1′ of arc on the Earth's surface at the equator
1 British yard = 3 feet = 36 inches = 0.914399 meter.
1 British inch = 2.539998 centimeters.
1 British mile = 1,760 yards = 1.60934 kilometers.
1 furlong (fur.) = 40 rods = 220 yards = 660 feet = 201.168 meters.
1 pole (British) = 5.5 yards = 5.0292 meters = approximately 1 rod.
1 British fathom = 6.00 feet.
1 toise = 6 Paris feet = 1.94904 meters
1 Paris foot (pied) = 12 Paris inches = 0.324839 meter.
1 Paris inch (pouce) = 12 Paris lines = 2.70700 centimeters.
1 Paris line (ligne) = 0.225583 centimeter
1 light year = 5.9×10^{12} miles = 9.5×10^{12} kilometers.
1 point (type sizes) = $\frac{1}{72}$ or 0.01389 inch.
1 line = $\frac{1}{12}$ or 0.083333 inch.
1 cubit = 18 inches.

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Area

Sq. inches (sq. in.)	Sq. feet (sq. ft.)	Sq. yards (sq. yd.)	Sq. rods (sq. rd.)	Acres (A.)	Sq. miles (sq. mi.)	Metric equivalent
1	0.0069444					6.451626 sq. cm
144	1	0.111111				0.09290341 sq. m
1,296	9	1	0.03305785			0.8361307 sq. m
	272.25	30.25	1	0.00625		25.29295 sq. m
	43,560	4,840	160	1	0.0015625	40.46873 sq. dkm
	27,878,400	3,097,600	102,400	640	1	2.589998 sq. km

1 square mil = .000001 square inch = .00064516 square millimeter.
1 circular mil = area of a circle whose diameter is one mil = .00000078540 square inch.
1 square link = 62.7264 square inches = 404.6873 square centimeters.
1 square rod (sq rd.) = 625 square links = 25.29295 square meters.
1 square chain (sq. ch.) = 16 square rods = 404.6873 square meters.
1 acre (A.) = 10 square chains = 4,046.873 square meters.
1 British square yard = 9 square feet = 0.836126 square meter.
1 British square foot = 144 square inches = 9.29029 square decimeters.
1 British square inch = 6.45159 square centimeters.
1 square perch (British) = 30.25 square yards = 25.293 square meters.
1 rood (British) = 40 square perches = 10.117 ares or square dekameters.
1 acre (British) = 4 roods

Volume

Cubic inches (cu. in.)	Cubic feet (cu. ft.)	Cubic yards (cu. yd.)	Metric equivalent
1	0.000578704		16.3872 cu. cm
1,728	1	0.0370370	0.0283170 cu. m
46,656	27	1	0.764559 cu. m

1 board foot (bd. ft.) = 144 cubic inches = 2,359.8 cubic centimeters.
1 cord = 128 cubic feet = 3.625 cubic meters.
1 British cubic foot = 1,728 cubic inches = 0.0283168 cubic meter.
1 British cubic yard = 27 cubic feet = 0.764553 cubic meter.
1 cubic foot = 6.229 British gallons = 7.481 U. S. gallons.
1 cubic yard = 168.17 British gallons

U. S. System (Continued)

Capacity—Liquid Measure

Gills (gi.)	Pints (pt.)	Quarts (qt.)	Gallons (gal)	Cubic inches	Metric equivalent
1	0 25	0 125	0 03125	7 21875	118 292 milliliters
4	1	5	125	28 875	0 473167 liter
8	2	1	25	57.749	0 946333 liter
32	8	4	1	231	3.785332 liters

1 gill = 4 fluid ounces = 1 18292 deciliters
1 gallon (U S) of water at 15° weighs about 8 337 pounds avoirdupois or 3 7820 kilograms = 0.83268 British gallon.
1 hogshead = 63 gallons.
1 firkin = 9 gallons = 34 06799 liters.
1 tun = 252 gallons.
1 British gill = 1 4206 deciliters.
1 British pint = 4 gills = 0.56825 liter.
1 British quart = 2 pints = 1.13650 liters
1 British gallon = 4 quarts = 277 3 cubic inches = 0.16054 cubic foot = 4 5459631 liters.
1 British gallon of water at 15° C weighs 10 pounds = 1.20094 U S gallons

Apothecaries' Fluid Measure

Minims (min or ♏)	Fluid drams (fl dr or ʒ)	Fluid ounces (fl. oz or ℥)	Pints (pt)	Metric equivalent
1	0 016667	0 0020833		0 0616102 milliliter
60	1	125		3 69661 milliliters
480	8	1	0 0625	29 5729 milliliters
7 680	128	16	1	0 473167 liter

1 fluid ounce = 1 80469 cubic inches.
1 gallon = 128 fluid ounces = 8 pints
1 British Imperial gallon = 8 pints = 160 fluid ounces = 4 5459631 liters
1 British fluid ounce = 8 drachms = 28 4130 cubic centimeters
1 British fluid drachm = 60 minims = 3 5515 cubic centimeters.
1 British minim = 0 059194 cubic centimeter

Dry Measure

Pints (pt.)	Quarts (qt)	Pecks (pk)	Bushels (bu)	Cubic inches	Metric equivalent
1	0 5	0 0625	0 015625	33 6003	0 550599 liter
2	1	125	03125	67 2006	1 101198 liters
16	8	1	25	537 605	8 80958 liters
64	32	4	1	2 150 42	35 2383 liters

1 British peck = 2 British gallons = 554 6 cubic inches = 9 09193 liters
1 British bushel = 8 British gallons = 2 219 3 cubic inches = 36.3677 liters = 1.03205 U. S. bushels.
1 British quarter = 8 bushels = 2.909 hectoliters.
1 U. S. bushel = 0.96895 British bushel.

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Mass

Note: Three systems are in use,—avoirdupois, troy and apothecaries'. The grain is the same in all.

Avoirdupois—Commercial

The U. S. Standard pound avoirdupois is defined as 453.5924277 grams.

Grains (gr.)	Drams (dr. av.)	Ounces (oz av)	Pounds (lb. av)	Tons (short) (tn.)	Metric equivalent
1	0 03657143			. .	0 064798918 g
27 34375	1	0 0625			1 771845 g
437 5	16	1	0 0625	.	28 349527 g
7,000	256	16	1	0 0005	453 5924 g 0 4535924 kg
		32,000	2,000	1	907 18486 kg

1 pound avoirdupois is the mass of 27 692 cubic inches of water weighed in air at 4° C, 760 mm pressure
1 short hundredweight (cwt) = 100 pounds = 45 359243 kilograms.
1 short ton = 20 short hundredweight = 2,430 56 troy pounds = 907.18486 kilograms
1 stone (British) = 14 pounds = 6.350 kilograms
1 quarter (British) = 28 pounds = 12 70 kilograms.
1 long hundredweight (British) = 4 quarters = 112 pounds = 50 802352 kilograms
1 long ton (British) = 20 long hundredweight = 1,016 04704 kilograms
1 long ton = 1.12000 short tons = 2,722.22 troy pounds = 1 01605 metric tons.
1 short ton = 0.892857 long ton = 29,166.66 troy or apothecaries' ounces = 0 907185 metric ton.
1 avoirdupois pound = 1 21528 troy or apothecaries' pounds = 14.5833 troy ounces.
1 avoirdupois ounce = 0 911458 troy or apothecaries' ounce

Troy Weight

Grains (gr.)	Pennyweights (dwt.)	Ounces (oz t)	Pounds (lb. t)	Metric equivalent
1	0 041667	0 0020833		64 798918 mg 0 064798918 g
24	1	05	0 0041667	1.555174 g
480	20	1	083333	31 103481 g
5,760	240	12	1	373 24177 g

1 troy pound = 5,760/7,000 or 0 822857 avoirdupois pound = 13 1657 avoirdupois ounces.
1 carat (1877) = 3.168 grains = 205 6 milligrams.
1 troy ounce = 1 09714 avoirdupois ounces
1 troy pound = 0 00036735 long ton = 0.00041143 short ton = 0 00037324 metric ton.

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Apothecaries' Weight

Grains (gr.)	Scruples (℈ or s. ap.)	Drams (ʒ or dr. ap.)	Ounces (℥ or oz. ap.)	Pounds (lb. ap.)	Metric equivalent
1	0.05	0.016667	0.0020833	. . .	64.798918 mg
20	1	.33333	.041667	0.0034722	1.2959784 g
60	3	1	.125	.0104167	3.8879351 g
480	24	8	1	.083333	31.103481 g
5,760	288	96	12	1	373.24177 g

Time

Seconds (sec.)	Minutes (min.)	Hours (hr.)	Days (da.)	Years (yr.)
1	0.0166667	0.000277778		
60	1	.0166667	0.000694446	
3,600	60	1	.0416667	
86,400	1,440	24	1	
	. . .	. .	365.2422	1 (common)
	.		365.256	1 (sidereal)

1 lunar month (mo.) = 29 days 12 hours 44 minutes.
1 sidereal second = 0.997270 mean solar second.

Angle

Seconds (″)	Minutes (′)	Degrees (°)	Circumference	Radians
1	0.0166667	0.000277778	0.00000771605	0.00000484814
60	1	.0166667	.0000462963	.000290888
3,600	60	1	.00277778	.0174533
1,296,000	21,600	360	1	6.28319
206,265	3,437.75	57.2958	0.159155	1

1 radian = 57° 17′ 44.8″ = $1/2\pi$ of a circumference
2π radians = 360° = 1 circumference
π radians = 180°.
$\pi/2$ radians = 90°
$\pi/4$ radians = 45°.
1 grade = $\frac{1}{400}$ circumference = 100 centesimal minutes = 0.0157079 radian
1 centesimal minute = 100″ centesimal seconds

Solid Angle

1 steradian = $1/4\pi$ of the solid angle around a point.

UNITS AND CONVERSION FACTORS

Each unit named is followed by its equivalent in one or more other units of the same quantity. While the list of equivalents is incomplete it is intended to include all those which will be in common use

Symbols in the dimensional formulae given after the headings have the following significance: m, mass, l, length; t, time; θ, temperature; ϵ, dielectric constant of a vacuum; μ, permeability of a vacuum.

Mass, Length, Time, Angle, Area and Volume

Acre (A.) (U. S.).—0 0015625 square mile, 10 square chains (Gunter's), 160 square rods or square perches; 4840 square yards; 4.3560×10^4 square feet, 1×10^5 square links (Gunter's), 0.4046873 hectare or square hectometer, 40 46873 ares or square dekameters; 4046.873 square meters

Acre (A.) (British).—4 roods (British), 4840 square yards (British); 0.4046849 hectare or square hectometer, 4046 849 square meters

Ångström Unit (Å. or Å. U.).—$3\ 937 \times 10^{-9}$ inch, 0.003937 millionths of an inch, 1×10^{-10} meter, 1×10^{-8} centimeter, 1×10^{-4} micron (μ); 0 1 milli-micron or micro-millimeter; 100 millionth microns or micro-microns ($\mu\mu$)

Are (a).—3.8610×10^{-5} square mile, 0.02471044 acre (U. S.); 119.60 square yards; 1076.4 square feet, 0.01 hectare, 1 square dekameter, 100 square meters

Astronomical unit.—$1\ 495 \times 10^8$ kilometers

Bag (British).—3 bushels (dry), 0 109107 cubic meter.

Barleycorn (British).—1 /3 inch, 0.84667 centimeter

Barrel (bbl.) (U. S., dry).—3.281 bushels, 105.0 quarts (dry); 7056 cubic inches for dry commodities except cranberry barrel which = 5826 cubic inches; 0 11562 cubic meter

Barrel (bbl.) (U. S., liquid).—31.5 gallons, 0 11924 cubic meter

Barrel (bbl.) (British, dry).—36 gallons (British), 0 16366 cubic meter

Board Foot (bd. ft.).—1 /12 cubic foot, 144 cubic inches (1 foot × 1 foot × 1 inch); 2359.8 cubic centimeters

Bolt (U. S., cloth.).—120 linear feet; 36.576 meters.

Bucket (British, dry).—4 gallons (British); 1.8184×10^4 cubic centimeters.

Bushel (bu.) (U. S., dry).—0.304785 barrel; 0.96895 bushel (British); 1.2444 cubic feet, 4 pecks, 32 quarts (dry); 64 pints (dry); 2150 42 cubic inches; 0.035239 cubic meter; 0.35238 hectoliter, 3.5238 dekaliters; 35 238 liters; 3.5239×10^4 cubic centimeters.

Bushel (bu.) (British, dry).--1/8 or 0.125 quarter (British, capacity); 1/3 or 0.33333 bag (British); 1.03205 bushels (U S.); 1.2843 cubic feet; 8 gallons (British); 2219.3 cubic inches; 0.363677 hectoliter; 3 63677 dekaliters; 36.3677 liters; $3\ 6369 \times 10^4$ cubic centimeters.

Butt (British, dry).—126 gallons; 0.57281 cubic meter.

Cable Length (British & U S.).—720 feet; 219.46 meters.

Carat (c) (metric)—3.08647 grains; 0.2 gram; 200 milligrams

Carat (c) (1877).—3 168 grains, 205.6 milligrams.

Cental—100 pounds, 45.359 kilograms.

Centare (ca).—1 196 square yards, 10 764 square feet; 1550 square inches; 0.01 are, 1 square meter

Centigram (cg).—0 1543236 grain; 0.01 gram.

Centiliter (cl).—0.33815 ounce (fluid, U. S.); 0.61025 cubic inch; 2.705179 drams (fluid, U S.); 0.01 liter; 10.00027 cubic centimeters.

Centimeter (cm).—0 01093611 yard (U. S.); 0.01093614 yard (British); 0.032808 foot (U S or British); 0.39370 inch (U S. or British), 4.4330 lignes (Paris lines); 393.70 mils; 0.01 meter; 10 millimeters; 1×10^4 microns; 1×10^7 milli-microns or micro-millimeters; 1×10^8 Ångstrom units.

Chain (ch.) (Engineer's or Ramden's).—100 feet: 100 links of 1 foot each; 30 4801 meters

Chain (ch.) (Surveyor's or Gunter's).—0.1 furlong; 0.0125 mile, 4 rods; 22 yards; 66 feet, 100 links; 792 inches; 20.117 meters; 2011 7 centimeters

Chaldron (U S., dry)—*36 bushels (U S); 1.2686 cubic meters

Chaldron (British, dry).—*32 bushels (British); 1 1638 cubic meters

Circle (cir)—2π or 6 2832 radians, 12 signs; 360 degrees.

Circular Inch.—Area of circle, diameter of which is one inch; 0 78540 square inch; 5.0671 square centimeters.

Circular Mil.—Area of circle, diameter of which is one mil

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*Variable.

or 1/1000 inch; 7.854×10^{-7} square inch; 0.78540 square mil; 5.0671×10^{-6} square centimeter; 5.0671×10^{-4} square millimeter.

Circular Millimeter.—0.0078540 square centimeter; 0.78540 square millimeter.

Circumference.—2π or 6.28319 radians; 360 degrees; 400 grades; $2\ 1600 \times 10^4$ minutes; $1\ 296000 \times 10^6$ seconds.

Clove or Customary Stone (British).—8 pounds; 3.6287 kilograms.

Coomb (British, dry).—4 bushels; 0.14548 cubic meter.

Cord (cd.).—8 cord feet; 128 cubic feet (8 feet$\times$4 feet$\times$4 feet); 3.625 cubic meters.

Cord-Foot (cd. ft.)—1/8 or 0.125 cord; 16 cubic feet (4 feet $\times$ 4 feet $\times$ 1 foot).

Cubic Centimeter (cm³).—1.3079×10^{-6} cubic yard; 2.7496×10^{-5} bushel (British); 2.83776×10^{-5} bushel (U. S.); 3.531445×10^{-5} cubic foot (U. S.); 3.531477×10^{-5} cubic foot (British); 2.1997×10^{-4} gallon (British); 2.6417×10^{-4} gallon (U. S.); 4.2376×10^{-4} board foot; 8.7988×10^{-4} quart (liquid, British), 9.0808×10^{-4} quart (dry, U. S.); 0.0010567 quart (liquid, U. S.); 0.0018162 pint (dry, U. S.); 0.0021134 pint (liquid, U. S.); 0.033814 ounce (fluid, U. S.); 0.035195 ounce (fluid, British); 0.061023 cubic inch; 0.27051 dram (fluid, U. S.); 0.28157 drachm (fluid, British); 16.231 minims (U. S.); 16.894 minims (British); 1×10^{-6} cubic meter; 9.9997×10^{-4} liter; 0.001 cubic decimeter; 0.99997 milliliter; 1000 cubic millimeters.

Cubic Decimeter (dm³).—0.0013079 cubic yard; 0.035314 cubic foot; 61.023 cubic inches; 0.001 cubic meter; 0.99997 liter; 1000 cubic centimeters.

Cubic Dekameter (dkm³).—1000 cubic meters.

Cubic Foot (ft.³ or cu. ft.) (U. S.).—1/128 or 0.0078125 cord. 0.01 register ton (British); 1/27 or 0.037037 cubic yard; 1/16 or 0.0625 cord-foot; 0.77861 bushel (British); 0.80357 bushel (U. S.); 6.229 gallons (British); 7.481 gallons (U. S.); 12 board feet; 25.714 quarts (dry, U. S.); 29.922 quarts (liquid, U. S.); 59.844 pints (liquid, U. S.); 1728 cubic inches; 0.02831701 cubic meter; 28.316 liters; 2.8317×10^4 cubic centimeters.

Cubic Foot (ft.³ or cu. ft.) (British).—0.02831677 cubic meter; 2.831677×10^4 cubic centimeters.

Cubic Inch (in.³ or cu. in.) (U. S.).—2.143347×10^{-5} cubic yard; 4.65025×10^{-4} bushel (U. S.); 5.78704×10^{-4} cubic foot; 0.00186010 peck; 0.0043290 gallon (U. S.); 1/144 or 0.006944 board foot; 0.014881 quart (dry, U. S.); 0.017316 quart (liquid, U. S.); 0.0297616 pint (dry); 0.5541 ounce (fluid); 4.4329 drams

(fluid); 1.6387162 × 10⁻⁵ cubic meter; 0.0163868 liter; 1.63868 centiliters; 16.3868 milliliters; 16.387162 cubic centimeters; 1.6387162 × 10⁴ cubic millimeters.

Cubic Inch (in.³ or cu. in) (British).—4.5081 × 10⁻⁴ bushel (British); 5.7870 × 10⁻⁴ cubic foot (British); 0.0018031 peck (British); 0.003606 gallon (British); 16.3870253 cubic centimeters.

Cubic Hectometer (hm³).—1 × 10⁶ cubic meters.

Cubic Kilometer (km³).—1 × 10⁹ cubic meters.

Cubic Meter (m³).—0.2759 cord; 1.3079428 cubic yards (U. S.); 1.307954 cubic yards (British); 28.3776 bushels (U. S.); 35.314445 cubic feet (U. S.); 35.31477 cubic feet (British); 264.173 gallons (U. S.); 1056.7 quarts (liquid); 2113.4 pints (liquid, U. S.); 6.1023 × 10⁴ cubic inches; 1 stere; 999.973 liters; 1000 cubic decimeters; 1 × 10⁶ cubic centimeters; 1 × 10⁹ cubic millimeters.

Cubic Millimeter (mm³).—6.1023 × 10⁻⁵ cubic inch; 0.01623 minim (U. S.); 0.01689 minim (British); 1 × 10⁻⁹ cubic meter; 0.001 cubic centimeter.

Cubic Yard (yd.³ or cu. yd.) (U. S.).—27 cubic feet; 168.17 gallons (British); 202.0 gallons (U. S.); 807.9 quarts (liquid, U. S.); 1616 pints (liquid, U. S.); 4.6656 × 10⁴ cubic inches; 0.76455945 cubic meter; 764.54 liters; 7.6455945 × 10⁵ cubic centimeters.

Cubic Yard (yd.³ or cu. yd.) (British).—27 cubic feet; 0.76455285 cubic meter.

Cubit.—18 inches; 45.72 centimeters.

Dalton.—1/16 the mass of an atom of oxygen; 1.650 × 10⁻²⁴ gram.

Day (da) (tropical, mean solar).—24 hours (mean solar); 1440 minutes (mean solar); 8.6400 × 10⁴ seconds (mean solar).

Day (da) (sidereal).—8.6164 × 10⁴ seconds (mean solar).

Decigram (dg.).—1.543236 grains; 0.1 gram.

Deciliter (dl).—0.176 pint (British); 3.38147 ounces (fluid, U. S.); 0.1 liter; 100.0027 cubic centimeters.

Decimeter (dm).—0.3280833 foot (U. S.); 0.3280843 foot (British); 3.93700 inches (U. S.); 3.937011 inches (British); 0.1 meter.

Decistere (ds).—0.1 stere or cubic meter.

Degree (°).—1/360 or 0.0027778 circumference or revolution; 1/90 or 0.01111 quadrant; 0.017453 radian; 60 minutes; 3600 seconds.

Dekagram (dkg).—0.35273957 ounce (avoirdupois); 5.64383 drams (avoirdupois); 0.01 kilogram; 10 grams.

Dekaliter (dkl).—0.27497 bushel (British); 0.28378 bushel (U. S.); 1.13513 pecks (U. S.); 9.08102 quarts (U. S., dry); 18.162 pints (dry, U. S.); 10 liters; 10.00027 cubic decimeters.

Dekameter (dkm).—1.98838 rods (U. S.); 10.93611 yards (U. S.); 10.93614 yards (British); 393.70 inches; 10 meters.

Dekastere (dks).—10 steres or cubic meters.

Drachm (fluid) (dr. fl. or ʒ fl.) (British).—⅛ or 0.125 ounce (fluid, British); 60 minims; 3.5515 cubic centimeters.

Dram (apothecaries' or troy) (dr. ap. or t. or ʒ ap. or t.)—(Same as British Drachm)—0.008571429 pound (avoidrupois); 1/96 or 0.010416667 pound (apothecary or troy); ⅛ or 0.12500 ounce (apothecary or troy); 0.1371429 ounce (avoirdupois); 2.194286 drams (avoirdupois); 2.5 pennyweights; 3 scruples; 60 grains; 3.8879351 grams.

Dram (avoirdupois) (dr. av. or ʒ av.).—1/256 or 0.00390625 pound (avoirdupois); 0.004747178S pound (apothecary or troy); 0.056966146 ounce (apothecary or troy); 0.0625 ounce (avoirdupois); 0.4557292 dram (apothecary or troy); 1.139323 pennyweights; 1.3671875 scruples; 27.34375 grains; 1.771845 grams; 1771.845 milligram.

Dram (fluid) (dr. fl. or ʒ fl.) (U.S.).—0.00390625 quart (liquid, U. S.); 0.0078125 pint (liquid, U. S.); 0.03125 gill (U. S.); ⅛ or 0.125 ounce (fluid); 0.225586 cubic inch; 60 minims; 3.6966 milliliters; 3.6967 cubic centimeters.

Ell.—45 inches; 114.30 centimeters.

Em, Pica (printing industry).—1/6 or 0.16667 inch; 0.42333 centimeter.

Fathom (fath.) (nautical).—6 feet, 1.828804 meter.

Firkin (fir.) (U. S.).—9 gallons (U. S.); 34.068 liters.

Firkin (fir.) (British).—9 gallons (British); 40.914 liters.

Fluid Ounce (fl. oz.)—See **Ounce (Fluid)**.

Foot (ft.) (U. S.)—1.6447×10^{-4} mile (nautical); 1.893939×10^{-4} mile (statute); 0.00151515 furlong; 0.0151515 chain (Gunter's); 0.0606061 rod; 1/6 or 0.16667 fathom; 1/3 or 0.33333 yard; 12 inches; 0.3048006 meter, 30.48006 centimeter; 473404 wave-lengths of red line of cadmium.

Foot (ft.) (British).—0.4 pace (British); 30.47997 centimeters.

Foot (Paris).—(See **Pied**).

Furlong (fur.) (U. S. or British).—⅛ or 0.125 mile (U. S.); 10 chains(Gunter's); 40 rods, 220 yards; 660 feet; 201.168 meters.

Gallon (gal.) (U.S.).—1 U. S. gallon of water at 62°F weighs 3.7820 kilograms or 8.337 pounds (avoirdupois); 0.004951 cubic yard; 0.031746 barrel (liquid, U. S.); 0.13368 cubic foot; 0.83268 gallons (British); 4 quarts (liquid); 8 pints (liquid); 32 gills; 128 ounces (fluid); 231.00 cubic inches; 6.1440 $\times$ 10^4 minims; 0.0037854 cubic meter; 3.7853 liters; 3785.4 cubic centimeters.

Gallon (gal.) (British Imperial) (Canadian).—1 British gallon of water at 62°F has a mass of 10 pounds (avoirdupois); 0.02778 barrel (dry, British); ⅛ or 0.125 bushel (dry, British); 0.16054 cubic foot; 0.5 peck (British); 1.20094 gallons (U. S.); 4 quarts (liquid, British); 8 pints (liquid, British); 32 gills (liquid, British); 160 ounces (fluid, British); 277.3 cubic inches; 4.54596 liters; 4546.1 cubic centimeters.

Geepound—See Slug.

Gill (gi.) (U. S.).—1/32 or 0.03125 gallon (U. S.); ⅛ or 0.125 quart (liquid, U. S.); ¼ or 0.25 pint (liquid, U. S.); 4 ounces (fluid); 7.21875 cubic inches; 32 drams (fluid); 1920 minims; 0.118292 liters; 118.295 cubic centimeters.

Gill (gi.) (British).—1/32 or 0.03125 gallon (British); ¼ or 0.25 pint (liquid, British); 5 ounces (fluid, British); 0.14206 liter; 142.07 cubic centimeters.

Grade—1/400 or 0.0025 circumference; 0.0157079 radian; 0.9 degree; 100 centesimal minutes.

Grain (gr.).—1/7000 or 1.42857 $\times$ 10^{-4} pound (avoirdupois); 1/5760 or 1.736111 $\times$ 10^{-4} pound (apothecary or troy); 0.0020833 ounce (apothecary or troy); 0.0022857 ounce (avoirdupois); 0.016667 dram (apothecary or troy); 0.03657143 dram (avoirdupois); 0.0416667 pennyweight (troy); 0.05000 scruple (apothecary); 0.06479891S gram; 0.3240 carat (metric); 64.798918 milligram.

Gram (g).—0.00220462 pound (avoirdupois); 0.00267923 pound (apothecary or troy); 0.0321507 ounce (apothecary or troy); 0.0352739 ounce (avoirdupois); 0.257206 dram (apothecary or troy); 0.564383 dram (avoirdupois); 0.6430149 pennyweight; 0.771618 scruple; 15.4324 grains; 1 $\times$ 10^{-6} ton (metric); 1 $\times$ 10^{-4} myriagram; 0.001 kilogram; 5 carats (metric); 1000 milligrams; 1 $\times$ 10^6 microgram.

Hand.—4 inches; 10.160 centimeters.

Hectare (ha)—2.471044 acres (U. S.); 2.471058 acres (British); 395.367 square rods (U. S.); 1.195985 $\times$ 10^4 square yards (U. S.); 1.0764 $\times$ 10^5 square feet; 100 ares; 1 $\times$ 10^4 square meters.

Hectogram (hg).—3.52739 ounces (avoirdupois); 100 grams.

Hectoliter (hl).—2.7497 bushels (British); 2.8378 bushels (U. S.); 11.3513 pecks (U. S.); 100 liters.

Hectometer (hm).—19.8838 rods; 109.3611 yards (U. S.); 109.3614 yards (British); 328.08 feet (U. S.); 100 meters.

Hemisphere.—0.5 sphere; 4 spherical right angles; 6.2832 steradians.

Hogshead (hhd.) (British).—63 gallons (British); 10.114 cubic feet; 0.28640 cubic meters.

Hogshead (hhd.) (U. S.).—63 gallons (U. S.); 8.4218 cubic feet; 0.23848 cubic meter.

Hour (hr.) **(tropical, mean solar).**—0.0059524 week; 0.041667 day (mean solar); 60 minutes (mean solar); 3600 seconds (mean solar).

Hundredweight (cwt.) **(short).**—100 pounds; 0.044643 ton (long); 0.05 ton (short); 4 quarters (British); 1600 ounces (avoirdupois); 0.0453592 ton (metric); 45.3592 kilograms.

Hundredweight (cwt.) **(long).**—112 pounds; 0.05 ton (long); 4 quarters (British); 50.8023 kilograms.

Inch (in.) **(U. S.).**—1.57828×10^{-5} mile; 0.00126263 chain (Gunter's); 0.00505051 rod; 1/36 or 0.027778 yard; 1/12 or 0.08333 foot; 0.126263 link (Gunter's); 72 points (printer's type); 1000 mils; 2.540005 centimeter; 25.40005 millimeters; 2.5400×10^{8} Ångström unit; 39450.33 wave lengths of red line of cadmium.

Inch (in.) **(British).**—1/36 or 0.027778 yard (British); 1/9 or 0.1111 quarter (British, linear); 2.539998 centimeters; 25.39998 millimeter.

Inch (Paris).—See **Pouce.**

Kilderkin (British).—18 gallons (British); 0.081830 cubic meter.

Kilogram (kg).—9.842064×10^{-4} ton (long); 0.0011023112 ton (short); 0.019684 hundredweight (long); 0.022046223 hundredweight (short); 0.07874 quarter (British); 2.2046223 pounds (avoirdupois); 2.6792285 pounds (apothecary or troy); 32.150742 ounces (apothecary or troy); 35.273957 ounces (avoirdupois); 257.21 dram (apothecary or troy); 564.38 dram (avoirdupois); 643.01 pennyweight; 771.62 scruples; 1.54324×10^{4} grains; 0.001 ton (metric); 1000 grams.

Kiloliter (kl).-1.3080 cubic yards; 35.316 cubic feet; 264.18 gallons (liquid, U. S.); 1.000027 cubic meters; 1000 liters.

Kilometer (km).—1.0567×10^{-13} light year; 0.53961 mile (nautical); 0.62137 mile (statute); 1093.6 yards; 3280.8 feet; 0.1 myriameter; 1000 meters; 1×10^{5} centimeters.

Minute (min.) (time).—9.9206 × 10^{-5} week; 6.94446 × 10^{-4} day; 0.016667 hour; 60 seconds.

Month (mo.) (mean calendar).—30.42 days; 730 hours; 4.3800 × 10^4 minutes; 2.628 × 10^6 seconds.

Month (mo.) (lunar).—29 days 12 hours 44 minutes.

Myriagram (Mg).—22.04622 pounds (avoirdupois); 10 kilograms; 1 × 10^4 grams.

Myriameter (Mm).—6.21372 miles; 10 kilometers; 1 × 10^4 meters.

Nail (British).—2.25 inch; 5.715 centimeters.

Noggin (British).—1/32 or 0.03125 gallon (liquid); 142.06 cubic centimeters.

Ounce (Fluid) (oz. fl. or ℥ fl.) (U. S.).—1/128 or 0.0078125 gallon (U. S.); 0.03125 quart (liquid, U. S.); 1/16 or 0.0625 pint (liquid); ¼ or 0.25 gill (U. S.); 1.80469 cubic inches; 8 drams (fluid); 480 minims; 0.0295729 liter; 0.295729 deciliter; 29.5729 milliliters; 29.5737 cubic centimeters.

Ounce (fluid) (oz. fl. or ℥ fl.) (British).—0.006250 gallon (British); 8 drachms (fluid, British); 480 minims; 28.4130 cubic centimeters.

Ounce (avoirdupois) (oz. av. or ℥ av.).—2.790179 × 10^{-5} ton (long); 3.125 × 10^{-5} ton (short); 6.25 × 10^{-4} hundredweight (short); 1/16 or 0.062500 pound (avoirdupois); 0.075954861 pound (apothecary or troy); 0.9114583 ounce (apothecary or troy); 7.29166 drams (apothecary or troy); 16 drams (avoirdupois); 18.22917 pennyweights; 21.875 scruples (apothecary); 437.5 grains; 2.83495 × 10^{-5} ton (metric); 28.349527 grams.

Ounce (apothecary or troy) (oz. ap. or t. or ℥ ap. or t.).—3.4285 × 10^{-5} ton (short); 0.06857143 pound (avoirdupois); 0.08333 pound (apothecary or troy); 1.09714 ounces (avoirdupois); 8 drams (apothecary or troy); 17.55428 drams (avoirdudupois); 20 pennyweights (troy); 24 scruples; 480 grains; 31.103481 grams; 3.1103481 × 10^4 milligrams.

Pace.—2½ feet; 30 inches (British); 76.2 centimeters.

Palm (British).—3 inches; 7.62 centimeters.

Parsec.—19 × 10^{12} miles; 3.084 × 10^{13} kilometers.

Peck (pk.) (U. S.).—¼ or 0.25 bushel; 8 quarts; 16 pints; 537.605 cubic inches; 0.880958 dekaliter; 8.80958 liters.

Peck (pk.) (British).—2 gallons (British); 554.6 cubic inches; 9.0919 liters.

Pennyweight (dwt.) (troy).—0.003428571 pound (avoirdupois); 0.0041667 pound (apothecary or troy); 1/20 or 0.05

ounce (apothecary or troy); 0.0548571 ounce (avoirdupois); 0.8777143 dram (avoirdupois); 24 grains; 1.55517 grams; 1555.17 milligrams.

Perch (British & U. S.).—1 rod; 16.5 feet; 5.0292 meters.

Perch (masonry).—24.75 cubic feet.

Pied (French foot).—1 /6 or 0.16667 toise (French); 12 Paris inches; 0.3248 meter.

Pint (pt.) (dry, U. S.).—1/64 or 0.015625 bushel; 0.0625 peck; 0.5 quart; 33.600 cubic inches; 0.550599 liter; 550.61 cubic centimeters.

Pint (pt.) (liquid, U. S.).—6.1881×10^{-4} cubic yard; 0.016711 cubic foot; 1/8 or 0.125 gallon (U. S.); 0.5 quart (U. S.); 0.83268 British pint; 4 gills (U. S.); 16 fluid ounces (U. S.); 28.875 cubic inches; 128 fluid drams; 7680 minims; 0.473167 liter; 473.167 milliliters; 473.179 cubic centimeters.

Pint (pt.) (liquid, British).—1/8 or 0.125 gallon (British); 0.5 quart (British); 1.20094 U. S. pints; 4 gills (British); 20 fluid ounces (British); 0.56825 liter; 568.25 milliliters; 568.26 cubic centimeters.

Point (printer's type).—1 /72 or 0.01389 inch; 0.035278 centimeter.

Pole (British).—1 rod; 5.5 yards; 16.5 feet; 5.0292 meters.

Pottle (British).—½ gallon (liquid); 2.273 cubic decimeters.

Pouce (Paris inch).—1 /12 or 0.083333 pied or Paris foot; 12 lignes or Paris lines; 2.70700 centimeters.

Pound (avoirdupois) (lb. av.) (U. S. or British).—Is the mass of 27.692 cubic inches of water weighed in air at 4° C, 760 mm pressure; 4.464286×10^{-4} ton (long); 5×10^{-4} ton (short); 0.0089286 hundredweight (long); 0.01 hundredweight (short); 1.2152778 pounds (apothecary or troy); 14.5833 ounces (apothecary or troy); 16 ounces (avoirdupois); 116.6667 drams (apothecary or troy); 256 drams (avoirdupois); 291.6667 pennyweights; 350.01 scruples; 7000 grains; 4.5359243×10^{-4} ton (metric); 0.4535924 kilogram; 453.5924 grams.

Pound (apothecary or troy) (lb. ap. or t.) (U. S. or British).—3.6735×10^{-4} ton (long); 4.1143×10^{-4} ton (short); 0.822857 pound (avoirdupois); 12 ounces (apothecary or troy); 13.165714 ounces (avoirdupois); 96 drams (apothecary or troy); 210.6514 drams (avoirdupois); 240 pennyweights; 288 scruples; 5760 grains; 3.7324×10^{-4} ton (metric); 0.3732418 kilogram; 373.2418 grams.

Puncheon (British).—70 gallons (British); 84 wine gallons; 0.31823 cubic meter.

Quadrant.—1.57080 radians; 90 degrees; 5400 minutes.

Quart (qt.) (U. S., dry).—1/32 or 0.03125 bushel; 0.038889 cubic foot; 1/8 or 0.125 peck; 2 pints (dry); 67.2006 cubic inches; 1.10120 liters; 1101.23 cubic centimeters.

Quart (qt.) (U. S., liquid).—0.033421 cubic foot; 1/4 or 0.25 gallon; 2 pints (liquid); 8 gills; 32 ounces (fluid); 57.749 cubic inches; 256.00 drams (fluid); 0.946333 liter; 946.358 cubic centimeters.

Quart (qt.) (British, liquid).—1/4 gallon (British); 2 pints (liquid, British); 1.13650 liters; 1136.52 cubic centimeters.

Quarter (U. S., mass).—1/4 short ton or 500 pounds; 226.795 kilograms.

Quarter (U. S., mass).—1/4 long ton or 560 pounds; 254.01 kilograms.

Quarter (British, capacity)—8 bushels; 2.909 hectoliters.

Quarter (British, linear).—1 span; 1/4 yard; 9 inches; 22.860 centimeters.

Quarter (British, mass).—1/4 short hundredweight or 25 pounds; 11.340 kilograms.

Quarter (British, mass).—1/4 long hundredweight or 28 pounds; 12.70 kilograms.

Quartern (British, dry).—1/2 gallon; 2273.1 cubic centimeters.

Quartern (British, liquid).—1/32 gallon; 142.07 cubic centimeters.

Quintal (q) (metric).—1.96841 hundredweights (long); 220.46 pounds; 100 kilograms; 1×10^5 grams.

Quintal* (q) (U. S. or British).—100 or 112 pounds.

Quire.—25 sheets.

Radian.—$\frac{1}{2}\pi$ or 0.159155 circumference or revolution; 0.637 quadrant; 57.29578 degrees; 57° 17′ 44.8″; 3437.75 minutes; 2.06265×10^5 seconds.

Ream.—500 sheets.

Register Ton (British).—100 cubic feet; 2.8317 cubic meters.

Revolution.—4 quadrants; 2π or 6.2832 radians; 360 degrees.

Rod (rd.) (surveyor's measure).—0.003125 mile; 0.025 furlong; 0.25 chain (Gunter's); 1 perch; 5.5 yards; 16.5 feet; 25 links; 198 inches; 5.029210 meters.

Rod (rd.) (British, volume).—1000 cubic feet; 28.317 cubic meters.

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*Variable.

Rood (British).—¼ or 0.25 acre; 40 square perches; 1210 square yards; 10.117 ares or square dekameters.

Rope (British).—20 feet; 6.0960 meters.

Sack (British).—3 bushels; 0.10911 cubic meter.

Scruples (apothecary) (s. ap. or ℈).—0.002857143 pound (avoirdupois); 0.003472222 pound (apothecary or troy); 0.041667 ounce (apothecary or troy); 0.0457143 ounce (avoirdupois); 1/3 or 0.33333 dram (apothecary or troy); 0.7314286 dram (avoirdupois); 0.833333 pennyweight; 20 grains; 1.2959784 grams; 1295.9784 milligrams.

Seam (British).—8 bushels; 0.29095 cubic meter.

Second (Angle) (″).—4.84814×10^{-6} radian; 2.7778×10^{-4} degree; 0.016667 minute.

Second (sec) (time, mean solar).—1.1574×10^{-5} day (mean solar); 1.1606×10^{-5} day (sidereal); 2.7778×10^{-4} hour (mean solar); 0.016667 minute (mean solar); 1.00273791 seconds (sidereal).

Second (sec) (time, sidereal).—0.997270 second (mean solar).

Sign (s).—30 degrees.

Skein.—360 feet; 109.73 meters.

Slug.—1 geepound; 32.174 pounds; 14.594 kilograms.

Space, Entire (solid angle).—4π or 12.5664 steradians.

Span.—⅛ fathom; 1 quarter (British, linear); 9 inches; 22.86005 centimeters.

Sphere (solid angle).—2 hemispheres; 4π or 12.5664 steradians.

Spherical Right Angle.—⅛ or 0.125 sphere; ¼ or 0.25 hemisphere; $\pi/2$ or 1.5708 steradians.

Square Centimeter (cm^2).—2.47104×10^{-7} square chain; 3.95367×10^{-6} square rod; 1.1960×10^{-4} square yard; 0.0010764 square foot; 0.00247104 square link; 0.15500 square inch; 1.5500×10^5 square mils; 1.9735×10^5 circular mils; 127.32 circular millimeters; 1×10^{-4} square meter; 0.01 square decimeter; 100 square millimeters.

Square Chain (sq. ch.) (Gunter's).—1.5625×10^{-4} square mile; 16 square rods; 484 square yards; 4356 square feet; 1×10^4 square links; 6.27264×10^5 square inches; 404.6873 square meters.

Square Decimeter (dm^2).—15.500 square inch; 0.01 square meter; 100 square centimeters.

Square Degree.—3.0462 × 10^{-4} steradian.

Square Dekameter (dkm²).—0.02471044 acre (U. S.); 119.60 square yards; 1 are; 100 square meters.

Square Foot (ft.² or sq. ft.) (U. S.).—3.58701 × 10^{-8} square mile; 2.29568 × 10^{-5} acre; 2.29568 × 10^{-4} square chain; 0.00367309 square rod; 1/9 or 0.111111 square yard; 2.29568 square links; 144 square inches ; 9.290341 × 10^{-4} are; 0.09290341 square meter; 929.0341 square centimeters.

Square Foot (ft.² or sq. ft.) (**British**).—0.09290289 square meter.

Square Hectometer (hm²).—2.471044 acres (U. S.); 2.471058 acres (British); 1 × 10^4 square meters.

Square Inch (in.² or sq. in.) (**U. S.**).—1.59423 × 10^{-6} square chain; 1/144 or 0.0069444 square foot; 1/1296 or 0.000771605 square yard; 0.0159423 square link; 1 × 10^6 square mils; 1.27324 × 10^6 circular mils; 6.4516258 × 10^{-4} square meter; 6.4516258 square centimeters; 645.16258 square millimeters.

Square Inch (in.² or sq. in.) (**British**). 6.4515898 square centimeters.

Square Kilometer (km²).—0.3861006 square mile (U. S.); 247.1044 acres (U. S.); 247.1058 acres (British); 1.1960 × 10^6 square yards; 1.0764 × 10^7 square feet; 1 × 10^6 square meters.

Square Link (li.² or sq. li.) (**Gunter's**).—1 × 10^{-5} acre; 1 × 10^{-4} square chain; 0.0016 square rod; 0.0484 square yard; 0.4356 square foot; 62.7264 square inches; 0.040469 square meter; 404.69 square centimeters.

Square Meter (m²).—3.8610 × 10^{-7} square mile; 2.471044 × 10^{-4} acre (U. S.); 2.471058 × 10^{-4} acre (British); 0.00247104 square chain (Gunter's); 0.039537 square rod; 1.195985 square yards (U. S.); 1.195992 square yards (British); 10.76387 square feet (U. S.); 10.76390 square feet (British); 24.7104 square links (Gunter's); 1550.0 square inches; 1 × 10^{-6} square kilometer; 1 × 10^{-4} hectare or square hectometer; 0.01 are; 1 centare 1 × 10^4 square centimeters; 1 × 10^6 square millimeters.

Square Mil.—1 × 10^{-6} square inch; 1.2732 circular mils; 6.4516 × 10^{-6} square centimeter; 6.4516 × 10^{-4} square millimeter.

Square Mile (mi.² or sq. mi.).—640 acres; 6400 square chains; 1.02400 × 10^5 square rods; 3.0976 × 10^6 square yards; 2.78784 × 10^7 square feet; 2.589998 square kilometers; 258.9998 hectares; 2.589998 × 10^6 square meters.

Square Millimeter (mm²).—0.0015500 square inch; 1550.0 square mils; 1973.5 circular mils; 1 × 10^{-6} square meter; 0.01 square centimeter; 1.2732 circular millimeters.

Square Perch (British & U. S.).—1/160 or 0.00625 acre; 30.25 square yards; 25.293 square meters.

Square Pole (British).—30.25 square yards.

Square Rod (rd. ² or sq. rd.).—9.765625×10^{-6} mile; 0.00625 acre; 0.0625 square chain (Gunter's); 30.25 square yards; 272.25 square feet; 625 square links (Gunter's); 3.9204×10^4 square inches; 0.0025293 hectare or square hectometer; 25.293 square meters or centares.

Square Yard (yd. ² or sq. yd.) (U. S.).—3.22831×10^{-7} square mile; 2.06612×10^{-4} acre; 0.00206612 square chain; 0.0330579 square rod or square perch; 9 square feet; 20.6612 square link 1296 square inches; 8.36131×10^{-5} hectare; 0.0083613 square dekameter or are; 0.83613 square meter or centare; 8361.31 square centimeters.

Square Yard (yd. ² or sq. yd.) (British).—2.0661×10^{-4} acre (British); 8.2645×10^{-4} rood (British); 0.836126 square meter.

Steradian.—$\frac{1}{4}\pi$ of the solid angle around a point; 0.07958 sphere; 0.15916 hemisphere; 0.6366 spherical right angle; 3282.8 square degrees.

Stere (s).—0.1 dekastere; 1 cubic meter; 10 decisteres; 999.973 liters.

Stone (British).—14 pounds (avoirdupois); 6.350 kilograms.

Strike (British).—2 bushels (dry); 0.072738 cubic meter.

Toise (French).—6 Paris feet; 1.9490365 meters (legal, 1799); 1.949090 meters (measured, 1887).

Ton (long) (tn. l.) (U. S. or British).—1.12000 tons (short); 22.400 hundredweights (short); 2240 pounds (avoirdupois); 2722.22 pounds (apothecary or troy); 3.5840×10^4 ounces (avoirdupois); 1.0160470 metric tons; 1016.0470 kilograms.

Ton (short) (tn. sh.) (U. S.).—0.89286 ton (long); 20 hundredweights (short); 2000 pounds (avoirdupois); 2430.56 pounds (apothecary or troy); 2.916666×10^4 ounces (apothecary or troy); 3.2000×10^4 ounces (avoirdupois); 0.907185 ton (metric); 907.185 kilograms.

Tonne (t) (metric ton, millier).—0.984206 ton (long); 1.10231 tons (short); 22.046223 hundredweights (short); 2204.62 pounds (avoirdupois); 2679.23 pounds (apothecary or troy); 3.527396×10^4 ounces (avoirdupois); 1000 kilograms; 1×10^6 grams.

Township (U. S.).—36 square miles; 2.3040×10^4 square yards; 93.240 square kilometers.

Tun.—252 gallons.

Week (wk.).—168 hours; 1.0080×10^4 minutes; 6.04800×10^5 seconds.

Wey (British, capacity).—*40 bushels.

Wey (British, mass).—*252 pounds.

Yard (yd.) (U. S.).—5.68182×10^{-4} mile; 0.00454545 furlong; 0.0454545 chain (Gunter's); 0.181818 rod; 3 feet; 4.54545 links (Gunter's); 36 inches; 3600/3937 or 0.91440183 meter; 91.440183 centimeters.

Yard (yd.) (British).—0.18182 pole (British); 4 quarters (British, linear); 0.9143992 meter (present legal equivalent of Imperial yard); 91.43992 centimeters; 1.420212×10^6 wave lengths of red line of cadmium.

Year (yr.) (leap).—366 days; 8784 hours.

Year (yr.) (tropical, mean solar).—365.2422 day (mean solar); 8765.8128 hours (mean solar); 3.15569×10^7 seconds (mean solar).

Year (yr.) (sidereal).—365.256 days (mean solar); 8766.144 hours (mean solar).

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*Variable.

Reciprocal Units

x **per Ångström** = 1×10^8 x per centimeter.

x **per circular mil** = 1.9735×10^5 x per square centimeter.

x **per circular millimeter** = 127.324 x per square centimeter.

x **per circumference** = 0.159155 x per radian.

x **per cubic foot** = 3.5314×10^{-5} x per cubic centimeter.

x **per cubic inch** = 0.061023 x per cubic centimeter.

x **per cubic yard** = 1.3079 x per cubic meter.

x **per day (mean solar)** = 1.15741×10^{-5} x per second (mean solar).

x **per degree** = 57.29578 x per radian.

x **per entire space** = 0.079577 x per steradian.

x **per foot** = 0.032808 x per centimeter.

x **per gallon (British)** = 2.1997×10^{-4} x per cubic centimeter.

x **per gallon (U. S.)** = 2.6417×10^{-4} x per cubic centimeter.

x **per grain** = 0.01543236 x per milligram.

x **per hemisphere** = 0.15916 x per steradian.

x **per hour (mean solar)** = 2.77778×10^{-4} x per second (mean solar).

x per **inch** = 0.39370 x per centimeter.

x per **liter** = 9.9997×10^{-4} x per cubic centimeter.

x per **micron** = 1.0000×10^{4} x per centimeter.

x per **mil** = 393.70 x per centimeter.

x per **mile** = 0.62137 x per kilometer.

x per **minute** = 3437.75 x per radian.

x per **minute (mean solar)** = 0.0166667 x per second (mean solar).

x per **ounce (avoirdupois)** = 0.035274 x per gram.

x per **ounce (apothecary or troy)** = 0.032151 x per gram.

x per **ounce (fluid, British)** = 0.035195 x per cubic centimeter.

x per **ounce (fluid, U. S.)** = 0.033814 x per cubic centimeter.

x per **pound (avoirdupois)** = 0.00220462 x per gram.

x per **quart (dry, U. S.)** = 9.0808×10^{-4} x per cubic centimeter.

x per **quart (liquid, U. S.)** = 0.0010567 x per cubic centimeter.

x per **quart (British)** = 8.7988×10^{-4} per cubic centimeter.

x per **second** = 2.06265×10^{5} x per radian.

x per **second (sidereal)** = 1.002738 x per second (mean solar).

x per **square degree** = 3282.8 x per steradian.

x per **square foot** = 0.0010764 x per square centimeter.

x per **square inch** = 0.15500 x per square centimeter.

x per **square meter** = 1×10^{-4} x per square centimeter.

x per **square mile** = 0.38610 x per square kilometer.

x per **square millimeter** = 100.0000 x per square centimeter.

x per **square yard** = 1.19599×10^{-4} x per square centimeter.

x per **ton (2000 pounds)** = 0.00110231 x per kilogram.

x per **ton (2240 pounds)** = 9.8421×10^{-4} x per kilogram.

x per **year (mean solar)** = 0.00273781 x per day (mean solar) = 3.16888×10^{-8} x per second (mean solar).

Velocity $[lt^{-1}]$

Centimeter per second.—3.728×10^{-4} mile per minute; 0.02237 mile per hour; 0.032808 foot per second; 0.03600 kilometer per hour; 0.6000 meter per minute; 1.9685 feet per minute.

UNITS AND CONVERSION FACTORS (Continued)

Degree per second.—0.002778 revolution per second; 0.017453 radian per second; 0.1667 revolution per minute.

Foot per minute.—0.005080 meter per second; 0.011364 mile per hour; 0.016667 foot per second; 0.01829 kilometer per hour; 0.3048 meter per minute; 0.5080 centimeter per second.

Foot per second.—0.011364 mile per minute; 0.5921 knot per hour; 0.6818 mile per hour; 1.0973 kilometers per hour; 18.29 meters per minute; 30.4801 centimeters per second.

Kilometer per hour.—0.016667 kilometer per minute; 0.27778 meter per second; 0.5396 knot; 0.6214 mile per hour; 0.9113 foot per second; 16.67 meters per minute; 27.7778 centimeters per second; 54.68 feet per minute.

Kilometer per minute.—0.6215 mile per minute; 37.284 miles per hour; 60 kilometers per hour; 1666.7 centimeters per second; 3280.8 feet per minute.

Knot.—1 nautical mile per hour; 1.1516 miles per hour; 1.689 feet per second; 1.853 kilometers per hour; 51.48 centimeters per second; 6080.20 feet per hour.

Meter per minute.—0.03728 mile per hour; 0.05468 foot per second; 0.06 kilometer per hour; 1.6667 centimeters per second; 3.281 feet per minute.

Meter per second.—0.03728 mile per minute; 0.06000 kilometer per minute; 2.2369 miles per hour; 3.281 feet per second; 3.600 kilometers per hour; 196.8 feet per minute.

Mile per hour.—0.016667 mile per minute; 0.8684 knot; 1.4667 feet per second; 1.6093 kilometers per hour; 26.82 meters per minute; 44.7041 centimeters per second; 88 feet per minute.

Mile per minute.—52.104 knot; 1.609 kilometers per minute; 60 miles per hour; 88 feet per second; 2682.2 centimeters per second.

Radian per second.—0.1592 revolution per second; 9.549 revolutions per minute; 57.296 degrees per second.

Revolution per day.—7.2722×10^{-5} radian per second.

Revolution per minute (R.P.M.).—0.01667 revolution per second; 0.10472 radian per second; 6 degrees per second.

Revolution per second.—6.2832 radians per second; 60 revolutions per minute; 360 degrees per second.

Velocity of light.—2.9986×10^{10} centimeters per second.

Acceleration $[l\ t^{-2}]$

Centimeter per second per second.—0.02237 mile per hour per second; 0.03281 foot per second per second; 0.03600 kilometer per hour per second.

Foot per second per second.—0.304801 meter per second per second; 0.6818 mile per hour per second; 1.097 kilometer per hour per second; 30.4801 centimeter per second per second.

Gravity, standard.—32.174 feet per second per second; 980.665 centimeters per second per second.

Kilometer per hour per second.—0.27778 meter per second per second; 0.6214 mile per hour per second; 0.9133 foot per second per second; 27.778 centimeters per second per second.

Meter per second per second.—2.237 miles per hour per second; 3.2808 feet per second per second; 3.600 kilometers per hour per second; 100.00 centimeters per second per second.

Mile per hour per minute.—0.74507 centimeter per second per second.

Mile per hour per second.—0.44704 meter per second per second; 1.467 feet per second per second; 1.609 kilometers per hour per second; 44.704 centimeters per second per second.

Radians per second per second.—0.1592 revolution per second per second; 9.549 revolutions per minute per second; 572.96 revolutions per minute per minute.

Revolution per minute per second.—0.10420 radian per second per second.

Revolution per minute per minute.—2.778×10^{-4} revolution per second per second; 0.0017453 radian per second per second; 0.01667 revolution per minute per second.

Revolution per second per second.—6.2832 radians per second per second; 60 revolutions per minute per second; 3600 revolutions per minute per minute.

Density $[m\ l^{-3}]$

Demal.—1 gram equivalent per cubic decimeter.

Grain per cubic foot.—2.288 grams per cubic meter.

Gram per cubic centimeter.—3.405×10^{-7} pound per mil-foot; 0.03613 pound per cubic inch; 8.3452 pounds per gallon

(U. S.); 10.022 pounds per gallon (British); 62.43 pounds per cubic foot.

Gram per cubic meter.—0.437 grains per cubic foot.

Gram per milliliter.—(Numerically equal to specific gravity t°/4°); 0.999973 gram per cubic centimeter.

Kilogram per cubic meter.—3.613×10^{-5} pound per cubic inch; 0.001 gram per cubic centimeter; 0.06243 pound per cubic foot.

Mercury at 0°C.—13.5951 grams per cubic centimeter (Internationally accepted conventional value to be used in expressing pressures in terms of columns of mercury.)

Pound per cubic foot.—5.787×10^{-4} pound per cubic inch; 0.016018 gram per cubic centimeter; 16.018 kilograms per cubic meter.

Pound per cubic inch.—27.680 grams per cubic centimeter; 2.768×10^{4} kilograms per cubic meter.

Pound per mil foot.—2.9369×10^{6} grams per cubic centimeter.

Pound per gallon (U. S.).—0.119826 gram per cubic centimeter.

Pound per gallon (British).—0.099776 gram per cubic centimeter.

Slug per cubic foot.—0.5154 gram per cubic centimeter.

Mass Concentration

Gram per metric ton.—1.0000 milligram per kilogram.

Gram per ton (2000 pound).—1.1023 milligrams per kilogram.

Gram per ton (2240 pound).—0.9842 milligram per kilogram.

Karat (1 of gold to 24 of mixture).—41.667 milligrams per gram.

Milligram per assay ton (Equals one troy ounce per 2000 pound (avoirdupois).)—34.276 milligrams per kilogram.

Milligram per kilogram.—0.002 pound (avoirdupois) per ton (2000 pound); 0.029175 milligram per assay ton; 0.032000 ounce (avoirdupois) per ton (2000 pound); 1 gram per metric ton.

Ounce (avoirdupois) per ton (2000 pound.).—31.2500 milligrams per kilogram.

Ounce (avoirdupois) per ton (2240 pound).—27.9018 milligrams per kilogram.

Pound (avoirdupois) per ton (2000 pound).—500.000 milligrams per kilogram.

Pound (avoirdupois) per ton (2240 pound).—446.429 milligrams per kilogram.

Flow $[l^3t^{-1}]$

Cubic centimeter per second.—0.0021186 cubic foot per minute.

Cubic foot per minute.—0.1247 gallon per second; 0.4720 liter per second; 62.4 pounds of water per minute; 472.0 cubic centimeters per second.

Cubic foot per second.—2.2222 cubic yards per minute; 448.83 gallons per minute; 1699.3 liters per minute.

Cubic yard per minute.—0.45 cubic foot per second; 3.367 gallons per second; 12.74 liters per second.

Gallon per second.—0.297 cubic yard per minute; 8.0192 cubic feet per minute.

Gallon per minute.—0.002228 cubic foot per second; 0.06308 liter per second.

Liter per minute.—5.885×10^{-4} cubic foot per second; 0.004403 gallon per second.

Liter per second.—0.078493 cubic yard per minute; 2.12 cubic feet per minute; 15.85 gallons per minute (U. S.).

Miner's Inch.—1.2 cubic feet per minute.

Pounds of water per minute.—0.01603 cubic foot per minute.

Force $[mlt^{-2}]$

Conversion factors between the absolute and gravitational units of force, torque, energy and power are dependent on the value of g, the acceleration due to gravity. The standard value of g adopted by the International Committee on Weights and Measures is 980.665 cm / sec². This value or its equivalent, 32.174 ft. / sec², is used except where otherwise noted.

Dyne.—2.2481×10^{-6} pound weight; 7.2330×10^{-5} poundal; 0.0010197 gram weight; 0.015737 grain weight.

Grain weight.—63.546 dynes.

Gram weight—0.070932 poundal; 980.665 dynes.

Kilogram weight.—70.932 poundals; 9.80665×10^5 dynes.

Poundal.—0.031081 pound weight; 14.098 grams weight; 1.3825×10^4 dynes.

Pound weight.—32.174 poundals; 453.59 grams weight; 4.4482×10^5 dynes.

Ton weight (2000 pound).—8.8964×10^8 dynes.

Ton weight (2240 pound).—9.9640×10^8 dynes.

Reciprocal Force $[m^{-1}\ l^{-1}\ t^2]$

x per **gram weight**$=0.0010197$ x per dyne.

x per **poundal**$=7.2330 \times 10^{-5}$ x per dyne.

x per **pound weight**$=2.2481 \times 10^{-6}$ x per dyne.

Pressure $[m\ l^{-1}\ t^{-2}]$

Atmosphere (normal).—Pressure exerted by 76 cm of Hg, density 13.5951 g / cm³, $g=980.665$ cm / sec²; 0.0073480 ton (2000 pound) per square inch; 1.0133 bars; 1.0581 tons (2000 pound) per square foot; 14.696 pounds per square inch; 29.921 inches of mercury at 32° F; 33.899 feet of water at 39.1° F; 760 millimeters of mercury at 0° C; 1033.2 grams per square centimeter; 2116.2 pounds per square foot; 1.0332×10^4 kilograms per square meter; 1.01325×10^6 dynes per square centimeter.

Bar.—0.98692 atmosphere; 14.504 pounds per square inch, 1.01971×10^4 kilograms per square meter; 1.000×10^6 dynes per square centimeter. (This value accords with the only internationally accepted use of this term; but "bar" has also been used to denote a pressure of one dyne per square centimeter).

Barye.—1.0000 dyne per square centimeter.

Centimeter of mercury at 0 °C.—0.013158 atmosphere; 0.19337 pound per square inch; 0.44604 foot of water; 27.845 pounds per square foot; 135.95 kilograms per square meter; 1.33322×10^4 dynes per square centimeter.

Centimeter of water at 4 °C.—980.638 dynes per square centimeter.

Dyne per square centimeter.—9.8692×10^{-7} atmosphere; 1×10^{-6} bar; 1.4504×10^{-5} pound per square inch; 2.9530×10^{-5} inch of mercury at 32 °F; 4.0148×10^{-4} inch of water at 4 °C; 7.5006×10^{-4} millimeter of mercury; 0.00101971 gram per square centimeter; 0.00101974 centimeter of water at 4 °C; 0.0020886 pound per square foot; 0.0101971 kilogram per square meter.

Foot of water at 4 °C or 39.1 °F.—0.029499 atmosphere; 0.43352 pound per square inch; 0.88265 inch of mercury at

32 °F; 62.426 pounds per square foot; 304.79 kilograms per square meter.

Gram (weight) per square centimeter.—9.6784×10^{-4} atmosphere; 0.014223 pound per square inch; 0.73556 millimeter of mercury at 0 °C; 2.0482 pound per square foot; 10 kilograms per square meter; 980.665 dynes per square centimeter.

Inch of mercury at 32 °F.—0.033421 atmosphere; 0.49116 pound per square inch; 1.13299 feet of water at 39.1 °F; 13.595 inches of water at 4 °C; 70.727 pounds per square foot; 345.31 kilograms per square meter; 3.38639×10^{4} dynes per square centimeter.

Inch of water at 4 °C.—0.0024583 atmosphere; 0.036136 pound per square inch; 0.073554 inch of mercury; 0.57818 ounce per square inch; 5.2022 pounds per square foot; 25.399 kilograms per square meter; 2490.82 dynes per square centimeter.

Kilogram (weight) per square centimeter.—14.223 pounds per square inch; 73.556 centimeters of mercury at 0 °C; 980,665 dynes per square centimeter.

Kilogram (weight) per square meter.—9.6784×10^{-5} atmosphere; 0.0014223 pound per square inch; 0.0028959 inch of mercury; 0.0032809 foot of water; 0.073556 millimeter of mercury; 0.1 gram per square centimeter; 0.20482 pound per square foot; 98.0665 dyne per square centimeter.

Kilogram (weight) per square millimeter.—0.71114 ton (2000 pounds) per square inch; 1×10^{6} kilograms per square meter; 9.80665×10^{7} dynes per square centimeter.

Millimeter of mercury at 0 °C.—0.0013158 atmosphere; 0.019337 pound per square inch; 1.3595 grams per square centimeter; 2.7845 pounds per square foot; 13.595 kilograms per square meter; 1333.22 dynes per square centimeter.

Ounce (weight) per square inch.—0.0625 pound per square inch; 4309.2 dynes per square centimeter.

Pound (weight) per square foot.—4.7254×10^{-4} atmosphere; 4.7880×10^{-4} bar; 0.0069445 pound per square inch; 0.016018 foot of water at 39.1 °F; 0.35913 millimeter of mercury at 0 °C; 0.48824 gram per square centimeter; 4.8824 kilograms per square meter; 478.80 dynes per square centimeter.

Pound (weight) per square inch.—5×10^{-4} ton (2000 pound) per square inch; 0.068046 atmosphere; 0.068947 bar; 0.070307 kilogram per square centimeter; 2.0360 inches of mercury at 32 °F; 2.3066 feet of water at 39.1 °F; 5.1715 centimeters of mercury at 0 °C; 27.673 inches of water at 4 °C; 51.715 millimeters of mercury; 70.307 grams per square centimeter; 703.07 kilograms per square meter; 6.8947×10^{4} dynes per square centimeter.

Ton (2000 pound) (weight) per square foot.—0.94509 atmosphere; 13.889 pounds per square inch; 9764.8 kilograms per square meter; 9.5760×10^5 dynes per square centimeter.

Ton (2240 pound) (weight) per square foot.—10.7251×10^5 dynes per square centimeter.

Ton (2000 pound) (weight) per square inch.—1.4062 kilograms per square millimeter; 2000 pounds per square inch; 1.4062×10^6 kilograms per square meter; 1.3789×10^8 dynes per square centimeter.

Ton (2240 pound) (weight) per square inch.—1.5749 kilograms per square millimeter; 152.42 atmospheres; 1.5444×10^8 dynes per square centimeter.

Work and Energy $[m\ l^2\ t^{-2}]$

British thermal unit (mean) (BTU).—2.930×10^{-4} kilowatt-hour; 3.9292×10^{-4} horse power-hour; 0.25198 kilogram-calorie or large calorie (mean); 0.2930 watt-hour; 10.409 liter-atmospheres; 107.56 kilogram-meters; 251.98 gram-calories (mean); 777.97 foot-pounds; 1054.8 joules (absolute); 0.3676 cubic foot-atmospheres; 2.5030×10^4 foot-poundals; 1.0548×10^{10} ergs.

British thermal unit (39 °F) (BTU).—1060.4 joules (absolute).

British thermal unit (60 °F) (BTU).—1054.6 joules (absolute).

Calorie.—*See* gram-calorie or kilogram-calorie.

Centigrade thermal unit (15 °C) (CTU).—1898.3 joules (absolute).

Centimeter-dyne.—*See* erg.

Centimeter-gram force.—*See* gram-centimeter.

Cheval-vapeur heure.—2.6478×10^6 joules (absolute).

Cubic centimeter-atmosphere (normal).—0.101325 joule (absolute).

Cubic foot atmosphere.—2.7203 British thermal unit (mean); 28.313 liter-atmospheres; 292.59 kilogram-meters; 680.74 gram-calories (mean); 2116.3 foot-pounds; 2869.4 joules (absolute).

Erg.—2.3889×10^{-11} kilogram-calorie (mean); 9.4805×10^{-11} British thermal unit (mean); 1.0197×10^{-8} kilogram-meter; 2.3889×10^{-8} gram-calorie (mean); 7.3756×10^{-8} foot-pound; 1×10^{-7} joule; 2.3730×10^{-6} foot-poundal; 0.0010197 gram-centimeter; 1 dyne-centimeter.

Foot-Pound.—3.7662×10^{-7} kilowatt-hour; 5.0505×10^{-7} horse power-hour; 3.2389×10^{-4} kilogram-calorie (mean); 3.7662×10^{-4} watt-hour; 4.7253×10^{-4} cubic foot-atmosphere; 0.0012854 Brit-

ish thermal unit (mean); 0.013381 liter-atmosphere; 0.138255 kilogram-meter; 0.32389 gram-calorie (mean); 1.35582 joule (absolute); 32.174 foot-poundals; 1.3825×10^{4} gram-centimeters; 1.35582×10^{7} ergs or centimeter-dynes.

Foot-poundal.—3.9952×10^{-5} British thermal unit (mean); 4.1589×10^{-4} liter-atmosphere (normal); 0.0042972 kilogram-meter; 0.010067 gram-calorie; 0.031081 foot-pound; 0.042140 joule; 4.21402×10^{5} ergs.

Gram-calorie (**mean**).—1.5593×10^{-6} horse power hours; 0.001 kilogram-calorie; 0.0011628 watt-hour; 0.001459 cubic foot-atmosphere; 0.0039685 British thermal unit (mean); 0.041311 liter-atmosphere; 0.42685 kilogram-meter; 3.0874 foot-pounds; 4.186 joules (absolute); 99.334 foot-poundals.

Gram-calorie (**15 °C**).—4.185 joules (absolute).

Gram-calorie (**20 °C**).—4.181 joules (absolute).

Gram-centimeter.—2.3427×10^{-8} kilogram-calorie (mean); 9.2972×10^{-8} British thermal unit (mean); 1×10^{-5} kilogram-meter; 2.3427×10^{-5} gram-calorie (mean); 7.233×10^{-5} foot-pound; 9.80665×10^{-5} joule (absolute); 980.7 ergs.

Horse power hour. (**IP hr. or h. p. hr.**).—0.7457 kilowatt-hour; 641.30 kilogram-calories (mean); 745.7 watt-hours; 2545.0 British thermal units (mean); 2.7374×10^{5} kilogram-meters; 1.9800×10^{6} foot-pounds; 2.6845×10^{6} joules (absolute).

Horse power hour (**electrical, U. S. & British**).—2.6856×10^{6} joules (absolute).

International volt (v) **electronic charge**).—1.5927×10^{-19} joule (absolute).

International volt (v) **Faraday.**—9.6541×10^{4} joules (absolute).

Joule (**absolute**).—2.778×10^{-7} kilowatt-hour; 3.725×10^{-7} horse power-hour; 2.3889×10^{-4} kilogram-calorie (mean); 2.778×10^{-4} watt-hour; 3.485×10^{-4} cubic foot-atmosphere; 9.480×10^{-4} British thermal unit (mean); 0.009869 liter-atmosphere; 0.10197 kilogram-meter; 0.23889 gram-calorie (mean); 0.23895 gram-calorie at 15 °C; 0.23918 gram-calorie at 20 °C; 0.73756 foot-pound; 0.999680 joule (International); 1 watt-second; 23.730 foot-poundals; 1.0197×10^{4} gram-centimeters; 1×10^{7} ergs.

Joule (**International**) (v).—1.00032 joule (absolute).

Kilogram-calorie or large calorie (**mean**).—0.0011628 kilowatt-hour; 0.0015593 horse power-hour; 1.1628 watt-hour; 3.9685 British thermal units (mean); 426.85 kilogram-meters; 1000 small or gram-calories; 3087.4 foot-pounds; 4186 joules; 4.2686×10^{7} gram-centimeters; 4.186×10^{10} ergs.

Kilogram-meter.—2.7235×10^{-6} kilowatt hour; 3.6530×10^{-6}

horse power-hour; 0.0027235 watt-hour; 0.0034177 cubic foot-atmosphere; 0.0092972 British thermal unit (mean); 0.096782 liter-atmosphere; 2.3427 gram-calories (mean); 7.2330 foot-pounds; 9.80665 joules (absolute); 232.71 foot-poundals; 1×10^5 gram-centimeters; 9.80665×10^7 ergs.

Kilowatt-hour.—1.3410 horse power-hours; 1000 watt-hours; 3413.0 British thermal units (mean); 3.6710×10^5 kilogram-meters; 8.6001×10^5 gram-calories (mean); 2.6552×10^6 foot-pounds; 3.6000×10^6 joules (absolute).

Large Calorie.—*See* kilogram-calorie.

Liter-atmosphere (normal).—3.7745×10^{-5} horse power-hour; 0.035319 cubic foot-atmosphere; 0.09607 British thermal unit (mean); 10.333 kilogram-meters; 24.206 gram-calories (mean); 74.735 foot-pounds; 101.328 joules (absolute); 2404.5 foot-poundals.

Liter-atmosphere (lat. 45°, g=980.616).—101.323 joules (absolute).

Megalerg.—1×10^6 ergs.

Meter-kilogram.—*See* kilogram-meter.

Watt-hour.—0.001 kilowatt-hour; 0.0013410 horse power-hour; 0.86001 kilogram-calorie (mean); 3.4130 British thermal units (mean); 367.10 kilogram-meters; 860.01 gram-calories (mean); 2655.3 foot-pounds; 3600 joules.

Power $[m\, l^2\, t^{-3}]$

British thermal unit (BTU) (mean) per minute.—0.023575 horse power; 17.580 watts (absolute).

British thermal unit (BTU) (mean) per second.—1.4145 horse power; 1054.8 watts (absolute).

British thermal unit (BTU) (39 °F) per second.—1060.4 watts (absolute).

British thermal unit (BTU) (60 °F) per second.—1054.6 watts (absolute).

Cheval-vapeur.—For electrical purposes usually used as 736 watts. *See* Force de cheval.

Erg per second.—1×10^{-10} kilowatt; 1.3412×10^{-10} horse power; 1.4333×10^{-9} kilogram-calorie (mean) per minute; 5.688×10^{-9} British thermal unit (mean) per minute; 7.3756×10^{-8} foot-pound per second; 1×10^{-7} watt; 4.4254×10^{-6} foot-pound per minute; 1 dyne-centimeter per second.

Foot-pound per minute.—2.2597×10^{-5} kilowatt; 3.0303×10^{-5} horse power; 3.072×10^{-5} horse power (metric); 3.2389×10^{-4}

kilogram-calorie (mean) per minute; 0.0012854 British thermal unit (mean) per minute; 0.016667 foot-pound per second; 0.022597 watt.

Foot-pound per second.—0.0013558 kilowatt; 0.0018182 horse power; 0.019433 kilogram-calorie (mean) per minute 0.077124 British thermal unit (mean) per minute; 1.35582 watt (absolute).

Force de cheval (cheval-vapeur).—*See* horse power (metric).

Gram-centimeter per second.—9.80665×10^{-5} watt (absolute).

Hectowatt.—100 watts.

Horse power (h. p. or HP).—0.70696 British thermal unit (mean) per second; 0.7452 kilowatt ($g=980$); 0.74570 ($g=980.665$) kilowatt; 1.0139 horse power (metric) or cheval-vapeur; 10.688 kilogram-calories (mean) per minute; 42.418 British thermal units (mean) per minute; 550 foot-pounds per second; 745.2 watts ($g=980$); 745.70 watts ($g=980.665$); 3.3000×10^4 foot-pounds per minute.

Horse power, electrical (U. S. & British).—746.00 watt (absolute) (Commonly used in rating electrical machinery).

Horse power, metric (cheval vapeur).—0.98632 horse power (U. S.); 75 kilogram-meters per second; 735.499 watts; 3.2549×10^4 foot-pounds per minute.

Kilogram-calorie (mean) per minute.—0.093557 horse power; 51.457 foot-pounds per second; 69.767 watts.

Kilogram calorie (mean) per second.—4.186 kilowatts.

Kilogram-meter per second.—9.80665 watts (absolute).

Kilowatt.—0.23889 kilogram-calorie (mean) per second; 0.94827 British thermal unit (mean) per second; 1.3410 horse power; 1.3597 horse power (metric); 14.333 kilogram-calories (mean) per minute; 56.896 British thermal units (mean) per minute; 737.56 foot-pounds per second; 1000 watts; 4.4254×10^4 foot-pounds per minute; 2.6552×10^6 foot-pounds per hour.

Lumen.—0.001496 watt.

Metric horse power.—*See* horse power, metric.

Watt (absolute).—0.001 kilowatt; 0.0013410 horse power; 0.0013596 force de cheval or horse power (metric); 0.01433 kilogram-calorie (mean) per minute; 0.056896 British thermal unit (mean) per minute; 0.73756 foot-pound per second; 1 joule per second; 44.254 foot-pounds per minute; 1×10^7 ergs per second.

Watt (International) (v).—1.00032 watt (absolute).

Watt of maximum visibility radiation.—668 lumens.

Action $[m\ l^2\ t^{-1}]$

Calorie (15 °C) second.—6.3854×10^{33} quanta.

Calorie (15 °C) second / N_0 *—1.0535×10^{10} quanta.

Joule second.—1.5258×10^{33} quanta.

Joule second / N_0 *.—2.5173×10^{9} quanta.

Planck's quantum.—6.554×10^{-27} erg second.

Volt electronic-charge second.—2.4292×10^{14} quanta.

Volt faraday second.—1.4724×10^{38} quanta.

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*N_0 denotes Avogadro's number, the number of molecules per gram mole.

Torque or Moment of Force $[m\ l^2\ t^{-2}]$

Dyne-centimeter.—1.0197×10^{-8} kilogram-meter; 7.3757×10^{-8} pound-foot; 8.8511×10^{-7} pound-inch; 2.3731×10^{-6} poundal-foot.

Kilogram-meter.—9.8066×10^{7} dyne-centimeters.

Pound-foot.—1.3558×10^{7} dyne-centimeters.

Poundal-foot.—4.2140×10^{5} dyne-centimeters.

Pound-inch.—1.1298×10^{6} dyne-centimeters.

Moment of Area $[l^4]$

Square centimeter-centimeter squared.—0.02402 square inch-inch squared.

Square foot-foot squared.—2.074×10^{4} square inch-inch squared.

Square inch-inch squared.—4.823×10^{-5} square foot-foot squared; 41.62 square centimeter-centimeter squared.

Moment of Inertia $[m\ l^2]$

Gram-centimeter squared (g cm^2).—2.3730×10^{-6} pound-foot squared; 3.4172×10^{-4} pound-inch squared.

Kilogram-centimeter squared.—0.0023730 pound-foot squared; 0.3417 pound-inch squared.

Pound-foot squared.—144 pound-inches squared; 421.40 kilogram-centimeters squared; 4.2140×10^{5} gram-centimeters squared.

Pound-inch squared.—0.006945 pound-foot squared; 2.9264 kilogram-centimeters squared; 2926.4 gram-centimeters squared.

Thermal Units

Temperature

Degree Centigrade (°C).—0.8 or 4/5 degree Réaumur; 1.00 degree absolute, Kelvin; 1.8 or 9/5 degrees Fahrenheit.

Degree Fahrenheit (°F).—0.44444 or 4/9 degree Réaumur; 0.55556 or 5/9 degree Centigrade.

Degree Réaumur (°R).—1.25 or 5/4 degrees Centigrade; 2.25 or 9/4 degrees Fahrenheit.

Temperature, absolute Centigrade or Kelvin (K) scale.—$x°\,K = T\,°C + 273.18$.

Temperature, degrees Centigrade (°C).—$x\,°C = 5/9\,(T\,°F - 32)$; $x\,°C = 5/4\,T\,°R$.

Temperature, degrees Fahrenheit (°F).—$x\,°F = 9/5\,T\,°C + 32$; $x\,°F = 9/4\,T\,°R + 32$.

Temperature, degrees Réaumur (°R).—$x\,°R = 4/9\,(T\,°F - 32)$; $x\,°R = 4/5\,T\,°C$.

Thermal Capacity of a Substance

British thermal unit (mean) per pound per °F.—1 gram-calorie per gram per °C; 4.186 joules per gram per °C.

Gram-calorie (mean) per gram per °C.—1 British thermal unit (60 °F) per pound per °F; 4.186 joules per gram per °C.

Joule per gram per °C.—0.2389 gram-calorie (mean) per gram per °C; 0.2389 British thermal unit (mean) per pound per °F.

Thermal Capacity of a Body. Water Equivalent

British thermal unit (60 °F) per °F.—453.59 gram-calories per °C; 1898.3 joules per °C.

Gram-calorie (15°) per °C.—0.0022046 British thermal unit (60 °F) per °F; 4.185 joules per °C.

Joule per °C.—5.268×10^{-4} British thermal unit (60 °F) per °F; 0.2389 gram-calorie per °C.

Heat Equivalent. Latent Heat

British thermal unit (mean) per pound.—0.5556 gram-calorie (mean) per gram; 2.325 joules per gram.

Gram-calories (mean) per gram.—1.8 British thermal units (mean) per pound; 4.186 joules per gram.

Joule per gram.—0.2389 gram-calories (mean) per gram; 0.4301 British thermal unit per pound.

THERMAL CONDUCTIVITY

British thermal unit (mean) per square foot per second for a temperature gradient of 1 °F per inch=5.191 joules (absolute) per square centimeter per second for a temperature gradient of 1 °C per centimeter=1.2404 gram-calories (15 °C) per square centimeter per second for a temperature gradient of 1 °C per centimeter.

Gram-calorie (15 °C) per square centimeter per second for a temperature gradient of 1 °C per centimeter=4.185 joules (absolute) per square centimeter per second for a temperature gradient of 1 °C per centimeter=0.80620 British thermal units (mean) per square foot per second for a temperature gradient of 1 °F per inch.

Joule per square centimeter per second for a temperature gradient of 1 °C per centimeter=0.2389 gram-calorie (15 °C) per square centimeter per second for a temperature gradient of 1 °C per centimeter=0.1926 British thermal unit per square foot per second for a temperature gradient of 1 °F per inch.

Photometric Units

Bougie Decimale (intensity of source).—1.0 International candle (approximately).

Candle (International) (intensity of source).—0.104 Carcel unit (approximately); 1.0000 International lumen per steradian; 1 Pentane candle (approximately); 1 English sperm candle (approximately); 1.11 Hefner unit (approximately).

Candle per square centimeter (surface brightness).—3.1416 lamberts; 3141.6 millilamberts.

Candle per square inch (surface brightness).—0.48695 lambert; 486.95 millilamberts.

Carcel unit (intensity of source).—9.6 International candle (approximately).

English sperm candle (intensity of source).—1.0 International candle (approximately).

Foot-candle (illumination of a surface).—1 lumen incident per square foot; 1.0764 milliphots; 10.764 lumen per square meter; 10.764 lux.

Hefner unit (intensity of source).—0.90 International candle (approximately).

Lambert (surface brightness).—0.3183 candle per square centimeter; 2.054 candles per square inch; 1 lumen emitted per square centimeter of a perfectly diffusing surface.

Lumen (flux of luminous energy).—Is emitted by 0.07958 spherical candle power. A source of one spherical candle power emits 4π or 12.566 lumens.

Lumen per square centimeter per steradian (surface brightness).—3.1416 lambert.

Lumen per square foot (illumination of a surface).—1 foot-candle; 10.764 lumens per square meter.

Lumen per square foot per steradian (surface brightness).—3.3816 millilambert.

Lumen per square meter (surface illumination).—1×10^{-4} phot; 0.092902 foot candle or lumen per square foot.

Lux (illumination of a surface).—1×10^{-4} phot; 0.1 milliphot; 0.092902 foot-candle; 1.000 lumen per square meter.

Meter-candle (illumination of a surface).—1.000 lumen per square meter.

Millilambert (surface brightness).—0.929 lumen emitted per square foot (perfect diffusion).

Milliphot (illumination of a surface).—0.001 phot; 0.929 foot-candle.

Pentane candle (intensity of source).—1.0 International candle (approximately).

Phot (illumination of a surface).—1 lumen incident per square centimeter; 1000 milliphots; 1.000×10^4 lumens per square meter; 1×10^4 lux.

Stilb (surface brightness).—1 candle per square centimeter.

Viscosity

Viscosity $[ml^{-1} t^{-1}]$

Gram weight second per square centimeter.—980.665 poise.

Poise.—1.00 gram per centimeter per second.

Pound weight second per square foot.—478.8 poise.

Pound weight second per square inch.—6.895×10^4 poise.

Kinematic Viscosity $[l^2 t^{-1}]$

Inch squared per second.—6.451 centimeters squared per second.

Poise centimeter cubed per gram.—1.000 centimeter squared per second.

Poise foot cubed per pound.—62.43 centimeters squared per second.

Poise inch cubed per gram.—16.387 centimeters squared per second.

Reciprocal Viscosity (Fluidity) $[m^{-1}\,lt]$

Rhe.—1.000 per poise.

Diffusivity; Coefficient of Diffusion $[l^2\,t^{-1}]$

Centimeter squared per day.—1.1574×10^{-5} centimeter squared per second.

Inch squared per second.—6.4516 centimeters squared per second.

Liter per centimeter per day.—0.011574 centimeter squared per second.

Surface Tension $[mt^{-2}]$

Dyne per centimeter.—0.01 erg per square millimeter; 0.10197 milligram weight per millimeter; 1 erg per square centimeter; 2.5901 milligram weight per inch.

Erg per square centimeter.—0.01000 erg per square millimeter; 1.0000 dyne per centimeter.

Erg per square millimeter.—100.00 dynes per centimeter; 100.00 ergs per square centimeter.

Milligram weight per inch.—0.38609 dyne per centimeter.

Milligram weight per millimeter.—9.80665 dynes per centimeter.

Rotatory Power $[l^{-1}]$

Degree per centimeter.—0.017453 radian per centimeter.

Degree per foot.—5.7261×10^{-4} radian per centimeter.

Degree per inch.—0.0068714 radian per centimeter.

Minute per centimeter.—2.9089×10^{-4} radian per centimeter.

Radian per centimeter.—57.296 degrees per centimeter; 145.50 degrees per inch; 1746.4 degrees per foot; 3437.7 minutes per centimeter.

UNITS AND CONVERSION FACTORS (Continued)

ELECTRICAL UNITS

Electrical units are designated as "absolute" when based on the electromagnetic cgs system, "International" when based on legal definitions of the ohm, Weston cell or silver voltammeter.

The basis of International units is indicated as follows: "(a)" based on a silver deposit of 1.11800 mg per International ampere second; "(v)" based on the International ohm and Weston cell,—1.018300 volts at 20°C.

Quantity or Charge $[\epsilon^{1/2}m^{1/2}l^{3/2}t^{-1}]$, $[\mu^{-1/2}m^{1/2}l^{1/2}]$

Abcoulomb.—*See* electromagnetic cgs unit electrical quantity.

Ampere-hour (absolute).—3600.0 coulomb (absolute)

Coulomb (absolute).—0.1000 electromagnetic cgs unit or abcoulomb; 1.00007 International coulombs (a); 1.00010 International coulombs (v); 2.99796×10^{9} electrostatic cgs units or statcoulombs; 6.281×10^{18} electronic charges

Electromagnetic cgs unit or abcoulomb.—10.0000 coulombs (absolute); 2.99796×10^{10} electrostatic cgs units or statcoulombs

Electronic charge.—1.5921×10^{-20} electromagnetic cgs unit or abcoulomb; 1.5921×10^{-19} coulomb (absolute), $4\ 774 \times 10^{-10}$ electrostatic cgs unit or statcoulomb

Electrostatic cgs unit or statcoulomb.—3.33560×10^{11} electromagnetic cgs unit or abcoulomb, 3.33560×10^{-10} coulomb (absolute), 2.0947×10^{9} electronic charges

Electrostatic foot-pound second unit.—$1\ 1952 \times 10^{-6}$ coulomb (absolute); 117.58 electromagnetic cgs units or abcoulombs; 3583 9 electrostatic cgs units or statcoulombs

Faraday.—9.6500×10^{4} coulombs (absolute); 9.6507×10^{4} International coulombs (a), 9.6510×10^{4} International coulombs (v); $2\ 89365 \times 10^{14}$ electrostatic cgs units or statcoulombs

International coulomb (a).—0.99993 coulomb (absolute)

International coulomb (v).—0 99990 coulomb (absolute).

Statcoulomb.—*See* electrostatic cgs unit

Reciprocal Quantity $[\epsilon^{-1/2}m^{-1/2}l^{-3/2}t]$; $[\mu^{1/2}m^{-1/2}l^{-1/2}]$

x **per ampere-hour** $= 2.7778 \times 10^{-4}$ x per coulomb (absolute).

x **per coulomb (absolute)** $= 0.99990$ x **per International coulomb (v); 0.99993** x **per International coulomb (a).**

x per electromagnetic cgs unit=0.1000 *x* per coulomb (absolute).

x per electronic charge=6 281×10^{18} *x* per coulomb (absolute).

x per electrostatic cgs unit=2 99796×10^{9} *x* per coulomb (absolute)

x per faraday=1 0363×10^{-5} *x* per coulomb (absolute)

Current $[\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2}]$; $[\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$

Abampere.—*See* electromagnetic cgs unit.

Ampere (absolute).—1.0363×10^{-5} faraday per second; 0.1 electromagnetic cgs unit or abampere; 1.00007 International amperes (a), 1.00010 International amperes (v), 2.99796×10^{9} electrostatic cgs units or statamperes

Electromagnetic cgs unit or abampere.—10.0000 amperes (absolute); 2 99796×10^{10} electrostatic cgs units or statamperes.

Electrostatic cgs unit or statampere.—3.33560×10^{-11} electromagnetic cgs unit or abampere; 3.33560×10^{-10} ampere (absolute)

Faraday per second —9.6500×10^{4} ampere (absolute).

International ampere (a) —Based on the deposit of 0.00111800 grams of silver per second; 0 99993 ampere (absolute)

International ampere (v) —As defined by the International ohm and volt, 0 99990 ampere (absolute)

International ampere (U S before 1911) —0 99916 International ampere (v)

International ampere (England before 1906) —0 99870 International ampere (v)

International ampere (England 1906-8).—0.99894 International ampere (v)

International ampere (England 1909-10) —0.99990 International ampere (v)

International ampere (France before 1911).—0.9998 International ampere (v)

International ampere (Germany before 1911).—0.99968 International ampere (v)

Statampere.—*See* electrostatic cgs unit

Electrical Field Strength $[\epsilon^{-\frac{1}{2}}m^{\frac{1}{2}}l^{-\frac{1}{2}}t^{-1}]$; $[\mu^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-2}]$

Electrostatic cgs unit of potential per centimeter.—299.796 volts per centimeter (absolute).

Electrostatic cgs unit of potential per inch.—118.05 volts per centimeter (absolute).

Electromagnetic cgs unit of potential per centimeter.—1.0000×10^{-8} volt per centimeter (absolute).

Electromagnetic cgs unit of potential per inch.—3.9370×10^{-9} volt per centimeter (absolute).

Volt per inch.—0.39370 volt per centimeter.

Potential $[\epsilon^{-\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-1}]$; $[\mu^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{3}{2}}t^{-2}]$

Abvolt.—*See* electromagnetic cgs unit.

Electromagnetic cgs unit or abvolt.—3.33560×10^{-11} electrostatic cgs unit or statvolt; 1.0000×10^{-8} volt (absolute).

Electrostatic cgs unit or statvolt.—299.796 volts (absolute); 2.99796×10^{10} electromagnetic cgs units or abvolts.

International volt (a).—Based on the International ohm and ampere; 1.00045 volts (absolute).

International volt (v).—Based on the acceptance of the electromotive force of a Weston cell at 20 °C as 1.0183 International volts; 1.00042 volts (absolute).

International volt (U. S. before 1911).—0.99916 International volt (v).

International volt (England before 1906).—0.99870 International volt (v).

International volt (England 1906-8).—0.99894 International volt (v).

International volt (England 1909-10).—0.99990 International volt (v).

International volt (Germany and France, before 1911).—0.99968 International volt (v).

Statvolts.—*See* electrostatic cgs unit.

Volt (absolute).—0.0033356 electrostatic cgs unit or statvolts; 0.99955 International volt (a); 0.99958 International volt (v); 1×10^{8} electromagnetic cgs units or abvolts.

Resistance $[\epsilon^{-1}l^{-1}t]$; $[\mu l t^{-1}]$

Abohm.—*See* electromagnetic cgs unit.

Board of trade unit (England 1903).—0.9984 International ohm.

Electromagnetic cgs unit or abohm.—1.11263×10^{-21} electrostatic cgs unit or statohm; 1×10^{-15} megohm; 1.0000×10^{-9} ohm (absolute); 0.001 microhm.

Electrostatic cgs unit or statohm.—8.98776×10^{11} ohms (absolute); 8.98776×10^{20} electromagnetic cgs units or abohms.

International ohm.—The resistance of a uniform column of mercury at 0 °C, 106.300 centimeters long, having a mass of 14.4521 grams; 1.00052 ohms (absolute); 1.0016 board of trade unit (England 1903); 1.0630 Siemens unit.

International ohm (France before 1911).—0.9999 International ohm.

"Legal ohm" of 1884 (England).—0.99718 International ohm.

Megohm.—1×10^{6} ohms.

Microhm.—1.11263×10^{-18} electrostatic cgs unit or statohm; 1×10^{-12} megohm; 1×10^{-6} ohm; 1000 electromagnetic cgs units or abohms.

Ohm (absolute).—1.11263×10^{-12} electrostatic cgs unit or statohm; 1×10^{-6} megohm (absolute); 0.99948 International ohm; 1×10^{6} microhms (absolute); 1×10^{9} electromagnetic cgs units or abohms.

Siemens unit.—0.94073 International ohm.

Statohm.—*See* electrostatic cgs unit.

Volume Resistivity $[\epsilon^{-1}t]$; $[\mu l^{2}t^{-1}]$

Electromagnetic cgs unit (abohm)-centimeter.—9.9948×10^{-10} International ohm-centimeter; 0.001 microhm-centimeter; 0.0060153 ohm-mil*-foot.

Electrostatic cgs unit-centimeter.—8.98776×10^{11} International ohm-centimeters.

International annealed copper standard (20 °C).—Volume resistivity of annealed copper; 1.7241 microhm-centimeters.

International ohm-centimeter.—1.00052 ohm-centimeters (absolute).

Microhm-centimeter.—1.0000×10^{-6} ohm-centimeter; 0.3937 microhm-inch; 6.0153 ohm-mil*-foot; 1000 abohm-centimeters.

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*The unit thus marked refers to the diameter of a wire of circular cross section.

Microhm-inch.—2.5400 microhm-centimeters.

Ohm-centimeter (absolute).—0.99948 International ohm-centimeter; 1×10^6 microhm-centimeters.

Ohm-inch.—2.5400×10^6 microhm-centimeters.

Ohm-meter-millimeter^2.—100.0000 microhm-centimeters.

Ohm-meter-millimeter*.—78.540 microhm-centimeters.

Ohm-mil*-foot.—0.16624 microhm-centimeter; 166.24 electromagnetic cgs unit (abohm) centimeters.

Mass Resistivity $[\epsilon^{-1}ml^{-3}t]$; $[\mu ml^{-1}t^{-1}]$

Electromagnetic cgs unit.—9.9948×10^{-6} International ohm-meter-gram.

Electrostatic cgs unit.—8.9869×10^{15} International ohm-meter-gram.

International ohm-meter-gram.—1.00052 ohm (absolute)-meter-gram.

Ohm (absolute)-meter-gram.—0.99948 International ohm-meter-gram.

Ohm-centimeter-gram.—D† ohm-centimeter; 1.0000×10^4 ohm-meter-gram.

Ohm-mile-pound.—1.7513×10^{-4} ohm-meter-gram.

Volume Conductivity $[\epsilon t^{-1}]$; $[\mu^{-1}l^{-2}t]$

Electromagnetic cgs unit or abmhos per centimeter cube (ohm^{-1}-centimeter^{-1}).—166.2 mhos per mil* foot; 1000 megmhos per centimeter cube; 1.00052×10^9 International ohm^{-1}-centimeter^{-1}.

Electrostatic cgs unit.—1.11273×10^{-12} International ohm^{-1}-centimeter^{-1}.

International annealed copper standard (20 °C).—0.5800 microhm^{-1}-centimeter^{-1}.

International ohm^{-1}-centimeter^{-1}.—0.99948 ohm^{-1}-centimeter^{-1} (absolute).

Megmhos per centimeter cube.—0.001 abmhos per centi-

†D represents the density in grams per centimeter cubed.

*The unit thus marked refers to the diameter of a wire of circular cross section.

meter cube; 0.1662 mhos per mil* foot; 2.540 megmhos per inch cube; 1 microhm^{-1}-centimeter^{-1}.

Megmhos per inch cube.—0.39370 megmhos per centimeter cube; 1 microhm^{-1}-inch^{-1}.

Mho centimeter cube.—1 ohm^{-1}-centimeter^{-1}.

Microhm^{-1}-centimeter^{-1}.—1.0000×10^{6} ohm^{-1}-centimeter^{-1}; 1 megmho per centimeter cube.

Microhm^{-1}-inch^{-1}.—0.39370 microhm^{-1}-centimeter^{-1}; 1 megmho per inch cube.

Ohm^{-1}-centimeter^{-1} (absolute).—1 mho per centimeter cube; 1.00052 International ohm^{-1}-centimeter^{-1}.

Ohm^{-1}-inch^{-1}.—3.9370×10^{-7} microhm^{-1}-centimeter^{-1}.

Ohm^{-1} (meter, millimeter*)$^{-1}$.—0.012732 microhm^{-1}-centimeter^{-1}.

Ohm^{-1} (meter, millimeter^{2})$^{-1}$.—0.01000 microhm^{-1}-centimeter^{-1}.

Ohm^{-1} (mil, foot)$^{-1}$.—6.0153 microhm^{-1}-centimeter^{-1}.

100% conductivity (20 °C).—0.5800 microhm^{-1}-centimeter^{-1}.

Mass Conductivity $[\epsilon m^{-1} l^{3} t^{-1}]$; $[\mu^{-1} m^{-1} l t]$

x per **electromagnetic cgs unit**$=1.00052\times10^{5}$ x per International ohm-meter-gram.

x per **electrostatic cgs unit**$=1.1127\times10^{-16}$ x per International ohm-meter-gram.

x per **International ohm-meter-gram**$=0.99948$ x per ohm (absolute)-meter-gram.

x per **ohm (absolute)-meter-gram**$=1.00052$ x per International ohm-meter-gram.

x per **ohm-centimeter-gram**$=1.0000\times10^{-4}$ x per ohm-meter-gram.

x per **ohm-mile-pound**$=0.0057100$ x per ohm-meter-gram.

Capacitance $[\epsilon l]$; $[\mu^{-1} l^{-1} t^{2}]$

Electromagnetic cgs unit or abfarad.—1.0000×10^{9} farads (absolute); 1×10^{15} microfarads; 8.98776×10^{20} electrostatic cgs units or statfarads.

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*The unit thus marked refers to the diameter of a wire of circular cross section.

Electrostatic cgs unit (statfarad or centimeter).—1.11263×10^{-21} electromagnetic cgs unit or abfarad; 1.11263×10^{-12} farad (absolute); 1.11263×10^{-6} microfarad.

Farad (absolute).—1×10^{-9} electromagnetic cgs unit or abfarad; 1.00052 International farad; 1×10^{6} microfarads; 8.98776×10^{11} electrostatic cgs units or statfarads.

International farad.—0.99948 farad (absolute).

Microfarad.—1×10^{-15} electromagnetic cgs unit or abfarad; 1×10^{-6} farad; 8.98776×10^{5} electrostatic cgs units or statfarads.

Micromicrofarad.—1×10^{-12} farad.

Statfarad.—*See* electrostatic cgs unit.

Inductance $[\epsilon^{-1}\, l^{-1}\, t^{2}]$; $[\mu l]$

Abhenry.—*See* electromagnetic cgs unit.

Electromagnetic cgs unit (abhenry or centimeter).—1.11263×10^{-21} electrostatic cgs unit or stathenry; 1.0000×10^{-9} henry (absolute); 1×10^{-6} millihenry.

Electrostatic cgs unit or stathenry.—8.98776×10^{11} henry (absolute); 8.98776×10^{14} millihenries; 8.98776×10^{20} abhenries.

Henry (absolute).—1.11263×10^{-12} electrostatic cgs unit or stathenry; 0.99948 International henry; 1000 millihenries; 1×10^{9} electromagnetic cgs units or abhenries.

International henry.—1.00052 henry (absolute).

Millihenry.—1.11263×10^{-15} stathenry; 0.001 henries; 1×10^{6} abhenries.

Stathenry.—*See* electrostatic cgs unit.

Thermoelectric Units

THERMOELECTRIC POWER $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}\ \theta^{-1}]$; $[\mu^{\frac{1}{2}}\ m^{\frac{1}{2}}\ l^{\frac{3}{2}}\ t^{-2}\ \theta^{-1}]$

Electromagnetic cgs unit of potential per °C.—0.010000 microvolt per °C (absolute).

Electromagnetic cgs unit of potential per °F.—0.018000 microvolt per °C (absolute).

Electrostatic cgs unit of potential per °C.—2.9986×10^{8} microvolt per °C (absolute).

Electrostatic cgs unit of potential per °F.—5.3975×10^{8} microvolt per °C (absolute).

Microvolt per °F.—1.8000 microvolt per °C.

PELTIER COEFFICIENT $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2}]$

Calorie (15 °C) per ampere-hour.—0.011625 joule per electromagnetic unit quantity.

Calorie (15 °C) per coulomb.—41.850 joules per electromagnetic unit quantity.

Joule per ampere-hour (absolute).—9.2636×10^{-14} joule per electrostatic unit quantity; 0.0027778 joule per electromagnetic unit quantity.

Joule per coulomb.—10.000 joules per electromagnetic unit quantity.

Joule per electron.—6.2811×10^{19} joules per electromagnetic unit quantity.

Joule per faraday.—1.0363×10^{-4} joule per electromagnetic unit quantity.

COEFFICIENT OF THOMSON EFFECT

$[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1} \theta^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} t^{-2} \theta^{-1}]$

Joule per coulomb per °F.—1.8000 joules per coulomb per °C.

Joule per electromagnetic unit quantity per °F.—0.1800 joule per coulomb per °C.

Joule per electron per °C.—6.2811×10^{18} joules per coulomb per °C.

Joule per electrostatic unit quantity per °C.—2.9986×10^{9} joules per coulomb per °C.

Joule per electrostatic unit quantity per °F.—5.3975×10^{9} joules per coulomb per °C.

Joule per faraday per °C.—1.0363×10^{-5} joule per coulomb per °C.

Volt per °C.—1.0000 joule per coulomb per °C.

Piezoelectric Constant $[\epsilon^{\frac{1}{2}} m^{-\frac{1}{2}} l^{\frac{1}{2}} t]$; $[\mu^{-\frac{1}{2}} m^{-\frac{1}{2}} l^{-\frac{3}{2}} t^{2}]$

Coulomb per kilogram weight.—3057.7 electrostatic unit quantity per dyne.

Electromagnetic unit quantity per kilogram weight.—3.0577×10^{4} electrostatic unit quantity per dyne.

Electromagnetic unit quantity per pound weight—6.7411×10^{4} electrostatic unit quantity per dyne.

Electron per kilogram weight.— 4.868×10^{-16} electrostatic unit quantity per dyne.

Electrostatic unit quantity per kilogram weight.—1.0197×10^{-6} electrostatic unit quantity per dyne.

Electrostatic unit quantity per pound weight.—2.2481×10^{-6} electrostatic unit quantity per dyne.

Faraday per kilogram weight.— 2.9507×10^{8} electrostatic unit quantity per dyne.

Flux of Magnetic Induction; Magnetic Flux; Pole Strength $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-1}]$

Electromagnetic cgs unit (unit pole).—4π maxwell (absolute).

Electrostatic cgs unit.—2.99796×10^{10} maxwells (absolute).

International maxwell (a).—1.00045 maxwells (absolute).

International maxwell (v).—1.00042 maxwells (absolute).

Kilolines.—1000 maxwells.

Line.—1.0000 maxwell (absolute).

Maxwell (absolute).—3.3356×10^{-11} electrostatic cgs unit; 0.99955 International maxwell (a); 0.99958 International maxwell (v); 1.0000 line.

Megaline.—1×10^{6} maxwells.

Volt-second.—1×10^{8} maxwells.

Weber.—1 volt-second; 1×10^{8} maxwells.

Magnetic Field Intensity $[\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}]$; $[\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}]$

Ampere-turn per centimeter.—1.2566 gauss.

Ampere-turn per inch.—0.49474 gauss.

Electromagnetic cgs unit.—1.0000 gauss (absolute).

Electrostatic cgs unit.—3.33560×10^{-11} gauss (absolute).

Gamma (γ).—1.0000×10^{-5} gauss.

Gauss (absolute).—0.79580 ampere-turn per centimeter; 1 electromagnetic cgs unit; 1 gilbert per centimeter; 1.00007 International gauss (a); 1.00010 International gauss (v); 2.0213 ampere-turns per inch; 6.452 lines per square inch; 1×10^{5} gamma (γ); 2.99796×10^{10} electrostatic cgs units.

Gilbert per centimeter.—1.0000 gauss; 2.021 ampere-turns per inch.

International gauss (a).—0.99993 gauss (absolute).

International gauss (v).—0.99990 gauss (absolute).

Lines per square centimeter.—1 gauss.

Lines per square inch.—0.1550 gauss.

Magnetomotive Force; Magnetic Potential

$[\epsilon^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{3}{2}}\, t^{-2}]$; $[\mu^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{\frac{1}{2}}\, t^{-1}]$

Abampere-turn.—10 ampere-turns; 12.566 gilberts.

Ampere-turn.—0.1 abampere-turn; 1.2566 gilberts.

Electromagnetic cgs unit.—1.00000 gilbert (absolute).

Electrostatic cgs unit.—3.33560×10^{-11} gilbert (absolute).

Gilbert (**absolute**).—0.07958 abampere-turn; 0.7958 ampere-turn; 1.00007 International gilbert (a); 1.00010 International gilbert (v).

International gilbert (a).—0.99993 gilbert (absolute).

International gilbert (v).—0.99990 gilbert (absolute).

Reluctance $[\epsilon\, l\, t^{-2}]$; $[\mu^{-1}\, l^{-1}]$

Electromagnetic cgs unit.—1.0000 oersted (absolute).

Electrostatic cgs unit.—1.1122×10^{-21} oersted (absolute).

International oersted.—0.99948 oersted (absolute).

Oersted (**absolute**).—1.00052 International oersted.

Magnetic Induction; Intensity of Magnetization

$[\epsilon^{-\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{3}{2}}]$; $[\mu^{\frac{1}{2}}\, m^{\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^{-1}]$

Electromagnetic cgs unit.—1.00000 maxwell (absolute) per square centimeter.

Electrostatic cgs unit.—2.9986×10^{10} maxwells (absolute) per square centimeter.

International maxwell per square centimeter (a).—1.00045 maxwells (absolute) per square centimeter.

International maxwell per square centimeter (v).—1.00042 maxwells (absolute) per square centimeter.

Line per square centimeter.—1.00000 maxwell per square centimeter.

Line per square inch.—0.15500 maxwell per square centimeter.

Maxwell per square centimeter (absolute).—0.99955 International maxwell per square centimeter (a); 0.99958 International maxwell per square centimeter (v).

Maxwell per square inch.—0.15500 maxwell per square centimeter.

Dielectric Constant; Electrical Inductivity; Magnetic Permeability; Susceptibility.

Electromagnetic cgs unit.—8.9916×10^{20} electrostatic cgs units.

Foot-pound-second electromagnetic unit.—0.0010764 electromagnetic cgs unit; 9.6784×10^{17} electrostatic cgs units.

Foot-pound-second-electrostatic unit.—1.0000 electrostatic cgs unit.

Magnetic Effects

COEFFICIENT OF LEDUC EFFECT $[\epsilon^{-\frac{1}{2}}\, m^{-\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^2]$; $[\mu^{\frac{1}{2}}\, m^{-\frac{1}{2}}\, l^{\frac{1}{2}}\, t]$

x centimeters per **ampere-turn**$=0.79577\ x$ per gauss.

x centimeters per **gilbert**$=1.0000\ x$ per gauss.

x per **electrostatic cgs unit**$=2.9986 \times 10^{10}\ x$ per gauss.

x inches per **ampere-turn**$=2.0213\ x$ per gauss.

COEFFICIENT OF HALL EFFECT $[\epsilon^{-\frac{3}{2}}\, m^{-\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^3]$; $[\mu^{\frac{3}{2}}\, m^{-\frac{1}{2}}\, l^{\frac{5}{2}}]$

Electrostatic cgs unit.—2.6962×10^{31} electromagnetic cgs unit.

Volt centimeter per ampere gauss (absolute).—1.0000×10^9 electromagnetic cgs unit.

Volt inch per ampere gauss (absolute).—2.5400×10^9 electromagnetic cgs unit.

COEFFICIENT OF ETTINGHAUSEN EFFECT

$[\epsilon^{-1}\, m^{-1}\, l^{-1}\, t^4\, \theta]$; $[\mu m^{-1}\, l t^2\, \theta]$

°C centimeter per ampere gauss (absolute).—10.000 °C centimeter per electromagnetic cgs unit.

°C centimeter per electrostatic cgs unit.—8.9916×10^{20} °C centimeter per electromagnetic cgs unit.

°F inch per ampere gauss (absolute).—45.720 °C centimeter per electromagnetic cgs unit.

COEFFICIENT OF NERNST EFFECT $[\epsilon^{-1}\, t\, \theta^{-1}]$; $[\mu l^2\, t^{-1}\, \theta^{-1}]$

Electrostatic cgs unit per °C.—8.9916×10^{20} electromagnetic cgs unit per °C.

Volt per gauss °C (absolute).—1.0000×10^{8} electromagnetic cgs unit per °C.

Volt per gauss °F (absolute).—1.8000×10^{8} electromagnetic cgs unit per °C.

VERDET'S CONSTANT $[\epsilon^{-\frac{1}{2}}\, m^{-\frac{1}{2}}\, l^{-\frac{1}{2}}\, t^2]$; $[\mu^{\frac{1}{2}}\, m^{-\frac{1}{2}}\, l^{-\frac{1}{2}}\, t]$

Minute per ampere-turn.—1.2566 minute per electromagnetic cgs unit.

Minute per gilbert.—1.0000 minute per electromagnetic cgs unit.

Radian per gilbert.—3437.7 minute per electromagnetic cgs unit.

RELATIONS OF ELECTRICAL UNITS

1 ohm	$= 10^9$ electromagnetic	$= 1/9 \times 10^{-11}$ electrostatic
1 volt	$= 10^8$ electromagnetic	$= 1/3 \times 10^{-2}$ electrostatic
1 ampere	$= 10^{-1}$ electromagnetic	$= 3 \times 10^9$ electrostatic
1 coulomb	$= 10^{-1}$ electromagnetic	$= 3 \times 10^9$ electrostatic
1 farad	$= 10^{-9}$ electromagnetic	$= 9 \times 10^{11}$ electrostatic
1 farad	$= 1{,}000{,}000$ microfarads	
1 henry	$= 10^9$ electromagnetic	$= 1/9 \times 10^{-11}$ electrostatic

VALUE OF THE GAS CONSTANT *R* FOR VARIOUS UNITS

8.3136×10^7 ergs per °C per mole.
1.9864 calories per °C per mole.

Units of pressure	Units of volume.	*R* per gram molecule.
Atmospheres	Volume at 0° C.	0.003662
Atmospheres	cm³	82.07
Atmospheres	liters	0.08207
Atmospheres	cubic meters	
Dynes per cm² [barye]	cm³	8.3156×10^7
Kilograms per m² [g = 980.6]	cm³	8.48×10^5
		***R* per lb. molecule.**
Pounds per sq.in.	cu.in.	18510.
Pounds per sq.in.	cu.ft.	10.71
Atmospheres	cu.in.	1260.
Atmospheres	cu.ft.	0.729

FACTORS FOR CONVERSION OF ENERGY UNITS

(From Perkins' Introduction to General Thermodynamics, John Wiley & Sons, publishers, by permission.)

	Gram-calories (4° C)	B.T U *	Joules	Foot-pounds	Kilogr.-meters	Liter-atmos.	Cu ft.-atmos.	Foot-poundals	Horse-power hours
Gram-calorie	1	3.968×10^{-3}	4.185	3.087	4267	$4\ 130 \times 10^{-2}$	1.459×10^{-3}	99 31	1.5591×10^{-6}
B.T.U.	252	1	1055	777.9	107.5	10.41	3676	25030	3.929×10^{-4}
Joule.	2389	9.482×10^{-4}	1	.73756	.1019	9.869×10^{-3}	3.485×10^{-4}	23.73	3.725×10^{-7}
Foot-pound. . .	3240	1.286×10^{-3}	1 356	1	.13826	1.3381×10^{-2}	4.7253×10^{-4}	32.174	5.0505×10^{-7}
Kilogr.-meter .	2 343	$9\ 298 \times 10^{-3}$	9 806	7 2327	1	9.678×10^{-2}	$3\ 4177 \times 10^{-3}$	232 7	3.6529×10^{-6}
Liter-atmos . . .	24.21	9.607×10^{-2}	101.32	74 733	10.333	1.	$3\ 5319 \times 10^{-2}$	2403 8	$3\ 7734 \times 10^{-5}$

* At temp. of maximum density.

CONVERSION OF PRESSURE UNITS

(From Perkins' Introduction to General Thermodynamics, John Wiley & Sons, publishers, by permission.)

	Dynes per sq. cm	Grams per sq. cm	Kilo. per sq. meter	Mm of mercury	Atmospheres	Lbs. per sq. in.	Lbs. per sq. ft.
Dynes per sq. centimeter.	1.	1.0198×10^{-3}	1.0198×10^{-2}	7.5010×10^{-4}	9.8697×10^{-7}	$1\ 4504 \times 10^{-5}$	$2\ 0887 \times 10^{-3}$
Gram per sq. centimeter	980 6	1	10	$7\ 3551 \times 10^{-1}$	9.6777×10^{-4}	1.4223×10^{-2}	2.0481
Kilogram per sq. meter. .	98.06	10^{-1}	1	$7\ 3551 \times 10^{-2}$	$9\ 6777 \times 10^{-5}$	1.4223×10^{-3}	2.0481×10^{-1}
Millimeter of mercury. . . .	1332.	1 3595	13 595	1	$1\ 3158 \times 10^{-3}$	$1\ 9337 \times 10^{-2}$	2 7845
Atmosphere.	1013200.	1033 3	10333	760	1	14 696	2116.32
Pound per square inch. . . .	68944	70.308	703.12	51.715	6.8046×10^{-2}	1	144
Pound per square foot. . . .	478.78	4.883×10^{-1}	4 883	3.5912×10^{-1}	4.7252×10^{-4}	$6\ 9445 \times 10^{-3}$	1

In the two tables above the numbers show the value of the energy or pressure unit named at the left in the units named at the top. For example, 1 gram-calorie is equivalent to 3.968×10^{-3} B.T.U.

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10

Length

Inches	Millimeters	Inches	Centimeters	Feet	Meters	U. S. Yards	Meters	U. S. Miles	Kilometers
0.03937 =	**1**	0.3937 =	**1**	**1**	= 0 304801	**1**	= 0.914402	0.62137 =	**1**
0.07874 =	**2**	0 7874 =	**2**	**2**	= 0.609601	1.093611 =	**1**	**1** =	1.60935
0.11811 =	**3**	**1** =	2.54001	**3**	= 0.914402	**2**	= 1 828804	1.24274 =	**2**
0 15748 =	**4**	1 1811 =	**3**	3.28083 =	**1**	2 187222 =	**2**	1.86411 =	**3**
0.19685 =	**5**	1.5748 =	**4**	**4**	= 1 219202	**3**	= 2 743205	**2** =	3.21869
0.23622 =	**6**	1 9685 =	**5**	**5**	= 1.524003	3 280833 =	**3**	2 48548 =	**4**
0.27559 =	**7**	**2** =	5.08001	**6**	= 1.828804	**4**	= 3 657607	**3** =	4.82804
0.31496 =	**8**	2 3622 =	**6**	6 56167 =	**2**	4 374444 =	**4**	3.10685 =	**5**
0.35433 =	**9**	2 7559 =	**7**	**7**	= 2 133604	**5**	= 4 572009	3 72822 =	**6**
1 =	25.4001	**3** =	7.62002	**8**	= 2 438405	5.468056 =	**5**	**4** =	6.43739
2 =	50.8001	3.1496 =	**8**	**9**	= 2.743205	**6**	= 5.486411	4.34959 =	**7**
3 =	76.2002	3.5433 =	**9**	9.84250 =	**3**	6 561667 =	**6**	4 97096 =	**8**
4 =	101 6002	**4** =	10 16002	13.12333 =	**4**	**7**	= 6 400813	**5** =	8.04674
5 =	127.0003	**5** =	12 70003	16.40417 =	**5**	7 655278 =	**7**	5.59233 =	**9**
6 =	152.4003	**6** =	15.24003	19.68500 =	**6**	**8**	= 7 315215	**6** =	9.65608
7 =	177.8004	**7** =	17.78004	22.96583 =	**7**	8.748889 =	**8**	**7** =	11.26543
8 =	203.2004	**8** =	20.32004	26.24667 =	**8**	**9**	= 8.229616	**8** =	12 87478
9 =	228.6005	**9** =	22.86005	29 52750 =	**9**	9 842500 =	**9**	**9** =	14.48412

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Area

SQUARE INCHES	SQUARE MILLI-METERS	SQUARE INCHES	SQUARE CENTI-METERS	SQUARE FEET	SQUARE METERS	SQUARE YARDS	SQUARE METERS	SQUARE MILES	SQUARE KILO-METERS
0 00155 =	**1**	0.1550 =	**1**	**1**	= 0 09290	**1**	= 0 8361	0 3861 =	**1**
0 00310 =	**2**	0 3100 =	**2**	**2**	= 0.18581	1.1960 =	**1**	0.7722 =	**2**
0 00465 =	**3**	0 4650 =	**3**	**3**	= 0 27871	**2**	= 1 6723	**1** =	2.5900
0 00620 =	**4**	0 6200 =	**4**	**4**	= 0 37161	2 3920 =	**2**	1 1583 =	**3**
0.0075 =	**5**	0.7750 =	**5**	**5**	= 0.46452	**3**	2 5084	1.5444 =	**4**
0.00930 =	**6**	0.9300 =	**6**	**6**	= 0 55742	3.5880 =	**3**	1.9305 =	**5**
0.01085 =	**7**	**1** =	6 452	**7**	= 0 65032	**4**	= 3.3445	**2** =	5.1800
0.01240 =	**8**	1.0850 =	**7**	**8**	= 0.74323	4.7839 =	**4**	2.3166 =	**6**
0.01395 =	**9**	1.2400 =	**8**	**9**	= 0 83613	**5**	= 4.1807	2.7027 =	**7**
1	= 645.16	1.3950 =	**9**	10.764 =	**1**	5.9799 =	**5**	**3** =	7.7700
2	= 1,290.33	**2**	= 12.903	21 528 =	**2**	**6**	= 5 0168	3.0888 =	**8**
3	= 1,935.49	**3**	= 19 355	32.292 =	**3**	**7**	= 5.8529	3 4749 =	**9**
4	= 2,580 65	**4**	= 25 807	43 055 =	**4**	7 1759 =	**6**	**4**	= 10.3600
5	= 3,225.81	**5**	= 32.258	53.819 =	**5**	**8**	= 6.6890	**5**	= 12.9500
6	= 3,870 98	**6**	= 38.710	64 583 =	**6**	8.3719 =	**7**	**6**	= 15.5400
7	= 4,516.14	**7**	= 45 161	75 347 =	**7**	**9**	= 7.5252	**7**	= 18.1300
8	= 5,161 30	**8**	= 51.613	86 111 =	**8**	9.5679 =	**8**	**8**	= 20.7200
9	= 5,806.46	**9**	= 58.065	96.875 =	**9**	10.7639 =	**9**	**9**	= 23.3100

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Volume								AREA—Continued	
CUBIC INCHES	CUBIC MILLI-METERS	CUBIC INCHES	CUBIC CENTI-METERS	CUBIC FEET	CUBIC METERS	CUBIC YARDS	CUBIC METERS	ACRES	HECTARES
0.000061 =	1	0.0610 =	1	1	= 0.02832	1	= 0.7646	1	= 0.4047
0.000122 =	2	0 1220 =	2	2	= 0.05663	1 3079	= 1	2	= 0 8094
0.000183 =	3	0.1831 =	3	3	= 0.08495	2	= 1.5291	2.471	= 1
0.000244 =	4	0.2441 =	4	4	= 0.11327	2 6159	= 2	3	= 1.2141
0.000305 =	5	0 3051 =	5	5	= 0.14159	3	= 2 2937	4	= 1.6187
0.000366 =	6	0 3661 =	6	6	= 0.16990	3 9238	= 3	4.942	= 2
0.000427 =	7	0 4272 =	7	7	= 0 19822	4	= 3 0582	5	= 2.0234
0 000488 =	8	0 4882 =	8	8	= 0.22654	5	= 3 8228	6	= 2.4281
0.000549 =	9	0 5492 =	9	9	= 0.25485	5 2318	= 4	7	= 2.8328
1	= 16,387 2	1	= 16.3872	35 314	= 1	6	= 4 5874	7.413	= 3
2	= 32,774 3	2	= 32.7743	70.629	= 2	6 5397	= 5	8	= 3.2375
3	= 49,161 5	3	= 49 1615	105 943	= 3	7	= 5 3519	9	= 3.6422
4	= 65,548 6	4	= 65.5486	141.258	= 4	7 8477	= 6	9 884	= 4
5	= 81,935 8	5	= 81 9358	176 572	= 5	8	= 6 1165	12 355	= 5
6	= 98,323.0	6	= 98 3230	211 887	= 6	9	= 6.8810	14 826	= 6
7	= 114,710.1	7	= 114 7101	247 201	= 7	9 1556	= 7	17 297	= 7
8	= 131,097 3	8	= 131 0973	282 516	= 8	10 4635	= 8	19 768	= 8
9	= 147,484 5	9	= 147 4845	317 830	= 9	11 7715	= 9	22 239	= 9

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10 (Continued)

Capacity

The following equivalents are computed on the basis 1 liter = 1.000027 cubic decimeters.

MILLI-LITERS	U. S. LIQUID OUNCES	MILLI-LITERS	U. S. APOTHECARIES' DRAMS	U. S. APOTHECARIES' SCRUPLES	MILLI-LITERS	U. S. LIQUID QUARTS	LITERS	U. S. LIQUID GALLONS	LITERS
1	=0.03382	1	=0.2705	0 8116	= 1	1	=0 94633	0 26418	=1
2	=0.06763	2	=0 5410	1	= 1 2322	1 05671	=1	0.52836	=2
3	=0.10144	3	=0 8116	1 6231	= 2	2	=1 89267	0 79253	=3
4	=0.13526	3 6967	=1	2	= 2 4644	2 11342	=2	1	=3 78533
5	=0.16907	4	=1.0821	2 4347	= 3	3	=2 83900	1.05671	=4
6	=0.20289	5	=1.3526	3	= 3 6967	3 17013	=3	1 32089	=5
7	=0.23670	6	=1.6231	3 2462	= 4	4	=3 78533	1 58507	=6
8	=0.27052	7	=1.8936	4	= 4 9288	4 22684	=4	1 84924	=7
9	=0 30433	7.3932	=2	4 0578	= 5	5	=4.73167	2	=7 57066
29.573	=1	8	=2.1641	4 8693	= 6	5 28355	=5	2 11342	=8
59.146	=2	9	=2 4347	5	= 6 1610	6	=5.67800	2 37760	=9
88.719	=3	11 0898	=3	5 6809	= 7	6 34026	=6	3	=11 35600
118.292	=4	14 7864	=4	6	= 7 3932	7	=6 62433	4	=15 14133
147.864	=5	18.4831	=5	6 4924	= 8	7.39697	=7	5	=18 92666
177.437	=6	22 1797	=6	7	= 8 6254	8	=7 57066	6	=22.71199
207.010	=7	25.8763	=7	7 3040	= 9	8 45368	=8	7	=26.49732
236.583	=8	29 5729	=8	8	= 9.8576	9	=8.51700	8	=30.28266
266.156	=9	33.2695	=9	9	=11.0898	9.51039	=9	9	=34.06799

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10 (Continued)

Capacity

The following equivalents are computed on the basis 1 liter = 1.000027 cubic decimeters

U. S. DRY QUARTS	LITERS	U. S. PECKS	LITERS	DEKA-LITERS	U. S. PECKS	U. S. BUSHELS	HECTO-LITERS	U. S. BUSHELS PER ACRE	HECTO LITERS PER HECTARE
0 9081	=1	0.11351	= 1	0.8810	= 1	1	=0.35238	1	=0 87078
1	=1.1012	0.22703	= 2	1	= 1.1351	2	=0.70477	1 14840	=1
1 8162	=2	0.34054	= 3	1 7620	= 2	2.837819	=1	2	=1.74156
2	=2.2024	0 45405	= 4	2	= 2.2703	3	=1.05715	2.29680	=2
2 7243	=3	0.56756	= 5	2.6429	= 3	4	=1.40953	3	=2.61233
3	=3.3036	0.68108	= 6	3	= 3.4054	5	=1.76192	3.44519	=3
3 6324	=4	0.79459	= 7	3.5238	= 4	5.675638	=2	4	=3.48311
4	=4.4048	0.90810	= 8	4	= 4.5405	6	=2.11430	4.59359	=4
4 5405	=5	1	= 8.80958	4.4048	= 5	7	=2.46668	5	=4.35389
5	=5.5060	1.02161	= 9	5	= 5.6756	8	=2.81907	5.74199	=5
5 4487	=6	2	=17.61916	5.2857	= 6	8.513457	=3	6	=5.22467
6	=6.6072	3	=26.42875	6	= 6.8108	9	=3.17145	6.89039	=6
6.3568	=7	4	=35.23833	6.1667	= 7	11.351276	=4	7	=6.09545
7	=7.7084	5	=44.04791	7	= 7.9459	14 189095	=5	8	=6.96622
7 2649	=8	6	=52.85749	7.0477	= 8	17.026914	=6	8.03879	=7
8	=8.8096	7	=61.66708	7.9286	= 9	19.864733	=7	9	=7.83700
8.1730	=9	8	=70.47666	8	= 9.0810	22.702552	=8	9.18719	=8
9	=9.9108	9	=79.28624	9	=10.2161	25.540371	=9	10.33558	=9

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Weight (or Mass)

GRAINS	GRAMS	AVOIRDUPOIS OUNCES	GRAMS	TROY OUNCES	GRAMS	AVOIRDUPOIS POUNDS	KILOGRAMS	TROY POUNDS	KILOGRAMS
1	= 0.06480	0 03527 =	**1**	0 03215 =	**1**	**1**	= 0 45359	**1**	= 0.37324
2	= 0.12960	0.07055 =	**2**	0.06430 =	**2**	**2**	= 0 90718	**2**	= 0.74648
3	= 0 19440	0.10582 =	**3**	0 09645 =	**3**	2 20462	= **1**	2 67923	= **1**
4	= 0 25920	0 14110 =	**4**	0.12860 =	**4**	**3**	= 1 36078	**3**	= 1.11973
5	= 0.32399	0 17637 =	**5**	0.16075 =	**5**	**4**	= 1.81437	**4**	= 1.49297
6	= 0.38879	0.21164 =	**6**	0 19290 =	**6**	4 40924	= **2**	**5**	= 1.86621
7	= 0.45359	0.24692 =	**7**	0 22506 =	**7**	**5**	= 2.26796	5.35846	= **2**
8	= 0.51839	0 28219 =	**8**	0.25721 =	**8**	**6**	= 2.72155	**6**	= 2.23945
9	= 0.58319	0 31747 =	**9**	0 28936 =	**9**	6 61387	= **3**	**7**	= 2.61269
15.4324	= **1**	**1**	= 28 3495	**1**	= 31.10348	**7**	= 3.17515	**8**	= 2.98593
30 8647	= **2**	**2**	= 56.6991	**2**	= 62 20696	**8**	= 3 62874	8.03769	= **3**
46.2971	= **3**	**3**	= 85.0486	**3**	= 93.31044	8.81849	= **4**	**9**	= 3.35918
61.7294	= **4**	**4**	= 113 3981	**4**	= 124 41392	**9**	= 4 08233	10.71691	= **4**
77.1618	= **5**	**5**	= 141.7476	**5**	= 155 51740	11.02311	= **5**	13.39614	= **5**
92.5941	= **6**	**6**	= 170 0972	**6**	= 186.62088	13.22773	= **6**	16.07537	= **6**
108.0265	= **7**	**7**	= 198.4467	**7**	= 217.72437	15.43236	= **7**	18.75460	= **7**
123.4589	= **8**	**8**	= 226 7962	**8**	= 248.82785	17.63698	= **8**	21.43383	= **8**
138.8912	= **9**	**9**	= 255 1457	**9**	= 279.93133	19.84160	= **9**	24.11306	= **9**

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES

From 1 to 10 Units

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
0.00036735	0.00041143	0.00037324	0.37324	0.822857	1.
0.00044643	0.00050000	0.00045359	0.45359	1.	1.21528
0.00073469	0.00082286	0.00074648	0.74648	1.64571	2.
0.00089286	0.00100000	0.00090718	0.90718	2.	2.43056
0.00098421	0.00110231	0.00100000	1.	2.20462	2.67923
0.00110204	0.00123429	0.00111973	1.11973	2.46857	3.
0.00133929	0.00150000	0.00136078	1.36078	3.	3.64583
0.00146939	0.00164571	0.00149297	1.49297	3.29143	4.
0.00178571	0.00200000	0.00181437	1.81437	4.	4.86111
0.00183673	0.00205714	0.00186621	1.86621	4.11429	5.
0.00196841	0.00220462	0.00200000	2.	4.40924	5.35846
0.00220408	0.00246857	0.00223945	2.23945	4.93714	6.
0.00223214	0.00250000	0.00226796	2.26796	5.	6.07639
0.00257143	0.00288000	0.00261269	2.61269	5.76000	7.
0.00267857	0.00300000	0.00272155	2.72155	6.	7.29167
0.00293878	0.00329143	0.00298593	2.98593	6.58286	8.
0.00295262	0.00330693	0.00300000	3.	6.61387	8.03769
0.00312500	0.00350000	0.00317515	3.17515	7.	8.50694
0.00330612	0.00370286	0.00335918	3.35918	7.40571	9.
0.00357143	0.00400000	0.00362874	3.62874	8.	9.72222

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES (Continued)

From 1 to 10 Units

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
0.00393683	0.00440924	0.00400000	4.	8.81849	10.71691
0.00401786	0.00450000	0.00408233	4.08233	9.	10.93750
0.00492103	0.00551156	0.00500000	5.	11.0231	13.39614
0.00590524	0.00661387	0.00600000	6.	13.2277	16.07537
0.00688944	0.00771618	0.00780000	7.	15.4324	18.75460
0.00787365	0.00881849	0.00800000	8.	17.6370	21.43383
0.00885786	0.00992080	0.00900000	9.	19.8416	24.11306
0.89287	1.	0.90718	907.18	2,000.	2,430.56
0.98421	1.10231	1.	1,000.	2,204.62	2,679.23
1.	1.12000	1.01605	1,016.05	2,240.00	2,722.22
1.78571	2.	1.81437	1,814.37	4,000.00	4,861.11
1.96841	2.20462	2.	2,000.00	4,409.24	5,358.46
2.	2.24000	2.03209	2,032.09	4,480.00	5,444.44
2.67857	3.	2.72155	2,721.55	6,000.00	7,291.67
2.95262	3.30693	3.	3,000.00	6,613.87	8,037.69
3.	3.36000	3.04814	3,048.14	6,720.00	8,166.67
3.57143	4.	3.62874	3,628.74	8,000.00	9,722.22
3.93683	4.40924	4.	4,000.00	8,818.49	10,716.91
4.	4.48000	4.06419	4,064.19	8,960.00	10,888.89
4.46429	5.	4.53592	4,535.92	10,000.00	12,152.78

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES (Continued)

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
4.92103	5.51156	5.	5,000.00	11,023.11	13,396.14
5.	5.60000	5.08024	5,080.24	11,200.00	13,611.11
5.35714	6.	5.44311	5,443.11	12,000.00	14,583.33
5.90524	6.61387	6.	6,000.00	13,227.73	16,075.37
6.	6.72000	6.09628	6,096.28	13,440.00	16,333.33
6.25000	7.	6.35029	6,350.29	14,000.00	17,013.89
6.88944	7.71618	7.	7,000.00	15,432.36	18,754.60
7.	7.84000	7.11232	7,112.32	15,680.00	19,055.56
7.14286	8.	7.25748	7,257.48	16,000.00	19,444.44
7.87365	8.81849	8.	8,000.00	17,636.98	21,433.83
8.	8.96000	8.12838	8,128.38	17,920.00	21,777.78
8.03571	9.	8.16466	8,164.66	18,000.00	21,875.00
8.85786	9.92080	9.	9,000.00	19,841.60	24,113.06
9.	10.08000	9.14442	9,144.42	20,160.00	24,500.00

*

LENGTHS — CENTIMETERS TO INCHES

0.1 *to* 100 *Units*

1 centimeter = 0.393700 inches

The values found in the body of the table give, in inches, the lengths indicated in centimeters at the top and side.

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0		0.03937	0.07874	0.11811	0.15748	0.19685	0.23622	0.27559	0.31496	0.35433
1	0.39370	0.43307	0.47244	0.51181	0.55118	0.59055	0.62992	0.66929	0.70866	0.74803
2	0.78740	0.82677	0.86614	0.90551	0.94488	0.98425	1.0236	1.0630	1.1024	1.1417
3	1.1811	1.2205	1.2598	1.2992	1.3386	1.3780	1.4173	1.4567	1.4961	1.5354
4	1.5748	1.6142	1.6535	1.6929	1.7323	1.7717	1.8110	1.8504	1.8898	1.9291
5	1.9685	2.0079	2.0472	2.0866	2.1260	2.1654	2.2047	2.2441	2.2835	2.3228
6	2.3622	2.4016	2.4409	2.4803	2.5197	2.5591	2.5984	2.6378	2.6772	2.7165
7	2.7559	2.7953	2.8346	2.8740	2.9134	2.9528	2.9921	3.0315	3.0709	3.1102
8	3.1496	3.1890	3.2283	3.2677	3.3071	3.3465	3.3858	3.4252	3.4646	3.5039
9	3.5433	3.5827	3.6220	3.6614	3.7008	3.7402	3.7795	3.8189	3.8583	3.8976

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
10	3.9370	3.9764	4.0158	4.0551	4.0945	4.1339	4.1732	4.2126	4.2520	4.2913
11	4.3307	4.3701	4.4094	4.4488	4.4882	4.5276	4.5669	4.6063	4.6457	4.6850
12	4.7244	4.7638	4.8031	4.8425	4.8819	4.9213	4.9606	5.0000	5.0394	5.0787
13	5.1181	5.1575	5.1968	5.2362	5.2756	5.3150	5.3543	5.3937	5.4331	5.4724
14	5.5118	5.5512	5.5905	5.6299	5.6693	5.7087	5.7480	5.7874	5.8268	5.8661
15	5.9055	5.9449	5.9842	6.0236	6.0630	6.1024	6.1417	6.1811	6.2205	6.2598
16	6.2992	6.3386	6.3779	6.4173	6.4567	6.4961	6.5354	6.5748	6.6142	6.6535
17	6.6929	6.7323	6.7716	6.8110	6.8504	6.8898	6.9291	6.9685	7.0079	7.0472
18	7.0866	7.1260	7.1653	7.2047	7.2441	7.2835	7.3228	7.3622	7.4016	7.4409
19	7.4803	7.5197	7.5590	7.5984	7.6378	7.6772	7.7165	7.7559	7.7953	7.8346
20	7.8740	7.9134	7.9527	7.9921	8.0315	8.0709	8.1102	8.1496	8.1890	8.2283
21	8.2677	8.3071	8.3464	8.3858	8.4252	8.4646	8.5039	8.5433	8.5827	8.6220
22	8.6614	8.7008	8.7401	8.7795	8.8189	8.8583	8.8976	8.9370	8.9764	9.0157
23	9.0551	9.0945	9.1338	9.1732	9.2126	9.2520	9.2913	9.3307	9.3701	9.4094
24	9.4488	9.4882	9.5275	9.5669	9.6063	9.6457	9.6850	9.7244	9.7638	9.8031
25	9.8425	9.8819	9.9212	9.9606	10.000	10.039	10.079	10.118	10.157	10.197
26	10.236	10.276	10.315	10.354	10.394	10.433	10.472	10.512	10.551	10.591
27	10.630	10.669	10.709	10.748	10.787	10.827	10.866	10.905	10.945	10.984
28	11.024	11.063	11.102	11.142	11.181	11.220	11.260	11.299	11.339	11.378
29	11.417	11.457	11.496	11.535	11.575	11.614	11.654	11.693	11.732	11.772

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
30	11.811	11.850	11.890	11.929	11.968	12.008	12.047	12.087	12.126	12.165
31	12.205	12.244	12.283	12.323	12.362	12.402	12.441	12.480	12.520	12.559
32	12.598	12.638	12.677	12.717	12.756	12.795	12.835	12.874	12.914	12.953
33	12.992	13.031	13.071	13.110	13.150	13.189	13.228	13.268	13.307	13.346
34	13.386	13.425	13.465	13.504	13.543	13.583	13.622	13.661	13.701	13.740
35	13.780	13.819	13.858	13.898	13.937	13.976	14.016	14.055	14.094	14.134
36	14.173	14.213	14.252	14.291	14.331	14.370	14.409	14.449	14.488	14.528
37	14.567	14.606	14.646	14.685	14.724	14.764	14.803	14.842	14.882	14.921
38	14.961	15.000	15.039	15.079	15.118	15.157	15.197	15.236	15.276	15.315
39	15.354	15.394	15.433	15.472	15.512	15.551	15.591	15.630	15.669	15.709
40	15.748	15.787	15.827	15.866	15.905	15.945	15.984	16.024	16.063	16.102
41	16.142	16.181	16.220	16.260	16.299	16.339	16.378	16.417	16.457	16.496
42	16.535	16.575	16.614	16.654	16.693	16.732	16.772	16.811	16.850	16.890
43	16.929	16.968	17.008	17.047	17.087	17.126	17.165	17.205	17.244	17.283
44	17.323	17.362	17.402	17.441	17.480	17.520	17.559	17.598	17.638	17.677
45	17.717	17.756	17.795	17.835	17.874	17.913	17.953	17.992	18.031	18.071
46	18.110	18.150	18.189	18.228	18.268	18.307	18.346	18.386	18.425	18.465
47	18.504	18.543	18.583	18.622	18.661	18.701	18.740	18.779	18.819	18.858
48	18.898	18.987	18.976	19.016	19.055	19.094	19.134	19.173	19.213	19.252
49	19.291	19.331	19.370	19.409	19.449	19.488	19.528	19.567	19.606	19.646

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
50	19.685	19.724	19.764	19.803	19.842	19.882	19.921	19.961	20.000	20.039
51	20.079	20.118	20.157	20.197	20.236	20.276	20.315	20.354	20.394	20.433
52	20.472	20.512	20.551	20.591	20.630	20.669	20.709	20.748	20.787	20.827
53	20.866	20.905	20.945	20.984	21.024	21.063	21.102	21.142	21.181	21.220
54	21.260	21.299	21.339	21.378	21.417	21.457	21.496	21.535	21.575	21.614
55	21.654	21.693	21.732	21.772	21.811	21.850	21.890	21.929	21.968	22.008
56	22.047	22.087	22.126	22.165	22.205	22.244	22.283	22.323	22.362	22.402
57	22.441	22.480	22.520	22.559	22.598	22.638	22.677	22.716	22.756	22.795
58	22.835	22.874	22.913	22.953	22.992	23.031	23.071	23.110	23.150	23.189
59	23.228	23.268	23.307	23.346	23.386	23.425	23.465	23.504	23.543	23.583
60	23.622	23.661	23.701	23.740	23.779	23.819	23.858	23.898	23.937	23.976
61	24.016	24.055	24.094	24.134	24.173	24.213	24.252	24.291	24.331	24.370
62	24.409	24.449	24.488	24.528	24.567	24.606	24.646	24.685	24.724	24.764
63	24.803	24.842	24.882	24.921	24.961	25.000	25.039	25.079	25.118	25.157
64	25.197	25.236	25.276	25.315	25.354	25.394	25.433	25.472	25.512	25.551
65	25.591	25.630	25.669	25.709	25.748	25.787	25.827	25.866	25.905	25.945
66	25.984	26.024	26.063	26.102	26.142	26.181	26.220	26.260	26.299	26.339
67	26.378	26.417	26.457	26.496	26.535	26.575	26.614	26.653	26.693	26.732
68	26.772	26.811	26.850	26.890	26.929	26.968	27.008	27.047	27.087	27.126
69	27.165	27.205	27.244	27.283	27.323	27.362	27.402	27.441	27.480	27.520

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0 4	0.5	0.6	0.7	0.8	0.9
70	27.559	27.598	27.638	27.677	27.716	27.756	27.795	27.835	27.874	27.913
71	27.953	27.992	28.031	28.071	28.110	28.150	28.189	28.228	28.268	28.307
72	28.346	28.386	28.425	28.465	28.504	28.543	28.583	28.622	28.661	28.701
73	28.740	28.779	28.819	28.858	28.898	28.937	28.976	29.016	29.055	29.094
74	29.134	29.173	29.213	29.252	29.291	29.331	29.370	29.409	29.449	29.488
75	29.528	29.567	29.606	29.646	29.685	29.724	29.764	29.803	29.842	29.882
76	29.921	29.961	30.000	30.039	30.079	30.118	30.157	30.197	30.236	30.276
77	30.315	30.354	30.394	30.433	30.472	30.512	30.551	30.590	30.630	30.669
78	30.709	30.748	30.787	30.827	30.866	30.905	30.945	30.984	31.024	31.063
79	31.102	31.142	31.181	31.220	31.260	31.299	31.339	31.378	31.417	31.457
80	31.496	31.535	31.575	31.614	31.653	31.693	31.732	31.772	31.811	31.850
81	31.890	31.929	31.968	32.008	32.047	32.087	32.126	32.165	32.205	32.244
82	32.283	32.323	32.362	32.402	32.441	32.480	32.520	32.559	32.598	32.638
83	32.677	32.716	32.756	32.795	32.835	32.874	32.913	32.953	32.992	33.031
84	33.071	33.110	33.150	33.189	33.228	33.268	33.307	33.346	33.386	33.425
85	33.465	33.504	33.543	33.583	33.622	33.661	33.701	33.740	33.779	33.819
86	23.858	33.898	33.937	33.976	33.016	34.055	34.094	34.134	34.173	34.213
87	34.252	34.291	34.331	34.370	34.409	34.449	34.488	34.527	34.567	34.606
88	34.646	34.685	34.724	34.764	34.803	34.842	34.882	34.921	34.961	35.000
89	35.039	35.079	35.118	35.157	35.197	35.236	35.276	35.315	35.354	35.394

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0 5	0.6	0.7	0.8	0.9
90	35.433	35.472	35.512	35.551	35.590	35.630	35.669	35.709	35.748	35.787
91	35.827	35.866	35.905	35.945	35.984	36.024	36.063	36.102	36.142	36.181
92	36.220	36.260	36.299	36.339	36.378	36.417	36.457	36.496	36.535	36.575
93	36.614	36.653	36.693	36.732	36.772	36.811	36.850	36.890	36.929	36.968
94	37.008	37.047	37.087	37.126	37.165	37.205	37.244	37.283	37.323	37.362
95	37.402	37.441	37.480	37.520	37.559	37.598	37.638	27.677	37.716	37.756
96	37.795	37.835	37.874	37.913	37.953	37.992	38.031	38.071	38.110	38.150
97	38.189	38.228	38.268	38.307	38.346	38.386	38.425	38.464	38.504	38.543
98	38.583	38.622	38.661	38.701	38.740	38.779	38.819	38.858	38.898	38.937
99	38.976	39.016	39.055	39.094	39.134	39.173	39.213	39.252	39.291	39.331

*

LENGTHS — METERS TO FEET

From 1 *to* 1,000 *Units*

Reduction factor: 1 meter = 3.280833333 feet

The values found in the body of the table give, in feet, the length indicated in meters at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	3.2808	6.5617	9.8425	13.123	16.404	19.685	22.966	26.247	29.527
10	32.808	36.089	39.370	42.651	45.932	49.212	52.493	55.774	59.055	62.336
20	65.617	68.897	72.178	75.459	78.740	82.021	85.302	88.583	91.863	95.144
30	98.425	101.71	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.95
40	131.23	134.51	137.80	141.08	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.32	170.60	173.88	177.16	180.45	183.73	187.01	190.29	193.57
60	196.85	200.13	203.41	206.69	209.97	213.25	216.53	219.82	223.10	226.38
70	229.66	232.94	236.22	239.50	242.78	246.06	249.34	252.62	255.90	259.19
80	262.47	265.75	269.03	272.31	275.59	278.87	282.15	285.43	288.71	291.99
90	295.27	298.56	301.84	305.12	308.40	311.68	314.96	318.23	321.52	324.80

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
100	328.08	331.36	334.64	337.93	341.21	344.49	347.77	351.05	354.33	357.61
110	360.89	364.17	367.45	370.73	374.01	377.30	380.58	383.86	387.14	390.42
120	393.70	396.98	400.26	403.54	406.82	410.10	413.38	416.67	419.95	423.23
130	426.51	429.79	433.07	436.35	439.63	442.91	446.19	449.47	452.75	456.04
140	459.32	462.60	465.88	469.16	472.44	475.72	479.00	482.28	485.56	488.84
150	492.12	495.41	498.69	501.97	505.25	508.53	511.81	515.09	518.37	521.65
160	524.93	528.21	531.49	534.78	538.06	541.34	544.62	547.90	551.18	554.46
170	557.74	561.02	564.30	567.58	570.86	574.15	577.43	580.71	583.99	587.27
180	590.55	593.83	597.11	600.39	603.67	606.95	610.23	613.52	616.80	620.08
190	623.36	626.64	629.92	633.20	636.48	639.76	643.04	646.32	649.61	652.89
200	656.17	659.45	662.73	666.01	669.29	672.57	675.85	679.13	682.41	685.69
210	688.97	692.26	695.54	698.82	702.10	705.38	708.66	711.94	715.22	718.50
220	721.78	725.06	728.34	731.63	734.91	738.19	741.47	744.75	748.03	751.31
230	754.59	757.87	761.15	764.43	767.71	771.00	774.28	777.56	780.84	784.12
240	787.40	790.68	793 96	797.24	800.52	803.80	807.08	810.37	813.65	816.93
250	820.21	823.49	826.77	830.05	833.33	836.61	839.89	843.17	846.45	849.74
260	853.02	856.30	859.58	862.86	866.14	869.42	872.70	875.98	879.26	882.54
270	885.82	889.11	892.39	895.67	898.95	902.23	905.51	908.79	912.07	915.35
280	918.63	921.91	925.19	928.48	931.76	935.04	938.32	941.60	944.88	948.16
290	951.44	954.72	958.00	961.28	964.56	967.85	971.13	974.41	977.69	980.97

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
300	984.25	987.53	990.81	994.09	997.37	1,000.7	1,003.9	1,007.2	1,010.5	1,013.8
310	1,017.1	1,020.3	1,023.6	1,026.9	1,030.2	1,033.5	1,036.7	1,040.0	1,043.3	1,046.6
320	1,049.9	1,053.1	1,056.4	1,059.7	1,063.0	1,066.3	1,069.6	1,072.8	1,076.1	1,079.4
330	1,082.7	1,086.0	1,089.2	1,092.5	1,095.8	1,099.1	1,102.4	1,105.6	1,108.9	1,112.2
340	1,115.5	1,118.8	1,122.0	1,125.3	1,128.6	1,131.9	1,135.2	1,138.4	1,141.7	1,145.0
350	1,148.3	1,151.6	1,154.9	1,158.1	1,161.4	1,164.7	1,168.0	1,171.3	1,174.5	1,177.8
360	1,181.1	1,184.4	1,187.7	1,190.9	1,194.2	1,197.5	1,200.8	1,204.1	1,207.3	1,210.6
370	1,213.9	1,217.2	1,220.5	1,223.8	1,227.0	1,230.3	1,233.6	1,236.9	1,240.2	1,243.4
380	1,246.7	1,250.0	1,253.3	1.256.6	1,259.8	1,263.1	1,266.4	1,269.7	1,273.0	1,276.2
390	1,279.5	1,282.8	1,286.1	1,289.4	1,292.6	1,295.9	1,299.2	1,302.5	1,305.8	1,309.1
400	1,312.3	1,315.6	1,318.9	1,322.2	1,325.5	1,328.7	1,332.0	1,335.3	1,338.6	1,341.9
410	1,345.1	1,348.4	1,351.7	1,355.0	1,358.3	1,361.5	1,364.8	1,368.1	1,371.4	1,374.7
420	1,377.9	1,381.2	1,384.5	1,387.8	1,391.1	1,394.4	1,397.6	1,400.9	1,404.2	1,407.5
430	1,410.8	1,414.0	1,417.3	1,420.6	1,423.9	1,427.2	1,430.4	1,433.7	1,437.0	1,440.3
440	1,443.6	1,446.8	1,450.1	1,453.4	1,456.7	1,460.0	1,463.3	1,466.5	1,469.8	1,473.1
450	1,476.4	1,479.7	1,482.9	1,486.2	1,489.5	1,492.8	1,496.1	1,499.3	1,502.6	1,505.9
460	1,509.2	1,512.5	1,515.7	1,519.0	1,522.3	1,525.6	1,528.9	1,532.1	1,535.4	1,538.7
470	1,542.0	1,545.3	1,548.6	1,551.8	1,555.1	1,558.4	1,561.7	1,565.0	1,568.2	1,571.5
480	1,574.8	1,578.1	1,581.4	1,584.6	1,587.9	1,591.2	1,594.5	1,597.8	1,601.0	1,604.3
490	1,607.6	1,610.9	1,614.2	1,617.5	1,620.7	1,624.0	1,627.3	1,630.6	1,633.9	1,637.1

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
500	1,640.4	1,643.7	1,647.0	1,650.3	1,653.5	1,656.8	1,660.1	1,663.4	1,666.7	1,669.9
510	1,673.2	1,676.5	1,679.8	1,683.1	1,686.3	1,689.6	1,692.9	1,696.2	1,699.5	1,702.8
520	1,706.0	1,709.3	1,712.6	1,715.9	1,719.2	1,722.4	1,725.7	1,729.0	1,732.3	1,735.6
530	1,738.8	1,742.1	1,745.4	1,748.7	1,752.0	1,755.2	1,758.5	1,761.8	1,765.1	1,768.4
540	1,771.7	1,774.9	1,778.2	1,781.5	1,784.8	1,788.1	1,791.3	1,794.6	1,797.9	1,801.2
550	1,804.5	1,807.7	1,811.0	1,814.3	1,817.6	1,820.9	1,824.1	1,827.4	1,830.7	1,834.0
560	1,837.3	1,840.5	1,843.8	1,847.1	1,850.4	1,853.7	1,857.0	1,860.2	1,863.5	1,866.8
570	1,870.1	1,873.4	1,876.6	1,879.9	1,883.2	1,886.5	1,889.8	1,893.0	1,896.3	1,899.6
580	1,902.9	1,906.2	1,909.4	1,912.7	1,916.0	1,919.3	1,922.6	1,925.8	1,929.1	1,932.4
590	1,935.7	1,939.0	1,942.3	1,945.5	1,948.8	1,952.1	1,955.4	1,958.7	1,961.9	1,965.2
600	1,968.5	1,971.8	1,975.1	1,978.3	1,981.6	1,984.9	1,988.2	1,991.5	1,994.7	1,998.0
610	2,001.3	2,004.6	2,007.9	2,011.2	2,014.4	2,017.7	2,021.0	2,024.3	2,027.6	2,030.8
620	2,034.1	2,037.4	2,040.7	2,044.0	2,047.2	2,050.5	2,053.8	2,057.1	2,060.4	2,063.6
630	2,066.9	2,070.2	2,073.5	2,076.8	2,080.0	2,083.3	2,086.6	2,089.9	2,093.2	2,096.5
640	2,099.7	2,103.0	2,106.3	2,109.6	2,112.9	2,116.1	2,119.4	2,122.7	2,126.0	2,129.3
650	2,132.5	2,135.8	2,139.1	2,142.4	2,145.7	2,148.9	2,152.2	2,155.5	2,158.8	2,162.1
660	2,165.4	2,168.6	2,171.9	2,175.2	2,178.5	2,181.8	2,185.0	2,188.3	2,191.6	2,194.9
670	2,198.2	2,201.4	2,204.7	2,208.0	2,211.3	2,214.6	2,217.8	2,221.1	2,224.4	2,227.7
680	2,231.0	2,234.2	2,237.5	2,240.8	2,244.1	2,247.4	2,250.7	2,253.9	2,257.2	2,260.5
690	2,263.8	2,267.1	2,270.3	2,273.6	2,276.9	2,280.2	2,283.5	2,286.7	2,290.0	2,293.3

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
700	2,296.6	2,299.9	2,303.1	2,306.4	2,309.7	2,313.0	2,316.3	2,319.5	2,322.8	2,326.1
710	2,329.4	2,332.7	2,336.0	2,339.2	2,342.5	2,345.8	2,349.1	2,352.4	2,355.6	2,358.9
720	2,362.2	2,365.5	2,368.8	2,372.0	2,375.3	2,378.6	2,381.9	2,385.2	2,388.4	2,391.7
730	2,395.0	2,398.3	2,401.6	2,404.9	2,408.1	2,411.4	2,414.7	2,418.0	2,421.3	2,424.5
740	2,427.8	2,431.1	2,434.4	2,437.7	2,440.9	2,444.2	2,447.5	2,450.8	2,454.1	2,457.3
750	2,460.6	2,463.9	2,467.2	2,470.5	2,473.7	2,477.0	2,480.3	2,483.6	2,486.9	2,490.2
760	2,493.4	2,496.7	2,500.0	2,503.3	2,506.6	2,509.8	2,513.1	2,516.4	2,519.7	2,523.0
770	2,526.2	2,529.5	2,532.8	2,536.1	2,539.4	2,542.6	2,545.9	2,549.2	2,552.5	2,555.8
780	2,559.0	2,562.3	2,565.6	2,568.9	2,572.2	2,575.5	2,578.7	2,582.0	2,585.3	2,588.6
790	2,591.9	2,595.1	2,598.4	2,601.7	2,605.0	2,608.3	2,611.5	2,614.8	2,618.1	2,621.4
800	2,624.7	2,627.9	2,631.2	2,634.5	2,637.8	2,641.1	2,644.4	2,647.6	2,650.9	2,654.2
810	2,657.5	2,660.8	2,664.0	2,667.3	2,670.6	2,673.9	2,677.2	2,680.4	2,683.7	2,687.0
820	2,690.3	2,693.6	2,696.8	2,700.1	2,703.4	2,706.7	2,710.0	2,713.2	2,716.5	2,719.8
830	2,723.1	2,726.4	2,729.7	2,732.9	2,736.2	2,739.5	2,742.8	2,746.1	2,749.3	2,752.6
840	2,755.9	2,759.2	2,762.5	2,765.7	2,769.0	2,772.3	2,775,6	2,778.9	2,782.1	2,785.4
850	2,788.7	2,792.0	2,795.3	2,798.6	2,801.8	2,805.1	2,808.4	2,811.7	2,815.0	2,818.2
860	2,821.5	2,824.8	2,828.1	2,831.4	2,834.6	2,827.9	2,841.2	2,844.5	2,847.8	2,851.0
870	2,854.3	2,857.6	2,860.9	2,864.2	2,867.4	2,870.7	2,874.0	2,877.3	2,880.6	2,883.9
880	2,887.1	2.890.4	2,893.7	2,897.0	2,900.3	2,903.5	2,906.8	2,910.1	2,913.4	2,916.7
890	2,919.9	2,923.2	2,926.5	2,929.8	2,933.1	2,936.3	2,939.6	2,942.9	2,946.2	2,949.5

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
900	2,952.8	2,956.0	2,959.3	2,962.6	2,965.9	2,969.2	2,972.4	2,975.7	2,979.0	2,982.3
910	2,985.6	2,988.8	2,992.1	2,995.4	2,998.7	3,002.0	3,005.2	3,008.5	3,011.8	3,015.1
920	3,018.4	3,021.6	3,024.9	3,028.2	3,031.5	3,034.8	3,038.1	3,041.3	3,044.6	3,047.9
930	3,051.2	3,054.5	3,057.7	3,061.0	3,064.3	3,067.6	3,070.9	3,074.1	3,077.4	3,080.7
940	3,084.0	3,087.3	3,090.5	3,093.8	3,097.1	3,100.4	3,103.7	3,106.9	3,110.2	3,113.5
950	3,116.8	3,120.1	3,123.4	3,126.6	3,129.9	3,133.2	3,136.5	3,139.8	3,143.0	3,146.3
960	3,149.6	3,152.9	3,156.2	3,159.4	3,162.7	3,166.0	3,169.3	3,172.6	3,175.8	3,179.1
970	3,182.4	3,185.7	3,189.0	3,192.3	3,195.5	3,198.8	3,202.1	3,205.4	3,208.7	3,211.9
980	3,215.2	3,218.5	3,221.8	3,225.1	3,228.3	3,231.6	3,234.9	3,238.2	3,241.5	3,244.7
990	3,248.0	3,251.3	3,254.6	3,257.9	3,261.1	3,264.4	3,267.7	3,271.0	3,274.3	3,277.6

*

LENGTHS — KILOMETERS TO MILES

From 1 *to* 1,000 *Units*

Reduction factor: 1 kilometer = 0.6213699495 mile

Values found in the body of the table give, in miles, the length indicated in kilometers at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	0.62137	1.2427	1.8641	2.4855	3.1069	3.7282	4.3496	4.9710	5.5923
10	6.2137	6.8351	7.4564	8.0778	8.6992	9.3206	9.9419	10.563	11.185	11.806
20	12.427	13.049	13.670	14.292	14.913	15.534	16.156	16.777	17.398	18.020
30	18.641	19.262	19.884	20.505	21.127	21.748	22.369	22.991	23.612	24.233
40	24.855	25.476	26.098	26.719	27.340	27.962	28.583	29.204	29.826	30.447
50	31.069	31.690	32.311	32.933	33.554	34.175	34.797	35.418	36.039	36.661
60	37.282	37.904	38.525	39.146	39.768	40.389	41.010	41.632	42.253	42.875
70	43.496	44.117	44.739	45.360	45.981	46.603	47.224	47.845	48.467	49.088
80	49.710	50.331	50.952	51.574	52.195	52.816	53.438	54.059	54.681	55.302
90	55.923	56.945	57.166	57.787	58.409	59.030	59.652	60.273	60.894	61.516

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
100	62.137	62.758	63.380	64.001	64.622	65.244	65.865	66.487	67.108	67.729
110	68.351	68.972	69.593	70.215	70.836	71.458	72.079	72.700	73.322	73.943
120	74.564	75.186	75.807	76.429	77.050	77.671	78.293	78.914	79.535	80.157
130	80.778	81.399	82.021	82.642	83.264	83.885	84.506	85.128	85.749	86.370
140	86.992	87.613	88.235	88.856	89.477	90.099	90.720	91.341	91.963	92.584
150	93.205	93.827	94.448	95.070	95.691	96.312	96.934	97.555	98.176	98.798
160	99.419	100.04	100.66	101.28	101.90	102.53	103.15	103.77	104.39	105.01
170	105.63	106.25	106.88	107.50	108.12	108.74	109.36	109.98	110.60	111.23
180	111.85	112.47	113.09	113.71	114.33	114.95	115.57	116.20	116.82	117.44
190	118.06	118.68	119.30	119.92	120.55	121.17	121.79	122.41	123.03	123.65
200	124.27	124.90	125.52	126.14	126.76	127.38	128.00	128.62	129.24	129.87
210	130.49	131.11	131.73	132.35	132.97	133.59	134.22	134.84	135.46	136.08
220	136.70	137.32	137.94	138.57	139.19	139.81	140.43	141.05	141.67	142.29
230	142.92	143.54	144.16	144.78	145.40	146.02	146.64	147.26	147.89	148.51
240	149.13	149.75	150.37	150.99	151.61	152.24	152.86	153.48	154.10	154.72
250	155.34	155.96	156.59	157.21	157.83	158.45	159.07	159.69	160.31	160.93
260	161.56	162.18	162.80	163.42	164.04	164.66	165.28	165.91	166.53	167.15
270	167.77	168.39	169.01	169.63	170.26	170.88	171.50	172.12	172.74	173.36
280	173.98	174.60	175.23	175.85	176.47	177.09	177.71	178.33	178.95	179.58
290	180.20	180.82	181.44	182.06	182.68	183.30	183.93	184.55	185.17	185.79

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
300	186.41	187.03	187.65	188.28	188.90	189.52	190.14	190.76	191.38	192.00
310	192.62	193.25	193.87	194.49	195.11	195.73	196.35	196.97	197.60	198.22
320	198.84	199.46	200.08	200.70	201.32	201.95	202.57	203.19	203.81	204.43
330	205.05	205.67	206.29	206.92	207.54	208.16	208.78	209.40	210.02	210.64
340	211.27	211.89	212.51	213.13	213.75	214.37	214.99	215.62	216.24	216.86
350	217.48	218.10	218.72	219.34	219.96	220.59	221.21	221.83	222.45	223.07
360	223.69	224.31	224.94	225.56	226.18	226.80	227.42	228.04	228.66	229.29
370	229.91	230.53	231.15	231.77	232.39	233.01	233.64	234.26	234.88	235.50
380	236.12	236.74	237.36	237.98	238.61	239.23	239.85	240.47	241.09	241.71
390	242.33	242.96	243.58	244.20	244.82	245.44	246.06	246.68	247.31	247.93
400	248.55	249.17	249.79	250.41	251.03	251.65	252.28	252.90	253.52	254.14
410	254.76	255.38	256.00	256.63	257.25	257.87	258.49	259.11	259.73	260.35
420	260.98	261.60	262.22	262.84	263.46	264.08	264.70	265.32	265.95	266.57
430	267.19	267.81	268.43	269.05	269.67	270.30	270.92	271.54	272.16	272.78
440	273.40	274.02	274.65	275.27	275.89	276.51	277.13	277.75	278.37	279.00
450	279.62	280.24	280.86	281.48	282.10	282.72	283.34	283.97	284.59	285.21
460	285.83	286.45	287.07	287.69	288.32	288.94	289.56	290.18	290.80	291.42
470	292.04	292.67	293.29	293.91	294.53	295.15	295.77	296.39	297.01	297.64
480	298.26	298.88	299.50	300.12	300.74	301.36	301.99	302.61	303.23	303.85
490	304.47	305.09	305.71	306.34	306.96	307.58	308.20	308.82	309.44	310.06

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
500	310.68	311.31	311.93	312.55	313.17	313.79	314.41	315.03	315.66	316.28
510	316.90	317.52	318.14	318.76	319.38	320.01	320.63	321.25	321.87	322.49
520	323 11	323.73	324.36	324.98	325 60	326.22	326.84	327.46	328.08	328.70
530	329.33	329.95	330.57	331 19	331.81	332.43	333.05	333.68	334.30	334.92
540	335.54	336.16	336.78	337.40	338.03	338.65	339.27	339.89	340.51	341.13
550	341.75	342.37	343.00	343.62	344.24	344.86	345.48	346.10	346.72	347.35
560	347.97	348.59	349.21	349.83	350.45	351.07	351.70	352.32	352.94	353.56
570	354 18	354.80	355.42	356.05	356.67	357.29	357.91	358.53	359.15	359.77
580	360.39	361.02	361.64	362.26	362.88	363.50	364.12	364.74	365.37	365.99
590	366.61	367.23	367.85	368.47	369.09	369.72	370.34	370.96	371.58	372.20
600	372.82	373 44	374.06	374.69	375.31	375.93	376.55	377.17	377.79	378.41
610	379.04	379.66	380.28	380.90	381.52	382.14	382.76	383.39	384.01	384.63
620	385.25	385.87	386.49	387.11	387.73	388.36	388.98	389.60	390.22	390.84
630	391.46	392.08	392.71	393 33	393.95	394.57	395.19	395.81	396.43	397.06
640	397.68	398 30	398.92	399.54	400.16	400.78	401.40	402.03	402.65	403.27
650	403.89	404 51	405.13	405.75	406.38	407.00	407.62	408.24	408.86	409.48
660	410.10	410.73	411.25	411.97	412.59	413.21	413.83	414.45	415.08	415.70
670	416 32	416 94	417.56	418.18	418.80	419.42	420.05	420.67	421.29	421.91
680	422.53	423 15	423.77	424.40	425.02	425.64	426.26	426.88	427.50	428.12
690	428.75	429 37	429 99	430.61	431.23	431.85	432.47	433.09	433.72	434.34

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
700	434.96	435.58	436.20	436.82	437.44	438.07	438.69	439.31	439.93	440.55
710	441.17	441.79	442.42	443.04	443.66	444.28	444.90	445.52	446.14	446.76
720	447.39	448.01	448.63	449.25	449.87	450.49	451.11	451.74	452.36	452.98
730	453.60	454.22	454.84	455.46	456.09	456.71	457.33	457.95	458.57	459.19
740	459.81	460.44	461.06	461.68	462.30	462.92	463.54	464.16	464.78	465.41
750	466.03	466.65	467.27	467.89	468.51	469.13	469.76	470.38	471.00	471.62
760	472.24	472.86	473.48	474.11	474.73	475.35	475.97	476.59	477.21	477.83
770	478.45	479.08	479.70	480.32	480.94	481.56	482.18	482.80	483.43	484.05
780	484.67	485.29	485.91	486.53	487.15	487.78	488.40	489.02	489.64	490.26
790	490.88	491.50	492.13	492.75	493.37	493.99	494.61	495.23	495.85	496.47
800	497.10	497.72	498.34	498.96	499.58	500.20	500.82	501.45	502.07	502.69
810	503.31	503.93	504.55	505.17	505.80	506.42	507.04	507.66	508.28	508.90
820	509.52	510.14	510.77	511.39	512.01	512.63	513.25	513.87	514.49	515.12
830	515.74	516.36	516.98	517.60	518.22	518.84	519.47	520.09	520.71	521.33
840	521.95	522.57	523.19	523.81	524.44	525.06	525.68	526.30	526.92	527.54
850	528.16	528.79	529.41	530.03	530.65	531.27	531.89	532.51	533.14	533.76
860	534.38	535.00	535.62	536.24	536.86	537.49	538.11	538.73	539.35	539.97
870	540.59	541.21	541.83	542.46	543.08	543.70	544.32	544.94	545.56	546.18
880	546.81	547.43	548.05	548.67	549.29	549.91	550.53	551.16	551.78	552.40
890	553.02	553.64	554.26	554.88	555.50	556.13	556.75	557.37	557.99	558.61

LENGTHS—KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
900	559.23	559.85	560.48	561.10	561.72	562.34	562.96	563.58	564.20	564.83
910	565.45	566.07	566.69	567.31	567.93	568.55	569.17	569.80	570.42	571.04
920	571.66	572.28	572.90	573.52	574.15	574.77	575.39	576.01	576.63	577.25
930	577.87	578.50	579.12	579.74	580.35	580.98	581.60	582.22	582.85	583.47
940	584.09	584.71	585.33	585.95	586.57	587.19	587.82	588.44	589.06	589.68
950	590.30	590.92	591.54	592.17	592.79	593.41	594.03	594.65	595.27	595.89
960	596.52	597.14	597.76	598.38	599.00	599.62	600.24	600.86	601.49	602.11
970	602.73	603.35	603.97	604.59	605.21	605.84	606.46	607.08	607.70	608.32
980	608.94	609.56	610.19	610.81	611.43	612.05	612.67	613.29	613.91	614.53
990	615.16	615.78	616.40	617.02	617.64	618.26	618.88	619.51	620.13	620.75

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CAPACITIES—LITERS TO LIQUID QUARTS

From 1 *to* 1,000 *Units*

Reduction factor: 1 liter = 1.056710 liquid quarts (U. S.)

The values found in the body of the table give, in liquid quarts, the capacities indicated in liters at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	.	1.0567	2 1134	3.1701	4.2268	5.2836	6.3403	7.3970	8.4537	9.5104
10	10.567	11.624	12.681	13.737	14.794	15.851	16.907	17.964	19.021	20.077
20	21.134	22.191	23.248	24 304	25.361	26.418	27.474	28.531	29.588	30.645
30	31.701	32.758	33.815	34.871	35.928	36.985	38 042	39.098	40.155	41.212
40	42.268	43.325	44.382	45.439	46.495	47.552	48.609	49.665	50.722	51.779
50	52.836	53.892	54 949	56.006	57.062	58.119	59.176	60 232	61.289	62 346
60	63.403	64.459	65.516	66.573	67.629	68.686	69.743	70.800	71.856	72.913
70	73.970	75.026	76.083	77.140	78.197	79.253	80.310	81.367	82.423	83.480
80	84.537	85.594	86 650	87 707	88.764	89 820	90.877	91 934	92 990	94.047
90	95.104	96.161	97.217	98.274	99.331	100 39	101 44	102 50	103.56	104 61

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	105.67	106 73	107.78	108.84	109.90	110 95	112.01	113.07	114 12	115.18
110	116.24	117 29	118.35	119.41	120.46	121.52	122.58	123.64	124.69	125.75
120	126.81	127.86	128.92	129 98	131.03	132.09	133.15	134.20	135.26	136.32
130	137.37	138.43	139.49	140.54	141.60	142.66	143.71	144.77	145.83	146.88
140	147.94	149.00	150.05	151.11	152.17	153.22	154 28	155.34	156.39	157.45
150	158 51	159 56	160 62	161.68	162.73	163 79	164 85	165.90	166.96	168.02
160	169 07	170.13	171 19	172 24	173.30	174.36	175.41	176.47	177 53	178.58
170	179 64	180 70	181 75	182 81	183.87	184 92	185.98	187.04	188.09	189 15
180	190.21	191 26	192 32	193 38	194.43	195 49	196.55	197.60	198.66	199.72
190	200.77	201 83	202 89	203.95	205.00	206.06	207.12	208.17	209.23	210.29
200	211 34	212 40	213 46	214.51	215.57	216.63	217 68	218.74	219.80	220.85
210	221.91	222 97	224 02	225.08	226.14	227.19	228.25	229 31	230.36	231.42
220	232.48	233.53	234.59	235 65	236.70	237.76	238 82	239 87	240.93	241.99
230	243.04	244 10	245.16	246.21	247.27	248 33	249.38	250.44	251.50	252.55
240	253.61	254.67	255.72	256 78	257 84	258.89	259.95	261.01	262.06	263.12
250	264 18	265 23	266.29	267.35	268.40	269 46	270 52	271.57	272.63	273.69
260	274 74	275 80	276 86	277 91	278 97	280.03	281 08	282.14	283.20	284.25
270	285 31	286 37	287 43	288 48	289.54	290.60	291.65	292.71	293 77	294.82
280	295 88	296 94	297 99	299 05	300 11	301 16	302 22	303.28	304.33	305.39
290	306 45	307.50	308 56	309 62	310 67	311.73	312 79	313.84	314 90	315.96

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	317 01	318.07	319 13	320 18	321.24	322 30	323.35	324.41	325 47	326.52
310	327.58	328 64	329 69	330 75	331 81	332 86	333.92	334 98	336 03	337 09
320	338 15	339.20	340.26	341.32	342 37	343 43	344.49	345 54	346 60	347 66
330	348.71	349.77	350.83	351.88	352.94	354 00	355 05	356 11	357 17	358 22
340	359 28	360 34	361.39	362.45	363 51	364 56	365 62	366 68	367.74	368 79
350	369 85	370 91	371 96	373 02	374 08	375 13	376 19	377 25	378 30	379 36
360	380.42	381.47	382.53	383.59	384.64	385.70	386 76	387 81	388 87	389.93
370	390.98	392 04	393 10	394 15	395 21	396.27	397 32	398 38	399 44	400 49
380	401 55	402 61	403 66	404.72	405.78	406.83	407 89	408.95	410.00	411 06
390	412 12	413.17	414 23	415.29	416.34	417 40	418.46	419.51	420.57	421 63
400	422.68	423.74	424 80	425.85	426.91	427.97	429.02	430.08	431 14	432 19
410	433 25	434.31	435.36	436 42	437 48	438 53	439 59	440 65	441.70	442 76
420	443 82	444.87	445.93	446.99	448.05	449 10	450.16	451.22	452.27	453.33
430	454 39	455.44	456 50	457 56	458 61	459 67	460 73	461 78	462.84	463 90
440	464 95	466.01	467 07	468 12	469.18	470 24	471.29	472 35	473.41	474.46
450	475 52	476 58	477 63	478 69	479 75	480 80	481 86	482 92	483.97	485.03
460	486 09	487 14	488 20	489.26	490.31	491 37	492.43	493.48	494.54	495 60
470	496 65	497 71	498.77	499 82	500 88	501 94	502 99	504.05	505.11	506.16
480	507.22	508 28	509.33	510.39	511.45	512 50	513 56	514 62	515 67	516.73
490	517 79	518.84	519 90	520 96	522 01	523 07	524 13	525 18	526 24	527 30

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	528 36	529 41	530 47	531 53	532 58	533 64	534.70	535 75	536 81	537 87
510	538.92	539.98	541 04	542 09	543.15	544 21	545 26	546 32	547.38	548 43
520	549.49	550.55	551 60	552 66	553.72	554 77	555 83	556.89	557.94	559.00
530	560 06	561.11	562 17	563 23	564 28	565 34	566.40	567.45	568.51	569.57
540	570 62	571.68	572 74	573 79	574 85	575 91	576 96	578.02	579 08	580.13
550	581 19	582 25	583 30	584 36	585 42	586 47	587 53	588 59	589.64	590.70
560	591 76	592 81	593 87	594 93	595.98	597 04	598 10	599 15	600.21	601.27
570	602 32	603 38	604 44	605 49	606 55	607 61	608 66	609 72	610 78	611.84
580	612.89	613 95	615 01	616 06	617 12	618 18	619 23	620 29	621.35	622 40
590	623 46	624.52	625 57	626 63	627 69	628 74	629 80	630 86	631.91	632 97
600	634.03	635 08	636.14	637 20	638 25	639.31	640 37	641 42	642.48	643.54
610	644.59	645 65	646 71	647 76	648 82	649 88	650.93	651.99	653.05	654.10
620	655 16	656.22	657 27	658 33	659 39	660 44	661.50	662.56	663.61	664.67
630	665 73	666 78	667 84	668 90	669.95	671.01	672 07	673 12	674.18	675.24
640	676 29	677 35	678 41	679 46	680.52	681 58	682 63	683.69	684.75	685.80
650	686 86	687 92	688 97	690 03	691 09	692 15	693 20	694 26	695.32	696 37
660	697.43	698 49	699 54	700 60	701 66	702 71	703 77	704.83	705.88	706.94
670	708.00	709 05	710 11	711 17	712 22	713 28	714.34	715 39	716.45	717.51
680	718.56	719 62	720 68	721 73	722 79	723.85	724 90	725.96	727.02	728 07
690	729.13	730.19	731 24	732 30	733 36	734 41	735.47	736 53	737.58	738 64

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	739 70	740 75	741 81	742.87	743 92	744 98	746 04	747.09	748 15	749 21
710	750.26	751.32	752 38	753 43	754 49	755 55	756 60	757 66	758 72	759.77
720	760.83	761 89	762 94	764.00	765 06	766 11	767 17	768.23	769 28	770.34
730	771.40	772 46	773 51	774.57	775.63	776 68	777 74	778 80	779 85	780.91
740	781 97	783.02	784.08	785.14	786 19	787 25	788 31	789.36	790.42	791.48
750	792.53	793 59	794 65	795.70	796.76	797 82	798 87	799.93	800 99	802 04
760	803.10	804 16	805 21	806 27	807.33	808.38	809 44	810.50	811 55	812.61
770	813.67	814 72	815 78	816.84	817.89	818 95	820 01	821 06	822.12	823.18
780	824.23	825.29	826 35	827 40	828.46	829.52	830 57	831 63	832.69	833.74
790	834.80	835 86	836.91	837.97	839.03	840.08	841 14	842.20	843 25	844 31
800	845.37	846 42	847.48	848.54	849 59	850.65	851 71	852.76	853 82	854.88
810	855.94	856 99	858.05	859.11	860.16	861.22	862.28	863.33	864.39	865 45
820	866.50	867 56	868.62	869 67	870.73	871.79	872 84	873.90	874 96	876 01
830	877.07	878.13	879 18	880 24	881.30	882.35	883 41	884 47	885.52	886 58
840	887.64	888.69	889.75	890 81	891 86	892.92	893 98	895.03	896.09	897 15
850	898.20	899 26	900.32	901 37	902 43	903 49	904 54	905.60	906.66	907.71
860	908.77	909.83	910 88	911.94	913 00	914 05	915 11	916 17	917.22	918.28
870	919 34	920.39	921.45	922.51	923.56	924.62	925 68	926.73	927.79	928.85
880	929.90	930 96	932.02	933.07	934 13	935 19	936.25	937.30	938.36	939.42
890	940 47	941.53	942 59	943.64	944 70	945.76	946.81	947.87	948.93	949 98

CAPACITIES—LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	951.04	952.10	953.15	954.21	955.27	956.32	957.38	958.44	959.49	960.55
910	961.61	962.66	963.72	964.78	965.83	966.89	967.95	969.00	970.06	971.12
920	972.17	973.23	974.29	975.34	976.40	977.46	978.51	979.57	980.63	981.68
930	982.74	983.80	984.85	985.91	986.97	988.02	989.08	990.14	991.19	992 25
940	993.31	994.36	995.42	996.48	997.53	998.59	999.65	1,000.7	1,001.8	1,002.8
950	1,003.9	1,004.9	1,006.0	1,007.0	1,008.1	1,009.2	1,010.2	1,011.3	1,012.3	1,013.4
960	1,014.4	1,015.5	1,016.6	1,017.6	1,018.7	1,019.7	1,020.8	1,021.8	1,022.9	1,024.0
970	1,025.0	1,026.1	1,027.1	1,028.2	1,029.2	1,030.3	1,031.3	1,032.4	1,033.5	1,034.5
980	1,035.6	1,036.6	1,037.7	1,038.7	1,039.8	1,040.9	1,041.9	1,043.0	1,044.0	1,045.1
990	1,046.1	1,047.2	1,048.3	1,049.3	1,050.4	1,051.4	1,052.5	1,053.5	1,054.6	1,055.7

*

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS

From 1 *to* 1,000 *Units*

Reduction factor: 1 kilogram = 2.204622341 avoirdupois pounds

The values found in the body of the table give, in avoirdupois pounds, the weights indicated in kilograms at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	. .....	2.2046	4.4092	6.6139	8.8185	11.023	13.228	15.432	17.637	19.842
10	22.046	24.251	26.455	28.660	30.865	33.069	35.274	37.479	39.683	41.888
20	44.092	46.297	48.502	50.706	52.911	55.116	57.320	59.525	61.729	63.934
30	66.139	68.343	70.548	72.753	74.957	77.162	79.366	81.571	83.776	85.980
40	88.185	90.390	92.594	94.799	97.003	99.208	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.84	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.23	209.44	211.64	213.85	216.05	218.26

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	220.46	222.67	224.87	227.08	229.28	231.49	233.69	235.89	238.10	240.30
110	242.51	244.71	246.92	249.12	251.33	253.53	255.74	257.94	260.15	262.35
120	264.55	266.76	268.96	271.17	273.37	275.58	277.78	279.99	282.19	284.40
130	286.60	288.81	291.01	293.21	295.42	297.62	299.83	302.03	304.24	306.44
140	308.65	310.85	313.06	315.26	317.47	319.67	321.87	324.08	326.28	328.49
150	330.69	332.90	335.10	337.31	339.51	341.72	343.92	346.13	348.33	350.54
160	352.74	354.94	357.15	359.35	361.56	363.76	365.97	368.17	370.38	372.58
170	374.79	376.99	379.20	381.40	383.60	385.81	388.01	390.22	392.42	394.63
180	396.83	399.04	401.24	403.45	405.65	407.86	410.06	412.26	414.47	416.67
190	418.88	421.08	423.29	425.49	427.70	429.90	432.11	434.31	436.52	438.72
200	440.92	443.13	445.33	447.54	449.74	451.95	454.15	456.36	458.56	460.77
210	462.97	465.18	467.38	469.58	471.79	473.99	476.20	478.40	480.61	482.81
220	485.02	487.22	489.43	491.63	493.84	496.04	498.24	500.45	502.65	504.86
230	507.06	509.27	511.47	513.68	515.88	518.09	520.29	522.50	524.70	526.90
240	529.11	531.31	533.52	535.72	537.93	540.13	542.34	544.54	546.75	548.95
250	551.16	553.36	555.56	557.77	559.97	562.18	564.38	566.59	568.79	571.00
260	573.20	575.41	577.61	579.82	582.02	584.22	586.43	588.63	590.84	593.04
270	595.25	597.45	599.66	601.86	604.07	606.27	608.48	610.68	612.89	615.09
280	617.29	619.50	621.70	623.91	626.11	628.32	630.52	632.73	634.93	637.14
290	639.34	641.55	643.75	645.95	648.16	650.36	652.57	654.77	656.98	659.18

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	661.39	663.59	665.80	668.00	670.21	672.41	674.61	676.82	679.02	681.23
310	683.43	685.64	687.84	690.05	692.25	694.46	696.66	698.87	701.07	703.27
320	705.48	707.68	709.89	712.09	714.30	716.50	718.71	720.91	723.12	725.32
330	727.53	729.73	731.93	734.14	736.34	738.55	740.75	742.96	745.16	747.37
340	749.57	751.78	753.98	756.19	758.39	760.59	762.80	765.00	767.21	769.41
350	771.62	773.82	776.03	778.23	780.44	782.64	784.85	787.05	789.25	791.46
360	793.66	795.87	798.07	800.28	802.48	804.69	806.89	809.10	811.30	813.51
370	815.71	817.91	820.12	822.32	824.53	826.73	828.94	831.14	833.35	835.55
380	837.76	839.96	842.17	844.37	846.58	848.78	850.98	853.19	855.39	857.60
390	859.80	862.01	864.21	866.42	868.62	870.83	873.03	875.24	877.44	879.64
400	881.85	884.05	886.26	888.46	890.67	892.87	895.08	897.28	899.49	901.69
410	903.90	906.10	908.30	910.51	912.71	914.92	917.12	919.33	921.53	923.74
420	925.94	928.15	930.35	932.56	934.76	936.96	939.17	941.37	943.58	945.78
430	947.99	950.19	952.40	954.60	956.81	959.01	961.22	963.42	965.62	967.83
440	970.03	972.24	974.44	976.65	978.85	981.06	983.26	985.47	987.67	989.88
450	992.08	994.28	996.49	998.69	1,000.9	1,003.1	1,005.3	1,007.5	1,009.7	1,011.9
460	1,014.1	1,016.3	1,018.5	1,020.7	1,022.9	1,025.1	1,027.4	1,029.6	1,031.8	1,034.0
470	1,036.2	1,038.4	1,040.6	1,042.8	1,045.0	1,047.2	1,049.4	1,051.6	1,053.8	1,056.0
480	1,058.2	1,060.4	1,062.6	1,064.8	1,067.0	1,069.2	1,071.4	1,073.7	1,075.9	1,078.1
490	1,080.3	1,082.5	1,084.7	1,086.9	1,089.1	1,091.3	1,093.5	1,095.7	1,097.9	1,100.1

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	1,102.3	1,104.5	1,106.7	1,108.9	1,111.1	1,113.3	1,115.5	1,117.7	1,119.9	1,122.2
510	1,124.4	1,126.6	1,128.8	1,131.0	1,133.2	1,135.4	1,137.6	1,139.8	1,142.0	1,144.2
520	1,146.4	1,148.6	1,150.8	1,153.0	1,155.2	1,157.4	1,159.6	1,161.8	1,164.0	1,166.2
530	1,168.4	1,170.7	1,172.9	1,175.1	1,177.3	1,179.5	1,181.7	1,183.9	1,186.1	1,188.3
540	1,190.5	1,192.7	1,194.9	1,197.1	1,199.3	1,201.5	1,203.7	1,205.9	1,208.1	1,210.3
550	1,212.5	1,214.7	1,217.0	1,219.2	1,221.4	1,223.6	1,225.8	1,228.0	1,230.2	1,232.4
560	1,234.6	1,236.8	1,239.0	1,241.2	1,243.4	1,245.6	1,247.8	1,250.0	1,252.2	1,254.4
570	1,256 6	1,258.8	1,261.0	1,263.2	1,265.5	1,267.7	1,269.9	1,272.1	1,274.3	1,276.5
580	1,278.7	1,280.9	1,283 1	1,285.3	1,287.5	1,289.7	1,291.9	1,294.1	1,296.3	1,298.5
590	1,300.7	1,302.9	1,305.1	1,307.3	1,309.5	1,311.8	1,314.0	1,316.2	1,318.4	1,320.6
600	1,322.8	1,325.0	1,327.2	1,329.4	1,331.6	1,333.8	1,336.0	1,338.2	1,340.4	1,342.6
610	1,344.8	1,347.0	1,349.2	1,351.4	1,353.6	1,355.8	1,358.0	1,360.3	1,362.5	1,364.7
620	1,366.9	1,369.1	1,371.3	1,373.5	1,375.7	1,377.9	1,380.1	1,382.3	1,384.5	1,386.7
630	1,388.9	1,391.1	1,393.3	1,395.5	1,397.7	1,399.9	1,402.1	1,404.3	1,406.5	1,408.8
640	1,411.0	1,413.2	1,415.4	1,417.6	1,419.8	1,422.0	1,424.2	1,426.4	1,428.6	1,430.8
650	1,433.0	1,435.2	1,437.4	1,439.6	1,441.8	1,444.0	1,446.2	1,448.4	1,450.6	1,452.8
660	1,455.1	1,457.3	1,459.5	1,461.7	1,463.9	1,466.1	1,468.3	1,470.5	1,472.7	1,474.9
670	1,477.1	1,479.3	1,481.5	1,483.7	1,485.9	1,488.1	1,490.3	1,492.5	1,494.7	1,496.9
680	1,499.1	1,501.3	1,503.6	1,505.8	1,508.0	1,510.2	1,512.4	1,514.6	1,516.8	1,519.0
690	1,521.2	1,523.4	1,525.6	1,527.8	1,530.0	1,532.2	1,534.4	1,536.6	1,538.8	1,541.0

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	1,543.2	1,545.4	1,547.6	1.549.8	1,552.1	1,554.3	1,556.5	1,558.7	1,560.9	1,563.1
710	1,565.3	1,567.5	1,569.7	1,571.9	1,574.1	1,576.3	1,578.5	1,580.7	1,582.9	1,585.1
720	1,587.3	1,589.5	1,591.7	1,593.9	1,596.1	1,598.4	1,600.6	1,602.8	1,605.0	1,607.2
730	1,609.4	1,611.6	1,613.8	1,616.0	1,618.2	1,620.4	1,622.6	1,624.8	1,627.0	1,629.2
740	1,631.4	1,633.6	1,635.8	1,638.0	1,640.2	1,642.4	1,644.6	1,646.9	1,649.1	1,651.3
750	1,653.5	1,655.7	1,657.9	1,660.1	1,662.3	1,664.5	1,666.7	1,668.9	1,671.1	1,673.3
760	1,675.5	1,677.7	1,679.9	1,682.1	1,684.3	1,686.5	1,688.7	1,690.9	1,693.2	1,695.4
770	1,697.6	1,699.8	1,702.0	1,704.2	1,706.4	1,708.6	1,710.8	1,713.0	1,715.2	1,717.4
780	1,719.6	1,721.8	1,724.0	1,726.2	1,728.4	1,730.6	1,732.8	1,735.0	1,737.2	1,739.4
790	1,741.7	1,743.9	1,746.1	1,748.3	1,750.5	1,752.7	1,754.9	1,757.1	1,759.3	1,761.5
800	1,763.7	1,765.9	1,768.1	1,770.3	1,772.5	1,774.7	1,776.9	1,779.1	1,781.3	1,783.5
810	1,785.7	1,787.9	1,790.2	1,792.4	1,794.6	1,796.8	1,799.0	1,801.2	1,803.4	1,805.6
820	1,807.8	1,810.0	1,812.2	1,814.4	1,816.6	1,818.8	1,821.0	1,823.2	1,825.4	1,827.6
830	1,829.8	1,832.0	1,834.2	1,836.5	1,838.7	1,840.9	1,843.1	1,845.3	1,847.5	1,849.7
840	1,851.9	1,854.1	1,856.3	1,858.5	1,860.7	1,862.9	1,865.1	1,867.3	1,869.5	1,871.7
850	1,873.9	1,876.1	1,878.3	1,880.5	1,882.7	1,885.0	1,887.2	1,889.4	1,891.6	1,893.8
860	1,896.0	1,898.2	1,900.4	1,902.6	1,904.8	1,907.0	1,909.2	1,911.4	1,913.6	1,915.8
870	1,918.0	1,920.2	1,922.4	1,924.6	1,926.8	1,929.0	1,931.2	1,933.5	1,935.7	1,937.9
880	1,940.1	1,942.3	1,944.5	1,946.7	1,948.9	1,951.1	1,953.3	1,955.5	1,957.7	1,959.9
890	1,962.1	1,964.3	1,966.5	1,968.7	1,970.9	1,973.1	1,975.3	1,977.5	1,979.8	1,982.0

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	1,984.2	1,986.4	1,988.6	1,990.8	1,993.0	1,995.2	1,997.4	1,999.6	2,001.8	2,004.0
910	2,006.2	2,008 4	2,010.6	2,012.8	2,015.0	2,017.2	2,019.4	2,021.6	2,023.8	2,026.0
920	2,028.3	2,030.5	2,032.7	2,034.9	2,037.1	2,039.3	2,041.5	2,043.7	2,045.9	2,048.1
930	2,050.3	2,052.5	2,054.7	2,056.9	2,059.1	2,061.3	2,063.5	2,065.7	2,067.9	2,070.1
940	2,072.3	2,074.5	2,076.8	2,079.0	2,081.2	2,083.4	2,085.6	2,087.8	2,090.0	2,092.2
950	2,094.4	2,096.6	2,098.8	2,101.0	2,103.2	2,105.4	2,107.6	2,109.8	2,112.0	2,114.2
960	2,116.4	2,118.6	2,120.8	2,123.1	2,125.3	2,127.5	2,129.7	2,131.9	2,134.1	2,136.3
970	2,138.5	2,140.7	2,142.9	2,145.1	2,147.3	2,149.5	2,151.7	2,153.9	2,156.1	2,158.3
980	2,160.5	2,162.7	2,164.9	2,167.1	2,169.3	2,171.6	2,173.8	2,176.0	2,178.2	2,180.4
990	2,182.6	2,184.8	2,187.0	2,189.2	2,191.4	2,193.6	2,195.8	2,198.0	2,200.2	2,202.4

CONVERSION OF THERMOMETER SCALES

By I. Gottfried

1

FAHRENHEIT TO CENTIGRADE (WITH CONSTANT, 32.F.) (FROM 1.F. TO 9999.F.)

F.	C.	F.	C.	F.	C.	F.	C.
1	−17.22	10	−12.22	100	37.78	1000	537.78
2	−16.67	20	− 6.67	200	93.33	2000	1093.33
3	−16.11	30	− 1 11	300	148.89	3000	1648.89
4	−15.56	40	+ 4.44	400	204.44	4000	2204.44
5	−15	50	10	500	260	5000	2760
6	−14.44	60	15.56	600	315.56	6000	3315.56
7	−13.89	70	21.11	700	371.11	7000	3871.11
8	−13.33	80	26.67	800	426.67	8000	4426.67
9	−12.78	90	32.22	900	482.22	9000	4982.22

2

FAHRENHEIT TO CENTIGRADE (WITHOUT CONSTANT)

F.	C.	F.	C.	F.	C.	F.	C.
1	56	10	5.56	100	55.56	1000	555.56
2	1.11	20	11.11	200	111.11	2000	1111.11
3	1.67	30	16.67	300	166.67	3000	1666.67
4	2.22	40	22.22	400	222.22	4000	2222.22
5	2.78	50	27.78	500	277.78	5000	2777.78
6	3.33	60	33.33	600	333.33	6000	3333.33
7	3.89	70	38.89	700	388.89	7000	3888.89
8	4.44	80	44.44	800	444.44	8000	4444.44
9	5 00	90	50.00	900	500.00	9000	5000.00

TO CONVERT DEGREES FAHRENHEIT TO DEGREES CENTIGRADE

Use the first table for one of the digits, and the second table for the others; then add.

Examples: To find the Centigrade equivalent for 35.F.

30 = 16.67(2) 30 = −1.11(1)
5 = −15 (1) or, 5 = 2.78(2)
35 F = 1.67.C 35.F = 1.67.C

To find the C. equivalent for 355.F. and 5445.F.

300 148.89(1)
50 27.78(2) or,
5 2.78(2)
355.F 179.45.C

CONVERSION OF THERMOMETER SCALES (Continued)

300	166.67(2)	5000	2760 (1)
50	10 (1)	400	222.22(2)
5	2.78(2)	40	22.22(2)
355.F. =	179.45.C.	5	2.78(2)
		5445.F. =	3007.22.C.

1

Centigrade to Fahrenheit (With Constant 32.F.)

C.	F.	C.	F.	C.	F	C.	F.
				000	32		
1	33.8	10	50	100	212	1000	1832
2	35.6	20	68	200	392	2000	3632
3	37.4	30	86	300	572	3000	5432
4	39.2	40	104	400	752	4000	7232
5	41	50	122	500	932	5000	9032
6	42.8	60	140	600	1112		
7	44.6	70	158	700	1292		
8	46.4	80	176	800	1472		
9	48.2	90	194	900	1652		

2

Centigrade to Fahrenheit (Without Constant)

C.	F.	C.	F.	C.	F.	C.	F.
1	1.8	10	18	100	180	1000	1800
2	3.6	20	36	200	360	2000	3600
3	5.4	30	54	300	540	3000	5400
4	7.2	40	72	400	720	4000	7200
5	9.0	50	90	500	900	5000	9000
6	10 8	60	108	600	1080		
7	12.6	70	126	700	1260		
8	14.4	80	144	800	1440		
9	16.2	90	162	900	1620		

CONVERSION OF THERMOMETER SCALES
(Continued)

To Convert Degrees Centigrade to Degrees Fahrenheit

Use the first table for one digit, and the second table for the others; then add.

Examples: To find the Fahrenheit equivalents for 15.C.; 155.C.; and 5432.C.

10	= 50(1)		18(2)
5	= 9(2)	or,	41(1)
15.C.	= 59.F.		59.F.

100	= 212(1)		= 180(2)
50	= 90(2)	or,	= 90(2)
5	= 9(2)		41(1)
155.C.	= 311.F		= 311.F.

5000	= 9000(2)		= 9000(2)
400	= 720(2)	or,	= 752(1)
30	= 54(2)		= 54(2)
2	= 35.6(1)		= 3.6(2)
5432 C.	= 9809.6 F.		= 9809.6.F.

THERMOMETER SCALES

Corrections to Reduce Gas Thermometer Temperature to Thermodynamic Scale.

The values below are corrections to be applied to temperatures determined by the gas thermometer indicated to give temperatures in the thermodynamic centigrade scale for an initial pressure of 100 cm.

Temp. °C	Corrections in °C					
	Constant Volume			Constant Pressure		
	Hydrogen	Nitrogen	Helium	Hydrogen	Nitrogen	Helium
+1200		+1.0			+2.3	
1000		+0.7			+1.8	
800		+ .5			+1.3	
600		+ .3			+0.9	
500		+ .2			+ .7	
450		+ .17	+0.05		+ .6	+0.008
400		+ .14	+ .04		+ .5	+ 006
350		+ .10	+ .03		+ .4	+ .005
300		+ .07	+ .02	+0.04	+ .3	+ .003
250		+ .04	+ .01	+ .03	+ .2	+ .002
200	+0.02	+ .02	+ .006	+ .02	+ .12	+ .001
150	+ .01	+ .01	+ .002	+ .01	+ .05	+ .001
100	.000	.000	.000	.000	.00	.000
75	− .001	− .005	− .001	− .003	− .02	.000
50	− .002	− .010	− .001	− .004	− .03	.000
+ 25	− .001	− .008	− .001	− .003	− .02	− .001
0	.000	.00	.000	.000	.00	.000
− 50	+ .005	+ .03	+ .002	+ .02	+ .12	+ .002
− 100	+ .015	+ .06	+ .005	+ .04	+ .4	+ .005
− 150	+ .03	+ .2	+ .01	+ .1	+1.3	+ .02
− 200	+ .06	+ .5	+ .02	+ .3		+ .04
− 250	+ .12		+ .04			

THERMOMETER SCALES (Continued)

Corrections to reduce Liquid in Glass to Standard Thermodynamic Scale.

Temp. °C	Corrections in °C					
	Mercury in			Pentane in Jena 16III	Alcohol in verre dur	Toluene in verre dur
	Jena 16III	Jena 59III	Jena 1565III			
—190				-23 4		
—180				-21 0		
—170				- -18 6		
—160				—16 2		
—150				—13 9		
—140				11 6		
—130				- 9 4		
—120				- 7 3		
—110				- 5 3		
—100				— 3 4		
— 90				— 1 7		
— 80				— 0 2		0 0
— 78 5				0 0	0 0	0.0
— 70				+ 1 0	+0 3	+ .4
— 60				+ 2 0	+ 6	+ .8
— 50				+ 2 6	+ 7	+1 1
— 40				+ 3.0	+ 9	+1.2
— 30	0 28	0 13		+ 2 9	+ 9	+1.2
— 20	.16	.07		+ 2 4	+ 8	+1.0
— 10	07	03		+ 1 5	+ 5	+0.6
0	00	00	0 00	0 0	0	0.0
+ 10	— 06	— 02	— 03	— 2 0		
20	— 09	— 04	— 05	— 4 4		
30	— 11	— 04	— 06	— 7 6	—3 6	
40	— 12	— 03	— 06			
50	— .12	— 03	— 05			
60	— 10	— 02	— 04			
70	— 08	— 01	— 03			
80	— 06	00	— 02			
90	— 03	+ .02	— 01			
100	.00	00	00			—24 4
120	+ 03	— 05	+ 06			
140	+ 02	— 16	+ 03			
160	— 02	— 31	— 13			
180	— 12	— 52	— 38			
200	— 29	— 84	— 90			
220	— 5	— 1 3	— 1 3			
240	— 9	— 1 9	— 1 8			
260	— 1 4	— 2 6	— 2 4			
280	— 2 0	— 3 4	— 3 1			
300	— 2 7	— 4 4	— 3 9			
320		— 5 8	— 4 8			
340		— 7 2	— 5 9			
360		— 8 8	— 7 3			
380		—10 6	— 8 9			
400		—12 6	—10 5			
420		—14 9	—12 4			
440		—17 4	—14 7			
460		—20 2	—17 2			
480		—23.3	—20 0			
500		—26.9	—23 1			
550			—32.			
600			—44.			
650			—58.			

*

TEMPERATURES — CENTIGRADE TO FAHRENHEIT

Conversion Table

The values in the body of the table give, in degrees Fahrenheit, the temperatures indicated in degrees Centigrade at the top and side.

1° C. = 1.8° F.

For temperatures below 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
0	+ 32.0	30.2	28.4	26.6	24.8	23.0	21.2	19.4	17.6	15.8
– 10	+ 14.0	12.2	10.4	8.6	6.8	5.0	3.2	+ 1.4	– 0.4	– 2.2
– 20	– 4.0	5.8	7.6	9.4	11.2	13.0	14.8	16.6	18.4	20.2
– 30	– 22.0	23.8	25.6	27.4	29.2	31.0	32.8	34.6	36.4	38.2
– 40	– 40.0	41.8	43.6	45.4	47.2	49.0	50.8	52.6	54.4	56.2
– 50	– 58.0	59.8	61.6	63.4	65.2	67.0	68.8	70.6	72.4	74.2
– 60	– 76.0	77.8	79.6	81.4	83.2	85.0	86.8	88.6	90.4	92.2
– 70	– 94.0	95.8	97.6	99.4	101.2	103.0	104.8	106.6	108.4	110.2
– 80	– 112.0	113.8	115.6	117.4	119.2	121.0	122.8	124.6	126.4	128.2
– 90	– 130.0	131.8	133.6	135.4	137.2	139.0	140.8	142.6	144.4	146.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
−100	−148.0	149.8	151.6	153.4	155.2	157.0	158.8	160.6	162.4	164.2
−110	−166.0	167.8	169.6	171.4	173.2	175.0	176.8	178.6	180.4	182.2
−120	−184.0	185.8	187.6	189 4	191.2	193.0	194.8	196.6	198.4	200.2
−130	−202.0	203.8	205.6	207.4	209.2	211.0	212.8	214.6	216.4	218.2
−140	−220.0	221.8	223.6	225.4	227.2	229.0	230.8	232.6	234.4	236.2
−150	−238.0	239.8	241.6	243.4	245.2	247.0	248.8	250.6	252.4	254.2
−160	−256.0	257.8	259.6	261.4	263.2	265.0	266 8	268.6	270.4	272.2
−170	−274.0	275.8	277.6	279.4	281.2	283.0	284.8	286.6	288.4	290.2
−180	−292 0	293.8	295.6	297.4	299.2	301.0	302.8	304.6	306.4	308.2
−190	−310.0	311.8	313.6	315.4	317.2	319.0	320.8	322.6	324.4	326.2
−200	−328.0	329.8	331.6	333.4	335.2	337.0	338.8	340.6	342.4	344.2
−210	−346.0	347.8	349.6	351.4	353.2	355.0	356.8	358.6	360.4	362.2
−220	−364.0	365.8	367.6	369.4	371.2	373.0	374.8	376.6	378.4	380.2
−230	−382.0	383.8	385.6	387.4	389.2	391.0	392.8	394.6	396.4	398.2
−240	−400.0	401.8	403.6	405.4	407.2	409.0	410.8	412.6	414.4	416.2
−250	−418.0	419.8	421.6	423.4	425.2	427.0	428.8	430.6	432.4	434.2
−260	−436.0	437.8	439.6	441.4	443.2	445.0	446.8	448.6	450.4	452.2
−270	−454.0	455.8	457.6	459.4	......	......	......	......	......	......

−273.18° C = −459.72° F. = absolute zero

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
0	32.0	33.8	35.6	37.4	39.2	41.0	42.8	44.6	46.4	48.2
10	50.0	51.8	53.6	55.4	57.2	59.0	60.8	62.6	64.4	66.2
20	68.0	69.8	71.6	73.4	75.2	77.0	78.8	80.6	82.4	84.2
30	86.0	87.8	89.6	91.4	93.2	95.0	96.8	98.6	100.4	102.2
40	104.0	105.8	107.6	109.4	111.2	113.0	114.8	116.6	118.4	120.2
50	122.0	123.8	125.6	127.4	129.2	131.0	132.8	134.6	136.4	138.2
60	140.0	141.8	143.6	145.4	147.2	149.0	150.8	152.6	154.4	156.2
70	158.0	159.8	161.6	163.4	165.2	167.0	168.8	170.6	172.4	174.2
80	176.0	177.8	179.6	181.4	183.2	185.0	186.8	188.6	190.4	192.2
90	194.0	195.8	197.6	199.4	201.2	203.0	204.8	206.6	208.4	210.2
100	212.0	213.8	215.6	217.4	219.2	221.0	222.8	224.6	226.4	228.2
110	230.0	231.8	233.6	235.4	237.2	239.0	240.8	242.6	244.4	246.2
120	248.0	249.8	251.6	253.4	255.2	257.0	258.8	260.6	262.4	264.2
130	266.0	267.8	269.6	271.4	273.2	275.0	276.8	278.6	280.4	282.2
140	284.0	285.8	287.6	289.4	291.2	293.0	294.8	296.6	298.4	300.2
150	302.0	303.8	305.6	307.4	309.2	311.0	312.8	314.6	316.4	318.2
160	320.0	321.8	323.6	325.4	327.2	329.0	330.8	332.6	334.4	336.2
170	338.0	339.8	341.6	343.4	345.2	347.0	348.8	350.6	352.4	354.2
180	356.0	357.8	359.6	361.4	363.2	365.0	366.8	368.6	370.4	372.2
190	374.0	375.8	377.6	379.4	381.2	383.0	384.8	386.6	388.4	390.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
200	392.0	393.8	395.6	397.4	399.2	401.0	402.8	404.6	406.4	408.2
210	410.0	411.8	413.6	415.4	417.2	419.0	420.8	422.6	424.4	426.2
220	428.0	429.8	431.6	433.4	435.2	437.0	438.8	440.6	442.4	444.2
230	446.0	447.8	449.6	451.4	453.2	455.0	456.8	458.6	460.4	462.2
240	464.0	465.8	467.6	469.4	471.2	473.0	474.8	476.6	478.4	480.2
250	482.0	483.8	485.6	487.4	489.2	491.0	492.8	494.6	496.4	498.2
260	500.0	501.8	503.6	505.4	507.2	509.0	510.8	512.6	514.4	516.2
270	518.0	519.8	521.6	523.4	525.2	527.0	528.8	530.6	532.4	534.2
280	536.0	537.8	539.6	541.4	543.2	545.0	546.8	548.6	550.4	552.2
290	554.0	555.8	557.6	559.4	561.2	563.0	564.8	566.6	568.4	570.2
300	572.0	573.8	575.6	577.4	579.2	581.0	582.8	584.6	586.4	588.2
310	590.0	591.8	593.6	595.4	597.2	599.0	600.8	602.6	604.4	606.2
320	608.0	609.8	611.6	613.4	615.2	617.0	618.8	620.6	622.4	624.2
330	626.0	627.8	629.6	631.4	633.2	635.0	636.8	638.6	640.4	642.2
340	644.0	645.8	647.6	649.4	651.2	653.0	654.8	656.6	658.4	660.2
350	662.0	663.8	665.6	667.4	669.2	671.0	672.8	674.6	676.4	678.2
360	680.0	681.8	683.6	685.4	687.2	689.0	690.8	692.6	694.4	696.2
370	698.0	699.8	701.6	703.4	705.2	707.0	708.8	710.6	712.4	714.2
380	716.0	717.8	719.6	721.4	723.2	725.0	726.8	728.6	730.4	732.2
390	734.0	735.8	737.6	739.4	741.2	743.0	744.8	746.6	748.4	750.2

For interpolation	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
400	752.0	753.8	755.6	757.4	759.2	761.0	762.8	764.6	766.4	768.2
410	770.0	771.8	773.6	775.4	777.2	779.0	780.8	782.6	784.4	786.2
420	788.0	789.8	791.6	793.4	795.2	797.0	798.8	800.6	802.4	804.2
430	806.0	807.8	809.6	811.4	813.2	815.0	816.8	818.6	820.4	822.2
440	824.0	825.8	827.6	829.4	831.2	833.0	834.8	836.6	838.4	840.2
450	842.0	843.8	845.6	847.4	849.2	851.0	852.8	854.6	856.4	858.2
460	860.0	861.8	863.6	865.4	867.2	869.0	870.8	872.6	874.4	876.2
470	878.0	879.8	881.6	883.4	885.2	887.0	888.8	890.6	892.4	894.2
480	896.0	897.8	899.6	901.4	903.2	905.0	906.8	908.6	910.4	912.2
490	914.0	915.8	917.6	919.4	921.2	923.0	924.8	926.6	928.4	930.2
500	932.0	933.8	935.6	937.4	939.2	941.0	942.8	944.6	946.4	948.2
510	950.0	951.8	953.6	955.4	957.2	959.0	960.8	962.6	964.4	966.2
520	968.0	969.8	971.6	973.4	975.2	977.0	978.8	980.6	982.4	984.2
530	986.0	987.8	989.6	991.4	993.2	995.0	996.8	998.6	1000.4	1002.2
540	1004.0	1005.8	1007.6	1009.4	1011.2	1013.0	1014.8	1016.6	1018.4	1020.2
550	1022.0	1023.8	1025.6	1027.4	1029.2	1031.0	1032.8	1034.6	1036.4	1038.2
560	1040.0	1041.8	1043.6	1045.4	1047.2	1049.0	1050.8	1052.6	1054.4	1056.2
570	1058.0	1059.8	1061.6	1063.4	1065.2	1067.0	1068.8	1070.6	1072.4	1074.2
580	1076.0	1077.8	1079.6	1081.4	1083.2	1085.0	1086.8	1088.6	1090.4	1092.2
590	1094.0	1095.8	1097.6	1099.4	1101.2	1103.0	1104.8	1106.6	1108.4	1110.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
600	1112.0	1113.8	1115.6	1117.4	1119.2	1121.0	1122.8	1124.6	1126.4	1128.2
610	1130.0	1131.8	1133.6	1135.4	1137.2	1139.0	1140.8	1142.6	1144.4	1146.2
620	1148.0	1149.8	1151.6	1153.4	1155.2	1157.0	1158.8	1160.6	1162.4	1164.2
630	1166.0	1167.8	1169.6	1171.4	1173.2	1175.0	1176.8	1178.6	1180.4	1182.2
640	1184.0	1185.8	1187.6	1189.4	1191.2	1193.0	1194.8	1196.6	1198.4	1200.2
650	1202.0	1203.8	1205.6	1207.4	1209.2	1211.0	1212.8	1214.6	1216.4	1218.2
660	1220.0	1221.8	1223.6	1225.4	1227.2	1229.0	1230.8	1232.6	1234.4	1236.2
670	1238.0	1239.8	1241.6	1243.4	1245.2	1247.0	1248.8	1250.6	1252.4	1254.2
680	1256.0	1257.8	1259.6	1261.4	1263.2	1265.0	1266.8	1268.6	1270.4	1272.2
690	1274.0	1275.8	1277.6	1279.4	1281.2	1283.0	1284.8	1286.6	1288.4	1290.2
700	1292.0	1293.8	1295.6	1297.4	1299.2	1301.0	1302.8	1304.6	1306.4	1308.2
710	1310.0	1311.8	1313.6	1315.4	1317.2	1319.0	1320.8	1322.6	1324.4	1326.2
720	1328.0	1329.8	1331.6	1333.4	1335.2	1337.0	1338.8	1340.6	1342.4	1344.2
730	1346.0	1347.8	1349.6	1351.4	1353.2	1355.0	1356.8	1358.6	1360.4	1362.2
740	1364.0	1365.8	1367.6	1369.4	1371.2	1373.0	1374.8	1376.6	1378.4	1380.2
750	1382.0	1383.8	1385.6	1387.4	1389.2	1391.0	1392.8	1394.6	1396.4	1398.2
760	1400.0	1401.8	1403.6	1405.4	1407.2	1409.0	1410.8	1412.6	1414.4	1416.2
770	1418.0	1419.8	1421.6	1423.4	1425.2	1427.0	1428.8	1430.6	1432.4	1434.2
780	1436.0	1437.8	1439.6	1441.4	1443.2	1445.0	1446.8	1448.6	1450.4	1452.2
790	1454.0	1455.8	1457.6	1459.4	1461.2	1463.0	1464.8	1466.6	1468.4	1470.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
800	1472.0	1473.8	1475.6	1477.4	1479.2	1481.0	1482.8	1484.6	1486.4	1488.2
810	1490.0	1491.8	1493.6	1495.4	1497.2	1499.0	1500.8	1502.6	1504.4	1506.2
820	1508.0	1509.8	1511.6	1513.4	1515.2	1517.0	1518.8	1520.6	1522 4	1524.2
830	1526.0	1527.8	1529.6	1531.4	1533.2	1535.0	1536.8	1538.6	1540 4	1542.2
840	1544.0	1545.8	1547.6	1549.4	1551.2	1553.0	1554.8	1556.6	1558.4	1560.2
850	1562.0	1563.8	1565.6	1567.4	1569.2	1571.0	1572.8	1574.6	1576.4	1578.2
860	1580.0	1581.8	1583.6	1585.4	1587.2	1589.0	1590.8	1592.6	1594.4	1596.2
870	1598.0	1599.8	1601.6	1603.4	1605.2	1607.0	1608.8	1610.6	1612.4	1614.2
880	1616.0	1617.8	1619.6	1621.4	1623.2	1625.0	1626.8	1628.6	1630.4	1632.2
890	1634.0	1635.8	1637.6	1639.4	1641.2	1643.0	1644.8	1646.6	1648.4	1650.2
900	1652.0	1653.8	1655.6	1657.4	1659.2	1661.0	1662.8	1664.6	1666.4	1668.2
910	1670.0	1671.8	1673.6	1675.4	1677.2	1679.0	1680.8	1682.6	1684.4	1686.2
920	1688.0	1689.8	1691.6	1693.4	1695.2	1697.0	1698.8	1700.6	1702.4	1704.2
930	1706.0	1707.8	1709.6	1711.4	1713.2	1715.0	1716.8	1718.6	1720.4	1722.2
940	1724.0	1725.8	1727.6	1729.4	1731.2	1733.0	1734.8	1736.6	1738.4	1740.2
950	1742.0	1743.8	1745.6	1747.4	1749.2	1751.0	1752.8	1754.6	1756.4	1758.2
960	1760.0	1761.8	1763.6	1765.4	1767.2	1769.0	1770.8	1772.6	1774.4	1776.2
970	1778.0	1779.8	1781.6	1783.4	1785.2	1787.0	1788.8	1790.6	1792.4	1794.2
980	1796.0	1797.8	1799.6	1801.4	1803.2	1805.0	1806.8	1808.6	1810.4	1812.2
990	1814.0	1815.8	1817.6	1819.4	1821.2	1823.0	1824.8	1826.6	1828.4	1830.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1000	1832.0	1833.8	1835.6	1837.4	1839.2	1841.0	1842.8	1844.6	1846.4	1848.2
1010	1850.0	1851.8	1853.6	1855.4	1857.2	1859.0	1860.8	1862.6	1864.4	1866.2
1020	1868.0	1869.8	1871.6	1873.4	1875.2	1877.0	1878.8	1880.6	1882.4	1884.2
1030	1886.0	1887.8	1889.6	1891.4	1893.2	1895.0	1896.8	1898.6	1900.4	1902.2
1040	1904.0	1905.8	1907.6	1909.4	1911.2	1913.0	1914.8	1916.6	1918.4	1920.2
1050	1922.0	1923.8	1925.6	1927.4	1929.2	1931.0	1932.8	1934.6	1936.4	1938.2
1060	1940.0	1941.8	1943.6	1945.4	1947.2	1949.0	1950.8	1952.6	1954.4	1956.2
1070	1958.0	1959.8	1961.6	1963.4	1965.2	1967.0	1968.8	1970.6	1972.4	1974.2
1080	1976.0	1977.8	1979.6	1981.4	1983.2	1985.0	1986.8	1988.6	1990.4	1992.2
1090	1994.0	1995.8	1997.6	1999.4	2001.2	2003.0	2004.8	2006.6	2008.4	2010.2
1100	2012.0	2013.8	2015.6	2017.4	2019.2	2021.0	2022.8	2024.6	2026.4	2028.2
1110	2030.0	2031.8	2033.6	2035.4	2037.2	2039.0	2040.8	2042.6	2044.4	2046.2
1120	2048.0	2049.8	2051.6	2053.4	2055.2	2057.0	2058.8	2060.6	2062.4	2064.2
1130	2066.0	2067.8	2069.6	2071.4	2073.2	2075.0	2076.8	2078.6	2080.4	2082.2
1140	2084.0	2085.8	2087.6	2089.4	2091.2	2093.0	2094.8	2096.6	2098.4	2100.2
1150	2102.0	2103.8	2105.6	2107.4	2109.2	2111.0	2112.8	2114.6	2116.4	2118.2
1160	2120.0	2121.8	2123.6	2125.4	2127.2	2129.0	2130.8	2132.6	2134.4	2136.2
1170	2138.0	2139.8	2141.6	2143.4	2145.2	2147.0	2148.8	2150.6	2152.4	2154.2
1180	2156.0	2157.8	2159.6	2161.4	2163.2	2165.0	2166.8	2168.6	2170.4	2172.2
1190	2174.0	2175.8	2177.6	2179.4	2181.2	2183.0	2184.8	2186.6	2188.4	2190.2

For Interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1200	2192.0	2193.8	2195.6	2197.4	2199.2	2201.0	2202.8	2204.6	2206.4	2208.2
1210	2210.0	2211.8	2213.6	2215.4	2217.2	2219.0	2220.8	2222.6	2224.4	2226.2
1220	2228.0	2229.8	2231.6	2233.4	2235.2	2237.0	2238.8	2240.6	2242.4	2244.2
1230	2246.0	2247.8	2249.6	2251.4	2253.2	2255.0	2256.8	2258.6	2260.4	2262.2
1240	2264.0	2265.8	2267.6	2269.4	2271.2	2273.0	2274.8	2276.6	2278.4	2280.2
1250	2282.0	2283.8	2285.6	2287.4	2289.2	2291.0	2292.8	2294.6	2296.4	2298.2
1260	2300.0	2301.8	2303.6	2305.4	2307.2	2309.0	2310.8	2312.6	2314.4	2316.2
1270	2318.0	2319.8	2321.6	2323.4	2325.2	2327.0	2328.8	2330.6	2332.4	2334.2
1280	2336.0	2337.8	2339.6	2341.4	2343.2	2345.0	2346.8	2348.6	2350.4	2352.2
1290	2354.0	2355.8	2357.6	2359.4	2361.2	2363.0	2364.8	2366.6	2368.4	2370.2
1300	2372.0	2373.8	2375.6	2377.4	2379.2	2381.0	2382.8	2384.6	2386.4	2388.2
1310	2390.0	2391.8	2393.6	2395.4	2397.2	2399.0	2400.8	2402.6	2404.4	2406.2
1320	2408.0	2409.8	2411.6	2413.4	2415.2	2417.0	2418.8	2420.6	2422.4	2424.2
1330	2426.0	2427.8	2429.6	2431.4	2433.2	2435.0	2436.8	2438.6	2440.4	2442.2
1340	2444.0	2445.8	2447.6	2449.4	2451.2	2453.0	2454.8	2456.6	2458.4	2460.2
1350	2462.0	2463.8	2465.6	2467.4	2469.2	2471.0	2472.8	2474.6	2476.4	2478.2
1360	2480.0	2481.8	2483.6	2485.4	2487.2	2489.0	2490.8	2492.6	2494.4	2496.2
1370	2498.0	2499.8	2501.6	2503.4	2505.2	2507.0	2508.8	2510.6	2512.4	2514.2
1380	2516.0	2517.8	2519.6	2521.4	2523.2	2525.0	2526.8	2528.6	2530.4	2532.2
1390	2534.0	2535.8	2537.6	2539.4	2541.2	2543.0	2544.8	2546.6	2548.4	2550.2

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1400	2552.0	2553.8	2555.6	2557.4	2559.2	2561.0	2562.8	2564.6	2566.4	2568.2
1410	2570.0	2571.8	2573.6	2575.4	2577.2	2579.0	2580.8	2582.6	2584.4	2586.2
1420	2588.0	2589.8	2591.6	2593.4	2595.2	2597.0	2598.8	2600.6	2602.4	2604.2
1430	2606.0	2607.8	2609.6	2611.4	2613.2	2615.0	2616.8	2618.6	2620.4	2622.2
1440	2624.0	2625.8	2627.6	2629.4	2631.2	2633.0	2634.8	2636.6	2638.4	2640.2
1450	2642.0	2643.8	2645.6	2647.4	2649.2	2651.0	2652.8	2654.6	2656.4	2658.2
1460	2660.0	2661.8	2663.6	2665.4	2667.2	2669.0	2670.8	2672.6	2674.4	2676.2
1470	2678.0	2679.8	2681.6	2683.4	2685.2	2687.0	2688.8	2690.6	2692.4	2694.2
1480	2696.0	2697.8	2699.6	2701.4	2703.2	2705.0	2706.8	2708.6	2710.4	2712.2
1490	2714.0	2715.8	2717.6	2719.4	2721.2	2723.0	2724.8	2726.6	2728.4	2730.2
1500	2732.0	2733.8	2735.6	2737.4	2739.2	2741.0	2742.8	2744.6	2746.4	2748.2
1510	2750.0	2751.8	2753.6	2755.4	2757.2	2759.0	2760.8	2762.6	2764.4	2766.2
1520	2768.0	2769.8	2771.6	2773.4	2775.2	2777.0	2778.8	2780.6	2782.4	2784.2
1530	2786.0	2787.8	2789.6	2791.4	2793.2	2795.0	2796.8	2798.6	2800.4	2802.2
1540	2804.0	2805.8	2807.6	2809.4	2811.2	2813.0	2814.8	2816.6	2818.4	2820.2
1550	2822.0	2823.8	2825.6	2827.4	2829.2	2831.0	2832.8	2834.6	2836.4	2838.2
1560	2840.0	2841.8	2843.6	2845.4	2847.2	2849.0	2850.8	2852.6	2854.4	2856.2
1570	2858.0	2859.8	2861.6	2863.4	2865.2	2867.0	2868.8	2870.6	2872.4	2874.2
1580	2876.0	2877.8	2879.6	2881.4	2883.2	2885.0	2886.8	2888.6	2890.4	2892.2
1590	2894.0	2895.8	2897.6	2899.4	2901.2	2903.0	2904.8	2906.6	2908.4	2910.2

For Interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1600	2912.0	2913.8	2915.6	2917.4	2919.2	2921.0	2922.8	2924.6	2926.4	2928.2
1610	2930.0	2931.8	2933.6	2935.4	2937.2	2939.0	2940.8	2942.6	2944.4	2946.2
1620	2948.0	2949.8	2951.6	2953.4	2955.2	2957.0	2958.8	2960.6	2962.4	2964.2
1630	2966.0	2967.8	2969.6	2971.4	2973.2	2975.0	2976.8	2978.6	2980.4	2982.2
1640	2984.0	2985.8	2987.6	2989.4	2991.2	2993.0	2994.8	2996.6	2998.4	3000.2
1650	3002.0	3003.8	3005.6	3007.4	3009.2	3011.0	3012.8	3014.6	3016.4	3018.2
1660	3020.0	3021.8	3023.6	3025.4	3027.2	3029.0	3030.8	3032.6	3034.4	3036.2
1670	3038.0	3039.8	3041.6	3043.4	3045.2	3047.0	3048.8	3050.6	3052.4	3054.2
1680	3056.0	3057.8	3059.6	3061.4	3063.2	3065.0	3066.8	3068.6	3070.4	3072.2
1690	3074.0	3075.8	3077.6	3079.4	3081.2	3083.0	3084.8	3086.6	3088.4	3090.2
1700	3092.0	3093.8	3095.6	3097.4	3099.2	3101.0	3102.8	3104.6	3106.4	3108.2
1710	3110.0	3111.8	3113.6	3115.4	3117.2	3119.0	3120.8	3122.6	3124.4	3126.2
1720	3128.0	3129.8	3131.6	3133.4	3135.2	3137.0	3138.8	3140.6	3142.4	3144.2
1730	3146.0	3147.8	3149.6	3151.4	3153.2	3155.0	3156.8	3158.6	3160.4	3162.2
1740	3164.0	3165.8	3167.6	3169.4	3171.2	3173.0	3174.8	3176.6	3178.4	3180.2
1750	3182.0	3183.8	3185.6	3187.4	3189.2	3191.0	3192.8	3194.6	3196.4	3198.2
1760	3200.0	3201.8	3203.6	3205.4	3207.2	3209.0	3210.8	3212.6	3214.4	3216.2
1770	3218.0	3219.8	3221.6	3223.4	3225.2	3227.0	3228.8	3230.6	3232.4	3234.2
1780	3236.0	3237.8	3239.6	3241.4	3243.2	3245.0	3246.8	3248.6	3250.4	3252.2
1790	3254.0	3255.8	3257.6	3259.4	3261.2	3263.0	3264.8	3266.6	3268.4	3270.2

TEMPERATURE CONVERSION—C TO F. (Continued)

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1800	3272.0	3273.8	3275.6	3277.4	3279.2	3281.0	3282.8	3284.6	3286.4	3288.2
1810	3290.0	3291.8	3293.6	3295.4	3297.2	3299.0	3300.8	3302.6	3304.4	3306.2
1820	3308.0	3309.8	3311.6	3313.4	3315.2	3317.0	3318.8	3320.6	3322.4	3324.2
1830	3326.0	3327.8	3329.6	3331.4	3333.2	3335.0	3336.8	3338.6	3340.4	3342.2
1840	3344.0	3345.8	3347.6	3349.4	3351.2	3353.0	3354.8	3356.6	3358.4	3360.2
1850	3362.0	3363.8	3365.6	3367.4	3369.2	3371.0	3372.8	3374.6	3376.4	3378.2
1860	3380.0	3381.8	3383.6	3385.4	3387.2	3389.0	3390.8	3392.6	3394.4	3396.2
1870	3398.0	3399.8	3401.6	3403.4	3405.2	3407.0	3408.8	3410.6	3412.4	3414.2
1880	3416.0	3417.8	3419.6	3421.4	3423.2	3425.0	3426.8	3428.6	3430.4	3432.2
1890	3434.0	3435.8	3437.6	3439.4	3441.2	3443.0	3444.8	3446.6	3448.4	3450.2
1900	3452.0	3453.8	3455.6	3457.4	3459.2	3461.0	3462.8	3464.6	3466.4	3468.2
1910	3470.0	3471.8	3473.6	3475.4	3477.2	3479.0	3480.8	3482.6	3484.4	3486.2
1920	3488.0	3489.8	3491.6	3493.4	3495.2	3497.0	3498.8	3500.6	3502.4	3504.2
1930	3506.0	3507.8	3509.6	3511.4	3513.2	3515.0	3516.8	3518.6	3520.4	3522.2
1940	3524.0	3525.8	3527.6	3529.4	3531.2	3533.0	3534.8	3536.6	3538.4	3540.2
1950	3542.0	3543.8	3545.6	3547.4	3549.2	3551.0	3552.8	3554.6	3556.4	3558.2
1960	3560.0	3561.8	3563.6	3565.4	3567.2	3569.0	3570.8	3572.6	3574.4	3576.2
1970	3578.0	3579.8	3581.6	3583.4	3585.2	3587.0	3588.8	3590.6	3592.4	3594.2
1980	3596.0	3597.8	3599.6	3601.4	3603.2	3605.0	3606.8	3608.6	3610.4	3612.2
1990	3614.0	3615.8	3617.6	3619.4	3621.2	3623.0	3624.8	3626.6	3628.4	3630.2
For interpolation	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2000	3632.0	3633.8	3635.6	3637.4	3639.2	3641.0	3642.8	3644.6	3646.4	3648.2
2010	3650.0	3651.8	3653.6	3655.4	3657.2	3659.0	3660.8	3662.6	3664.4	3666.2
2020	3668.0	3669.8	3671.6	3673.4	3675.2	3677.0	3678.8	3680.6	3682.4	3684.2
2030	3686.0	3687.8	3689.6	3691.4	3693.2	3695.0	3696.8	3698.6	3700.4	3702.2
2040	3704.0	3705.8	3707.6	3709.4	3711.2	3713.0	3714.8	3716.6	3718.4	3720.2
2050	3722.0	3723.8	3725.6	3727.4	3729.2	3731.0	3732.8	3734.6	3736.4	3738.2
2060	3740.0	3741.8	3743.6	3745.4	3747.2	3749.0	3750.8	3752.6	3754.4	3756.2
2070	3758.0	3759.8	3761.6	3763.4	3765.2	3767.0	3768.8	3770.6	3772.4	3774.2
2080	3776.0	3777.8	3779.6	3781.4	3783.2	3785.0	3786.8	3788.6	3790.4	3792.2
2090	3794.0	3795.8	3797.6	3799.4	3801.2	3803.0	3804.8	3806.6	3808.4	3810.2
2100	3812.0	3813.8	3815.6	3817.4	3819.2	3821.0	3822.8	3824.6	3826.4	3828.2
2110	3830.0	3831.8	3833.6	3835.4	3837.2	3839.0	3840.8	3842.6	3844.4	3846.2
2120	3848.0	3849.8	3851.6	3853.4	3855.2	3857.0	3858.8	3860.6	3862.4	3864.2
2130	3866.0	3867.8	3869.6	3871.4	3873.2	3875.0	3876.8	3878.6	3880.4	3882.2
2140	3884.0	3885.8	3887.6	3889.4	3891.2	3893.0	3894.8	3896.6	3898.4	3900.2
2150	3902.0	3903.8	3905.6	3907.4	3909.2	3911.0	3912.8	3914.6	3916.4	3918.2
2160	3920.0	3921.8	3923.6	3925.4	3927.2	3929.0	3930.8	3932.6	3934.4	3936.2
2170	3938.0	3939.8	3941.6	3943.4	3945.2	3947.0	3948.8	3950.6	3952.4	3954.2
2180	3956.0	3957.8	3959.6	3961.4	3963.2	3965.0	3966.8	3968.6	3970.4	3972.2
2190	3974.0	3975.8	3977.6	3979.4	3981.2	3983.0	3984.8	3986.6	3988.4	3990.2

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2200	3992.0	3993.8	3995.6	3997.4	3999.2	4001.0	4002.8	4004.6	4006.4	4008.2
2210	4010.0	4011.8	4013.6	4015.4	4017.2	4019.0	4020.8	4022.6	4024.4	4026.2
2220	4028.0	4029.8	4031.6	4033.4	4035.2	4037.0	4038.8	4040.6	4042.4	4044.2
2230	4046.0	4047.8	4049.6	4051.4	4053.2	4055.0	4056.8	4058.6	4060.4	4062.2
2240	4064.0	4065.8	4067.6	4069.4	4071.2	4073.0	4074.8	4076.6	4078.4	4080.2
2250	4082.0	4083.8	4085.6	4087.4	4089.2	4091.0	4092.8	4094.6	4096.4	4098.2
2260	4100.0	4101.8	4103.6	4105.4	4107.2	4109.0	4110.8	4112.6	4114.4	4116.2
2270	4118.0	4119.8	4121.6	4123.4	4125.2	4127.0	4128.8	4130.6	4132.4	4134.2
2280	4136.0	4137.8	4139.6	4141.4	4143.2	4145.0	4146.8	4148.6	4150.4	4152.2
2290	4154.0	4155.8	4157.6	4159.4	4161.2	4163.0	4164.8	4166.6	4168.4	4170.2
2300	4172.0	4173.8	4175.6	4177.4	4179.2	4181.0	4182.8	4184.6	4186.4	4188.2
2310	4190.0	4191.8	4193.6	4195.4	4197.2	4199.0	4200.8	4202.6	4204.4	4206.2
2320	4208.0	4209.8	4211.6	4213.4	4215.2	4217.0	4218.8	4220.6	4222.4	4224.2
2330	4226.0	4227.8	4229.6	4231.4	4233.2	4235.0	4236.8	4238.6	4240.4	4242.2
2340	4244.0	4245.8	4247.6	4249.4	4251.2	4253.0	4254.8	4256.6	4258.4	4260.2
2350	4262.0	4263.8	4265.6	4267.4	4269.2	4271.0	4272.8	4274.6	4276.4	4278.2
2360	4280.0	4281.8	4383.6	4285.4	4287.2	4289.0	4290.8	4292.6	4294.4	4296.2
2370	4298.0	4299.8	4301.6	4303.4	4305.2	4307.0	4308.8	4310.6	4312.4	4314.2
2380	4316.0	4317.8	4319.6	4321.4	4323.2	4325.0	4326.8	4328.6	4330.4	4332.2
2390	4334.0	4335.8	4337.6	4339.4	4341.2	4343.0	4344.8	4346.6	4348.4	4350.2

For Interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2400	4352.0	4353.8	4355.6	4357.4	4359.2	4361.0	4362.8	4364.6	4366.4	4368.2
2410	4370.0	4371.8	4373.6	4375.4	4377.2	4379.0	4380.8	4382.6	4384.4	4386.2
2420	4388.0	4389.8	4391.6	4393.4	4395.2	4397.0	4398.8	4400.6	4402.4	4404.2
2430	4406.0	4407.8	4409.6	4411.4	4413.2	4415.0	4416.8	4418.6	4420.4	4422.2
2440	4424.0	4425.8	4427.6	4429.4	4431.2	4433.0	4434.8	4436.6	4438.4	4440.2
2450	4442.0	4443.8	4445.6	4447.4	4449.2	4451.0	4452.8	4454.6	4456.4	4458.2
2460	4460.0	4461.8	4463.6	4465.4	4467.2	4469.0	4470.8	4472.6	4474.4	4476.2
2470	4478.0	4479.8	4481.6	4483.4	4485.2	4487.0	4488.8	4490.6	4492.4	4494.2
2480	4496.0	4497.8	4499.6	4501.4	4503.2	4505.0	4506.8	4508.6	4510.4	4512.2
2490	4514.0	4515.8	4517.6	4519.4	4521.2	4523.0	4524.8	4526.6	4528.4	4530.2
2500	4532.0	4533.8	4535.6	4537.4	4539.2	4541.0	4542.8	4544.6	4546.4	4548.2
2510	4550.0	4551.8	4553.6	4555.4	4557.2	4559.0	4560.8	4562.6	4564.4	4566.2
2520	4568.0	4569.8	4571.6	4573.4	4575.2	4577.0	4578.8	4580.6	4582.4	4584.2
2530	4586.0	4587.8	4589.6	4591.4	4593.2	4595.0	4596.8	4598.6	4600.4	4602.2
2540	4604.0	4605.8	4607.6	4609.4	4611.2	4613.0	4614.8	4616.6	4618.4	4620.2
2550	4622.0	4623.8	4625.6	4627.4	4629.2	4631.0	4632.8	4634.6	4636.4	4638.2
2560	4640.0	4641.8	4643.6	4645.4	4647.2	4649.0	4650.8	4652.6	4654.4	4656.2
2570	4658.0	4659.8	4661.6	4663.4	4665.2	4667.0	4068.8	4670.6	4672.4	4674.2
2580	4676.0	4677.8	4679.6	4681.4	4683.2	4685.0	4686.8	4688.6	4690.4	4692.2
2590	4694.0	4695.8	4697.6	4699.4	4701.2	4703.0	4704.8	4706.6	4708.4	4710.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2600	4712.0	4713.8	4715.6	4717.4	4719.2	4721.0	4722.8	4724.6	4726.4	4728.2
2610	4730.0	4731.8	4733.6	4735.4	4737.2	4739.0	4740.8	4742.6	4744.4	4746.2
2620	4748.0	4749.8	4751.6	4753.4	4755.2	4757.0	4758.8	4760.6	4762.4	4764.2
2630	4766.0	4767.8	4769.6	4771.4	4773.2	4775.0	4776.8	4778.6	4780.4	4782.2
2640	4784.0	4785.8	4787.6	4789.4	4791.2	4793.0	4794.8	4796.6	4798.4	4800.2
2650	4802.0	4803.8	4805.6	4807.4	4809.2	4811.0	4812.8	4814.6	4816.4	4818.2
2660	4820.0	4821.8	4823.6	4825.4	4827.2	4829.0	4830.8	4832.6	4834.4	4836.2
2670	4838.0	4839.8	4841.6	4843.4	4845.2	4847.0	4848.8	4850.6	4852.4	4854.2
2680	4856.0	4857.8	4859.6	4861.4	4863.2	4865.0	4866.8	4868.6	4870.4	4872.2
2690	4874.0	4875.8	4877.6	4879.4	4881.2	4883.0	4884.8	4886.6	4888.4	4890.2
2700	4892.0	4893.8	4895.6	4897.4	4899.2	4901.0	4902.8	4904.6	4906.4	4908.2
2710	4910.0	4911.8	4913.6	4915.4	4917.2	4919.0	4920.8	4922.6	4924.4	4926.2
2720	4928.0	4929.8	4931.6	4933.4	4935.2	4937.0	4938.8	4940.6	4942.4	4944.2
2730	4946.0	4947.8	4949.6	4951.4	4953.2	4955.0	4956.8	4958.6	4960.4	4962.2
2740	4964.0	4965.8	4967.6	4969.4	4971.2	4973.0	4974.8	4976.6	4978.4	4980.2
2750	4982.0	4983.8	4985.6	4987.4	4989.2	4991.0	4992.8	4994.6	4996.4	4998.2
2760	5000.0	5001.8	5003.6	5005.4	5007.2	5009.0	5010.8	5012.6	5014.4	5016.2
2770	5018.0	5019.8	5021.6	5023.4	5025.2	5027.0	5028.8	5030.6	5032.4	5034.2
2780	5036.0	5037.8	5039.6	5041.4	5043.2	5045.0	5046.8	5048.6	5050.4	5052.2
2790	5054.0	5055.8	5057.6	5059.4	5061.2	5063.0	5064.8	5066.6	5068.4	5070.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2800	5072.0	5073.8	5075.6	5077.4	5079.2	5081.0	5082.8	5084.6	5086.4	5088.2
2810	5090.0	5091.8	5093.6	5095.4	5097.2	5099.0	5100.8	5102.6	5104.4	5106.2
2820	5108.0	5109.8	5111.6	5113.4	5115.2	5117.0	5118.8	5120.6	5122.4	5124.2
2830	5126.0	5127.8	5129.6	5131.4	5133.2	5135.0	5136.8	5138.6	5140.4	5142.2
2840	5144.0	5145.8	5147.6	5149.4	5151.2	5153.0	5154.8	5156.6	5158.4	5160.2
2850	5162.0	5163.8	5165.6	5167.4	5169.2	5171.0	5172.8	5174.6	5176.4	5178.2
2860	5180.0	5181.8	5183.6	5185.4	5187.2	5189.0	5190.8	5192.6	5194.4	5196.2
2870	5198.0	5199.8	5201.6	5203.4	5205.2	5207.0	5208.8	5210.6	5212.4	5214.2
2880	5216.0	5217.8	5219.6	5221.4	5223.2	5225.0	5226.8	5228.6	5230.4	5232.2
2890	5234.0	5235.8	5237.6	5239.4	5241.2	5243.0	5244.8	5246.6	5248.4	5250.2
2900	5252.0	5253.8	5255.6	5257.4	5259.2	5261.0	5262.8	5264.6	5266.4	5268.2
2910	5270.0	5271.8	5273.6	5275.4	5277.2	5279.0	5280.8	5282.6	5284.4	5286.2
2920	5288.0	5289.8	5291.6	5293.4	5295.2	5297.0	5298.8	5300.6	5302.4	5304.2
2930	5306.0	5307.8	5309.6	5311.4	5313.2	5315.0	5316.8	5318.6	5320.4	5322.2
2940	5324.0	5325.8	5327.6	5329.4	5331.2	5333.0	5334.8	5336.6	5338.4	5340.2
2950	5342.0	5343.8	5345.6	5347.4	5349.2	5351.0	5352.8	5354.6	5356.4	5358.2
2960	5360.0	5361.8	5363.6	5365.4	5367.2	5369.0	5370.8	5372.6	5374.4	5376.2
2970	5378.0	5379.8	5381.6	5383.4	5385.2	5387.0	5388.8	5390.6	5392.4	5394.2
2980	5396.0	5397.8	5399.6	5401.4	5403.2	5405.0	5406.8	5408.6	5410.4	5412.2
2990	5414.0	5415.8	5417.6	5419.4	5421.2	5423.0	5424.8	5426.6	5428.4	5430.2

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Concluded)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
3000	5432.0	5433.8	5435.6	5437.4	5439.2	5441.0	5442.8	5444.6	5446.4	5448.2
3010	5450.0	5451.8	5453.6	5455.4	5457.2	5459.0	5460.8	5462.6	5464.4	5466.2
3020	5468.0	5469.8	5471.6	5473.4	5475.2	5477.0	5478.8	5480.6	5482.4	5484.2
3030	5486.0	5487.8	5489.6	5491.4	5493.2	5495.0	5496.8	5498.6	5500.4	5502.2
3040	5504.0	5505.8	5507.6	5509.4	5511.2	5513.0	5514.8	5516.6	5518.4	5520.2
3050	5522.0	5523.8	5525.6	5527.4	5529.2	5531.0	5532.8	5534.6	5536.4	5538.2
3060	5540.0	5541.8	5543.6	5545.4	5547.2	5549.0	5550.8	5552.6	5554.4	5556.2
3070	5558.0	5559.8	5561.6	5563.4	5565.2	5567.0	5568.8	5570.6	5572.4	5574.2
3080	5576.0	5577.8	5579.6	5581.4	5583.2	5585.0	5586.8	5588.6	5590.4	5592.2
3090	5594.0	5595.8	5597.6	5599.4	5601.2	5603.0	5604.8	5606.6	5608.4	5610.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

MOMENT OF INERTIA FOR VARIOUS BODIES

The mass of the body is indicated by m.

Body	Axis	Moment of inertia
Uniform thin rod	Normal to the length, at one end	$m\frac{l^2}{3}$
Uniform thin rod	Normal to the length, at the center	$m\frac{l^2}{12}$
Thin rectangular sheet, sides a and b	Through the center parallel to b	$m\frac{a^2}{12}$
Thin rectangular sheet, sides a and b	Through the center perpendicular to the sheet	$m\frac{a^2+b^2}{12}$
Thin circular sheet of radius r	Normal to the plate through the center	$m\frac{r^2}{2}$
Thin circular sheet of radius r	Along any diameter	$m\frac{r^2}{4}$
Thin circular ring. Plane figure formed by two concentric circles of radius r_1 and r_2	Through center normal to plane of ring	$m\frac{r_1^2+r_2^2}{2}$
Thin circular ring. Plane figure formed by two concentric circles of radius, r_1 and r_2	Any diameter	$m\frac{r_1^2+r_2^2}{4}$
Rectangular parallelopiped, edges a, b, and c	Through center perpendicular to face ab, (parallel to edge c)	$m\frac{a^2+b^2}{12}$
Sphere, radius r	Any diameter	$m\frac{2}{5}r^2$
Spherical shell, external radius, r_1 internal, radius r_2	Any diameter	$m\frac{2}{5}\frac{(r_1^5-r_2^5)}{(r_1^3-r_2^3)}$

MOMENT OF INERTIA FOR VARIOUS BODIES (Continued)

The mass of the body is indicated by m.

Body	Axis	Moment of inertia
Spherical shell, very thin, mean radius, r	Any diameter	$m\frac{2r^2}{3}$
Right circular cylinder (or disk) of radius r	The longitudinal axis of the solid (central axis perpendicular to circular section of disk)	$m\frac{r^2}{2}$
Right circular cylinder of radius r, length l	Through center perpendicular to the axis of the figure, (transverse diameter)	$m\left(\frac{r^2}{4}+\frac{l^2}{12}\right)$
Hollow circular cylinder, length l, external radius r_1 internal radius r_2	The longitudinal axis of the figure	$m\frac{(r_1^2+r_2^2)}{2}$
Thin cylindrical shell, length l, mean radius, r	The longitudinal axis of the figure	mr^2
Hollow circular cylinder, length l, external radius r_1, internal radius r_2	Transverse diameter	$m\left[\frac{r_1^2+r_2^2}{4}+\frac{l^2}{12}\right]$
Hollow circular cylinder, length l, very thin, mean radius r	Transverse diameter	$m\left(\frac{r^2}{2}+\frac{l^2}{12}\right)$
Elliptic cylinder, length l, transverse semiaxes a and b	Longitudinal axis	$m\left(\frac{a^2+b^2}{4}\right)$
Right cone, altitude h, radius of base r	Axis of the figure	$m\frac{3}{10}r^2$
Spheroid of revolution, equatorial radius r	Polar axis	$m\frac{2r^2}{5}$
Ellipsoid, axes $2a$, $2b$, $2c$	Axis $2a$	$m\frac{(b^2+c^2)}{5}$

RADIO FORMULÆ

A collection of formulae useful in the computation of inductance, capacitance, and other constants of oscillating circuits. From Radio Instruments and Measurements, Bureau of Standards.

CAPACITANCE

Units.—In the following formula all lengths are expressed in centimeters, areas in square centimeters; the dielectric constant K, is taken as unity for air. Capacitances will be given in micromicrofarads = 10^{-12} farads. The electrostatic unit of capacitance, sometimes called the centimeter = 1.1124 micromicrofarads.

Parallel plate condenser.—If s be the area of one plate: t, the thickness of the dielectric; K, the dielectric constant; and N, the number of plates,—the capacitance

$$C = 0.0885\, K \frac{(N-1)s}{t}.$$

Variable condenser, semicircular plates.—Where N is the total number of parallel plates; r_1 the outer, and r_2 the inner radius of the plates; t, the thickness of the dielectric, and K the dielectric constant,—the maximum capacitance is given by

$$C = 0.1390K \frac{(N-1)(r_1^2 - r_2^2)}{t}.$$

Isolated thin circular disk. — If d is the diameter of the disk

$$C = 0.354d.$$

Isolated sphere. — If d is the diameter of the sphere

$$C = 0.556d.$$

Two concentric spheres. — If r_1 is the radius of the outer sphere; r_2, that of the inner sphere; K, the dielectric constant of the material between the spheres,

$$C = 1.112K \frac{r_1 r_2}{r_1 - r_2}.$$

Two coaxial cylinders. — If r_1 is the radius of the outer cylinder; r_2, that of the inner; l, the length of the cylinders; K, the dielectric constant,

$$C = K \frac{0.2416\, l}{\log_{10} \frac{r_1}{r_2}}.$$

Single long wire parallel to the ground. — For a wire of length l; diameter, d; suspended at a height h above the ground, where the diameter is small compared with the length,

For $\frac{4h}{l} = \text{or} < 1 \qquad C = \dfrac{0.2416\,l}{\log_{10}\frac{4h}{d} - k_1}$

For $\frac{l}{4h} = \text{or} < 1 \qquad C = \dfrac{0.2416\,l}{\log_{10}\frac{2\,l}{d} - k_2}$

In which,

$$k_1 = \log_{10}\left[\frac{1+\sqrt{1+\left(\frac{4h}{l}\right)^2}}{2}\right] \qquad k_2 = \log_{10}\left[\frac{l}{4h} + \sqrt{1+\left(\frac{l}{4h}\right)^2}\right]$$

the values of which may be found in a table at the end of this section.

Vertical wire. — For a wire of length l, relatively high above the ground; of diameter d, the approximate capacitance is as follows,

$$C = \frac{0.2416\,l}{\log_{10}\frac{2l}{d}}.$$

Two horizontal parallel wires at the same height. — If d is the diameter of each wire; l, the length of each; h, the height above the ground; D, the distance between wires, — where d and D are small compared to l,

$$C = \frac{0.1208\,l}{\log_{10}\frac{2D}{d} - \frac{D^2}{8h^2}}.$$

Two parallel horizontal wires, one above the other. — Use the preceding formula for parallel wires at the same height, substituting the mean height for h.

Two parallel wires joined together, both at the same height. — Let l be the length of each wire; D, the distance between centers; h, the height above the ground; d_2 the diameter of cross section of the wire. If d^2 and D^2 are small compared with l^2 and $4h^2$ respectively

For $\frac{4h}{l} = \text{or} < 1 \qquad C = \dfrac{0.4831\,l}{\log_{10}\frac{4h}{d} + \log_{10}\frac{2h}{D} - 2k_1}.$

For $\frac{l}{4h} = \text{or} < 1 \qquad C = \dfrac{0.4831\,l}{\log_{10}\frac{2l}{d} + \log_{10}\frac{l}{D} - 2k_2}.$

k_1 and k_2 have the same significance as above and may be found from the tables at the end of the section.

RADIO FORMULAE (Continued)

Several wires in parallel.—If n parallel wires are joined together; D, the spacing between the wires; d, the diameter of the wire; h, the height above the ground; l, the length of the group,—the approximate capacitance is,

$$C = \frac{1.112\,l}{\dfrac{p_{11} + (n-1)p_{12}}{n} - k}.$$

p_{11} and p_{12} may be computed from the following:

For $\frac{4h}{l}$ = or < 1

$$p_{11} = 4.605\left[\log_{10}\frac{4h}{d} - k_1\right]$$

$$p_{12} = 4.605\left[\log_{10}\frac{2h}{D} - k_1\right]$$

For $\frac{l}{4h}$ = or < 1

$$p_{11} = 4.605\left[\log_{10}\frac{2l}{d} - k_2\right]$$

$$p_{12} = 4.605\left[\log_{10}\frac{l}{D} - k_2\right]$$

Values of k, k_1, k_2 may be found in the following table.

TABLE 1

$\frac{4h}{l}$	k_1	$\frac{l}{4h}$	k_2	n	k	n	k
0	0	0	0	2	0	11	2.22
0.1	0.001	0.1	0.043	3	0.308	12	2.37
.2	.004	.2	.086	4	.621	13	2.51
.3	.009	.3	.128	5	.906	14	2.63
.4	.016	.4	.169	6	1.18	15	2.74
.5	.025	.5	.209	7	1.43	16	2.85
.6	.035	.6	.247	8	1.66	17	2.95
.7	.045	.7	.283	9	1.86	18	3.04
.8	.057	.8	.318	10	2.05	19	3.14
.9	.069	.9	.351			20	3.24
1.0	.082	1.0	.383				

Inductance

Units. — In the following formulæ all lengths are expressed in centimeters. The inductance calculated will be in microhenries = 10^{-6} henry.

Long straight round wire. — If l is the length; d, the diameter of cross section; μ the permeability of the material, — the inductance at zero or low frequency is,

$$L = 0.002\,l\left[2.303\log_{10}\frac{4l}{d} - 1 + \frac{\mu}{4}\right]$$

RADIO FORMULAE (Continued)

For all except iron wire $\mu = 1$ and the last term becomes 0.25. For wires whose length is less than about 1000 times the diameter the term $+\frac{d}{2l}$ should be added inside the brackets.

For any frequency:

$$L = 0.002\,l\left[2.303\,\log_{10}\frac{4l}{d} - 1 + \mu\delta\right]$$

where δ is a quantity given in Table 2 below as a function of x. x is to be computed from the relation

$$x = 0.1405d\sqrt{\frac{\mu f}{\rho}}$$

where d and μ are as above; f, the frequency and ρ the resistivity of the material of the wire expressed in microhm-centimeters. (See Properties of Metallic Conductors.)

For copper at 20° C.

$$x = 0.1071\,d\sqrt{f}.$$

For wires other than iron, whose length is 100,000 times the diameter the inductance at infinite frequency is about 2% less than at zero frequency.

TABLE 2

Values of δ for computing inductance at any frequency.

x	δ	x	δ
0	0.250	12	0.059
0.5	.250	14	.050
1.0	.249	16	.044
1.5	.247	18	.039
2.0	.240	20	.035
2.5	.228	25	.028
3.0	211	30	.024
3.5	.191	40	.0175
4.0	.1715	50	.014
4.5	.154	60	.012
5.0	.139	70	.010
6.0	.116	80	.009
7.0	.100	90	.008
8.0	.088	100	.007
9.0	.078	∞	.000
10.0	.070		

Two parallel round wires, return circuit.—If l is the length of each wire; d, the diameter; D, the distance between centers of wires; μ the permeability,—the inductance for any frequency is

$$L = 0.004\, l\left[2.303 \log_{10} \frac{2D}{d} - \frac{D}{l} + \mu\delta\right]$$

where δ is a quantity to be obtained from the table above as a function of x which is to be computed as explained for the previous formula.

For copper and at low frequency the term δ becomes 0.25.

Square of round wire.—If a is the length of the side of the square; d, the diameter of the wire; μ the permeability, the inductance for any frequency is,

$$L = 0.008a\left[2.303 \log_{10} \frac{2a}{d} + \frac{d}{2a} - 0.774 + \mu\delta\right]$$

where δ is obtained as above. For low frequency and for wires other than iron δ becomes 0.25; for infinite frequency the value is zero.

Grounded horizontal wire, the Earth acting as return circuit. If l is the length of wire; h, the height above the ground: d, the diameter of the wire; μ the permeability and δ the frequency constant (see table 2), the inductance,—where d is small compared with l,—is given as follows:

For $\frac{2h}{l} =$ or < 1 $\qquad L = 0.002\, l\left[2.3026 \log_{10} \frac{4h}{d} - P + \mu\delta\right]$

For $\frac{l}{2h} =$ or < 1 $\qquad L = 0.002\, l\left[2.3026 \log_{10} \frac{4\,l}{d} - Q + \mu\delta\right]$

P and Q may be found in the following table.

TABLE 3

$\frac{2h}{l}$	P	$\frac{l}{2h}$	Q	$\frac{2h}{l}$	P	$\frac{l}{2h}$	Q
0	0	0	1.0000	0.6	0.5136	0.6	1.2918
0.1	0.0975	0.1	1.0499	.7	.5840	.7	1.3373
.2	.1900	.2	1.0997	.8	.6507	.8	1.3819
.3	.2778	.3	1.1489	.9	.7139	.9	1.4251
.4	.3608	.4	1.1975	1.0	.7740	1.0	1.4672
.5	.4393	.5	1.2452	.	....	....	......

The mutual inductance of the case above may be expressed.

For $\frac{2h}{l}$ = or <1 $\quad M = 0.002\, l\left[2.3026 \log_{10}\frac{2h}{D} - P + \frac{D}{l}\right]$

For $\frac{l}{2h}$ = or <1 $\quad M = 0.002\, l\left[2.3026 \log_{10}\frac{2l}{D} - Q + \frac{D}{l}\right]$

The values of P and Q are found in the table above.

Grounded wires in parallel. — Compute by the above formulae the inductance L_1 per unit length of a single wire and the mutual inductance M_1 per unit length of two adjacent wires, using the actual length in determining the ratios $\frac{2h}{l}$, $\frac{2l}{d}$ etc. Then the inductance of n parallel wires will be,

$$L = l\left[\frac{L_1 + (n-1)M_1}{n} - 0.001k\right]$$

where k is a function of n found in Table 1 under capacity formulae.

Circular ring of round wire. — If a is the mean radius of the ring; d, the diameter of the wire, the inductance at any frequency is

$$L = 0.01257a\left[2.303 \log_{10}\frac{16a}{d} - 2 + \mu\delta\right]$$

where δ is determined from the table above.

Circular coil of circular cross section. — For a coil of n fine wires wound with mean radius of the turns a, the cross section of whose winding is a circle of diameter d, the inductance at low frequency, for wire other than iron, neglecting insulation space is,

$$L = 0.01257an^2\left[2.303 \log_{10}\frac{16a}{d} - 1.75\right]$$

Torus with a single layer transverse winding, — a circular solenoid of circular cross section. If r is the distance from the center of the torus to the center of the transverse section; a, the radius of the turns of the winding; n, the number of turns, the inductance at low frequency is

$$L = 0.01257n^2\left[r - \sqrt{r^2 - a^2}\right]$$

Solenoid, single layer. If n is the number of turns; a the radius of the coil; b, the length, the approximate inductance at any frequency is,

$$L = \frac{0.03948a^2n^2}{b}K$$

where K is a function of $\frac{2a}{b}$ given in the table below.

TABLE 4

$\frac{2a}{b}$	K	$\frac{2a}{b}$	K	$\frac{2a}{b}$	K
0.00	1.0000	2.00	0.5255	7.00	0.2584
.05	.9791	2.10	.5137	7.20	.2537
.10	.9588	2.20	.5025	7.40	.2491
.15	.9391	2.30	.4918	7.60	.2448
.20	.9201	2.40	.4816	7.80	.2406
.25	.9016	2.50	.4719	8.00	.2366
.30	.8838	2.60	.4626	8.50	.2272
.35	.8665	2.70	.4537	9.00	.2185
.40	.8499	2.80	.4452	9.50	.2106
.45	.8337	2.90	.4370	10.00	.2033
50	.8181	3.00	.4292	......	......
.55	.8031	3.10	.4217	11.0	.1903
.60	.7885	3.20	.4145	12.0	.1790
.65	.7745	3.30	.4075	13.0	.1692
.70	.7609	3.40	.4008	14.0	.1605
.75	.7478	3.50	.3944	15.0	.1527
.80	.7351	3.60	.3882	16.0	.1457
.85	.7228	3.70	.3822	17.0	.1394
.90	.7110	3.80	.3764	18.0	.1336
.95	.6995	3.90	.3708	19.0	.1284
1.00	.6884	4.00	.3654	20.0	.1236
1.05	.6777	4.10	.3602	22.0	.1151
1.10	.6673	4.20	.3551	24.0	.1078
1.15	.6573	4.30	.3502	26.0	.1015
1.20	.6475	4.40	.3455	28.0	.0959
1.25	.6381	4.50	.3409	30.0	.0910
1.30	.6290	4.60	.3364	35.0	.0808
1.35	.6201	4.70	.3321	40.0	.0728
1.40	.6115	4.80	.3279	45.0	.0664
1.45	.6031	4.90	.3238	50.0	.0611
1.50	.5950	5.00	.3198	60.0	.0528
1.55	.5871	5.20	.3122	70.0	.0467
1.60	.5795	5.40	.3050	80.0	.0419
1.65	.5721	5.60	.2981	90.0	.0381
1.70	.5649	5.80	.2916	100.0	.0350
1.75	.5579	6.00	.2854	......	......
1.80	.5511	6.20	.2795	......	......
1.85	.5444	6.40	.2739	......	......
1.90	.5379	6.60	.2685	......	......
1.95	.5316	6.80	.2633	......	......

Long multiple layer solenoid. — The inductance is given approximately by,

$$L = L_1 - \frac{0.01257 n^2 ac}{b}(0.693 + B_s)$$

where L_1 is the inductance calculated from the formula for a single layer solenoid, n being the number of turns of the winding; a, the radius of the coil measured from the axis to the center of the cross section of the winding; b, the length of the coil; c, the radial depth of the winding; B_s a correction given in table below as a function of b/c.

TABLE 5

b/c	B_s	b/c	B_s
1	0.0000	16	0.3017
2	.1202	17	.3041
3	.1753	18	.3062
4	.2076	19	.3082
5	.2292	20	.3099
6	.2446	21	.3116
7	.2563	22	.3131
8	.2656	23	.3145
9	.2730	24	.3157
10	.2792	25	.3169
11	.2844	26	.3180
12	.2888	27	.3190
13	.2927	28	.3200
14	.2961	29	.3209
15	.2991	30	.3218

Square coil of rectangular cross section. — If a be the side of the square measured to the center of the rectangular section which has sides b and c and if n be the number of turns,

$$L = 0.008an^2\left[2.303 \log_{10} \frac{a}{b+c} + 0.2235 \frac{b+c}{a} + 0.726\right]$$

If the cross section is a square $b = c$ and the expression becomes

$$L = 0.008an^2\left[2.303 \log_{10} \frac{a}{b} + 0.447 \frac{b}{a} + 0.033\right]$$

MUTUAL INDUCTANCE

Two parallel wires. — If l be the length of each wire; D, the distance between, the inductance is

$$M = 0.002\,l\left[2.303 \log_{10} \frac{2l}{D} - 1 + \frac{D}{l}\right]$$

Coaxial solenoids, single layer coils, not concentric. If a is the radius of the smaller coil; A, the radius of the larger: n_1 and n_2 the number of turns on the smaller and larger coil respectively; $2l$ the length of the smaller coil; $2x$, the length of

the larger; D, the distance between the centers of the coils measured along the common axis,

$$M = 0.009870\frac{a^2 A^2 n_1 n_2}{2x.2\,l}\left[K_1 k_1 + K_3 k_3 + K_5 k_5\right]$$

where

$$K_1 = \frac{2}{A^2}\left(\frac{x_2}{r_2} - \frac{x_1}{r_1}\right) \qquad k_1 = 2\,l$$

$$K_3 = \frac{1}{2}\left(\frac{x_1}{r_1^5} - \frac{x_2}{r_2^5}\right) \qquad k_3 = a^2\,l\left(3 - 4\frac{l^2}{a^2}\right)$$

$$K_5 = -\frac{A^2}{8}\left[\frac{x_1}{r_1^9}\left(3 - 4\frac{x_1^2}{A^2}\right) - \frac{x_2}{r_2^9}\left(3 - 4\frac{x_2^2}{A^2}\right)\right]$$

$$k_5 = a^4\,l\left(\frac{5}{2} - 10\frac{l^2}{a^2} + 4\frac{l^4}{a^4}\right)$$

where

$$x_1 = D - x \qquad r_1 = \sqrt{x_1^2 + A^2}$$

$$x_2 = D + x \qquad r_2 = \sqrt{x_2^2 + A^2}$$

The above is most accurate for short coils with relatively great distance between.

Coaxial, concentric solenoids, outer coil the longer. If a be the radius of the smaller coil; A, that of the larger; $2l$, the length of the inner coil; $2x$, the length of the outer; n_1 and n_2 the number of turns on the inner and outer coil respectively,

$$M = \frac{0.01974a^2 n_1 n_2}{g}\left[1 + \frac{A^2 a^2}{8g^4}\left(3 - 4\frac{l^2}{a^2}\right)\right]$$

where $g = \sqrt{x^2 + A^2}$.

Coaxial, concentric solenoids, outer coil the shorter. Assuming the symbols as before except

$$g = \sqrt{l^2 + A^2}$$

$$M = 0.01974\frac{a^2 n_1 n_2}{g}\left[1 + \frac{A^2 a^2}{8g^4}\left(3 - 4\frac{x^2}{a^2}\right)\right]$$

High Frequency Resistance

Cylindrical straight wires.—The ratio R/R_0 of the high frequency resistance to the resistance at low frequency may be found from the table below, by calculating first the value of x from the relation,

$$x = \pi d\sqrt{\frac{2\mu f}{\rho}}\sqrt{\frac{1}{1000}}$$

where d is the diameter of the wire in centimeters; μ, the magnetic permeability; f, the frequency; ρ, the resistivity in microhm-centimeters.

For copper wire $x = 10da$ where a has a value given by $a = 0.01071$. The value of a for various frequencies may be found in the second of the two tables below. The above method gives the high-frequency resistance of simple circuits of any shape where the length is great compared with the diameter of the wire and the different portions of the circuit are not close to each other.

TABLE 6

Ratio of High-Frequency Resistance to the Direct-Current Resistance

x	R/R_0	x	R/R_0	x	R/R_0
0	1.0000	5.2	2.114	14.0	5.209
0.5	1.0003	5.4	2.184	14.5	5.386
.6	1.0007	5.6	2.254	15.0	5.562
.7	1.0012	5.8	2.324	16.0	5.915
.8	1.0021	6.0	2.394	17.0	6.268
.9	1.0034	6.2	2.463	18.0	6.621
1.0	1.005	6.4	2.533	19.0	6.974
1.1	1.008	6.6	2.603	20.0	7.328
1.2	1.011	6.8	2.673	21.0	7.681
1.3	1.015	7.0	2.743	22.0	8.034
1.4	1.020	7.2	2.813	23.0	8.387
1.5	1.026	7.4	2.884	24.0	8.741
1.6	1.033	7.6	2.954	25.0	9.094
1.7	1.042	7.8	3.024	26.0	9.447
1.8	1.052	8.0	3.094	28.0	10.15
1.9	1.064	8.2	3.165	30.0	10.86
2.0	1.078	8.4	3.235	32.0	11.57
2.2	1.111	8.6	3.306	34.0	12.27
2.4	1.152	8.8	3.376	36.0	12.98
2.6	1.201	9.0	3.446	38.0	13.69
2.8	1.256	9.2	3.517	40.0	14.40
3.0	1.318	9.4	3.587	42.0	15.10
3.2	1.385	9.6	3.658	44.0	15.81
3.4	1.456	9.8	3.728	46.0	16.52
3.6	1.529	10.0	3.799	48.0	17.22
3.8	1.603	10.5	3.975	50.0	17.93
4.0	1.678	11.0	4.151	60.0	21.47
4.2	1.752	11.5	4.327	70.0	25.00
4.4	1.826	12.0	4.504	80.0	28.54
4.6	1.899	12.5	4.680	90.0	32.07
4.8	1.971	13.0	4.856	100.0	35.61
5.0	2.043	13.5	5.033	. . .	. . .

As an extension of the above table the following relation may be used

$$R/R_0 = x/2.828 + 0.25$$

The equation is valid for values of x greater than 7 at which point the error is about 1% and decreasing with increasing values of x.

TABLE 7

Values of a ($= 0.01071\sqrt{f}$) for various frequencies.

f	a	Wave-length meters	f	a	Wave-length meters
100	0.1071	. .	50,000	2.395	6,000
200	.1514	. . .	60,000	2.624	5,000
300	.1855	.	70,000	2.834	4,286
400	.2142	. . . . .	80,000	3.029	3,750
500	2395	. .	90,000	3.213	3,333
600	2624	. . .	100,000	3.387	3,000
700	.2834	. .	150,000	4.148	2,000
800	.3029	. .	200,000	4.790	1,500
900	.3213	. . .	250,000	5.355	1,200
1,000	.3387	.	300,000	5.866	1,000
2,000	.4790	.	333,333	6.184	900
3,000	.5866	. .	375,000	6.564	800
4,000	.6774	.	428,570	7.012	700
5,000	.7573	. .	500,000	7.573	600
6,000	.8296		600,000	8.296	500
7,000	.8960		700,000	8.960	429
8,000	9579		750,000	9.275	400
9,000	1 0160	. . .	800,000	9.579	375
10,000	1.071	30,000	900,000	10.16	333
15,000	1 312	20,000	1,000,000	10.71	300
20,000	1 514	15,000	1,500,000	13.12	200
30,000	1.855	10,000	3,000,000	18.55	100
40,000	2.142	7,500	. . . .	. . . . . .	. . . . .

Wave Length

The wave length in meters is given by the following expression when L, the inductance, is in microhenries and C, the capacitance, is in microfarads. The resistance is assumed negligible.

$$\lambda = 1884\sqrt{LC}$$

VALUES OF "L C"

The following table gives values of the product of the inductance and capacitance (L C) in microhenries and microfarads for wave lengths from 1 to 20,000 meters, and the corresponding frequencies in kilocycles.

Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads	Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads
1	300,000.	.00000028	570	526.3	.09141
10	30,000.	.00002816	580	517.2	.09467
20	15,000.	.0001129	590	508.5	.09803
30	10,000.	.0002530	600	500.	.1014
40	7,500.	.0004503	610	491.8	.1047
50	6,000.	.0007039	620	483 7	.1082
60	5,000.	.001014	630	476.2	.1117
70	4,286.	.001378	640	468.7	1154
80	3,750.	.001801	650	461.5	.1188
90	3,333.	.002280	660	454.5	.1225
100	3,000.	.002816	670	447.8	.1263
110	2,727.	.003404	680	441.2	.1302
120	2,500.	.004052	690	434 8	.1341
130	2,308.	.004757	700	428.6	.1378
140	2,144.	.005518	710	422 5	.1419
150	2,000.	.006335	720	416 7	1459
160	1,875.	.007204	730	411.	.1501
170	1,765.	.008134	740	405 4	.1540
180	1,667.	.009120	750	400.	.1583
190	1,579.	.01016	760	394 7	.1625
200	1,500.	.01129	770	389 6	.1668
210	1,428.5	.01239	780	384.6	.1714
220	1,364.	.01362	790	379 8	.1756
230	1,304.2	.01490	800	375	1801
240	1,250.	.01624	810	370 4	.1847
250	1,200.	.01755	820	365 9	.1893
260	1,153.8	.01901	830	361 4	.1941
270	1,111.	.02052	840	357 1	.1985
280	1,071.3	.02209	850	352 9	.2034
290	1,034.3	.02372	860	348 8	.2082
300	1,000.	.02530	870	344 8	.2132
310	967.7	.02704	880	340 9	.2179
320	937.5	.02884	890	337 1	.2229
330	909 1	.03069	900	333 3	.2280
340	882 4	.03250	910	329 7	.2332
350	859.1	.03446	920	326 1	.2381
360	833 3	.03648	930	322 6	.2434
370	810.8	.03856	940	319 1	.2487
380	789 5	.04070	950	315 9	2541
390	769.2	.04277	960	312.5	.2595
400	750.	.04503	970	309 3	.2647
410	731.7	.04733	980	306.1	.2704
420	714 3	.04968	990	303.	.2759
430	697 7	.05198	1,000	300.	.2816
440	681 8	.05446	1,010	297 03	.2870
450	666.7	.05700	1,020	294 12	.2927
460	652.2	.05960	1,030	291.26	.2986
470	638.3	.06225	1,040	288 45	.3045
480	625.	.06485	1,050	285.71	.3105
490	612.2	.06757	1,060	283.	.3161
500	600.	.07039	1,070	280 37	.3222
510	588 2	.07327	1,080	277 78	.3283
520	576.9	.07606	1,090	275.23	.3345
530	566.	.07903	1,100	272 73	.3404
540	555.6	.08208	1,110	270 27	.3467
550	545 4	.08518	1,120	267.85	.3531
560	535 7	.08836	1,130	265.48	.3595

VALUES OF "L C" (Continued)

Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads	Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads
1,140	263.15	.3660	1,740	172.41	.8520
1,150	260.86	.3721	1,750	171.43	.8620
1,160	258.61	.3787	1,760	170.46	.8720
1,170	256.4	.3853	1,770	169.49	.8821
1,180	254.23	.3921	1,780	168.54	.8916
1,190	252.1	.3988	1,790	167.6	.9019
1,200	250.	.4052	1,800	166.67	.912
1,210	247.93	.4121	1,810	165.75	.9224
1,220	245.9	.4190	1,820	164.84	.9327
1,230	243.9	.4260	1,830	163.94	.9425
1,240	241.93	.4326	1,840	163.04	.9530
1,250	240.	.4397	1,850	162.22	.9634
1,260	238.09	.4469	1,860	161.29	.9741
1,270	236.22	.4541	1,870	160.43	.9844
1,280	234.37	.4610	1,880	159.58	.9948
1,290	232.56	.4683	1,890	158.73	1.0056
1,300	230.76	.4757	1,900	157.89	1.0164
1,310	229.01	.4831	1,910	157.06	1.0265
1,320	227.27	.4906	1,920	156.30	1.0375
1,330	225.56	4978	1,930	155 44	1.0485
1,340	223.87	.5053	1.940	154.63	1.0597
1,350	222.22	.5130	1,950	153.84	1.0706
1,360	220 59	.5208	1,960	153.06	1.0811
1,370	218.97	.5281	1,970	152.28	1.0923
1,380	217.39	.5359	1,980	151.51	1.1035
1,390	215.83	.5438	1,990	150.75	1.1148
1,400	214.38	.5518	2,000	150.	1 1256
1,410	212 76	.5598	2,100	142.85	1.2412
1,420	211.26	.5674	2,200	136.36	1.3624
1,430	209.79	5755	2,300	130.43	1 4893
1,440	208.34	5837	2,400	125.00	1.6218
1,450	206.90	.5919	2,500	120.	1.7597
1,460	205.47	.5998	2,600	115.38	1.9026
1,470	204.08	.6081	2,700	111.11	2.0520
1,480	202.70	.6165	2,800	107.14	2.207
1,490	201.34	.6250	2,900	103.45	2.3663
1,500	200.	.6335	3,000	100.	2 533
1,510	198.68	.6416	3,100	96.77	2.705
1,520	197.36	.6502	3,200	93.75	2.883
1,530	196.07	.6590	3,300	90.91	3.085
1,540	194.80	.6670	3,400	88.24	3.255
1,550	193.56	.6760	3,500	85.91	3.448
1,560	192.31	.6849	3,600	83.33	3.648
1,570	191.06	.6938	3,700	81.08	3.854
1,580	189.86	.7028	3,800	78.95	4.065
1,590	188.67	.7118	3,900	76.92	4.281
1,600	187.5	.7204	4,000	75.00	4.500
1,610	186.34	.7295	4,100	73.17	4.732
1,620	185.19	.7387	4,200	71.43	4.966
1,630	184.05	.7480	4,300	69.77	5 206
1,640	182.93	7573	4,400	68.18	5 451
1,650	181.82	.7662	4,500	66.67	5 700
1,660	180.73	.7756	4,600	65.22	5.956
1,670	179.64	.7852	4,700	63.83	6.219
1,680	178.57	.7946	4,800	62.500	6.486
1,690	177.51	.8037	4,900	61.22	6.759
1,700	176.46	.8134	5,000	60.00	7.038
1,710	175.44	.8231	5,100	58.82	7.32
1,720	174.42	.8329	5,200	57.69	7.61
1,730	173.41	.8422	5,300	56.60	7 91

VALUES OF "L C" (Continued)

Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads	Wave length, meters	Frequency, kilocycles	L C Microhenries Microfarads
5,400	55.56	8.21	10,600	28.30	31.6
5,500	54.55	8.51	10,800	27.78	32.8
5,600	53.57	8.83	11,000	27.275	34.0
5,700	52.63	9.15	11,200	26.785	35.3
5,800	51.72	9.47	11,400	26.315	36.6
5,900	50.85	9.81	11,600	25.86	37.9
6,000	50.	10.1	11,800	25.425	39.2
6,100	49.18	10.5	12,000	25.0	40.4
6,200	48.55	10.8	12,200	24.590	42.0
6,300	47.62	11.1	12,400	24.275	43.3
6,400	46.87	11.5	12,600	23.86	44 4
6,500	46.15	11.9	12,800	23.435	46 0
6,600	45.45	12.3	13,000	23.075	47.6
6,700	44.78	12.6	13,200	22.275	49.2
6,800	44.12	13 0	13,400	22.39	50.4
6,900	43 48	13.4	13,600	22.06	52 0
7,000	42.86	13.8	13,800	21.74	53 2
7,100	42.25	14.2	14,000	21 43	55.2
7,200	41.67	14.6	14,200	21.125	56 8
7,300	41.1	15.0	14,400	20 835	58 4
7,400	40.54	15.4	14,600	20.55	60.0
7,500	40.	15.8	14,800	20 27	61.6
7,600	39.47	16.3	15,000	20.00	63.2
7,700	38 96	16.7	15,200	19.735	65 2
7,800	38.46	17.1	15,400	19 48	66 1
7,900	37.98	17.6	15,600	19.23	68 4
8,000	37.50	18.0	15,800	18.990	70 4
8,100	37.04	18.5	16,000	18 75	72 0
8,200	36 59	18.9	16,200	18.52	74 0
8,300	36 14	19.4	16,400	18.295	75.6
8,400	35.71	19.9	16,600	18.07	77.6
8,500	35.29	20.3	16,800	17.855	79 6
8,600	34.88	20.8	17,000	17.645	81.2
8,700	34.48	21.3	17,200	17.440	83.2
8,800	34.09	21.8	17,400	17.24	85 2
8,900	33.71	22.3	17,600	17.045	87.2
9,000	33.33	22.8	17,800	16.855	89.2
9,100	32.97	23.3	18,000	16.665	91.2
9,200	32.61	23.8	18,200	16.485	93.2
9,300	32.26	24 3	18,400	16.305	95.2
9,400	31.91	24 9	18,600	16.13	97.2
9,500	31.59	25 4	18,800	15 955	99.6
9,600	31.25	25.9	19,000	15.795	101.6
9,700	30.93	26.5	19,200	15.625	103.6
9,800	30.61	27.0	19,400	15.465	106 0
9,900	30.31	27.6	19,600	15.305	108.0
10,000	30.00	28.1	19,800	15 155	110.4
10,200	29.41	29.3	20,000	15.00	112.4
10,400	28.845	30.4			

VALUES OF W AND 1/W²

Computed by C. W. Winkler,
submitted by J. Johnsen

The values for w were computed to 9 significant figures and rounded to 8. These values, in the range 100 to 1000 kc, were obtained by adding the common difference $2\pi \times 10^{-3}$ for intervals of 1 kc. Every fifth entry was checked by adding $\pi \times 10^{-1}$ to the previous key entry. Values from 1000 to 2000 kc were obtained in the same way except the common difference here is $2\pi \times 10^{-3}$. The values for $1/w^2$ were obtained by taking the reciprocal of the squared values of w and were checked with some previously computed tables.

EXTENSION OF TABLES

Let the tabulated value for w be M. The range of the tables may be extended as follows.

Frequency	w	$1/w^2$
5 cycles	$M \times 10^{-5}$	$M \times 10^{10}$
50 cycles	$M \times 10^{-4}$	$M \times 10^{8}$
500 cycles	$M \times 10^{-3}$	$M \times 10^{6}$
5 kc	$M \times 10^{-2}$	$M \times 10^{4}$
50 kc	$M \times 10^{-1}$	$M \times 10^{2}$
500 kc	M	M
5 mc	$M \times 10$	$M \times 10^{-2}$
50 mc	$M \times 10^{2}$	$M \times 10^{-4}$
500 mc	$M \times 10^{3}$	$M \times 10^{-6}$
5000 mc	$M \times 10^{4}$	$M \times 10^{-8}$

VALUES OF W

Freq. kc	$w \times 10^5$	Freq. kc	$w \times 10^6$	Freq. kc	$w \times 10^6$	Freq. kc	$w \times 10^6$
100	6.2831853						
105	6.5973446	205	1.2880530	305	1.9163715	405	2.5446900
110	6.9115038	210	1.3194689	310	1.9477874	410	2.5761060
115	7.2256631	215	1.3508848	315	1.9792034	415	2.6075219
120	7.5398224	220	1.3823008	320	2.0106192	420	2.6389378
125	7.8539816	225	1.4137167	325	2.0420352	425	2.6703538
130	8.1681409	230	1.4451326	330	2.0734511	430	2.7017697
135	8.4823001	235	1.4765485	335	2.1048671	435	2.7331856
140	8.7964594	240	1.5079645	340	2.1362830	440	2.7646015
145	9.1106187	245	1.5393804	345	2.1676989	445	2.7960175
150	9.4247779	250	1.5707963	350	2.1991148	450	2.8274334
155	9.7389372	255	1.6022122	355	2.2305308	455	2.8588493
160	10.0530965	260	1.6336282	360	2.2619467	460	2.8902652
	$w \times 10^6$						
165	1.0367256	265	1.6650441	365	2.2933626	465	2.9216812
170	1.0681415	270	1.6964600	370	2.3247786	470	2.9530971
175	1.0995574	275	1.7278759	375	2.3561945	475	2.9845130
180	1.1309733	280	1.7592919	380	2.3876104	480	3.0159289
185	1.1623893	285	1.7907078	385	2.4190263	485	3.0473449
190	1.1938052	290	1.8221237	390	2.4504423	490	3.0787608
195	1.2252211	295	1.8535397	395	2.4818582	495	3.1101767
200	1.2566371	300	1.8849556	400	2.5132741	500	3.1415927

VALUES OF W (Continued)

Freq. kc	$w \times 10^6$	Freq. kc	$w \times 10^6$	Freq. kc	$w \times 10^6$	Freq. kc	$w \times 10^6$
505	3.1730086	755	4.7438049	1005	6.3146012	1255	7.8853976
510	3.2044245	760	4.7752208	1010	6.3460172	1260	7.9168135
515	3.2358404	765	4.8066368	1015	6.3774331	1265	7.9482294
520	3.2672564	770	4.8380527	1020	6.4088490	1270	7.9796453
525	3.2986723	775	4.8694686	1025	6.4402649	1275	8.0110613
530	3.3300882	780	4.9008845	1030	6.4716809	1280	8.0424772
535	3.3615041	785	4.9323005	1035	6.5030968	1285	8.0738931
540	3.3929200	790	4.9637164	1040	6.5345127	1290	8.1053090
545	3.4243360	795	4.9951323	1045	6.5659286	1295	8.1367250
550	3.4557519	800	5.0265482	1050	6.5973446	1300	8.1681409
555	3.4871678	805	5.0579642	1055	6.6287605	1305	8.1995568
560	3.5185838	810	5.0893801	1060	6.6601764	1310	8.2309727
565	3.5499997	815	5.1207960	1065	6.6915923	1315	8.2623887
570	3.5814156	820	5.1522119	1070	6.7230083	1320	8.2938046
575	3.6128315	825	5.1836279	1075	6.7544242	1325	8.3252205
580	3.6442475	830	5.2150438	1080	6.7858401	1330	8.3566364
585	3.6756634	835	5.2464597	1085	6.8172561	1335	8.3880524
590	3.7070793	840	5.2778757	1090	6.8486720	1340	8.4194683
595	3.7384953	845	5.3092916	1095	6.8800879	1345	8.4508842
600	3.7699112	850	5.3407075	1100	6.9115038	1350	8.4823002
605	3.8013271	855	5.3721234	1105	6.9429198	1355	8.5137161
610	3.8327430	860	5.4035394	1110	6.9743357	1360	8.5451320
615	3.8641590	865	5.4349553	1115	7.0057516	1365	8.5765479
620	3.8955749	870	5.4663712	1120	7.0371675	1370	8.6079639
625	3.9269908	875	5.4977871	1125	7.0685835	1375	8.6393798
630	3.9584067	880	5.5292031	1130	7.0999994	1380	8.6707957
635	3.9896827	885	5.5606190	1135	7.1314153	1385	8.7022116
640	4.0212386	890	5.5920349	1140	7.1628312	1390	8.7336276
645	4.0526545	895	5.6234508	1145	7.1942472	1395	8.7650435
650	4.0840704	900	5.6548668	1150	7.2256631	1400	8.7964594
655	4.1154864	905	5.6862827	1155	7.2570790	1405	8.8278753
660	4.1469023	910	5.7176986	1160	7.2884949	1410	8.8592913
665	4.1783182	915	5.7491145	1165	7.3199109	1415	8.8907072
670	4.2097342	920	5.7805305	1170	7.3513268	1420	8.9221231
675	4.2411501	925	5.8119464	1175	7.3827427	1425	8.9535391
680	4.2725660	930	5.8433623	1180	7.4141587	1430	8.9849550
685	4.3039819	935	5.8747783	1185	7.4455746	1435	9.0163709
690	4.3353979	940	5.9061942	1190	7.4769905	1440	9.0477868
695	4.3668138	945	5.9376101	1195	7.5084064	1445	9.0792028
700	4.3982297	950	5.9690260	1200	7.5398224	1450	9.1106187
705	4.4296456	955	6.0004420	1205	7.5712383	1455	9.1420346
710	4.4610616	960	6.0318579	1210	7.6026542	1460	9.1734505
715	4.4924775	965	6.0632738	1215	7.6340701	1465	9.2048665
720	4.5238934	970	6.0946897	1220	7.6654861	1470	9.2362824
725	4.5553093	975	6.1261057	1225	7.6969020	1475	9.2676983
730	4.5867253	980	6.1575216	1230	7.7283180	1480	9.2991142
735	4.6181412	985	6.1889375	1235	7.7597338	1485	9.3305302
740	4.6495571	990	6.2203534	1240	7.7911498	1490	9.3619461
745	4.6809730	995	6.2517694	1245	7.8225657	1495	9.3933620
750	4.7123890	1000	6.2831853	1250	7.8539816	1500	9.4247779

VALUES OF W (Continued)

Freq. kc	w × 10^6	Freq. kc	w × 10^6	Freq. kc	w × 10^6	Freq. kc	w × 10^6
1505	9.4561939	1630	1 0241592	1755	1 1026990	1880	1 1812388
1510	9.4876098	1635	1 0273008	1760	1 1058406	1885	1 1843804
1515	9.5190257	1640	1 0304424	1765	1 1089822	1890	1 1875220
1520	9.5504417	1645	1 0334840	1770	1.1121238	1895	1 1906636
1525	9.5818576	1650	1 0367256	1775	1.1152654	1900	1.1938052
1530	9 6132735	1655	1 0398672	1780	1.1184070	1905	1 1969468
1535	9 6446894	1660	1 0430088	1785	1.1215486	1910	1 2000884
1540	9.6761054	1665	1 0461504	1790	1 1246902	1915	1 2032300
1545	9.7075213	1670	1 0492919	1795	1 1278318	1920	1 2063716
1550	9.7389372	1675	1 0524335	1800	1.1309734	1925	1 2095132
1555	9 7703531	1680	1 0555751	1805	1 1341149	1930	1 2126548
1560	9 8017691	1685	1 0587167	1810	1 1372565	1935	1 2157964
1565	9 8331850	1690	1 0618583	1815	1 1403981	1940	1 2189379
1570	9 8646009	1695	1 0649999	1820	1 1435397	1945	1 2220795
1575	9 8960168	1700	1 0681415	1825	1 1466813	1950	1 2252211
1580	9 9274328	1705	1 0712831	1830	1 1498229	1955	1 2283627
1585	9 9588487	1710	1 0744247	1835	1 1529645	1960	1 2315043
1590	9 9902646	1715	1 0775663	1840	1 1561061	1965	1 2346459
1595	10 0216806	1720	1 0807079	1845	1 1592477	1970	1 2377875
1600	10.0530965	1725	1 0838495	1850	1 1623893	1975	1 2409291
1605	1 0084512	1730	1 0869911	1855	1 1655309	1980	1 2440707
1610	1 0115928	1735	1 0901326	1860	1.1686725	1985	1 2472123
1615	1 0147344	1740	1 0932742	1865	1 1718141	1990	1 2503539
1620	1 0178760	1745	1 0964158	1870	1 1749557	1995	1 2534955
1625	1 0210176	1750	1 0995574	1875	1 1780972	2000	1 2566371

VALUES OF $1/W^2$

Freq. kc	$1/w^2 \times 10^{-12}$	Freq. kc	$1/w^2 \times 10^{-13}$	Freq. kc	$1/w^2 \times 10^{-13}$	Freq. kc	$1/w^2 \times 10^{-14}$
100	2 533029						
105	2 297532	205	6 027435	305	2 722955	405	1 544294
110	2 093412	210	5.743831	310	2 635826	410	1 506858
115	1 915334	215	5.479783	315	2 552813	415	1 470767
120	1 759048	220	5.258299	320	2 473661	420	1 435957
125	1 621138	225	5.003515	325	2 398134	425	1 402369
130	1 498834	230	4 788335	330	2 326014	430	1.369945
135	1 389865	235	4 586744	335	2.257099	435	1 338633
140	1 292362	240	4.397620	340	2.191202	440	1.308383
145	1 204770	245	4 219957	345	2 128149	445	1 279146
150	1 125790	250	4 052847	350	2.067779	450	1 250878
155	1 054330	255	3 895470	355	2 009942	455	1.223538
	$1/w^2 \times 10^{-13}$	260	3 747085	360	1 954498	460	1 197083
		265	3 607019	365	1 901317	465	1 171478
		270	3.474663	370	1.850277	470	1 146686
160	9 894647	275	3.349460	375	1.801265	475	1.122672
165	9 304056						
170	8 764808	280	3 230905	380	1 754175	480	1 099405
175	8 271117	285	3 118534	385	1 708908	485	1 076853
		290	3 011925	390	1 665371	490	1 054989
180	7 817993	295	2 910691	395	1 623476	495	1 033784
185	7 401108	300	2 814477	400	1 583143	500	1 013211
190	7 016702						
195	6 661485						
200	6 332573						

VALUES OF $1/W^2$ (Continued)

Freq. kc	$1/w^2 \times 10^{-14}$	Freq. kc	$1/w^2 \times 10^{-14}$	Freq. kc	$1/w^2 \times 10^{-14}$	Freq. kc	$1/w^2 \times 10^{-14}$
505	9 932475	755	4 44372	1005	2 50789	1255	1 60825
510	9.738676	760	4 38542	1010	2 48312	1260	1 59550
515	9 55051	765	4 32831	1015	2 45871	1265	1 58292
520	9 36772	770	4 27227	1020	2 43467	1270	1 57048
525	9 19013	775	4 21732	1025	2 41097	1275	1 55819
530	9 01754	780	4 16342	1030	2 38763	1280	1 54604
535	8 84977	785	4 11055	1035	2 36461	1285	1 53403
540	8.68664	790	4 05869	1040	2 34193	1290	1.52216
545	8 52800	795	4 00780	1045	2 31957	1295	1 51043
550	8 37365	800	3 95785	1050	2 29753	1300	1 49883
555	8 22345	805	3 90884	1055	2 27581	1305	1 48737
560	8 07726	810	3 86074	1060	2 25438	1310	1 47604
565	7.93495	815	3 81550	1065	2 23327	1315	1 46484
570	7 79650	820	3 76714	1070	2 21239	1320	1 45376
575	7 66134	825	3 72162	1075	2 19191	1325	1 44281
580	7 52981	830	3 67692	1080	2 17166	1330	1 43198
585	7 40166	835	3 63302	1085	2 15170	1335	1 42127
590	7 27673	840	3 58990	1090	2 13200	1340	1 41069
595	7 15495	845	3 54753	1095	2 11257	1345	1 40022
600	7 03620	850	3.50592	1100	2 09341	1350	1 38986
605	6 92039	855	3 46504	1105	2 07451	1355	1 37963
610	6 80738	860	3 42487	1110	2 05586	1360	1 36950
615	6 69716	865	3 38539	1115	2 03747	1365	1 35949
620	6 58955	870	3 34660	1120	2 01931	1370	1 34957
625	6 48456	875	3 30844	1125	2 00416	1375	1 33978
630	6 38201	880	3 27095	1130	1 98373	1380	1 33009
635	6 28190	885	3 23410	1135	1 96629	1385	1 32051
640	6 18416	890	3 19786	1140	1 94908	1390	1 31102
645	6 08863	895	3 16110	1145	1 93210	1395	1 30164
650	5 99535	900	3 12719	1150	1.91533	1400	1 29236
655	5 90416	905	3 09274	1155	1 89879	1405	1 28318
660	5 81503	910	3 05885	1160	1 88245	1410	1 27410
665	5 72792	915	3 02551	1165	1 86633	1415	1 26511
670	5 64274	920	2 99270	1170	1 85041	1420	1 25621
675	5 55958	925	2 96044	1175	1 83469	1425	1 24741
680	5 47800	930	2 92869	1180	1 81918	1430	1 23870
685	5 39831	935	2 89745	1185	1 80386	1435	1 23009
690	5 32037	940	2 86671	1190	1 78873	1440	1 22185
695	5 24408	945	2 83646	1195	1 77380	1445	1 21312
700	5 16944	950	2 80667	1200	1 75905	1450	1 20477
705	5 09640	955	2 77737	1205	1 74448	1455	1 19650
710	5 02486	960	2 74851	1210	1 73010	1460	1 18832
715	4 95483	965	2 72011	1215	1 71588	1465	1 18023
720	4 88626	970	2 69213	1220	1 70185	1470	1 17221
725	4 81908	975	2 66459	1225	1 68798	1475	1 16428
730	4 75339	980	2 63747	1230	1 67429	1480	1 15642
735	4 68885	985	2 61077	1235	1 66076	1485	1 14865
740	4 62569	990	2 58446	1240	1 64739	1490	1 14096
745	4 56382	995	2 55855	1245	1 63419	1495	1 13333
750	4 50317	1000	2 53303	1250	1 62114	1500	1.12579

VALUES OF 1/W² (Continued)

Freq. kc	$1/w^2 \times 10^{-14}$	Freq. kc	$1/w^2 \times 10^{-15}$	Freq. kc	$1/w^2 \times 10^{-15}$	Freq. kc	$1/w^2 \times 10^{-15}$
1505	1.11832	1630	9 53375	1755	8 22406	1880	7 16679
1510	1 11193	1635	9 47556	1760	8 17738	1885	7 12882
1515	1 10361	1640	9 41785	1765	8 13113	1890	7 09115
1520	1.09636	1645	9 36070	1770	8 08526	1895	7 05378
1525	1.08918	1650	9 30404	1775	8 03977	1900	7.01670
1530	1 08208	1655	9 24792	1780	7 99467	1905	6 97992
1535	1 07504	1660	9.19230	1785	7 94994	1910	6 94342
1540	1 06807	1665	9 13717	1790	7 90559	1915	6 90721
1545	1 06117	1670	9.08256	1795	7 86161	1920	6 87128
1550	1 05433	1675	9 02840	1800	7 81799	1925	6 83563
1555	1 04756	1680	8 97475	1805	7.77474	1930	6 80026
1560	1 04086	1685	8 92155	1810	7 73185	1935	6 76516
1565	1 03422	1690	8 86882	1815	7 68930	1940	6 73034
1570	1 02764	1695	8 81659	1820	7 64711	1945	6 69578
1575	1.02113	1700	8 76480	1825	7 60527	1950	6 66149
1580	1.01467	1705	8 71348	1830	7 56377	1955	6 62745
1585	1 00828	1710	8 66260	1835	7 52260	1960	6.59368
1590	1 00195	1715	8 61216	1840	7 48177	1965	6.56017
	$1/w^2 \times 10^{-15}$						
1595	9 95678	1720	8 56218	1845	7 44128	1970	6 52691
1600	9 89464	1725	8 51260	1850	7 40111	1975	6 49391
1605	9 83310	1730	8 46371	1855	7 36126	1980	6 46115
1610	9 77211	1735	8 41475	1860	7 32174	1985	6 42864
1615	9 71170	1740	8 36647	1865	7 28253	1990	6 39638
1620	9 65184	1745	8 31858	1870	7 24364	1995	6 36436
1625	9 59254	1750	8 27112	1875	7 20506	2000	6 33257

CHARACTERISTICS OF

Compiled by

Since the exact operating characteristics may vary considerably depending upon the use information should be consulted for further details.

Abbreviations

A.C., alternating current	D.C., direct current
A.F., audio frequency	Det., detector
Amp., amperes, amplifier, amplification	Diss., dissipation
B, bayonet	Fil., filament
Coat., coated	Heat., heater
Cond., conductance	H. F., high frequency
Conv., converter, conversion	m, milli-
Cur., current	M, medium

RECEIVING

Metal tubes are designated by the letter M in front of the tube number. The type of connections are indicated by diagrams with the corresponding numbers, following the tables.

Type No.	Description and use	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type[1]	Potential volts	Current amp			
00-A	Detector, triode	MB 4-4	D.C. Fil.	5.0	0.25	45	1.5	.
01-A	Det.,[2] amp., class A	MB 4-4	D.C. Fil.	5.0	0.25	90	2.5	. . .
						135	3.0	
1A4[3]	R.F.amp., pentode, class A	S 4-11	D.C. Fil.	2.0	0.06	90	2.2	67.5
						180	2.3	67.5
1A6[3]	Pentagrid conv.[4] . .	S 6-10	D.C. Fil.	2.0	0.06	135	1.2	67.5
						180	1.3	67.5
1B4	R.F.amp., pentode, class A	S 4-11	D.C. Fil	2.0	0.06	90	1.6	67.5
						180	1.7	67.5
1B5, 25S[3]	Duplex diode, triode, class A amp	S 6-11	D.C. Fil.	2.0	0.06	135	0.8	
1C6[3]	Pentagrid conv.[4]....	S 6-10	D.C. Fil.	2.0	0.12	135	1.3	67.5
						180	1.5	67.5
1F4[3]	Pow. amp., pentode, class A	M 5-9	D.C. Fil.	2.0	0.12	135	8.0	135
1F6[3]	Duplex diode, pentode							
	Pentode unit as R.F. amp	S 6-17	D.C. Fil	2.0	0.06	180	2.0	67.5
	Pentode unit as A.F. amp.	S 6-17	D.C. Fil	2.0	0.06	135[14]	. . . .	.
2A3	Pow. amp., triode							
	Class A . .	M 4-4	Fil.	2.5	2.5	250	60.0	.
	Push-pull, Class AB1[7]	M 4-4	Fil.	2.5	2.5	300	80.0	.
						300	80.0	
2A5	Pow. amp., pentode	M 6-2	Heat.	2.5	1.75		.	.
2A6	Duplex diode, high-mu triode, triode unit as amp.	S 6-7	Heat.	2.5	0.8	250		.
2A7	Pentagrid conv.[4]	S 7-3	Heat.	2.5	0.8	250		100
2B7	Duplex diode, pentode, amp.	S 7-4	Heat.	2.5	0.8	250		125

THERMIONIC VACUUM TUBES

J. R. Martin

tc which the electronic devices may be put, the manufacturers' specifications and special

Abbreviations

Ma, milliampere	Pow., power
Max., maximum	Resist., resistance
Meg., megohm	R.F., radio frequency
Min., minimum	S, small
Mod., modulator	Thor., thoriated
Mog.Scr., mogul screw	Tung., tungsten
O, octal	Volt., voltage
Osc., oscillator	μ, micro-

TUBES

base is indicated by two numbers the first of which is the number of prongs. The base

Type No.	Screen current ma	Grid bias[1] volts	Plate resist ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
00-A	Return to (−) filament		30000	20	666		
01-A		−4 5	11000	8	725		
		−9 0	10000	8	800		
1A4	0 9	−3 0 min.	600000	425	720		
	0 8	−3 0 min.	1000000	750	750		
1A6	2 5	−3 0 min.	400000	Anode-grid (#2): 180[5] max. volts, 2.3 ma.			
	2 4	−3 0 min.	500000	Osc.-grid (#1) resistor, 50000 ohms.			
				Conv. cond., 300 micromhos.			
1B4	0 7	−3 0	1000000	550	600		
	0 6	−3 0	1500000	1000	650		
1B5, 25S	. .	−3 0	35000	20	575		
1C6	2 0	−3 0 min.	550000	Anode-grid (#2): 180[5] max. volts, 3.3 ma.			
	2 0	−3 0 min.	750000	Osc.-grid (#1) resistor, 50000 ohms.			
				Conv. cond., 325 micromhos.			
1F4	2 6	−4 5	200000	340	1700	0 34	16000
1F6							
	0 6	−1 5	1000000	650	650		
		−2 0	Screen supply, 135 volts applied through 0.8 megohm resistor. Grid resistor,[6] 1.0 megohm. Voltage gain, 46.				
2A3							
		−45.0	800	4 2	5250	3 5	2500
	Self-bias, 780 ohms		..	..	......	10 0[8]	5000
	. .	−62.0	. .		......	15.0[8]	3000
2A5	.. . .	....	See type number 42.				
2A6	.. ..	. ...	See type number 75.				
2A7	...	. . ..	See type number 6A7.				
2B7	. . .	....	See type number 6B7.				

Type No.	Description and use	Base	Cathode Type[1]	Cathode Potential volts	Cathode Current amp.	Plate potential volts	Plate current ma	Screen potential volts
6A4, LA	Pow. amp., pentode, class A.	M 5-2	Fil.	6.3	0.3	100	9.0	100
						180	22.0	180
6A6	Twin triode, amp. .	M 7-2	Heat.	6.3	0.8	300	. . .	. . . .
6A7	Pentagrid conv.[4] . .	S 7-3	Heat.	6.3	0.3	100	1.3	50
						250	3.5	100
M 6A8[3]	Pentagrid conv.[4] . . .	SO 8-1	Heat.	6.3	0.3	100	1.2	50
						250	3.3	100
6B7	Duplex diode, pentode							
	Pentode unit as R.F. amp	S 7-4	Heat.	6.3	0.3	100	5.8	100
						250	9.0	125
	Pentode unit as A.F. amp	S 7-4	Heat.	6.3	0.3	90[14]	. .	
						300[14]	. .	
M 6B8	Duplex diode, pentode							
	Pentode unit as R.F. amp	SO 8-5	Heat.	6.3	0.3	250	10.0	125
	Pentode unit as A.F. amp.	SO 8-5	Heat.	6.3	0.3	90[14]	.	
						300[14]		
M 6C5[3]	Det.,[2] amp., triode							
	Class A amp	SO 6-12	Heat.	6.3	0.3	250	8.0	.
						250[15]	1.0	
	Bias detector .	SO 6-12	Heat.	6.3	0.3	250		
6C6	Triple grid det., amp	S 6-6	Heat.	6.3	0.3	250		100
6D6	Triple grid amp							
	Screen grid R.F. amp	S 6-6	Heat.	6.3	0.3	100	8.0	100
						250	8.2	100
	Mixer in superheterodyne	S 6-6	Heat.	6.3	0.3	100		100
						250		100
6E5	Electron ray tube, visual indicator	S 6-13	Heat.	6.3	0.3	100		.
						250[9]		.
M 6F5[3]	High-mu triode, class A amp.	SO 5-11	Heat.	6.3	0.3	250	0.9	
						250[14]	0.4	
M 6F6[3]	Pow. amp., pentode							
	Pentode, class A	SO 7-14	Heat.	6.3	0.7	250	34.0	250
						315	42.0	315
	Triode,[10] class A .	SO 7-14	Heat.	6.3	0.7	250	31.0	.
	Pentode, push-pull, class AB_2[7]	SO 7-14	Heat.	6.3	0.7	375	54.0	250
						375	34.0	250
	Triode, push-pull,[10] class AB_2[7]	SO 7-14	Heat.	6.3	0.7	350	50.0	.
						350	45.0	.
6F7	Triode, pentode							
	Triode, class A amp	S 7-5	Heat.	6.3	0.3	100	3.5	.
	Pentode, class A amp	S 7-5	Heat.	6.3	0.3	100	6.3	100
						250	6.5	100
	Pentode unit as mixer	S 7-5	Heat.	6.3	0.3	250	2.8	100

TUBES (Continued)

Type No.	Screen current ma	Grid bias[1] volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
6A4, LA	1 6	− 6 5	83250	100	1200	0 31	11000
	3 9	−12 0	45500	100	2200	1.40	8000
6A6	...	..	See type number 6N7.				
6A7	2 5	− 3 0 min.	600000	Anode-grid (#2): 250[5] max. volts, 4.0 ma.			
	2 2	− 3 0 min.	360000	Osc.-grid (#1) resistor, 50000 ohms.			
				Conv. cond., 520 micromhos.			
M 6A8	1 5	− 3 0 min.	600000	Anode-grid (#2): 250[5] max. volts, 4.0 ma.			
	3 2	− 3 0 min.	360000	Osc.-grid (#1) resistor, 50000 ohms.			
				Conv. cond., 500 micromhos.			
6B7							
	1 7	− 3 0	300000	285	950		
	2 3	− 3 0	650000	730	1125		
	Self-bias, 3500 ohms. Screen resistor = 1.1 meg Grid resistor,[6] 0.5 megohm. Gain per stage = 55.						
	Self-bias, 1600 ohms. Screen resistor = 1 2 meg. Grid resistor,[6] 0 5 megohm. Gain per stage = 79.						
M 6B8							
	2 3	− 3 0	600000	800	1325		
	Self-bias, 3500 ohms. Screen resistor = 1 1 meg. Grid resistor,[6] 0.5 megohm Gain per stage = 55.						
	Self-bias, 1600 ohms. Screen resistor = 1 2 meg. Grid resistor,[6] 0 5 megohm. Gain per stage = 79.						
M 6C5							
	.	− 8 0	10000	20	2000		
		− 5 0	Gain per stage = 14.				
	.	−17 0 approx.	Plate current to be adjusted to 0 2 ma with no signal.				
6C6		. .	See type number 6J7.				
6D6							
	2 2	− 3 0 min.	250000	375	1500		
	2 0	− 3 0 min.	800000	1280	1600		
	...	−10 0	Oscillator peak volts = 7 0				
	.	−10 0					
6E5	Plate & target supply = 100 volts Triode plate resistor = 0.5 meg. Target cur = 4.5 ma. Grid bias, −3 3 volts, shadow angle, 0°. Bias, 0 volts, angle, 90°; plate cur, 0.19 ma.						
	Plate & target supply = 250 volts. Triode plate resistor = 1.0 meg. Target cur. = 4.5 ma. Grid bias, −8.0 volts, shadow angle, 0°. Bias, 0 volts, angle, 90°, plate cur., 0.24 ma.						
M 6F5		− 2 0	66000	100	1500		
	...	− 0 3	Grid resistor, 0.25 meg[6] Gain per stage = 52.				
M 6F6							
	6 5	−16 5	80000	200	2500	3 0	7000
	8 0	−22 0	75000	200	2650	5 0	7000
		−20 0	2600	7	2700	0 85	4000
	8 0	Self-bias	Self-bias resistor, 340 ohms.			19 0[8]	10000
	5 0	−26 0		..	..	19 0[8]	10000
	. .	Self-bias	Self-bias resistor, 730 ohms.			14 0[8]	10000
	. .	−38 0	.	....	. ..	18.0[8]	6000
6F7							
	.	− 3 0	16000	8	500		
	1 6	− 3 0 min.	290000	300	1050		
	1 5	− 3 0 min.	850000	900	1100		
	0 6	−10.0	Osc. peak volts = 7.0. Conv. cond. = 300 micromhos				

Type No.	Description and use	Base	Cathode Type[1]	Cathode Potential volts	Cathode Current amp.	Plate potential volts	Plate current ma	Screen potential volts
6G5	Electron ray tube, visual indicator	S 6-13	Heat.	6.3	0.3	100	.	...
						250[9]		..
M 6J7[3]	Triple grid det., amp.							
	Screen grid, R.F. amp	SO 7-13	Heat.	6.3	0.3	100 250	2.0 2.0	100 100
	Screen grid, A.F. amp	SO 7-13	Heat.	6.3	0.3	90[14]		.
						300[14]	.	.
	Bias detector	SO 7-13	Heat	6.3	0.3	250	[11]	100
M 6K7[3]	Triple grid amp.							
	Screen grid R.F. amp	SO 7-13	Heat	6.3	0.3	90 250	5.4 10.5	90 125
	Mixer in superheterodyne	SO 7-13	Heat.	6.3	0.3	250		100
M 6L6[3]	Beam pow. amp.							
	Single tube, class A_1[7]	SO 7-18	Heat.	6.3	0.9	250 250	72.0 75.0	250 250
	Push-pull, class A_1[7]	SO 7-18	Heat.	6.3	0.9	250 250	120.0 120.0	250 250
	Push-pull, class AB_1[7].	SO 7-18	Heat.	6.3	0.9	400 400	102.0 112.0	300 300
	Push-pull, class AB_2[7]	SO 7-18	Heat.	6.3	0.9	400 400	88.0 102.0	250 300
M 6L7[3]	Pentagrid mixer,[12] amp.							
	Mixer in superheterodyne	SO 7-15	Heat.	6.3	0.3	250	2.4	100
	Class A amp .	SO 7-15	Heat	6.3	0.3	250	5.3	100
M 6N7[3]	Twin triode, amp.							
	Class A (as driver)[13]	SO 8-2	Heat.	6.3	0.8	250 294	6.0 7.0	.
	Class B	SO 8-2	Heat.	6.3	0.8	250 300		
M 6Q7[3]	Duplex diode, high-mu triode, triode unit as class A amp.	SO 7-16	Heat.	6.3	0.3	100 250 100[16] 250[17]	0.35 1.1 0.25 0.5	
M 6R7[3]	Duplex diode, triode, triode unit as class A amp	SO 7-16	Heat.	6.3	0.3	250 250[16]	9.5 1.3	
10	Pow. amp., triode, class A	MB 4-4	Fil.	7.5	1.25	350 425	16.0 18.0	.
12	Det.,[2] amp., triode, class A	MB 4-4	D.C. Fil	1.1	0.25	90 135	2.5 3.0	
12-A	General purpose .	4-4	Fil.	5.0	0.25	180	7.6	
15	R.F. amp., pentode, class A	S 5-6	Heat.	2.0	0.22	67.5 135	1.85 1.85	67.5 67.5
18	Output pentode . .	6-1	Heat.	14.0	0.30	250	34.0	250
19[3]	Twin triode, amp., class B	S 6-3	D.C. Fil.	2.0	0.26	135 135	. ..	.
20	Pow. amp., triode, class A	S 4-4	D.C. Fil.	3.3	0.132	90 135	3.0 6.5	.

TUBES (Continued)

Type No.	Screen current ma	Grid bias[1] volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
6G5	Plate & target supply = 100 volts. Triode plate resistor = 0.5 meg. Target cur. = 4.5 ma. Grid bias, −8 volts; shadow angle, 0°. Bias, 0 volts; angle, 90°; plate cur., 0.19 ma.						
	Plate & target supply = 250 volts. Triode plate resistor = 1.0 meg. Target cur. = 4.5 ma. Grid bias, −22 volts; shadow angle, 0°. Bias, 0 volts; angle, 90°; plate cur., 0 24 ma.						
M 6J7							
	0 5	− 3 0	1000000	1185	1185		
	0 5	− 3 0	>1500000	>1500	1225		
	Self-bias, 2600 ohms. Screen resistor = 1.2 meg. Grid resistor,[6] 0.5 megohm. Gain per stage = 85.						
	Self-bias, 1200 ohms. Screen resistor = 1.2 meg. Grid resistor,[6] 0.5 megohm. Gain per stage = 140.						
	[11]	− 4.3	.. ...	Plate resistor, 500000 ohms. Grid resistor,[6] 250000 ohms.			
M 6K7							
	1 3	− 3 0 min.	315000	400	1275		
	2 6	− 3 0 min.	600000	990	1650		
		−10 0	Oscillator peak volts = 7.0.				
M 6L6							
	5 0	−14 0	..	. . ..	...	6 5	2500
	5 4	Self-bias	Self-bias resistor, 170 ohms.			6 5	2500
	10 0	−16 0	.		...	14 5[8]	5000
	10 0	Self-bias	Self-bias resistor, 125 ohms.			13 8[8]	5000
	6 0	−25 0	. .		. .	34 0[8]	6600
	7 0	Self-bias	Self-bias resistor, 200 ohms.			32 0[8]	6600
	4 0	−20 0	. ..	.	.	40 0[8]	6000
	6 0	−25 0	. .. ...	. .		60 0[8]	3800
M 6L7							
	6 2	− 3 0	Osc.-grid (#3) bias, −10 volts. Grid #3 peak swing, 12 volts min. Conv. cond., 350 micromhos.				
	5 5	− 3 0 min[18]	800000	880	1100		
M 6N7							
		− 5 0	11300	35	3100	>0 4	>20000
	.	− 6 0	11000	35	3200	>0 4	>20000
	.	0	Power output is for one tube			8 0	8000
	.	0	at stated plate-to-plate load.			10 0	10000
M 6Q7		− 1 5	87500	70	800		
		− 3 0	58000	70	1200		
		− 1 1	(Grid resistor,[6] 0.5)		Gain per stage = 35.		
		− 2 0	(megohm.)		Gain per stage = 43.		
M 6R7		− 9 0	8500	16	1900	0 28	10000
		− 6 0	Grid resistor,[6] 0.5 megohm. Gain per stage = 12.				
10		−32 0	5150	8	1550	0 9	11000
		−40 0	5000	8	1600	1 6	10200
12	.	− 4 5	15500	6 6	425		
	.	−10 5	15000	6 6	440		
12-A		−13 5	5000	8 5	1700	0.260	10800
15	0 3	− 1 5	630000	450	710		
	0 3	− 1 5	800000	600	750		
18		−16 5	75000	165	2200	3 000	9000
19		0	Power output is for one tube at			2 1	10000
		− 3 0	stated plate-to-plate load.			1 9	10000
20		−16 5	8000	3 3	415	0 045	9600
		−22 5	6300	3 3	525	0.110	6500

Type No.	Description and use	Base		Cathode Type[1]	Cathode Potential volts	Cathode Current amp.	Plate potential volts	Plate current ma	Screen potential volts
22	R.F. amp., tetrode...	M	4-9	D.C. Fil.	3 3	0 132	135	1 7	45
							135	3 7	67 5
22	R.F. amp		5-5	Heat.	15 0	0 35	135	1.0	30
24-A	R.F. amp., tetrode								
	R.F. amp	M	5-5	Heat.	2 5	1 75	180	4 0	90
							250	4 0	90
	Bias detector	M	5-5	Heat.	2 5	1 75	250[19]		20to45
M 25A6[3]	Pow. amp., pentode, class A	SO	7-14	Heat.	25 0	0 3	95	20 0	95
							180	38 0	135
26	Amp., triode, class A...	M	4-4	Fil.	1.5	1.05	90	2 9	....
							180	6 2	.
26	Detector.......		5-1	Heat.	15 0	0 35	90	4 5	.
27	Det.,[2] amp., triode								
	Class A amp.......	M	5-1	Heat.	2 5	1 75	135	4 5	.
							250	5.2	...
	Bias detector	M	5-1	Heat.	2 5	1 75	250	.	.
28	General purpose		5-1	Heat.	15 0	0 35	90	7 5	
29	Special detector		5-1	Heat.	2 5	1 00	180	4 5	
30[3]	Det.,[2] amp., triode,								
	Class A amp..	S	4-4	D.C. Fil.	2 0	0 06	90	2 5	
							135	3 0	
							180	3 1	
	Class B amp..	S	4-4	D.C. Fil.	2 0	0 06	157 5	1 0	
30	Power amp.		5-1	Heat.	15 0	0 35	180	22 0	
31	Pow. amp., triode, class A	S	4-4	D.C. Fil	2 0	0 13	135	8 0	
							180	12 3	
32	R.F. amp., tetrode								
	R.F. amp..........	M	4-9	D.C. Fil	2 0	0 06	135	1 7	67 5
							180	1 7	67 5
	Bias detector	M	4-9	D.C. Fil.	2 0	0 06	180[15]		67 5
32	Voltage amp ..		5-1	Heat.	15 0	0 35	135	1 5	.
33	Pow. amp., pentode, class A	M	5-9	D.C. Fil.	2 0	0 26	180	22 0	180
34	R.F. amp., pentode....	M	4-11	D.C. Fil.	2 0	0 06	135	2 8	67 5
							180	2 8	67 5
35	R.F. amp., tetrode.. ..	M	5-5	Heat.	2 5	1 75	180	6 3	90
							250	6 5	90
36	R.F. amp., tetrode								
	R.F. amp	S	5-5	Heat.	6 3	0 3	100	1 8	55
							250	3 2	90
	Bias detector..	S	5-5	Heat.	6 3	0 3	100[19]	. .	55
							250[19]	.	90
37	Det.,[2] amp , triode								
	Class A amp	S	5-1	Heat.	6 3	0 3	90	2 5	
							250	7 5	
	Bias detector.. .. .	S	5-1	Heat.	6 3	0 3	90	.....	
							250		.
38	Pow amp., pentode, class A	S	5-6	Heat.	6 3	0 3	100	7 0	100
							250	22 0	250
39, 44	R.F. amp., pentode.	S	5-6	Heat.	6 3	0 3	90	5 6	90
							250	5 8	90
40	Voltage amp., triode, class A	MB	4-4	D.C. Fil.	5 0	0 25	135[14]	0 2	. .
							180[14]	0 2	.
40	Power amp		5-1	Heat.	15 0	0 40	180	21 0	.
41[3]	Pow. amp., pentode, class A	S	6-2	Heat.	6 3	0.4	100	9 0	100
							250	32 0	250

TUBES (Continued)

Type No.	Screen cur-rent ma	Grid bias[1] volts	Plate resist. ohms	Amp. factor	Trans-conduct-ance μ mhos	Power output watts	Load resist. ohms
22	0 6 max	− 1 5	725000	270	375		
	1 3 max.	− 1 5	325000	160	500		
22	. . .	− 1 5	700000	400	570		
24-A							
	1 7 max.	− 3 0	400000	400	1000		
	1 7 max.	− 3 0	600000	630	1050		
	.	− 5 0 approx.	Plate cur. to be adjusted to 0.1 ma with no signal.				
M 25A6	4 0	−15 0	45000	90	2000	0.9	4500
	7 5	−20 0	40000	100	2500	2.75	5000
26	. . .	− 7 0	8900	8 3	935		
	.	−14 5	7300	8 3	1150		
26	.	− 1 5	9000	10.5	1165		
27							
	.	− 9 0	9000	9	1000		
	.	−21 0	9250	9	975		
		−30 0 approx.	Plate current to be adjusted to 0.2 ma with no signal.				
28	.	− 1 5	9000	10.5	1165		
29	.	− 3 0	20700	30	1450		
30							
	.	− 4 5	11000	9 3	850		
	.	− 9 0	10300	9 3	900		
		−13 5	10300	9 3	900		
		−15 0	. . . . .	. .	.	2 1[8]	8000
30		−27 0	3500	3 8	1100		
31	. .	−22 5	4100	3 8	925	0 185	7000
	.	−30 0	3600	3 8	1050	0 375	5700
32							
	0 4 max.	− 3 0	950000	610	640		
	0 4 max.	− 3 0	1200000	780	650		
	.	− 6 0 approx.	Plate current to be adjusted to 0.2 ma with no signal.				
32		− 3 0	32000	30	940		
33	5 0	−18 0	55000	90	1700	1 4	6000
34	1 0	− 3 0 min.	600000	360	600		
	1 0	− 3 0 min.	1000000	620	620		
35	2 5 max.	− 3 0 min.	300000	305	1020		
	2 5 max.	− 3 0 min.	400000	420	1050		
36							
		− 1 5	550000	470	850		
	1 7 max.	− 3 0	550000	595	1080		
	.	− 5 0	Grid bias values are approximate. Plate current to				
	.	− 8 0	be adjusted to 0.1 ma with no signal.				
37							
		6 0	11500	9 2	800		
		−18 0	8400	9 2	1100		
		−10 0	Grid bias values are approximate. Plate current to				
		−28 0	be adjusted to 0.2 ma with no signal.				
38	1 2	− 9 0	140000	120	875	0 27	15000
	3 8	−25 0	100000	120	1200	2.50	10000
39, 44	1 6	− 3 0 min	375000	360	960		
	1 4	− 3 0 min.	1000000	1050	1050		
40	.	− 1 5	150000	30	200		
	.	− 3 0	150000	30	200		
40		−40 5	2000	3	1500		
41	1 6	− 7 0	103500	150	1450	0 33	12000
	5 5	−18 0	68000	150	2200	3.40	7600

Type No.	Description and use	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type[1]	Potential volts	Current amp.			
42	Pow. amp., pentode							
	Pentode, class A......	M 6-2	Heat.	6 3	0 7	250	34.0	250
						315	42.0	315
	Triode,[10] class A ...	M 6-2	Heat.	6 3	0 7	250	31 0	.....
	Pentode, push-pull, class AB2[7]	M 6-2	Heat.	6 3	0 7	375	54.0	250
						375	34 0	250
	Triode, push-pull,[10] class AB2[7]	M 6-2	Heat.	6 3	0 7	350	50 0	....
						350	45 0	....
43	Pow. amp., pentode, class A	M 6-2	Heat.	25.0	0 3	95	20 0	95
						180	38.0	135
45	Pow. amp., triode							
	Class A	M 4-4	Fil.	2 5	1 5	180	31 0	....
						275	36 0	...
	Class AB2[7]	M 4-4	Fil.	2.5	1 5	275	72 0	. .
						275	28 0	.. ...
46	Dual grid pow. amp.							
	Class A[10] . ..	M 5-3	Fil.	2 5	1 75	250	22 0	. . .
	Class B[20] . .	M 5-3	Fil.	2 5	1 75	300	8 0	. . .
						400	12 0	..
47	Pow. amp., pentode, class A	M 5-2	Fil.	2 5	1 75	250	31 0	250
48	Pow. amp., tetrode							
	Tetrode, class A . .	M 6-1	D.C. Heat.	30 0	0 4	96	52 0	96
						125	56 0	100
	Tetrode, push-pull, class A	M 6-1	D C. Heat.	30 0	0 4	125	100 0	100
48	General purpose..	5-1	Heat.	15 0	0 35	90	4 5	. .
49	Dual grid pow. amp.							
	Class A[10]	M 5-3	D.C. Fil	2 0	0 12	135	6 0	.. ..
	Class B[20]	M 5-3	D.C. Fil	2 0	0 12	180	4.0	. .
50	Pow. amp., triode, class A	MB 4-4	Fil.	7 5	1 25	300	35.0	...
						400	55.0	. ..
						450	55 0	. .
51	Variable mu	5-5	Fil.	2 5	1 75	180	5 8	75
						250	6 3	90
52	Output amp............	4-4	Fil.	6 3	0 30	100	42 0	.....
53	Twin triode, amp	M[21] 7-2	Heat.	2 5	2 0	300	...	. . .
55	Duplex diode, triode, triode unit as amp.	S 6-7	Heat.	2 5	1 0	250	..	. ...
56	Super-triode amp., det.[2].	S 5-1	Heat.	2 5	1 0	250	....	.
57	Triple grid det., amp .	S 6-6	Heat.	2 5	1 0	250	..	100
58	Triple grid amp., mixer .	S 6-6	Heat.	2 5	1 0	250	....	100
59	Triple grid pow. amp.							
	Triode,[22] class A ..	M 7-1	Heat.	2 5	2 0	250	26 0	.
	Pentode,[23] class A ...	M 7-1	Heat	2 5	2 0	250	35 0	250
	Triode,[24] class B	M 7-1	Heat.	2 5	2 0	300	20 0	.
						400	26 0	.
64	R. F. amp	5-5	Heat.	6 3	0 40	135	3 0	67
65	R. F. amp	5-5	Heat.	6 3	0 40	135	3 5	67
67	Power amp	5-1	Heat.	6 3	0 40	135	5 0	. .
68	Output pentode ..	6-1	Heat.	6 3	0 40	135	14 0	135
69	Special detector .	6-1	Heat.	6 3	0 30	180	4 5	..
71-A	Pow. amp., triode, class A	MB 4-4	Fil.	5 0	0 25	90	10 0	. .
						180	20 0	....
75	Duplex diode, high-mu triode	S 6-7	Heat.	6 3	0.3	250[14]	0 4	.....

TUBES (Continued)

Type No.	Screen current ma	Grid bias[1] volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
42							
	6.5	−16.5	80000	190	2350	3.0	7000
	8.0	−22.0	100000	260	2600	5.0	7000
		−20.0	2700	6.2	2300	0.65	3000
	8.0	Self-bias	Self-bias resistor, 340 ohms.			19.0[8]	10000
	5.0	−26.0				19.0[8]	10000
	Self-bias, 730 ohms.					14.0[8]	10000
		−38.0				18.0[8]	6000
43	4.0	−15.0	45000	90	2000	0.90	4500
	7.5	−20.0	40000	100	2500	2.75	5000
45							
		−31.5	1650	3.5	2125	0.82	2700
		−56.0	1700	3.5	2050	2.00	4600
	Self-bias, 775 ohms.					12.0[8]	5060
		−68.0				18.0[8]	3200
46							
		−33.0	2380	5.6	2350	1.25	6400
		0				16.0[8]	5200
		0				20.0[8]	5800
47	6.0	−16.5	60000	150	2500	2.7	7000
48							
	9.0	−19.0			3800	2.0	1500
	9.5	−20.0			3900	2.5	1500
		−20.0				5.0[8]	3000
48		−4.5	9000	10.5	1185		
49							
		−20.0	4175	4.7	1125	0.17	11000
		0				3.5[8]	12000
50		−54.0	2000	3.8	1900	1.6	4600
		−70.0	1800	3.8	2100	3.4	3670
		−84.0	1800	3.8	2100	4.6	4350
51		−1.5	500000	525	1050		
		−3.0	500000	525	1050		
52		0	Class B operation.				
53		See type number 6N7.					
55		See type number 85.					
56		See type number 76.					
57		See type number 6J7.					
58		See type number 6D6.					
59							
		−28.0	2300	6	2600	1.25	3000
	9.0	−18.0	40000	100	2500	3.0	6000
		0				15.0[8]	4600
		0				20.0[8]	6000
64		−1.5	350000	370	1050		
65		−1.5	320000	320	1000		
67		−9.0	8200	9	1100		
68		−13.5	64500	90	1400		
69		−3.0	20700	30	1450		
71-A		−19.0	2170	3	1400	0.125	3000
		−43.0	1750	3	1700	0.790	4800
75		−1.35				Gain per stage = 50–60	

Type No.	Description and use	Base	Cathode Type[1]	Cathode Potential volts	Cathode Current amp.	Plate potential volts	Plate current ma	Screen potential volts
76	Super-triode amp., det.[2]							
	Class A amp . .	S 5-1	Heat	6 3	0 3	100	2 5	
						250	5 0	.
						250[15]	1 0	
	Bias detector	S 5-1	Heat.	6 3	0 3	250	.	.
77	Triple grid det., amp.							
	Screen grid, R.F. amp.	S 6-6	Heat.	6 3	0 3	100	1 7	60
						250	2 3	100
	Bias detector	S 6-6	Heat.	6 3	0 3	250	[25]	50
78	Triple grid amp., mixer	S 6-6	Heat.	6 3	0 3	250		125
79	Twin triode, amp., class B	S 6-8	Heat.	6 3	0 6	180		.
						250		.
85	Duplex diode, triode, triode unit as class A amp.	S 6-7	Heat.	6 3	0 3	135	3 7	.
						250	8 0	
89	Triple grid pow. amp.							
	Triode,[22] class A amp	S 6-6	Heat.	6 3	0 4	160	17 0	.
						250	32 0	.
	Pentode,[23] class A amp	S 6-6	Heat.	6 3	0 4	100	9 5	100
						250	32 0	250
	Triode,[24] class B amp	S 6-6	Heat.	6 3	0 4	180	6 0	.
						180	6 0	.
99	Det.,[2] amp., triode, class A	S 4-4	D.C. Fil	3 3	0 063	90	2 5	.
112-A	Det.,[2] amp., triode, class A	MB 4-4	D C. Fil	5 0	0 25	90	5 0	.
						180	7 7	.
182-B	Power amp	4-4	Heat.	5 0	1 25	200	18 0	.
183	Power amp.	4-4	Fil.	5 0	1 25	250	25 0	.
210	Power amp.	4-4	Fil.	7 5	1 25	250	10 0	.
						350	16 0	. .
						425	18 0	. . .
257	Power pentode	5-3	Fil.	5 0	0 30	110	20 0	110
291	A.F. amp . .	5-1	Heat.	12 3	0 30	120	3 0	.
		Output stage				120	30 0	
293	A.F. amp . .	5-1	Heat.	6 3	0 60	173	4 0	.
		Output stage				180	17 5	.
295	A.F. amp . .	5-1	Heat.	2 5	4 0	250	4 0	.
		Output stage		. . .	.	250	52 0	.
303-A,[26]	309-A[26]							
401	General purpose	4-4	Fil.	3 0	1 00	90	3 0	.
402	Power output	4-4	Fil.	3 0	1 50	180	20 0	
483	Power output	4-4	Fil.	5 0	1 35	180	15 3	.
484	General purpose	4-4	Fil.	3 0	1 30	135	6 0	.
485	General purpose	5-1	Heat.	3 0	1 30	135	5 5	
864	Amp., det.	4-4	Fil.	1 1	0 25	135		
						90	2 9	
874	Voltage regulator . .	MB 4-14	. .					
876	Current regulator .	Mog.Scr	Fil.	. .				
886	Current regulator	Mog.Scr	Fil.				.	.
956	R.F amp., pentode	.	Heat.	6 3	0 15	250	5 5	100
1603	Triple grid det., amp							
	Class A amp., pentode	S 6-6	Heat.	6 3	0 3	250	2 0	100
	Class A amp., triode .	S 6-6	Heat.	6 3	0 3	250	6 5	. . .
GA	Pentode . .	. .	Fil.	5 0	0 25	180	7 5	180
KR-5	Output pentode	.	Fil.	6 3	0 30	165	17 0	165

Type No.	Screen current ma	Grid bias[1] volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
76							
		-5.0	12000	13.8	1150		
		-13.5	9500	13.8	1450		
		-9.0					
		-20.0 approx. Plate current to be adjusted to 0.2 ma with no signal.					
77							
	0.4	-1.5	650000	715	1100		
	0.5	-3.0	1500000	1500	1250		
	25	-1.95	....	Plate resistor, 250000 ohms. Grid resistor,[6] 250000 ohms			
78	...	See type number 6K7.					
79		0	Power output is for one tube at stated plate-to-plate load.			5.5	7000
		0				8.0	14000
85		-10.5	11000	8.3	750	0.075	25000
		-20.0	7500	8.3	1100	0.350	20000
89							
		-20.0	3300	4.7	1425	0.30	7000
		-31.0	2600	4.7	1800	0.90	5500
	1.6	-10.0	104000	125	1200	0.33	10700
	5.5	-25.0	7000	125	1800	3.40	6750
		0	......		......	2.50[8]	13600
		0	......		......	3.50[8]	9400
99		-4.5	15500	6.6	425		
112-A		-4.5	5400	8.5	1575		
		-13.5	4700	8.5	1800		
182-B		-29.0	3330	5	1500		
183		-60.0	1670	3	1800		
210		-22.0	6000	8	1330	0.400	13000
		-31.0	5150	8	1550	0.900	11000
		-39.0	5000	8	1600	1.600	10200
257		-21.5	41000	55	1350	0.800	6000
291		-11.0	8700	6.8	780		20000
		-11.0	4400	11.2	2550	1.250	3000
293		-6.5					100000
		-6.5				1.250	8000
295		-14.0	12000	14.4	1200		7500
		-3.0	3000	13	4350	4.500	4000
401		-4.5	10000	8	1000		
402		40.0	2000	3	1000		
483		40.5	2450	3.3	1340		
484		-6.0	8900	12.5	1400		
485		-6.0	8900	12.5	1400		
864		-9.0		8.2			
		-4.5	13500	8.2	610		
874	Min. D.C. starting supply voltage, 125 volts. D.C. operating current, 10-50 ma. D.C. operating voltage, 90 volts. Max. current (continuous), 50 ma.						
876	Voltage range, 40 to 60 volts. Operating current, 1.7 amperes.						
886	Voltage range, 40 to 60 volts. Operating current, 2.05 amperes.						
956	1.8	-3.0	800000	1440	1800		
1603							
	0.5	-3.0	>1500000	>1500	1225		
		-8.0	10500	20	1900		
GA		-10.0	30000	60	2000	0.800	7000
KR-5		-11.0	47000	100	2100	1.200	8000

RECEIVING

Type No.	Description and use	Base	Cathode			Plate potential volts	Plate current ma	Screen potential volts
			Type[1]	Potential volts	Current amp.			
KR-20	Two grid det		Heat.	2 5	1 00	250	3 5	.
KR-22	Two grid det . .	. .	Heat.	6 3	0 40	250	3 5	. . .
KR-25	Output pentode. ...	. .	Heat.	2 5	1 75	250	34 0	250

[1] Either A.C. or D.C. may be used on filament or heater, except as specifically noted. For use of D.C. on A.C. filament types, decrease stated grid volts by ½ (approx.) of filament voltage.

[2] For grid leak detection, plate volts 45, grid return to + filament or to cathode.

[3] Also available in octal base, glass bulb type. Characteristics data for the glass type, except for some difference in capacitance value, are the same as for the type listed In certain cases where socket connection to shield on metal type tube is indicated there is no connection on the glass type tube.

[4] Grids #3 and #5 are screen. Grid #4 is signal input control grid.

[5] Supply voltage applied through 20000 ohm voltage dropping resistor.

[6] For grid of following tube.

[7] Subscript 1 on class of amplifier service (as AB_1) indicates that grid current does not flow during any part of input cycle. Subscript 2 on class of amplifier service (as AB_2) indicates that grid current flows during some part of the input cycle.

[8] Power output is for two tubes at stated plate-to-plate load.

[9] Triode plate supply voltage and maximum target voltage, minimum target voltage = 90 volts.

[10] Grid #2 tied to plate.

TELEPHONE AND

Type No.	Description and use	Cathode			Max. plate potential volts	Max plate current ma
		Type	Potential volts	Current amp		
101-D	Repeater	Coat.	4 5	1 00	130	7 5
101-F	Amp., repeater	Coat.	4 15	0 50	190	10 0
101-H	Repeater	Coat.	4 5	1 00	130	7 5
101-J	Amp., repeater	Coat.	4 15	0 50	190	10 9
102-D	Volt. amp., det	Coat.	2 1	1 0	190	1 46
102-F	Volt. amp., det	Coat.	2 1	0 50	190	1 75
102-G	Volt. amp., det	Coat.	2 1	1 0	190	1 46
104-H	Cable amp	Coat.	4 5	1 00	130	20 5
105-A	Amplifier	Coat	4 0	0 50	150	40 0
107-A	18-cm osc	Tung.	4 0	3 00	— 50	10 0
203-D	General purpose	Coat	2 6	1 00	60	1 8
205-D, E	A.F. & R F. amp , osc	Oxide	4 5	1.6	400	50 0
215-A	Amp , det., osc	Coat.	1 0	0 25	100	2 1
216-A	General purpose	Coat.	6 0	1 05	130	6 5
230-D	General purpose	Coat.	3 1	0 06	90	2 1
231-D	Amp., det., osc	Coat.	3 1	0 060	135	2 50
235-D	General purpose	Coat.	5 0	0 25	135	5 0
239-A	General purpose	Coat.	1 1	0 27	100	2 3
244-A	Amp., osc .	Heat.	2 0	1 6	180	6 2
245-A	Volt. amp., det., tetrode . .	Heat.	2 0	1.60	180	5 1

TUBES (Continued)

Type No.	Screen current ma	Grid bias[1] volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output watts	Load resist. ohms
KR-20	.	0	10000	14	1400	......	100000
KR-22		0	10000	14	1400	...	100000
KR-25	. .	−16.5	100000	220	2200	3.000	9000

[11] Cathode current, 0.43 ma.
[12] Grids #2 and #4 are screen. Grid #1 is signal input control grid.
[13] Both grids connected together; likewise, both plates.
[14] Applied through plate resistor of 250000 ohms.
[15] Applied through plate resistor of 100000 ohms.
[16] Applied through plate resistor of 150000 ohms.
[17] Applied through 200000 ohm plate resistor.
[18] For signal input control grid (#1); control grid #3 bias, −3 volts.
[19] Applied through plate resistor of 250000 ohms or 500 henry choke shunted by 0.25 megohm resistor.
[20] Grids #1 and #2 tied together.
[21] Requires different socket from small 7-pin.
[22] Grid #1 is control grid. Grids #2 and #3 tied to plate.
[23] Grid #1 is control grid. Grid #2 is screen. Grid #3 tied to cathode.
[24] Grids #1 and #2 connected together. Grid #3 tied to plate.
[25] Cathode current, 0.65 ma.
[26] Tubes number 303-A and 309-A, often used as receiving tubes, are listed under *Telephone and Industrial Tubes.*

INDUSTRIAL TUBES

Type No.	Screen grid potential volts	Screen grid current ma	Grid bias volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output m watts
101-D			− 9 0	5700	5 9	1030	.....
101-F			−14 0	4800	6 5	1120	250
101-H		. .	− 9 0	5700	5 9	1030	....
101-J			−14 0	5000	6 6	....	250
102-D		. .	− 2 0	43000	30 2	700	.. ..
102-F		.	− 2 0	36000	30.6	850	. ...
102-G		.	− 2 0	43000	30.2	700	.. ..
104-H		..	−20 0	2100	2 5	1190	. ..
105-A			0	3000	5 0	1500	...
107-A		60 0(C.G.)	+250 0	..	.. ..	...	. ..
203-D		. . .	− 3 0	10000	6 8	680	. .
205-D, E		.....	−29 0	3800	7 2	1890	1400
215-A		. .	−10 0	14500	5 6	390	26
216-A		. .	− 9 0	6000	5 8	970	.....
230-D	.	..	− 3 0	16000	8 0	500	....
231-D	.	..	− 7 5	15600	8 4	540	27
235-D		..	− 6 0	7000	9 0	1280	.....
239-A		. . .	− 8 0	15000	6 2	410	....
244-A		.	−10 0	10000	9 8	980	128
245-A	45 0	1 5	− 1.5	220000	170 0	770	....

Type No.	Description and use	Cathode			Max. plate potential volts	Max. plate current ma
		Type	Potential volts	Current amp.		
246-A	Volt. amp., det., tetrode . . .	Coat.	3 3	0 100	180	1.55
247-A	Amp., det., osc	Heat.	2 0	1 6	135	2.0
252-A	Amp., osc.....	Coat.	5.0	2 0	500	58
257-A	Amp., det., osc...	Coat.	3 1	0 060	135	2.50
259-A	Volt. amp., det., tetrode	Heat.	2 0	1 60	250	5.7
259-B	Volt. amp., det., tetrode.. ..	Heat.	2 0	1 6	250	5.7
262-A	A.F. amp......	Heat.	10 0	0 32	180	2.8
264	A.F. amp....	Coat.	1 1	0 25	90	2.9
264-A, B	A.F. amp	Coat.	1 5	0 300	100	2.70
271-A	A.F. or R.F. amp., osc. . . .	Heat.	5 0	2 0	450	60.0
272-A	A.F. or R.F. amp., det.. .	Heat.	10 0	0 32	180	6 2
273-A	Detector......	Heat.	2 0	1 60	135	50 0
275-A	A.F. amp....	Coat.	5.0	1 2	300	51 0
281-A	A.F. amp., control, tetrode.. .	Oxide	5 0	1 6	250	45 0
283-A	Volt. amp., tetrode	Heat.	2 0	1 60	250	6 0
285-A	A.F. amp., pentode	Heat.	2 0	1 60	250	12 5
286-A	Volt. amp., pentode... .	Heat.	2 0	1 60	250	6 3
300-A	A.F. amp	...	5 0	1 2	450	80 0
303-A	A.F. amp., det., rectifier	Heat.	2 0	1 60	200	3 2
309-A	A.F. or R.F. amp., pentode	Heat.	10 0	0 32	250	4 85
310-A]	Voltage amp., pentode .	Heat.	10 0	0 32	250	5 5
864	Non-microphonic..	Coat.	1 1	0 25	90	2 7
DRH-500	Ionization gauge...	Tung.	5 5	1.15	180	3 5
DRH-501	Ionization gauge ...	Tung.	5 0	3 00	180	4.5
DRH-505	Electrometer tube	Coat.	2 5	0 25	6	0 2
DRJ-521	Interstage amp	Coat.	2 5	1 00	250	13 0
DRJ-522	Interstage amp .	Coat.	2 5	1 00	250	5.0
DRJ-524	Non-microphonic .	Coat.	1 1	0 25	90	2.5
DRJ-528	Low-filament cur. .	Coat.	10 0	0 06	135	9 0
DRJ-546	Volt. amp	Coat.	2 5	1 5	450	13 5
DRJ-548	Volt. amp....... ..	Coat	5 0	0 25	180	1 4
DRJ-549	Volt. amp...... . .	Coat.	2 5	1 00	180	4 0
DRJ-551	Current amp..... . .	Coat.	7 5	1 25	450	38 0
DRJ-552	Current amp....... .	Coat.	7 5	0 50	425	20.0
DRJ-554	Current amp	Coat.	1 1	0 25	135	8 0
DRJ-555	Osc., current amp .. .	Coat.	7 5	1 25	450	55 0
DRJ-556	Low grid current amp. .	Coat.	2 5	0 25	95	4 5
DRJ-557	Current amp	Heat.	2 5	1 00	180	20.0
DRJ-559	Low grid current . .	Coat	2 5	0 25	95	3.5
DRJ-562	Current amp	Coat	2 5	1 00	180	17 5
DRJ-564	Current amp	Coat.	2 5	4 00	250	320 0
DRJ-571	Three grid tube .	Heat.	2 5	1 00	250	4.0
FP-54	Low grid current, tetrode	Thor.	2 5	0 09	6	0.06
FP-62	Ionization gauge . .	Tung.	4 5	1 48		...
FP-110	A.F. amp...... . . .	Thor.	5 0	1 00	125	100 0
PJ-2	Volt. amp ..	Thor.	4 5	1 10	350	4 5
PJ-4	Power amp.. ...	Thor.	4 5	1 10	350	19 0
PJ-7	Volt. amp	Thor.	4 5	1 10	350	40 0
PJ-8	A.F. or R.F. amp., osc	Thor.	4 5	1 10	350	40 0
PJ-11	Volt. amp..... .	Thor.	5 0	0 25	180	0 45
PJ-21	A.F. amp., mod . .	Thor.	4 5	1 10	350	19 5
RJ-526	Interstage amp .	Coat.	1 25	0 92	135	5 2
RJ-544	Non-microphonic .	Coat.	1 1	0 25	180	1 0
RJ-550	Low grid current	Coat.	2 5	0 92	95	6 0
RJ-553	Low grid current amp	Coat.	6 0	1 05	95	8 5
RJ-563	Current amp...............	Coat.	2.5	3 00	250	200 0

INDUSTRIAL TUBES (Continued)

Type No.	Screen grid potential volts	Screen grid current ma	Grid bias volts	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Power output m watts
246-A	45.0	0.15	− 1 5	820000	335 0	410	.. .
247-A	.....	...	− 6 0	19600	14 5	730	50
252-A	... .	....	−70 0	1500	5 12	3450	8300
257-A	.		− 7 5	15600	8 4	540	27
259-A	75 0	1 1	− 1 5	430000	610 0	1420	.....
259-B	75 0	1 1	− 1 5	430000	610 0	1420	.....
262-A	.. .	. .	− 7 5	16200	14 7	910	90
264	....	..	− 4 5	13400	8 2	610	....
264-A, B	... .		− 7 0	11400	7.2	630	28
271-A	.		−30 0	2450	8 5	3480	3400
272-A	.		−21 0	7200	5 5	760	230
273-A			− 1 5	320000	102.0	320	.. ..
275-A			−80 0	1100	2.7	2450	4900
281-A	65 0	0 2	−70 0	3600	5 2	....	4200
283-A	75 0	1 5	− 1 5	700000	980.0	1400	.....
285-A	200 0	2 2	−16 5	137000	140.0	1020	1350
286-A	75 0	1 5	− 1 5	1050000	1275.0	1210	.....
300-A	... .	.. .	−97 0	...	. ....	....	17800
303-A	. ..	....	− 9 0	18000	13 2	...	105
309-A	75 0	1 1	− 1.5	1300000	1450 0	1110	.. .
310-A	135 0	2 5	− 3 0	.. .	.... ..	.. .	480
864	.. .	.....	− 4 5	15000	8 2	560	.....
DRH-500	..		−12 0	19000	6 6	350	..
DRH-501			−12 0	16500	6 6	400	....
DRH-505	..		− 4 5	20000	1.0	50	.....
DRJ-521	.		− 9 0	6000	12 0	2000	...
DRJ-522	...		−13 5	9500	13 8	1450	.....
DRJ-524	.		− 4 5	15000	8 0	530	.. .
DRJ-528			− 9 0	5000	5.7	1150	.....
DRJ-546	.		− 4 5	13500	30 0	2200	.....
DRJ-548	..		− 1 5	40000	37 0	925	....
DRJ-549	.		− 1 5	25000	30 0	1200	..
DRJ-551	.		−32 0	2900	8 0	2750	....
DRJ-552	.		−30 0	4000	8 4	2100	....
DRJ-554	.		−15 0	7000	3 5	5000	.. .
DRJ-555			−80 0	1800	3 8	2100	..
DRJ-556		.	− 5 0	7500	6 8	900	.. .
DRJ-557			−22 5	3500	3 5	1000	... .
DRJ-559	.	.	− 5 0	8800	8 4	950	..
DRJ-562	.		−22 5	2500	4 8	1925	.. ..
DRJ-564		.	− 5 0	500	3 5	7000	.....
DRJ-571	.... .	. ...	− 3 0	200000	200.0	1000	.....
FP-54	. ..	. .	− 4 0	45000	0.9	20	. .
FP-62	112 5	10 0	−22 5	....	....	....	...
FP-110	... .	.....	−50 0	320	0 8	2500	.....
PJ-2	..	...	− 4 0	26800	30.0	1120	.....
PJ-4	. . .	... .	−20 0	6400	8 5	1330	....
PJ-7	. .	..	− 4 0	26800	30 0	1120	.....
PJ-8	. ...	.. .	−20 0	6400	8 5	1330	.....
PJ-11	.....	.. .	− 1 5	100000	30 0	300	.....
PJ-21	. ...	.....	−83 0	3160	3 0	950	.....
RJ-526	. .	.....	− 9.0	8000	8 2	1050	.. .
RJ-544	.. ..	. ...	− 1 5	75000	35 0	465	....
RJ-550	.....	.....	− 5 0	5150	8 5	1650	....
RJ-553	... .	.....	−12 0	3200	3 85	1200	.....
RJ-563	.....	.....	− 5.0	800	4 0	5000	.. ..

TRANSMITTING

Type No.	Description and use	Cooling	Cathode Type	Cathode Potential volts	Cathode Current amp.	Max. plate potential volts	Max. plate current amp.
100-A	Osc., R.F. pow. amp.....	Air	Tung.	11 0	25.00	2000	0 175
101-A	Osc., R.F. pow. amp	Water	Tung.	28 0	51 0	1000	1.100
102-A	Osc., R.F. pow. amp ...	Air	Tung.	10 0	11 0	7000	0.150
203-A	A.F. or R.F. pow. amp., osc.	Air	Tung.	10.0	3.25	1250	0.175
204-A	A.F. or R.F. pow. amp., osc.	Air	Thor.	11 0	3 85	3000	0.275
206	Osc., R F. pow. amp	Air	Tung.	11 0	14 75	15000	0 023
207	Osc., R F. pow. amp ...	Water	Tung.	22 0	52 00	15000	0 750
211	A.F. or R.F. amp., osc...	Air	Thor.	10 0	3 25	1250	0 175
211-D, E	A.F. amp.............	Air	Coat.	10 0	3 00	750	0 065
212-D	250-w amp	Air	Coat.	14 0	6 00	1500	0 015
212-E	A.F. or R.F. amp., osc ...	Air	Thor.	14 0	6 0	3000	0 350
220-B	A.F. or R.F. amp., osc ...	Water	Tung.	21 5	41 0	12000	1.5
220-C	A.F. or R.F. amp., osc....	Water	Tung.	21 5	41 0	15000	1.5
228-A	A.F. or R.F. amp., osc...	Water	Tung.	21 5	41 0	6000	1.5
232-A	25-kw amp	Water	Tung.	21 0	61 0	18000	3.0
232-B	A.F. or R F. amp., osc .	Water	Tung.	20 0	60 0	20000	3 0
236-A	A.F. or R.F. amp., osc ..	Water	Tung.	21 5	41 0	20000	2 0
240-A	H.F. osc	Water	Tung.	21 0	41 0	10000	1.5
240-B	A.F. or R.F. amp., osc .	Water	Tung.	21 5	41 0	12000	1 7
241-A	H.F. amp	Air	Coat.	14 0	6 00	1500	0 200
241-B	A.F. or R.F. amp., osc ...	Air	Thor.	14 0	6 0	3000	0 350
242-A	A.F. or R.F. amp., osc ..	Air	Thor.	10 0	3 25	1250	0 150
242-B	A.F. or R.F. amp., osc ..	Air	Thor.	10 0	3 25	1250	0 150
242-C	A.F. or R.F. amp., osc...	Air	Thor.	10 0	3 25	1250	0 150
243-A	R.F. amp...............	Water	Tung.	10 5	41.00	10000	0 400
248-A	50-w amp	Air	Coat.	10 0	3 00	750	0.065
251-A	A.F. or R.F. amp., osc ..	Air	Thor.	10 0	16 0	3000	0 600
254-A	R.F. amp., osc., tetrode...	Air	Thor.	5 0	3 25	750	0 060
254-B	R.F. amp., osc., tetrode. .	Air	Thor.	7 5	3 25	750	0.075
260-A	R.F. amp., osc., tetrode...	Air	Thor.	10 0	3 25	3000	0.100
261-A	A.F. or R.F. amp., osc....	Air	Thor.	10 0	3 25	1250	0 150
265-A	R.F. amp	Water	Tung.	22.0	183 00	18000	8 000
268-A	A.F. or R.F. amp., osc ..	Air	Thor.	5 0	3 25	750	0.060
270-A	A.F. or R F. amp., osc .	Air	Thor.	10 0	9 75	3000	0 375
276-A	A.F. or R.F. amp., osc	Air	Thor.	10 0	3 0	1250	0 125
278-A	R.F. amp., osc., tetrode...	Air	Thor.	10 0	15 6	3000	0 600
279-A	A.F. or R.F. amp., osc ...	Air	Thor.	10 0	21 0	3000	0.800
282-A	R.F. amp., osc., tetrode.	Air	Thor.	10 0	3 0	1000	0.100
284-D	A.F. amp., mod	Air	Thor.	10 0	3 25	1250	0.150
295-A	A.F. or R.F. amp., osc	Air	Thor.	10 0	3 25	1250	0.175
304-B	A.F. or R F. amp., osc., ultra high frequency	Air	Thor.	7.5	3 25	1250	0.100
305-A	R.F. amp., osc., ultra high frequency, tetrode	Air	Thor.	10.0	3.1	1000	0 125
306-A	A.F. or R.F. amp., osc., pentode	Air	......	2 75	2.0	300	0.060
307-A	A.F. or R.F. amp., osc., pentode	Air	.....	5.5	1 0	500	0.060
308-B	A.F. or R.F. amp., osc....	Air	Thor.	14 0	6 0	2250	0 325
312-A	Amp., osc., pentode.. ..	Air	Thor.	10 0	2 8	1250	0.100
316-A	Ultra H.F. osc. and amp	Air	Thor.	2 0	3.65	450	0 080
348-A	Modulator..	Water	Tung.	22 0	52 0	5000	3.00
358-A	H.F. osc. and amp.. ..	Water	Tung.	22 0	52 0	15000	1.20
363-A	Osc., power amp.........	Water	Tung.	22 0	52 0	10000	0.80
500	Osc., R.F. amp...	Water	Tung.	22.0	30 0	10000	0.800

TUBES

Type No.	Screen grid potential volts	Max. R.F. grid current amp.	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Max. plate diss. watts
100-A		8 0	7000	14	2000	500
101-A		50 0	3000	18	6000	35000
102-A	.	30 0	3000	8	1500	150
203-A	.	7 5	6000	25	4200	100
204-A	.	10.0	6300	25	4000	250
206	..	10 0	300000	350	1170	350
207	.	30.0	3500	20	5700	10000
211	.	7.5	3400	12	3530	100
211-D, E	.	.	3200	12	3900	65
212-D		.	2150	16	7500	250
212-E		5 0	1900	16	8500	275
220-B		20 0	8000	40	5000	10000
220-C		20 0	7000	35	5000	10000
228-A		20 0	2500	16	6500	5000
232-A		..	7000	40	5700	25000
232-B	.	40 0	6150	40	6500	25000
236-A		25 0	6200	40	6450	20000
240-A		.	9000	40	4450	10000
240-B		60 0	8000	40	5000	10000
241-A		.	2150	16	7500	200
241-B		5 0	1900	16	8500	275
242-A		5.0	3500	12 5	3600	85
242-B		5 0	3500	12 5	3600	100
242-C		5.0	3500	12 5	3600	100
243-A		....	20000	40	2000	2000
248-A		..	3500	12	3400	65
251-A		15 0	2750	10 5	3800	1000
254-A	175	5 0	80000	80	1000	20
254-B	150	5 0	86000	100	1160	25
260-A	300	10 0	175000	200	1150	100
261-A		5.0	3000	12	4000	100
265-A		....	2250	32	14000	100000
268-A		3.0	6250	5	800	25
270-A		10 0	2800	16	5700	350
276-A		5 0	3000	12	4000	100
278-A	750	15 0	105000	400	3800	800
279-A	.	15 0	2000	10	5000	1200
282-A	250	5 0	70000	100	1430	70
284-D		5 0	1900	4 8	2500	85
295-A		7 5	6000	25	4200	100
304-B		6 0	5500	11	2000	50
305-A	200	5 0	40000	56	1400	60
306-A	300		70000	290	4150	15
307-A	300		. ...	......	. .	15
308-B	.	5 0	1070	8	7500	250
312-A	500	5 0	290000	1100	3800	50
316-A	..	.	2700	6.5	2400	30
348-A	.	30 0	2400	8	3300	10000
358-A	.	60 0	8700	42	4800	20000
363-A	.	30 0	7800	50	6400	10000
500	.	20 0	3800	....	3950	5000

Type No.	Description and use	Cooling	Cathode Type	Cathode Potential volts	Cathode Current amp.	Max. plate potential volts	Max. plate current amp.
504	Osc., R.F. amp		Thor.	11 0	14 75	2500	0 275
510	Osc. or amp		Oxide	7 5	1 25	500	0 06
520-B	Osc., R.F. amp	Water	Tung.	22 0	34 00	10000	0 400
520-M	Modulator	Water	Tung.	22 0	34 00	6000	0 800
525	H.F. osc., amp	Air	. . .	7 5	2 50	425	. . . .
545	A.F. amp., mod.	. .	Thor.	10 0	3 25	1000	. . .
571	Osc., R.F. pow. amp	Air	Thor.	11 0	10 0	3000	0 250
800	A.F. or R F. amp., osc	Air	. .	7 5	3 25	1250	0 115
801	A.F. or R.F. amp., osc	Air	Thor.	7 5	1 25	600	0 070
802	R.F. amp., osc., pentode	Air	Heat.	6 3	0 9	500	0 060
803	R.F. amp., osc., pentode	Air	Thor.	10 0	5 0	2000	0 175
804	R.F. amp., osc., pentode	Air	Thor.	7 5	3 0	1250	0 095
805	A.F. or R.F. amp., osc	Air	Thor.	10 0	3 25	1500	0 210
806	A.F. or R.F. amp., osc	Air	Thor.	5 0	10 0	3000	0 200
807	Beam power amp	Air	Heat.	6 3	0 9	400	0 120
808	A.F. or R.F. amp., osc	Air	Thor.	7 5	4 0	1500	0 150
830-B	A.F. or R.F. amp , osc	Air	Thor.	10 0	2 0	1000	0 150
831	Shortwave osc	Air	Thor.	11 0	10 0	3500	0 133
834	R.F. amp., osc	Air	Thor.	7 5	3 25	1250	0 100
838	A.F. or R.F. amp., osc	Air	Thor.	10 0	3 25	1250	0 175
841	A.F. or R.F. amp., osc	Air	Thor.	7 5	1 25	450	0 060
842	A.F. power amp , mod	Air	Thor.	7 5	1 25	425	0 034
843	A.F. or R.F. amp	Air	Heat.	2 5	2 50	500	0 025
844	General purpose, tetrode	. . . .	Heat.	2 5	2 50	500	0 030
845	A.F. pow. amp., mod	Air	Thor.	10 0	3 25	1250	0 095
846	Shortwave osc	Water	Tung.	11 0	49 0	7500	0 15
848	General purpose	Water	Tung.	22 0	52 0	15000	0 750
849	A.F. or R.F. amp., osc	Air	Thor.	11 0	5 0	3000	0 350
850	Osc.,R.F. amp , tetrode	Air	Thor.	10 0	3 25	1250	0 175
851	General purpose	Air	Thor.	11 0	15 50	2500	0 300
852	A F. or R.F. amp , osc	Air	Thor.	10 0	3 25	3000	0 150
853	Osc., R F. pow. amp	Air	Tung.	10 0	16 75	2500	0 130
858	Osc., R F. pow. amp	Water	Tung.	22 0	52 00	20000	0 750
860	Osc. R.F. amp., tetrode	Air	Thor.	10 0	3 25	3000	0 150
861	Osc., R.F. amp., tetrode	. .	Thor.	11 0	10 0	4000	0 350
862	Osc., R.F. pow. amp	Water	Tung.	33 0	207 0	20000	3 000
863	Osc., R F. pow. amp	Water	Tung.	22 0	52 00	15000	0 750
865	Osc., R.F. amp., tetrode	Air	Thor.	7 5	2 0	750	0 060
954	R.F. amp., det., pentode, ultra high frequency	Air	Heat.	6 3	0 15	250	0 002
955	Amp., det., osc., ultra high frequency	Air	Heat.	6 3	0.15	180	0 008
1652	General purpose	Water	Tung.	14 5	52 00	7500	0 750
AW-220	Osc., R.F. pow. amp.	Water	Tung.	30 0	325 0	22000	5 00
DRJ-571	Tetrode		Heat	2 5	1 0	.	
FH-11	Osc, magnetron	Air	Tung.	5 0	5 0	1500	0 075
FP-1	Osc., R.F. pow. amp	Air	Thor.	10 0	3 25	3000	0 100
FP-2	Osc., R.F. pow. amp	Air	Thor.	11 0	10 0	3500	0 350
FP-3	General purpose	Air	Thor.	11 0	5 0	3000	0 350
FP-57	R.F. amp., osc , tetrode	Air	Thor.	10 0	3 25	1250	0 175
FP-70	R.F. amp., osc.	Water	Tung.	11 0	51 0	7500	1 0
FP-126	Ultra H.F. osc	Air	Tung.	5 0	6 6	−150	.
FP-152	R.F. amp., osc	Air	Thor.	10 0	3 25	1500	0 200
PJ-12	General purpose	Air	Thor.	10 0	3 25	1250	0 175
PJ-13	General purpose	Air	Thor.	7 5	1 25	450	0 060

TUBES (Continued)

Type No.	Screen grid potential volts	Max. R.F. grid current amp.	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Max. plate diss. watts
504		10.0	5000	25	5000	250
510		5.0	5450	8	1550	15
520-B		20.0	4000	16	4000	5000
520-M			1600	8	5000	
525				6		.
545			2100	5	2380	
571			5000	16	3200	5000
800		5.0		15	.	35
801		5.0	4300	8	1840	20
802	250				2250	10
803	600				4000	125
804	300			. ..	3250	40
805				..	.. .	125
806				12.6		150
807	300			.	6000	21
808				47	.	50
830-B				25	.	60
831		10.0	6450	14.5	2250	400
834				10.5	.	50
838		7.5			.	100
841		5.0	40000	30	750	15
842			2500	3	1200	12
843			4250	8.5	2000	
844	180	2.0	125000	75		15
845			1800	5.3	3000	75
846		30.0		38		2500
848		30.0	2400	8	3300	10000
849		10.0	3200	19	6000	400
850	175	7.5	200000	550	2750	100
851		10.0	1400	20	15000	750
852		10.0	10000	12	1200	100
853			4100	12	2900	250
858		60.0	8700	42	4800	20000
860	300	10.0	180000	200	1100	100
861	750	10.0	143000	300		400
862		60.0	2800	48	17150	100000
863		30.0	7200	50	7000	10000
865	125	5.0	200000	150	750	15
954	100		>1500000	>2000	1400	
955			12500	25	2000	...
1652		10.0	2600	14	5400	5000
AW-220			640	10.5	21000	150000
DRJ-571	100		200000	200	.	
FH-11					.	60
FP-1		10.0	10000	12	1200	100
FP-2		10.0	6450	14.5	2250	400
FP-3		10.0	3200	19	6000	400
FP-57		7.5	200000	550	2750	100
FP-70		30.0	18500	40	2160	2500
FP-126	D.C. grid voltage, 300 volts, D.C. grid current. 0.10 amp.; grid diss., 20 watts.					
FP-152		7.5	6250	25	4000	125
PJ-12		7.5	3400	12	3530	100
PJ-13		5.0	5000	8	1600	15

Type No.	Description and use	Cooling	Cathode Type	Cathode Potential volts	Cathode Current amp.	Max. plate potential volts	Max plate current amp
PJ-27	R.F. amp., osc., tetrode	Air	Thor.	7 5	2 0	750	0 060
PR-3B	A F. or R.F. amp., osc	Air	Thor.	10 0	3 25	1250	0 175
PR-4B	R.F. amp , osc	Air	Thor.	11 0	3 85	2500	0 275
PR-11A	A.F. or R.F. amp., osc	Air	Thor.	10 0	3 25	1250	0 175
PR-51A	A.F. or R F. amp , osc	Air	Thor.	11 0	15 5	3000	1 0
PR-845	A.F. or R.F. amp., osc	Air	Thor.	10 0	3 25	1250	0 175
PR-861	R.F. amp , osc., tetrode.	Air	Thor.	11 0	10 0	3500	0 350
PT-210	A.F. or R.F. amp , osc	Air	Thor	7 5	1 25	450	0 060
PT-841	Voltage amp	Air	Thor	7 5	1 25	450	0 060
PT-842	A F. or R.F. amp., osc	Air	Thor.	7 5	1 25	425	0 060
PT-860	R F amp , osc , tetrode	Air	Thor	10 0	3 25	3000	0 150

GASEOUS RECTIFIERS

Type No	Cathode Type	Cathode Potential volts	Cathode Current amp	Max. peak inverse potential volts	Max. peak current amp	Max. average current amp.
82	Coat.	2 5	3 0	1400	0 400	0 125
83	Coat.	5 0	3 0	1400	0 800	0 250
249-A	Coat	2 5	7 0	6500	1 1	
249-B	Coat.	2 5	7 5	7500	1 5	
253-A	Coat.	2 5	3 0	3500	0 5	
255-A	Coat.	5 0	21 0	20000	5 0	
255-B	Coat.	5 0	19 0	20000	5 0	
258-A	Coat.	2 5	7 0	6300	1 1	
258-B	Coat.	2 5	7 5	7500	1 5	
263-A	Coat.	2 5	15 0	100	6 0	
263-B	Coat.	2 5	15 0	100	10 0	
266-A	Coat	5 0	60 0		12 0	
266-B	Coat	5 0	42 0	20000	20 0	
267-A	Coat	5 0	10 0	5000	2 5	
267-B	Coat.	5 0	6 75	7500	2 5	
280-A	Coat.	2 5	3 0	3500	0 5	
301-A		5 0	3 0	1800	1 0	
313-A[1]	Cold				0 030	0 010
314-A		5 0	5 0	300	2 5	
315-A		5 0	10 0	12500	2 5	
321-A		5 0	10 0	12500	2 5	
857	Coat.	5 0	37 0	20000	20 0	
866	Coat.	2 5	5 0	7500	1 0	0 25
866-A	Coat.	2 5	5 0	10000	0 6	
869	Coat.	5 0	20	20000	5 0	
871	Coat	2 5	2 0	5000	0 3	
872	Coat.	5 0	10 0	7500	2 5	
872-A	Coat	5 0	6 75	10000	2 5	
985	Coat	5 0	0 5	500	0 1	

[1] May be used as relay or voltage regulator in special circuits.

TUBES (Continued)

Type No.	Screen grid potential volts	Max. R.F. grid current amp.	Plate resist. ohms	Amp. factor	Trans-conductance μ mhos	Max. plate diss. watts
PJ-27		5.0	200000	150	750	15
PR-3B		7.5	6000	25	4200	100
PR-4B		10.0	6300	25	4000	250
PR-11A		7.5	3400	12	3530	100
PR-51A		8.0	1400	20.5	15000	750
PR-845		7.5	1800	5	3000	100
PR-861	500	10.0	143000	300	2100	400
PT-210		5.0	5000	8	1600	15
PT-841		5.0	21500	30	1400	15
PT-842		5.0	2500	3	1200	15
PT-860	300	10.0	180000	200	1100	100

GASEOUS RECTIFIERS (Continued)

Type No.	Cathode			Max. peak inverse potential volts	Max. peak current amp.	Max. average current amp.
	Type	Potential volts	Current amp			
BA				350		0.35
BH				350		0.12
BR				600		0.05
DKI-606	Mercury pool 3 phase			15000	50.0	20.0
DKI-624	Coat.	5.0	40.0	5000	65.0	25.0
FG-15	Heat	5.0	37.0	20000	40.0	10.0
FG-19	Coat.	5.0	10.0	7500	5.0	1.25
FG-19-A	Coat.	5.0	6.75	10000	5.0	1.25
FG-26	Coat.	5.0	7.0	1000	10.0	2.5
FG-28	Heat.	5.0	17.5	3500	75.0	12.5
FG-32	Heat.	5.0	4.5	1000	15.0	2.5
FG-42	Heat.	5.0	80.0	15000	450.0	75.0
FG-52	Heat.	5.0	80.0	1500	600.0	100.0
FG-64	Coat.	2.5	2.0	1000	0.5	0.12
FG-104	Heat.	5.0	10.0	1500	40.0	6.4
FG-139[2]	Mercury pool			900	1125.0	7.5
FG-190[3]	Fil.	2.5	12.0	175	5.00	1.25
FG-194[2]				900	105.0	1.25
FG-235-A[2]	Mercury pool			900	1000.0	135.0
FG-253[2]	Mercury pool			900	600.0	2.4
FG-258-A[2]	Mercury pool			900	7500.0	100.0
KI-605	Coat	2.5	2.0	5000	0.3	0.2
KI-620	Coat.	5.0	11.5	5000	10.0	4.0
KI-625	Coat.	5.0	20.0	5000	22.5	10.0
KI-626	Coat	2.5	6.0	5000	1.2	0.64
KR-1	Heat.	6.3	0.3	500	0.2	0.05
PJ-20[4]	Cold			160	200.0	0.25
PJ-26	Coat	5.0	20.0	20000	10.0	2.5
PJ-28	Coat	2.5	5.0	7500	2.0	0.5
PJ-28-A	Coat.	2.5	5.0	10000	2.0	0.5

[2] Ignitron [3] All metal tube. [4] Surge absorber tube.

HIGH VACUUM RECTIFIERS

Type No	Cooling	Cathode			Max peak potential volts	Max peak current amp
		Type	Potential volts	Current amp.		
1-v	.	Heat	6.3	0.3	350	0.050
5W4[1]		Fil.	5.0	1.5	350	0.110
5Z3	..	Fil	5.0	3.0	500	0.250
5Z4[1]	....	Heat.	5.0	2.0	400	0.125
6H6[1]	. .	Heat	6.3	0.3	100	0.004
6X5[1]	.	Heat	6.3	0.6	350	0.075
12Z3	.	Heat	12.6	0.3	250	0.060
25Z5[2]		Heat	25.0	0.3	250	0.085
25Z6[1,2]		Heat.	25.0	0.3	250	0.085
80		Coat	5.0	2.0	550	0.135
81		Coat.	7.5	1.25	700	0.085
83-v	.	Heat	5.0	2.0	400	0.200
84, 6Z4		Heat.	6.3	0.5	350	0.060
103-A	Water	Tung.	28.0	51.00	60000	6.500
104-A	Air	Tung.	11.0	25.00	30000	1.250
214	Water	Tung.	22.0	52.00	50000	7.500
214-E	Air	Thor.	10.0	3.20		0.150
217-A	Air	Coat.	6.0	1.00		0.025
217-A	Air	Thor	10.0	3.25	3500	0.600
217-C	Air	Thor.	10.0	3.25	7500	0.600
218	Air	Tung.	11.0	14.75	50000	0.750
219	Air	Tung.	22.00	24.50	50000	2.500
219-D	Air	Coat.	14.0	6.00		0.250
222-A	Water	Tung.	21.5	41.0	25000	5.0
233-A	Water	Tung	21.5	41.00		2.000
234-A	Air	Thor	11.0	3.90		1.000
237-A	Water	Tung	20.0	61.0	50000	8.0
274-A	Air	Coat	5.0	2.0	660	0.160
282	Air	Coat	2.5	3.00	1400	0.400
283	Air	Coat	2.5	5.00	500	0.250
1651	Air	Tung	11.0	14.75	4000	0.250
DRO-580	Air	Oxide	5.0	0.25	600	0.040
DRO-581	Air	Tung.	5.0	2.20	3000	0.010
DRO-582	Air	Tung.	5.0	2.50	7500	0.015
DRO-583	Air	Tung	5.0	4.50	15000	0.025
DRO-584	Air	Tung	5.0	5.50	30000	0.035
DRO-587	Air	Oxide	2.5	4.00	750	0.450
DRO-588	Air	Oxide	2.5	4.00	1500	0.450
FP-52	Air	Thor	10.0	3.25	1500	0.200
FP-78	Air	Tung	10.0	10.00	125000	0.300
FP-84	Oil, air	Tung	10.0	14.50	75000	0.300
FP-85	Air	Tung	10.0	5.0	20000	0.100
FP-92	Air	Tung	10.0	14.50	140000	0.300
KC-1	Air	Tung	9.0	32.00	100000	1.000
KC-3	Air	Tung	12.5	32.00	150000	1.000
KC-4	Air	Tung	20.0	25.00	140000	1.000
KP-2	Air, oil	Tung	10.0	10.0	75000	0.200
WL-608	Air	Tung	10.0	10.00	50000	0.200
WL-612	Air	Tung	10.0	50.00	150000	0.100
WL-613	Air	Tung.	10.0	10.00	140000	0.200
WL-660	Air	Tung.	10.0	10.00	230000	0.100

[1] Metal tube
[2] Also used as voltage doubler.

GRID CONTROLLED RECTIFIERS

Thyratrons, Grid-glow Tubes, Etc.

Type No	Cathode Type	Cathode Potential volts	Cathode Current amp.	Max. peak inverse potential volts	Max. peak current amp	Max. average current amp.
256-A	Heat	2 3	1 7	325	0 075	
269-A	Coat.	2 2	0 55	275	0 020	
277-A	Heat.	5 0	2 0	350	0 5	
287-A	...	2 5	7 0	2500	3 0	2 0
323-A	.	2 5	7 0	500	3 0	2 0
DKU-622	Coat	5 0	40 0	5000	65 0	25 0
DKU-623	Coat	5 0	20 0	5000	22 5	10 0
DKU-632	Coat	2 5	2 0	1500	0 30	0 10
FG-17	Coat	2 5	5 0	2500	2 0	0 5
FG-27	Coat	5 0	7 0	1000	10 0	2 5
FG-27-A	Coat	5 0	4 5	1000	10 0	2 5
FG-29	Heat	5 0	17 5	3500	75 0	12 5
FG-33	Heat.	5 0	4 5	1000	15 0	2 5
FG-37	Heat.	115 0	0 2	1000	15 0	2 5
FG-41	Heat	5 0	20 0	10000	75 0	12 5
FG-43	Heat.	5 0	80 0	15000	450 0	75 0
FG-53	Heat.	5 0	60 0	1500	600 0	100 0
FG-57	Heat.	5 0	4 5	1000	15 0	2 5
FG-65	Coat	2 5	2 0	1000	0 5	0 125
FG-67	Heat	5 0	4 5	1000	15 0	2 5
FG-81	Coat	2 5	5 0	180	2 0	0 50
FG-95[1]	Heat	5 0	4 5	1000	15 0	2 5
FG-97[1]	Coat	2 5	5 0	1000	2 0	0 5
FG-98[1]	Coat	2 5	5 0	180	2 0	0 5
FG-105[1]	Heat	5 0	10 0	1000	40 0	6 4
FG-154[1]	Coat	5 0	7 0	500	10 0	2 5
FG-172[1,2]	Heat	5 0	10 0	1000	40 0	6 4
FG-178	Coat	2 5	2 25	310	0 500	0 125
KU-610	Coat	2 5	6 5	1500	0 80	0 40
KU-618	Cold			800	0 1	0 015
KU-627	Coat.	2 5	6 0	5000	1 2	0 64
KU-628	Coat.	5 0	11 5	5000	10 0	4 0

[1] Double grid.
[2] All metal.

BASE CONNECTIONS

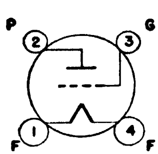
Looking at Bottom of Tube

BP, bayonet pin	H, heater	P, plate
F, filament	K, cathode	PBF, beam forming plates
G, grid	NC, no connection	TA, target

Alphabetical subscripts D, P and T indicate, respectively, diode unit, pentode unit, and triode unit in multi-unit types.

Numerical subscripts are used (1) in multi-grid types to indicate relative position of grids to cathode or filament, and (2) in multi-unit types to differentiate between two identical electrodes which would otherwise have the same designation.

BASE CONNECTIONS (Continued)



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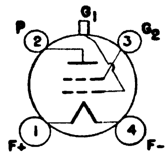

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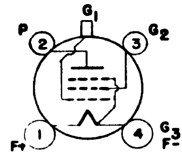

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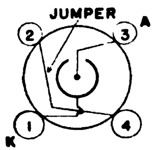

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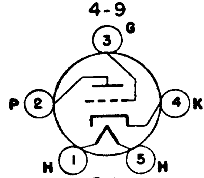

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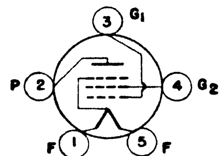

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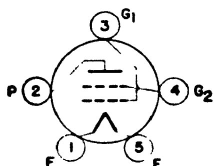

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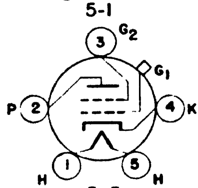

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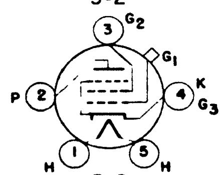

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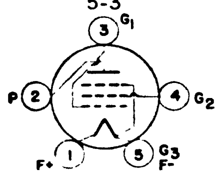

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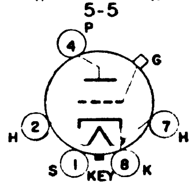

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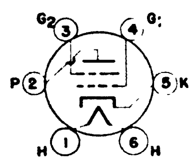

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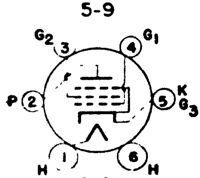

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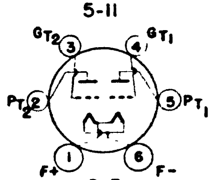

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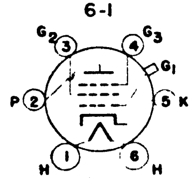

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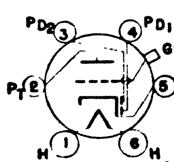

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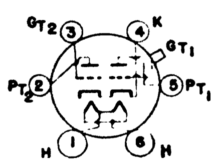

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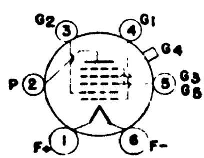
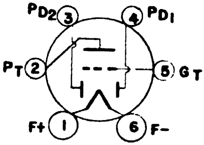


6-10

BASE CONNECTIONS (Continued)



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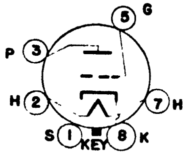

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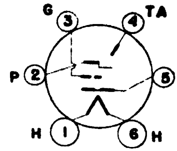

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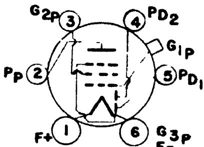

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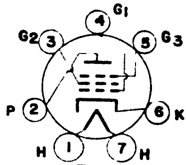

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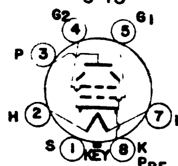

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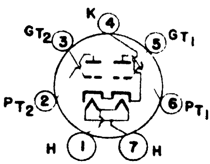

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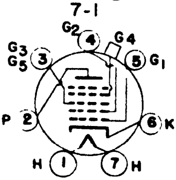

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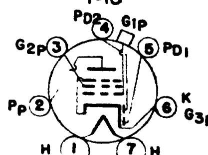

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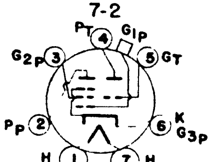

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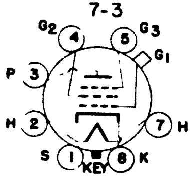

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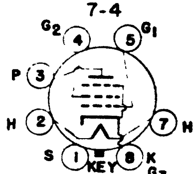

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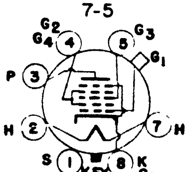

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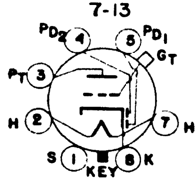

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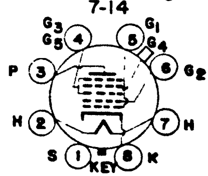

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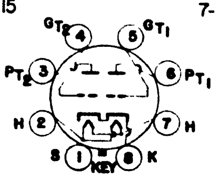

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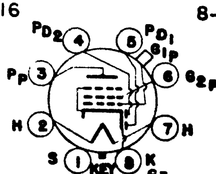

8-5

CONVERSION TABLE FOR TRANSMISSION UNITS

Decibels		Amplf'n ratio	Attenu'n ratio	Decibels		Amplf'n ratio	Attenu'n ratio
For current or voltage ratio	For power ratio			For current or voltage ratio	For power ratio		
				4.5	2 25	1 679	0 596
0 1	0.05	1 012	0 989	4 6	2 3	1 698	0 589
0.2	0 1	1 023	0 977	4 7	2 35	1 718	0 582
0 3	0 15	1 035	0 966	4 8	2 4	1 738	0 575
0.4	0 2	1.047	0 955	4 9	2 45	1 758	0 569
0.5	0 25	1.059	0 944	**5.0**	2 5	1 778	0 562
0.6	0 3	1 072	0 933	5 1	2 55	1 799	0 556
0.7	0 35	1 084	0 923	5 2	2 6	1 820	0 550
0.8	0 4	1 096	0 912	5 3	2 65	1.841	0 543
0.9	0.45	1.109	0 902	5 4	2.7	1.862	0 537
1.0	0 5	1 122	0 891	**5.5**	2 75	1 884	0 531
1.1	0 55	1 135	0 881	5 6	2 8	1 906	0 525
1.2	0 6	1 148	0 871	5 7	2 85	1 928	0 519
1 3	0 65	1 162	0 861	5 8	2 9	1 950	0 513
1.4	0 7	1 175	0 851	5 9	2 95	1.972	0 507
1.5	0 75	1 188	0 841	**6.0**	3 0	1 995	0 501
1 6	0 8	1 202	0 832	6 1	3 05	2 018	0 495
1 7	0 85	1 216	0 822	6 2	3 1	2 04	0 490
1 8	0 9	1 230	0 813	6 3	3 15	2 06	0 484
1 9	0 95	1 245	0 804	6 4	3 2	2 09	0 479
2.0	1 0	1 259	0 794	**6.5**	3 25	2 11	0 473
2 1	1 05	1 274	0 785	6 6	3 3	2 14	0 468
2 2	1 1	1 288	0 776	6 7	3 35	2 16	0 462
2 3	1 15	1 303	0 767	6 8	3 4	2 19	0 457
2 4	1 2	1 318	0 759	6 9	3 45	2 21	0 452
2.5	1 25	1 334	0 750	**7.0**	3 5	2 24	0 447
2 6	1 3	1 349	0 741	7 1	3 55	2 26	0 442
2 7	1 35	1 365	0 733	7 2	3 6	2 29	0 437
2 8	1 4	1 380	0 724	7 3	3 65	2 32	0 432
2.9	1 45	1 396	0 716	7.4	3 7	2 34	0 427
3.0	1 5	1 413	0 708	**7.5**	3 75	2 37	0 422
3 1	1.55	1 429	0 700	7 6	3 8	2 40	0 417
3 2	1 6	1 445	0 692	7 7	3 85	2 42	0 412
3 3	1 65	1 462	0 684	7 8	3 9	2 45	0 407
3 4	1.7	1 479	0 676	7 9	3 95	2 48	0 403
3.5	1.75	1 496	0 668	**8.0**	4 0	2 51	0 398
3 6	1 8	1 514	0 661	8 1	4 05	2 54	0 394
3 7	1 85	1 531	0 653	8 2	4 1	2 57	0 389
3.8	1 9	1 549	0 645	8 3	4 15	2 60	0 385
3.9	1 95	1 567	0 638	8 4	4 2	2 63	0 380
4.0	2 0	1 585	0 631	**8.5**	4 25	2 66	0 376
4.1	2 05	1 603	0 624	8 6	4 3	2 69	0 372
4.2	2 1	1 622	0 617	8 7	4 35	2 72	0 367
4.3	2 15	1 641	0 610	8 8	4 4	2 75	0 363
4.4	2 2	1 660	0.603	8 9	4 45	2 79	0 359
4.5	2 25	1 679	0 596	**9.0**	4 5	2 82	0 355

CONVERSION TABLE FOR TRANSMISSION UNITS

Decibels: For current or voltage ratio	Decibels: For power ratio	Amplf'n ratio	Attenu'n ratio	Decibels: For current or voltage ratio	Decibels: For power ratio	Amplf'n ratio	Attenu'n ratio
9.0	4 5	2 82	0 355	**14.0**	7.0	5 01	0 200
9 1	4 55	2 85	0 351	14 1	7 05	5 07	0 197
9 2	4.6	2 88	0 347	14 2	7.1	5 13	0 195
9.3	4 65	2 91	0 343	14 3	7.15	5 19	0 193
9.4	4.7	2 95	0 339	14 4	7.2	5 25	0.191
9.5	4.75	2 98	0 335	**14.5**	7 25	5 31	0 188
9 6	4 8	3 02	0 331	14 6	7 3	5 37	0.186
9 7	4 85	3 05	0 327	14 7	7 35	5 43	0 184
9 8	4 9	3 09	0 324	14 8	7 4	5 50	0 182
9 9	4 95	3.13	0 320	14.9	7.45	5 56	0 180
10.0	5 0	3 16	0 316	**15.0**	7 5	5 62	0 178
10 1	5 05	3 20	0 313	15 1	7 55	5 69	0 176
10 2	5 1	3 24	0 309	15 2	7 6	5 75	0 174
10 3	5 15	3 27	0 305	15 3	7 65	5 82	0 172
10.4	5 2	3 31	0 302	15 4	7 7	5 89	0 170
10.5	5 25	3 35	0 298	**15.5**	7 75	5 96	0 168
10.6	5 3	3 39	0 295	15 6	7 8	6 03	0 166
10 7	5 35	3 43	0 291	15 7	7 85	6 10	0 164
10 8	5 4	3 47	0 288	15 8	7 9	6 17	0.162
10 9	5 45	3 51	0 285	15 9	7.95	6.24	0.160
11.0	5 5	3 55	0 282	**16.0**	8 0	6 31	0 158
11 1	5 55	3 59	0 279	16 1	8 05	6 38	0 157
11 2	5 6	3 63	0 275	16 2	8 1	6 45	0 155
11 3	5 65	3 67	0 272	16 3	8 15	6 53	0.153
11 4	5 7	3 72	0 269	16 4	8 2	6.61	0.151
11.5	5 75	3 76	0 266	**16.5**	8 25	6 68	0 150
11 6	5 8	3 80	0 263	16 6	8 3	6 76	0.148
11 7	5 85	3 85	0 260	16 7	8 35	6 84	0 146
11 8	5 9	3 89	0 257	16 8	8 4	6 92	0 144
11.9	5 95	3 94	0 254	16 9	8 45	7 00	0 143
12.0	6 0	3 98	0 251	**17.0**	8 5	7 08	0 141
12 1	6 05	4 03	0 248	17 1	8 55	7.16	0 140
12 2	6 1	4 07	0 245	17 2	8 6	7 24	0 138
12 3	6 15	4 12	0 242	17 3	8 65	7 33	0 136
12.4	6 2	4 17	0 240	17.4	8 7	7 41	0 135
12.5	6 25	4 22	0 237	**17.5**	8 75	7 50	0.133
12 6	6 3	4 27	0 234	17 6	8 8	7 59	0 132
12 7	6 35	4 32	0 232	17 7	8 85	7 67	0 130
12 8	6 4	4 37	0 229	17 8	8 9	7.76	0 129
12 9	6.45	4 42	0 226	17 9	8 95	7.85	0 127
13.0	6 5	4 47	0 224	**18.0**	9 0	7 94	0 126
13.1	6.55	4 52	0.221	18.1	9 05	8 04	0 124
13 2	6 6	4 57	0 219	18 2	9.1	8 13	0 123
13 3	6 65	4 62	0 216	18 3	9 15	8 22	0 122
13.4	6 7	4 68	0 214	18 4	9 2	8 32	0 120
13.5	6 75	4,73	0 211	**18.5**	9 25	8 41	0 119
13.6	6 8	4 79	0 209	18 6	9 3	8 51	0 118
13 7	6 85	4 84	0 206	18 7	9 35	8.61	0 116
13 8	6 9	4 90	0 204	18 8	9 4	8 71	0 115
13 9	6 95	4 95	0 202	18 9	9 45	8.81	0 114
14.0	7 0	5 01	0 200	**19.0**	9 5	8 91	0 112

CONVERSION TABLE FOR TRANSMISSION UNITS
(Continued)

Decibels				Decibels			
For current or voltage ratio	For power ratio	Amplf'n ratio	Attenu'n ratio	For current or voltage ratio	For power ratio	Amplf'n ratio	Attenu'n ratio
19.0	9.5	8 91	0 112	**55**	27 5	562	0 00178
19 1	9.55	9 02	0 111	56	28 0	631.	0 00158
19 2	9 6	9.12	0 110	57	28 5	708	0 00141
19 3	9 65	9 23	0 108	58	29 0	794	0 00126
19 4	9.7	9.33	0 107	59	29.5	891	0 00112
19.5	9.75	9 44	0 106	**60**	30 0	1000	0 00100
19 6	9 8	9 55	0 105	61	30 5	1120	0 000891
19 7	9 85	9.66	0 104	62	31 0	1260	0 000794
19 8	9.9	9 77	0 102	63	31 5	1410.	0 000708
19 9	9.95	9 89	0 101	64	32 0	1580.	0 000631
20	10 0	10.00	0 100	**65**	32 5	1780	0.000562
21	10 5	11.2	0 0891	66	33 0	2000	0 000501
22	11.0	12 6	0 0794	67	33 5	2240.	0 000447
23	11 5	14 1	0 0708	68	34 0	2510	0 000398
24	12 0	15 8	0.0631	69	34 5	2820.	0 000355
25	12 5	17 8	0 0562	**70**	35 0	3160	0 000316
26	13 0	20 0	0 0501	71	35 5	3550	0 000282
27	13 5	22 4	0 0447	72	36 0	3980	0 000251
28	14 0	25 1	0 0398	73	36 5	4470	0 000224
29	14 5	28 2	0 0355	74	37 0	5010.	0 000200
30	15 0	31 6	0 0316	**75**	37 5	5620	0 000178
31	15 5	35 5	0 0282	76	38 0	6310	0 000158
32	16 0	39 8	0 0251	77	38 5	7080	0 000141
33	16 5	44 7	0 0224	78	39 0	7940	0 000126
34	17 0	50 1	0.0200	79	39 5	8910	0 000112
35	17 5	56 2	0 0178	**80**	40 0	10000	0 000100
36	18 0	63 1	0 0158	81	40 5	11200	0 0000891
37	18 5	70 8	0 0141	82	41 0	12600	0 0000794
38	19 0	79 4	0 0126	83	41 5	14100	0 0000708
39	19 5	89 1	0 0112	84	42 0	15800	0 0000631
40	20 0	100	0 0100	**85**	42 5	17800	0 0000562
41	20 5	112	0 00891	86	43 0	20000	0 0000501
42	21 0	126	0 00794	87	43 5	22400	0 0000447
43	21 5	141.	0 00708	88	44 0	25100	0 0000398
44	22 0	158	0 00631	89	44 5	28200	0.0000355
45	22 5	178	0 00562	**90**	45 0	31600	0 0000316
46	23 0	200	0 00501	91	45 5	35500	0 0000282
47	23 5	224	0 00447	92	46 0	39800.	0 0000251
48	24 0	251	0 00398	93	46 5	44700.	0.0000224
49	24 5	282	0.00355	94	47 0	50100.	0.0000200
50	25 0	316.	0 00316	**95**	47 5	56200	0 0000178
51	25 5	355.	0 00282	96	48.0	63100	0 0000158
52	26.0	398	0 00251	97	48 5	70800	0 0000141
53	26 5	447.	0 00224	98	49 0	79400	0 0000126
54	27 0	501.	0 00200	99	49 5	89100	0 0000112
55	27 5	562.	0 00178	**100**	50 0	100000.	0 0000100

LABORATORY ARTS AND RECIPES

Many of the following recipes have been contributed by users of the Handbook. To those who have cooperated in this way we extend our grateful acknowledgment.

BLUING STEEL AND IRON

The metal is cleaned with a potassium bichromate-sulfuric acid mixture, then washed with ammonium hydroxide and rubbed dry. Apply ammonium polysulfide until the desired depth of color is obtained, allowing the object to dry after each application and rubbing briskly with soft clean cloth. The result is a deep blue which may be made very nearly black by repeated applications. Rubbing with boiled linseed oil will deepen this color more. The finish thus obtained is very resistant to oxidation.

CEMENTS AND ADHESIVES

Acid Proof Cement

1

A handy acid resisting cement can be made by mixing sodium silicate and asbestos powder to the consistency of a thin paste. If allowed to dry for a day, the resulting cement will resist the strongest acids.

2

Barium sulfate 4 parts, water glass 3 parts, asbestos 1 part. Sodium fluosilicate or sodium fluoborate is advised in addition when the cement is used on glass.

Aquarium Cement

1

Glazier's putty	10 lb.
Litharge	1 lb.
Red lead	1 lb.
Asphaltum	4 oz. fl.

Mix with boiled linseed oil to the proper consistency. Lamp black may be added to give a gray color.

2

Red lead	3 parts
Litharge	7 parts
Fine sand	10 parts
Powdered rosin	1 part

Add sufficient spar varnish to give the proper consistency.

Cement for Cellophane

The following is said to be a very satisfactory glue or cement for cellophane:

Gum acacia (gum arabic)	16.5 parts by weight
Glycerin	29.5 parts by weight
Water	49.5 parts by weight
Formaldehyde (40 %)	4.5 parts by weight

Cupric Oxide Cement

For a strong adhesive cement for attaching metal articles to each other or for cementing glass, a paste of cupric oxide and phosphoric acid is very satisfactory. The cement is adhesive, strong and sets quite rapidly.

De Khotinsky Cement

1

About 70 grams of light brown orange shellac is added in small amounts to 30 grams of heated pine tar. The mixture is stirred at frequent intervals for a period of two hours (or four hours) and maintained at a temperature of 130° C. or slightly lower. (The longer heating period gives a cement that is suitable for high vacuum work.) The product may be tested at intervals by dropping some of it into cold water and then subjecting it to bending pressure. Under such treatment, the product should not bend but break with a conchoidal fracture.

If a harder product is desired, 85 grams of light brown shellac may be mixed and heated with 30 grams of pine tar.

The finished product, while still warm, may be spread on a stone slab or a smooth surface and rolled into small sticks.

This sealing cement will be found useful whenever two pieces of apparatus are to be cemented together. The cementing is effected by warming the surfaces and applying melted cement. The removal of the cement may be facilitated by softening it with alcohol.

2

A handy water-proof laboratory cement of the type "Kotinsky Cement" is made from:

Dry yellow or orange shellac	3 parts by weight
Pine tar . .	1 part by weight

Place the shellac in a double boiler using water in the outer member. Add the pine tar and permit to digest with occasional stirring until the mass is homogeneous; this will take about five hours. Pull out like taffy and make into sticks. The cement can be made harder or softer by varying the amount of tar.

General Hints

Glues of all kinds are useful for wood, leather, paper and glass, where the joints are not required to be waterproof.

For waterproof joints of nearly all substances, including metals, shellac may be used. Flakes of solid shellac may be used with heat or it may be used as a solution in alcohol.

Kotinsky cement, Chatterton's compound and other resinous cements are used for similar purposes and in the same way as solid shellac. Glass cells made up with compounds of this nature may be made impervious to alcohol by painting over the joints with a rubber cement made by melting up small pieces of rubber tubing and adding carbon disulfide to make a thin syrup.

For celluloid a cement made by dissolving celluloid shavings in acetone is recommended.

Brass fittings are usually cemented on glass tubing with sealing wax. The glass tube should be wound with thread or twine to secure a close fit. The glass and the brass fitting should be warmed

slightly above the melting point of wax. (Thick or pressed glass should be warmed slowly.) Wax may be applied to both parts and the thread well saturated with the melted wax. Enough should be used to insure filling the space completely. Join the parts while the wax is very soft and clamp in position until it is thoroughly cold.

For optical purposes, cementing glass, etc., Canada balsam is universally employed, and makes a permanent and nearly invisible joint.

Laboratory Adhesive

Nitrated cotton (5-6 sec.) .... 30 grams

Make up a solution of:

Di methyl ketone (acetone)	100	milliliters (c.c.)
Amyl acetate	45	milliliters (c.c.)
Butyl acetate	15	milliliters (c.c.)
Ethyl acetate	15	milliliters (c.c.)
*Ethyl abietate	1.5	milliliters (c.c.)

* $\frac{1}{2}$ above of castor oil is a substitute.

Using the latter solution as solvent, add the nitrated cotton until the solution is of the consistency of syrup. Dissolving the cotton takes about two hours. If the mixture is too thick, a little more of the above solvent, which should be kept on hand, is added.

The above solution should not blush when applied to any surface. It should dry quickly into a tough film which is stable over a long period owing to the plasticizer, ethyl abietate.

The above is useful for cementing cross hairs, coating labels, sealing rubber to tubing, etc.

In case a more flexible film is desired the amount of the plasticizer may be doubled. In case of blushing increase amyl acetate.

Litharge Cement for Joining Metal to Glass

In the preparation of tanks with glass sides or bottom, it is desired to make these water tight by cementing the glass to the iron frame or to repair the leaks that may occur.

Litharge (PbO)	260 grams
Glycerin solution (glycerin 2 parts, water 1 part)	100 milliliters (c.c.)

Place the litharge in a mortar, add the diluted glycerin slowly while grinding. Mix thoroughly by grinding a short time. Heat will be evolved and the mixture will begin to set. While still soft, pour it into place and by means of a spatula work it into position as in the case of putty. Allow to stand for a day when it will be thoroughly hard.

If desired, it may be covered with a layer of white lead or aluminum paint.

Mucilage or Paste

Gum arabic (gum acacia)	1 part
Rice starch	1 part
Sugar	4 parts
Water	10 parts

Warm the gum arabic with some of the water until it has a jelly-like consistency. Mix the sugar and starch with enough water to make a smooth paste. Combine these two mixtures, and boil until the starch is clear.

Shellac Cement

De Khotinsky Type

(Benzene Resistant)

Note: Most recipes for de Khotinsky cement call for pine tar, to the amount of 40 to 50 %, as the material with which shellac is plasticized for the application in question. Recent investigation indicates that pine tar is inferior to the creosote plasticizer recommended below.

Prepare the plasticizer by mixing one volume of terpineol with three volumes of beechwood creosote (alkali-soluble). Coal-tar creosote, not completely alkali-soluble, will not do.

Heat from 12 to 25 grams of the plasticizer to about 130° C. With constant stirring add 85 grams of shellac as fast as it dissolves smoothly. When the mixture is homogeneous, allow to cool until it will barely flow from the vessel, and pour into molds which have been lightly but completely covered with petrolatum. The use of only 12 grams of plasticizer gives a very hard cement; 25 grams gives a very soft product.

Shellac-Wax Cement

(Benzene Soluble)

Rosin	35 grams
Shellac	20 grams
Beeswax	20 grams
Talc, fibrous (asbestine pulp)	0 to 30 grams

Melt the rosin in a large (6 or 8 in.) hemispherical iron pan, add the shellac and beeswax with stirring. Heat strongly with a large Bunsen flame so that the temperature reaches 360° C. in six minutes; then extinguish the burner. When the temperature has reached about 275° C., add the talc, if any is to be used. Finally when the mixture is so viscous that it will barely pour from the pan, pour into metal molds which have previously been very thoroughly scoured with washing powder and thickly coated with aqueous dextrine paste which is still wet. The talc gives a more viscous cement at temperatures just above the melting point.

Transparent Sealing Resin

A transparent resin which adheres well to glass, quartz and metals may be made by heating together equimolal quantities of phthallic anhydride and ethylene glycol for 24 hours at 200° C. The resin softens at 95°–110° C. It is unaffected by water but slowly dissolved by organic solvents and is particularly useful for high-vacuum seals.

Vacuum Wax

Wax for coating joints which may be used for ordinary vacuum distillations etc. where the temperature does not get too high:

Melt together equal parts (by weight) of beeswax and rosin. The product is pliable and easily removed from apparatus by simply using hot water.

CLEANING COMPOUNDS AND METHODS

Alcoholic Sodium Hydroxide Solution for Cleaning

Dissolve 120 grams sodium hydroxide in 120 c.c. water. Dilute to 1 liter with 95 % alcohol.

Burette Cleaning Assembly

A burette cleaning assembly may consist of a 300 c.c. beaker of cleaning solution mounted on a ring stand having a 7 × 9″ base. Higher on the stand is a clamp for engaging the burette to be cleaned and still higher a mounting of $\frac{3}{16}$″ rubber tubing connected with an aspirator. The cleaning solution is heated, the burette placed with its top dipping into the cleaning solution while the aspirator tubing is slipped on the delivery end of the burette. When hot cleaning liquid has been aspirated to near the glass stopcock or pinch-cock, the cock is closed and the aspirator tubing slipped off, leaving the cleaning solution in the burette. After a minute or so, the cock is opened and the cleaning solution is allowed to run out of the burette, which will leave a uniform film if the burette is clean. The burette is transferred to a sink and after cooling is rinsed with tap and distilled water. By this means 50 burettes per hour may be made ready for use.

Brown Stains on Burettes

Brown stains left on the inside of burettes used for $KMnO_4$ solutions may be removed by filling the burette with $FeSO_4$ solution after which the liquid is removed and completely washed out. A convenient, ready for use, solution of $FeSO_4$ may be made by placing small nails in a dilute H_2SO_4 solution, keeping the flask closed except for a hydrogen vent, thus preventing oxidation of the iron.

Cleaning Engler Flasks

To thoroughly remove all of the carbonaceous deposit baked in the bottom of an Engler flask from gasoline distillation, place 2 or 3 grams of commercial Na_2SO_4 in the flask to be cleaned; apply heat directly to the flask from a Bunsen burner. Heat until all the carbon residue has been loosened. Cool, rinse and drain.

Cleaning Fermentation Tubes and Other Glassware

Fermentation tubes (used in water testing) and other glassware difficult to clean in the ordinary way, may be cleaned as follows:

Moisten the inside of the tube with ethyl alcohol. Pour off the excess alcohol, leaving not to exceed two c.c. of the liquid in the tube. Add ten c.c. of concentrated nitric acid and let it stand. Soon a vigorous reaction takes place with the elimination of large quantities of nitrogen dioxide. When the reaction stops, wash with water. As some nitric acid may be blown out of the tube, it should be placed in a sink (preferably in a hood) until the reaction ceases. Do not close the tube.

Cleaning Fluid

An excellent solution for cleaning grease stains from cloth or leather consists of the following:

CCl_4	80 %
Ligroin	16 %
Amyl alcohol (ter.)	4 %

Cleaning Mercury

Mercury may be cleaned sufficiently for many laboratory purposes without distilling. Allow the mercury to fall in a fine spray into a quantity of dilute nitric acid, 25 parts of acid to 75 parts of distilled water. After being passed through the acid one or more times it should be passed through distilled water and dried. Most of the water may be removed with a clean filter, and the mercury heated in a porcelain dish to about 110° C. To produce the spray the stem of a glass funnel may be drawn down so as to leave only a small opening for the escape of mercury or a glass tube with a capillary point attached to a funnel with a tightly fitting rubber tube.

A three- to four-foot length of one-inch glass tube closed at one end and supported in a vertical position may be used to contain the acid solution. If a small glass tube be fused into the lower closed end of the large tube, and bent so as to stand up for a distance a little greater than 1/13.6 the column of acid solution in the large tube, a U-tube is formed in which a short column of mercury supports the long column of acid solution.

The end of the small tube should be bent over at the top so as to facilitate the delivery of the mercury and a short piece of clean rubber tubing with a pinch-cock put on at the start; as soon as mercury enough has collected in the bottom of the tube the pinch-cock may be opened. The mercury will rise nearly or quite to the top of the small tube, and as the quantity increases will be delivered from the small tube as fast as it falls in the spray.

The reversed end of the small tube should be short to avoid forming a siphon, which would completely empty the apparatus.

An efficient procedure, especially if the mercury is greasy, consists in spraying the mercury by means of the above apparatus, first, through a dilute solution (10 %) of potassium hydroxide, then through dilute nitric acid (10–15 %) and finally through distilled water.

Cleaning Optical Surfaces for Silvering

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

Probably the most important part of the silvering process is the proper cleaning of the surface to be silvered.

The surface is thoroughly cleaned of grease or other organic matter by the usual methods, using alcohol or chromic acid. Then it should be carefully cleansed with strong nitric acid, the whole surface being firmly rubbed with clean cotton tied to a rod of wood or glass. Care should be taken not to injure the surface. Rinse with water, and then wash the surface thoroughly with a strong solution of caustic potash, rubbing with a cotton brush as before. Finally, rinse with distilled water, and keep the surface wet until it is placed in the silvering solution. If the distilled water wets the whole surface uniformly the cleaning may be sufficient; if it does not wet uniformly, the operations must be repeated. The fingers should not touch the edges of the glass during the latter cleaning operations, as a layer of organic matter is apt to spread over the surface and render the silvering uneven.

Dr. Brashear recommends that the surface, after the washings described above, be rubbed with prepared chalk on a cotton wad until it is thoroughly dry and clean. It may then be put into the silvering solution at one's convenience.

Cleaning Solution for Glass

35 c.c. saturated sodium dichromate (technical)
1 liter conc. sulfuric acid poured into the dichromate solution

Avoid contact with the flesh or clothing.

Cleaning Solution

Trisodium phosphate	2 oz.
Sodium oleate	1 oz.
Distilled water	1 pint

Soak apparatus in the warm solution 10–15 minutes, then brush with a stiff brush.

Iodine Stains

Iodine stains can readily be removed from clothing by washing the stain with a 10 % solution of sodium thiosulfate ("hypo") in water.

Paint Brush Cleaner

(1)	Kerosene	2 pints
	Oleic acid	1 pint
(2)	Aqueous ammonia (conc.)	¼ pint
	Denatured alcohol	¼ pint

Stir (2) into (1) until uniform. To clean brushes, place in the mixture over night. Wash thoroughly with warm water.

Removal of Carbonaceous Matter

A 10–15 % solution of NaOH or KOH removes carbon etc. quickly. Rinse well with acid and H_2O.

Removing Carbon Deposits from Flasks

First rinse flask with acetone or carbon disulfide to remove traces of oil or tar. Add a few grams of magnesium nitrate. Heat gradually over a free Bunsen flame till water is all expelled and the magnesium nitrate melts. Rotate the flask to distribute the melt and continue the heating till the brown fumes of nitric oxide cease to evolve. Finally cool and dissolve the residual magnesium oxide in dilute acid by boiling.

Large deposits of carbon or tar will require a repetition of the above procedure.

Removing Carbon Residue from Glassware

Tri-sodium phosphate (Na_3PO_4)	2 tablespoonfuls
Sodium oleate	1 tablespoonful
Soft water	1 quart

Allow to stand in the solution for several minutes, brush off the incrustation and rinse with water.

COLORED LIQUIDS

For rendering columns of water easily visible, add a few drops of one per cent alcoholic solution of fluorescein to a liter of water. The dilute solution of fluorescein is bright green by reason of its fluorescence, although colorless by transmitted light.

A small quantity of an aqueous (1 %) solution of uranine (the sodium salt of fluorescein) may be used in place of the alcoholic solution mentioned above.

If liquids showing color by transmission are desired, dilute aqueous solutions may be made with any of the following dyes:

Dye	Color
Erythrosine	Pink
Eosine	Pink (green fluorescence)
Rhodamine B	Pink (red fluorescence)
Ponceau 2R	Scarlet
Naphthol green	Green
Methylene green	Bluish green
Methylene blue	Blue
Methyl violet	Purple

CROSS HAIRS

The spider lines which serve as an index in reading telescopes may be quickly replaced in an emergency by single silk fibers (from ordinary sewing silk) attached by soft wax. Single fibers may easily be removed from an untwisted strand.

Spider web should be used in permanent work. The fibers of the egg nest of certain species are employed and may be obtained of most dealers in scientific apparatus. In mounting them the following suggestions may be useful: The cross hair diaphragm of the telescope should be removed and clamped in a horizontal position. A bow of brass wire, about No. 28, should be employed to stretch the fiber. A background of black velvet makes the fibers more easily visible. With soft wax or other convenient adhesive ready on both tips of the bow, a fiber of the required length is to be disentangled with tweezers and wrapped several times about the ends of the bow under tension sufficient to straighten the fiber. The fiber, now conveniently handled by the wire bow, should be cautiously lowered onto the diaphragm in the proper position, the wire left hanging.

A small drop of shellac varnish applied at each side will hold the fiber in position as soon as it is thoroughly dry, after which the ends of the fiber should be cut away.

DIALYZERS

As a substitute for parchment and similar natural membranes, it has been found that those made from cellulose trinitrate are superior. Parlodion (DuPont) may be used, dissolving one part of the nitrate in 2 each of ethanol and ethyl ether. The water adhering to the Parlodion should first be removed (the shreds are preserved by covering with water), otherwise a clear solution will not be obtained. Cut the round end off a $\frac{3}{4}''$ or $1''$ test tube, and dip the flared end of the tube into the alcohol-ether solution of Parlodion. Upon removing the tube from the solution a film will be found across the tube and after evaporation of the solvents the film will be found to be of sufficient strength to meet the purposes of a dialyzer. The liquid to be dialyzed is poured into the tube and contents are then set in a beaker of water. In a short time the working of the semi-permeable membrane will be shown by the rise of the level of the liquid inside the tube.

EXPANSION OF GLASSES, TEST FOR EQUALITY OF

In order to compare the coefficients of expansion of two pieces of glass, prior to sealing them together, melt the drawn out ends of each piece to beads; press these molten beads together with tweezers and draw into a thread. If the glasses can be sealed

together, the thread will be straight; otherwise, it will curve because of the different coefficients of expansion.

FLUORESCENT SCREENS

For observations of the ultraviolet spectrum, moisten a small quantity of anthracene with water and brush a thin layer over a ground-glass surface. On drying most of the anthracene will adhere to the glass. The prepared surface should be placed so as to receive the radiation directly, glass being comparatively opaque to the shorter wave lengths.

GLASS GRINDING FLUID

Turpentine	45 c.c.
Ether (ethyl oxide)	22.5 c.c.
Camphor gum	31 g

To be used with powdered emery for grinding glass.

For smoothing edges a sheet of emery cloth moistened with the above solution may be used.

Plane surfaces should be ground on thick plate glass.

For grinding glass stoppers use coarse emery, turn in one direction, finish with fine emery.

GLASS GRINDING MEDIUM

Glycerin may be used instead of a camphor-turpentine mixture for a medium in which to suspend emery powder for grinding glass. Glycerin has body enough and is sufficiently viscous to carry the emery well, and besides this it is water-soluble, thus making it very easy to wash away the excess grinding agent when the job is done or when it is desirable to make a close inspection of the work done.

HEATING BATH

A bath fluid at temperatures above 150° C. and which does not appreciably affect glass is prepared by fusing 10 parts of potassium nitrate with 8.5 parts of sodium nitrite.

HEATING BATHS

For uniform heating of reactions the following materials have proven satisfactory:

For temperatures up to 100° C.	Steam
For temperatures from 100° – 250° C.	Crisco or Nujol
For temperatures from 200° – 300° C.	*o*-tolyl phosphate
For temperatures above 250° C	Wood's metal.

HECTOGRAPH FILLER

Ingredients: ½ oz. of ground (dried) glue; 2 oz. of dried gelatine; 18 fluid oz. glycerin. These amounts should provide sufficient filler for a pan 12″ × 9″ × ½″.

Mix the glue with water and digest it on a water bath (a double boiler may be used) until it has the consistency of cream and is thoroughly melted. Soak the gelatine in cold water till soft, free it from as much water as is possible by pressure in a cheese-cloth and then melt it on a water bath or in a double boiler. Pour the three liquids together, and after they are thoroughly mixed, pour them into the pan. If any bubbles appear on the surface

of the filler, scrape them off with the edge of a piece of cardboard while the filler is hot. Do not use the filler until at least six hours after it has been poured into the pan. The materials gel slowly. Keep the pan level and covered until its contents is no longer fluid.

HECTOGRAPH INK

Violet

Aniline violet	1 oz.
Hot water	7 oz. fl.

On cooling, add:

Alcohol	1 oz.
Glycerin	¼ oz.
Carbolic acid (phenol)	a few drops

Black

Nigrosine	1 part
Water	14 parts
Glycerin	4 parts

HYDROGEN SULFIDE

Pure hydrogen sulfide may be generated by allowing distilled water to drop on aluminum sulfide.

HYDROGEN SULFIDE SUPPLY

Mix and heat slightly 3 parts by weight of sulfur with 1 part by weight of paraffin. Then mix with sufficient shredded asbestos to make a porous mass. Partly fill an 8″ Pyrex test tube, connect with delivery tube and safety bottle. Heat. Furnishes good supply of H_2S. No leakage into the room as generation of H_2S ceases as soon as heat is removed. Mixture keeps. Test tube may be heated over again until reactants are used up.

INK FOR GLASS MARKING

Barium sulfate	15 parts by weight
Ammonium bifluoride	15 parts by weight
Ammonium sulfate	10 parts by weight
Oxalic acid	8 parts by weight
Glycerin	40 parts by weight
Water	12 parts by weight

If too thick, add more water. If the action is too slow, up to 5 % of sodium fluoride may be added. Use in a hood or well ventilated room.

LABEL PROTECTION

Collodion for Labels on Bottles

Dissolve 3–4 grams pyroxylin in 100 c.c. 1:3 mixture of alcohol and ether (25 c.c. absolute alcohol, 75 c.c. dry ether).

First soak the pyroxylin in the alcohol, then add the ether.

Labels for Bottles

Labels should be written in India Ink. They can be made waterproof and durable by coating with a saturated solution of paraffin in benzene.

Lacquer for Protecting Labels

An excellent lacquer for protecting labels may be made by dissolving 20 grams of vinyl acetate polymer (Vinylite A) in 100 c.c. of a mixture of 3 parts of toluene and 1 part of 95 % alcohol. This lacquer forms a colorless, transparent film which resists most reagents very well.

Protecting Varnish for Labels

Typed labels may be protected by several coats of a varnish made by dissolving ordinary tooth brush handles in acetone. The quantity of solvent should be adjusted to give a convenient viscosity. The varnish is water and acid resistant.

LOW MELTING ALLOY

The following alloy, Wood's metal, melts at about 65° C.:

Bismuth	50	parts by weight
Lead	25	parts by weight
Tin	12 5	parts by weight
Cadmium	12 5	parts by weight

LUBRICANT, DRY

Melt a quantity of paraffin and add as much fine flake or powdered graphite as is readily moistened by the melted wax. Cool and cut while soft into convenient sticks.

This lubricant when rubbed on the surfaces involved, adheres and greatly reduces friction. It is particularly useful when one or both of the surfaces are of wood or other non-metallic substance.

MILDEW PREVENTION ON LEATHER BOOK BINDINGS

Make a 2 % to 5 % solution—not more than 5 %—of copper sulfate. Immerse a soft towel or cloth in this solution. Remove the cloth and thoroughly wring out. Then hang out to dry. When thoroughly dried, it can be used to rub leather bound books. One treatment of the cloth will easily take care of scores or a hundred volumes, and the leather will not be marked by the chemical.

MIRRORS FOR SPECTROMETER ADJUSTMENT

A small square of thick plate glass with edges ground smooth and silvered on one surface affords a means of accurate adjustment.

To avoid the necessity of frequently resilvering, which arises where the mirrors are in constant use, the following course is suggested:

From selected German plate mirror 2 to 3 mm thick, cut two pieces of the same size, say 4 × 5 cm. Remove the protective layer of varnish or paint from both pieces by soaking in alcohol and rubbing with cotton, being careful not to injure the silver surface. From one piece remove every trace of varnish by repeated rinsing, dry and polish the silver surface thus exposed by stroking lightly with a chamois rouge pad. From the other piece remove the silver by nitric acid, wash thoroughly in distilled water and dry. Cement the clear piece on the silver face of the other with Canada balsam. This is accomplished by placing two or three drops of Canada balsam in xylol (obtained in collapsible tubes) on the center of the silver face, and evenly lowering upon it the clear glass. The balsam should spread rapidly to the edges of

the plates Minute bubbles of air in the balsam film are harmless; if large bubbles are present the plates should be slipped apart, cleaned with alcohol and the process repeated.

The balsam will be sufficiently hard in a few days to allow the excess to be scraped from the edges and the plates bound together with lantern slide binding strip. Gentle heat may be used to harden the balsam more rapidly.

PHENOL (CARBOLIC ACID) BURNS

To c. p. glycerin add bromine until slightly colored or saturated. Keep in glass stoppered bottle and apply quickly to phenol burns. The bromide reacts instantly with the phenol to form phenyl bromides.

POLARITY TEST PAPER

Dissolve one gram of phenolphthalein in a small quantity of alcohol. Add the solution of phenolphthalein to 100 c.c. of a 10 per cent solution of potassium chloride in distilled water. Filter paper should be soaked in the solution and dried. A strip of paper moistened with water and placed in contact with the two terminals will show a bright red stain at the negative terminal.

PURIFICATION OF ALCOHOL

To remove aldehydes from alcohol intended for use in the preparation of alcoholic solutions of sodium or potassium hydroxide, add to one liter of alcohol 5 to 10 grams of aluminum or zinc and 8 to 10 grams of potassium hydroxide, boil under reflux for 20 minutes, and distil. Best results are obtained if an all-glass apparatus is used. Alcoholic solutions, prepared with alcohol so treated, will not discolor if the purification of the alcohol has been carefully carried out.

RESISTANT PAINTS AND VARNISHES

Acid Proof Wood Stain

Solution No. 1	Solution No. 2
125 grams of copper sulfate	150 grams of good fresh anilin oil
125 grams of potassium chlorate	180 grams of concentrated hydrochloric acid
1000 grams of water	1000 grams of water

Wood must be free from paint, varnish, grease or chemicals. Apply two coats of solution No. 1 boiling hot with a paint brush, allowing each coat to dry thoroughly before the next coat is applied. Then apply two coats of solution No. 2 in the same way. When the wood is completely dried wash off excess chemicals with hot soapsuds. Finish with raw linseed oil. Polish comes from rubbing the oil down well with a cloth or sponge. Whenever the tables get dingy again go over them with a coat of linseed oil and rub smooth.

Resistant Coal Tar Varnish

A resistant varnish is made from coal tar pitch as follows:

Coal tar pitch	65 parts by weight
Phenol	5 parts by weight
Benzene	30 parts by weight

Resistant Paint

The following paint when used on galvanized iron has been found to hold up well, without cracking or peeling in a three year's test. It can also be used on black iron, tin, copper, or stone such as is used for laboratory desk tops. It withstands dilute acids.

Formula: Stir in 10 parts by weight of benzol into 30 parts by weight of ordinary thin coal tar. Then add with vigorous stirring 10 parts by weight of Silica Black (a new product patented under U. S. No. 1,940,352).

SCALE POLISH

To brighten up refractometer and polarimeter scales without injury to the metal rub with bone black or clarifying charcoal. A dry cloth with a little of the bone black is rubbed on the scale until a bright polish is produced. The divisions then stand out clearly and are easily read. The great advantage is that the fine lines are not worn away and no corrosive material is left to cause discolorations.

SILVERING GLASS

Brashear's Process

(From Miller's Laboratory Physics, Ginn & Co , publishers, by permission.)

Two solutions are required, one, the reducing solution, should be prepared at least a week before it is used, and it may be made in large quantity and kept in stock with advantage; the other solution is to be prepared when used.

Reducing Solution

Distilled water	700 c.cm.
Pure sugar (loaf, granulated or rock candy)	80 g.

When dissolved add

Alcohol	175 c.cm.
Strong nitric acid (sp. gr. 1.42)	3 c.cm.
Add water to make...	1000 c.cm.

For silvering, the mirror may rest face up on the bottom of a suitable dish: it may stand on edge, or be supported in any manner, face downward, dipping into the upper part of the solution. In the latter case, the mirror may be fastened with wax to a stick laid across the dish, or it may be supported on glass feet or on paraffined wood wedges. Dr. Brashear recommends that the mirror, if round, form the botton of the silvering dish, which is completed by wrapping a strip of paraffined paper around the edge of the mirror, this being held in place by rubber bands or fastened with several wrappings of cord.

Having selected a dish and support for the mirror, measure with water the quantity of solution that will be required to make a layer a centimeter or two thick over the surface to be silvered. For each 150 c.cm. of final solution, 1 g. of silver nitrate and 0.5 g. of caustic potash (purified by alcohol) will be required. Dissolve the silver and potash separately, using quantities of water of the proportion of 100 c.cm. to 1 g. of the solid. Ordinary graduates or flasks are the most convenient form of vessel in which to mix the solutions. Into the silver nitrate solution pour a few drops of dilute aqua ammonia. The solution will turn to a dark brown color; add ammonia little by little till the precipitate is nearly but not quite redissolved. Now add the potash solution,

when a precipitate will again be formed. This is to be nearly, but not entirely, redissolved by the addition of more ammonia, a few drops being sufficient this time. After the ammonia has been added shake or stir the solution well and wait a minute or two to be certain that it does not entirely clear. If by chance too much ammonia has been used, a little silver nitrate is to be dissolved and added, a few drops at a time, till a permanent precipitate is formed. This excess of silver must be present, the solution showing a decided brown tint. The solution may be filtered, though usually this is not necessary.

A quantity of reducing solution equal to about a twenty-fifth part of the solution just prepared is measured out. The mirror, having been properly cleaned and rinsed with distilled water, is placed in position. The reducing solution is poured into the silver and potash solution, and mixed by a quick shaking of the graduate or stirring with a glass rod; the whole is then poured into the dish. If the mirror is immersed face down, care is necessary to remove air bubbles; the mirror may well be immersed after the solution is in, being dipped in at one side first. If the mirror is at the bottom of the dish, after cleaning it is covered with a thin layer of water, and the prepared solutions are poured into the dish without further trouble. In the latter case the dish must be rocked during the time of deposition.

The solution soon turns to a black color, which in a few minutes will turn to a brown; and when it becomes a light gray and the precipitate is flocculent, which may be in ten or fifteen minutes, the operation is at an end. If the mirror is allowed to remain in the solution too long, the surface will have a bleached appearance, which polishing will hardly remove. Remove the mirror, rinse with water, and carefully wipe off the sediment with a tuft of absorbent cotton. It is then set on edge to dry; a rinsing with alcohol will facilitate the drying, or all water may be safely taken up by pressing clean blotting paper over the surface.

When dry, the surface may be polished, if necessary, with a small pad of chamois leather stuffed with cotton, on which is spread a little rouge. Small, circular strokes of the pad, with light pressure, will soon bring out the deep luster of the silver.

A uniform temperature of the bath and the glass, of about 20° is essential to success.

Since fulminating silver is liable to be produced by the action of ammonia on silver oxide, especially in a warm room, all solutions should be thrown away as soon as the silvering operation is completed. The used solutions may be poured into a large jar, in which is thrown some common salt; this causes the silver to be precipitated as the chloride, and about 90 per cent of the original silver may be recovered.

Rochelle Salts Process

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission)

For depositing the uniform thin film of silver required on the half-silvered glass of the interferometer, the following method is more suitable than the one described above, as the silver is deposited more slowly. If a thick film is desired, two or more successive deposits may be made, each of which may require an hour's time.

Dissolve 5 g. of silver nitrate in 300 c.cm. of distilled water, and add dilute aqua ammonia until the precipitate formed is nearly, *but not entirely*, redissolved in the manner explained in

the preceding method. Filter the solution and add water to make 500 c.cm.

Dissolve one g. of silver nitrate in a small quantity of water and pour into about half a liter of boiling water; dissolve 0.83 g. of Rochelle salts in a small quantity of water, and add to the boiling solution. Continue the boiling for half an hour, till the gray precipitate collects as a powder in the bottom of the flask. Filter hot, and add water to make 500 c.cm.

These solutions may be kept in the dark for a month or two.

For silvering, equal volumes of the two solutions are mixed, and the glass is supported in the mixture in whatever fashion is convenient. Various methods are mentioned in the preceding article. The thickest possible deposit may require an hour's time. A second deposit may be made upon the first if necessary to secure the desired thickness. The drying and polishing may be carried out as described above.

A half-silvered film will be produced in about a minute; only experience can determine when the proper thickness has been secured. The glass appears as though it were very lightly smoked. A film that reflects a little more than half the light incident at 45° is desirable for interferometer use. A simple method of testing is to look at two similar gas flames, one seen through the film and the other seen reflected by it. It is well to silver at once all four surfaces of the two plane-parallel plates of the interferometer and to select for use that film which is of the proper and most uniform thickness.

SOAP SOLUTION FOR SOAP FILM EXPERIMENTS

Pure castile or palm-oil soap	1 oz.
Distilled water	8 oz.
Pure glycerin	4 oz.

Cut the soap in thin shavings and dissolve in the water. When the solution is complete, add the glycerin and mix very thoroughly. On standing the liquid becomes clear at the bottom. The clear portion may conveniently be removed by a siphon and preserved indefinitely.

SODIUM FLAME

An intense sodium flame is readily obtained by placing a small lump of rock salt in the center of the screen on a lighted Meker burner

SODIUM LIGHT

Paper is to be soaked in a saturated solution of common salt, borax or other salt of sodium, and dried. When wrapped around a Bunsen burner, secured by a twist of wire and pushed up into the edge of the flame, a sodium flame of considerable intensity is obtained. As the ash of the paper breaks away it must be occasionally raised. Lithium chloride may be used in place of or with sodium salt to give the lithium line for spectrometric measurement. Sheet asbestos (thin) may replace the paper if desired. Since the asbestos is not consumed it is necessary to moisten the mantle with salt solution at intervals.

SOLDERING PYREX GLASS TO METAL

Dip the Pyrex glass tube to be soldered into a solution of chlorplatinic acid (or platinic chloride may be substituted) made by

preparing a mixture consisting of 0.2 gram of the acid with 5 c.c. each of alcohol and ethyl ether to which 4 or 5 drops of turpentine have been added. After dipping the tube, carefully burn all the adhering liquid away leaving a film of platinum metal. That film will serve to hold the solder to the Pyrex glass and in doing so makes a very satisfactory gas-tight joint for a metal to glass connection.

SOLDERS

Composition by weight						Temperature of fusion	Metals for which it is used	Flux commonly used
Lead	Tin	Copper	Zinc	Silver	Gold			
1	1					188° C	Lead	Tallow
3	5					176	Zinc	Zinc chloride 25% HCl
2	5					170	Copper brass	Zinc chloride (neutral) or resin
							Iron	Zinc chloride or NH_4Cl
		2	1				Fe, Cu,	Borax
		55	45			880	Fe, Cu, brass	Borax
		4.5	0.5	15.0		1005	Fe, Cu, Au,	Borax
		6.5	2.0	11.0		983	Fe, Cu, Au,	Borax
		4	.	6	10		Gold	

STOPCOCK LUBRICANTS

Seal for Ground Glass Joints

Glycerin makes a very satisfactory seal for ground glass joints to prevent leakage of petroleum ether, ethyl ether or any other fluid in which glycerin is insoluble. Glycerin on the ground glass surface prevents sticking and so allows for the easy dismantling of the apparatus.

Stopcock Grease

Shepherd and Ledig (J. Ind. Eng. Chem. 19, 1059, 1927) prepare stopcock grease from the following ingredients by mixing with continuous stirring for 190 hours at 155° C., then placing the mixture in small 2 oz. containers, immediately chilling the contents on ice and allowing to age for 10 days before use. For high vacuum: 31 parts crepe rubber, 24 parts white "Vaseline" petroleum jelly, 5 parts paraffin (m. p. 36° C.); for general lubricant: 6 parts crepe rubber, 7 parts "Vaseline" petroleum jelly, 1 part paraffin; for light lubricant: 10 parts smoked sheet or pale crepe rubber, 18 parts "Vaseline" petroleum jelly and 1 part paraffin (m. p. 30° C.).

Stopcock Grease

Black rubber (red or pure gum)	1 part
Paraffin. . . .	2 parts
"Vaseline" petroleum jelly.	4 parts

Melt the paraffin and "Vaseline" petroleum jelly together, add the rubber slowly and in small pieces taking care not to burn the rubber. A larger quantity of "Vaseline" petroleum jelly may be desirable.

Stopcock Lubricant

Petrolatum (500 grams) and raw crepe rubber (50 grams) are stirred together and kept in an oven at 125°–150° C. for several days, or until the mixture is homogeneous.

Stopcock Lubricant

Standard Viscous Oil No. 32 (Standard Oil Co. of California)	200 grams
Aluminum stearate	50 grams

Dissolve the stearate in the oil, heated to about 150° C., and cool. This makes an extremely sticky, ropy, tough adhesive for ground glass surfaces.

Stopcock Lubricant

In the laboratory it is often desirable to have a stopcock lubricant that will not dissolve away with the ordinary fat solvents such as the hydrocarbons or chlorinated hydrocarbons. In some set-ups the ordinary stopcock greases are quite useless, and syrupy phosphoric acid is very unsatisfactory.

A paste of Bentonite (colloidal clay) and glycerin may be used for such a purpose. One can adjust the viscosity of the paste to suit his needs. Such a lubricant is entirely unaffected by the non-aqueous solvents, and even in the presence of water holds remarkably long, probably due to the fact that the Bentonite makes a jelly with either glycerin or water. In addition it has the very decided advantage of permitting a stopcock lubricant to be used at temperatures up to or even well above 100° C. The viscosity does not diminish very much with rise in temperature.

UNIVERSAL WAX

(1) A soft wax useful in the laboratory may be made by melting together paraffin, "Vaseline" petroleum jelly and paraffin oil in various proportions according to the pliability desired.

(2) Another authority recommends equal quantities of beeswax and turpentine (by weight). It is customary to color the wax by adding finely-powdered Venetian red.

(3) Melt together 1 part of Venice turpentine and 5 parts of beeswax. Color with vermilion.

PHOTOGRAPHIC FORMULAE

Pure water, preferably distilled, should be used in all solutions. Chemicals should be dissolved in the order given.

Desiccated or anhydrous sodium carbonate and sodium sulfite are specified in the following formulae. If the crystalline forms are employed, a larger quantity must be used.

Sodium carbonate exists in three forms: the anhydrous or desiccated, Na_2CO_3; the monohydrate, $Na_2CO_3 \cdot H_2O$; "washing soda," $Na_2CO_3 \cdot 10H_2O$. If the monohydrate is substituted for the desiccated, 1.17 times the specified quantity should be used. If the "crystal" form $Na_2CO_3 \cdot 10H_2O$ is substituted for the desiccated, 2.7 times the specified quantity should be used.

Sodium sulfite exists in two forms; the anhydrous or desiccated, Na_2SO_3, and a form, $Na_2SO_3 \cdot 7H_2O$. If the latter "crystal" form is substituted for the desiccated, 2 times the specified amount should be used.

Quantities required are given in both English and metric units. The values are, in most cases, not interchangeable since the amounts of water are not the same. According to recent usage quantities of liquid are often specified in milliliters (ml). The milliliter is 1.000027 cubic centimeters; the units are, of course, interchangeable for photographic formulae. The U. S. avoirdupois system of weights is used.

The following abbreviations are employed:

anh.	anhydrous
c.c.	cubic centimeter
dr.	dram
g	gram
gal.	gallon
gr.	grain
l	liter
min.	minim
ml	milliliter (equivalent to cubic centimeter cm or c.c.)
oz. (av.)	ounce (avoirdupois)
oz. fl.	fluid ounce
qt.	quart

DEVELOPERS FOR PLATES AND FILMS

When a time of development is suggested, it is intended to serve as a guide only. Individual requirements as to density and contrast vary. Greater or less contrast may be obtained by developing for a longer or a shorter time respectively.

General Purpose Negative Developers

Amidol (Diaminophenol hydrochloride)

For plates and films, to be mixed immediately before use.

Water	10 oz. fl.	1000 ml
Sodium sulfite, anh	120 gr.	29 g
Amidol	30 gr.	7 g
Potassium bromide	6–10 gr.	1.4–2 g

Amidol oxidizes so rapidly in solution that it is customary to make up this developer immediately before it is to be used. The time required for development is from 3 to 5 minutes at 18° C. or 65° F.

PHOTOGRAPHIC FORMULAE (Continued)

Amidol

Sulfite Stock Solution

Sodium sulfite, anh	2 oz.	100 g
Potassium metabisulfite	0.5 oz.	25 g
Water	20 oz.	1000 c.c.

Boil after dissolving in warm water. Developer is made when needed by adding dry amidol to the stock solution of sulfite which keeps for a long period.

Stock solution of sodium sulfite	2 oz.	200 c.c.
Water	10 oz.	1000 c.c.
Amidol	20–30 gr.	4.5–7 g

Athenon. See *Glycin*

Elon-Hydroquinone (Kodak D-76)

Developer for maximum speed at normal contrast on films and plates.

Water, about 125° F. (52° C.)	24 oz.	750 c.c.
Elon	29 gr.	2 g
Sodium sulfite, desiccated	3 oz. 145 gr. (1458 gr.)	100 g
Hydroquinone	73 gr.	5 g
Borax, granular	29 gr.	2 g
Water to make	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

Average development time about 17 minutes at 68° F. (20° C.). See individual recommendations listed for each material.

Replenisher (Kodak D-76R)

Water, about 125° F. (52° C.)	24 oz.	750 c.c.
Elon	44 gr.	3 g
Sodium sulfite, desiccated	3 oz. 145 gr. (1458 gr.)	100 g
Hydroquinone	¼ oz.	7.5 g
Borax, granular	290 gr.	20 g
Water to make	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

Use the replenisher without dilution and add to the tank to maintain the activity of the developer.

Elon-Hydroquinone-Pyro (Kodak D-75)

A long life deep tank developer for roll film.

Solution No. 1

Water (about 125° F.) (52° C.)	16 oz.	500 c.c.
Elon	44 gr.	3 g

Solution No. 2

Water (about 125° F.) (52° C.)	16 oz.	500 c.c.
Sodium sulfite, anh	260 gr.	18 g
Sodium bisulfite	1 oz. 85 gr.	36 g

Solution No. 3

Hot water (about 160° F.) (71° C.)	16 oz.	500 c.c.
Sodium sulfite, anh	260 gr.	18 g
Hydroquinone	175 gr.	12 g
Pyro	44 gr.	3 g

Solution No. 4

Water (about 125° F.) (52° C.)	16 oz.	500 c.c.
Sodium carbonate, anh.	2 oz. 175 gr.	72 g

Mix each solution separately and add to the tank at once in the order given.

Then add water to make	1 gal.	4000 c.c.

Develop 7 to 14 minutes at 65° F. (18° C.), in the fresh developer according to the contrast desired. Greater or less contrast may be obtained by developing for longer or shorter times than those specified. Avoid the use of galvanized ware when mixing, or trouble from fog will be encountered. Cool the mixture of the first three solutions, before adding the cooled solution No. 4 to it, to avoid effervescence.

For small scale mixing, that is, less than 1 gallon (4000 c.c.), all the chemicals may be dissolved in the order given in one-half the total volume of water (125° F.) (52° C.) and cold water added to make up to volume.

Replenisher Stock Solution

Water (about 125° F.) (52° C.)	64 oz.	2000 c.c.
Elon	½ oz.	15 g
Sodium sulfite, anh.	3 oz.	90 g
Sodium bisulfite	3 oz.	90 g
Hydroquinone	1 oz.	30 g
Sodium carbonate, anh.	8 oz.	240 g
Water to make	1 gal.	4000 c.c.

Dilute 1 part of stock solution with 1 part of water and add to the tank as required.

Elon-Pyro (Kodak D-7)

Stock Solution A

Water (about 125° F.) (52° C.)	16 oz.	500 c.c.
Elon	¼ oz.	7.5 g
Sodium bisulfite	¼ oz.	7.5 g
Pyro	1 oz.	30 g
Potassium bromide	60 gr.	4.2 g
Water to make	32 oz.	1000 c.c.

Stock Solution B

Water	32 oz.	1000 c.c.
Sodium sulfite, desiccated	5 oz.	150 g

Stock Solution C

Water	32 oz.	1000 c.c.
Sodium carbonate, desiccated	2½ oz.	75 g

Dissolve chemicals in the order given

TRAY DEVELOPMENT: Take 1 part of A, 1 part of B, 1 part of C, and 8 parts of water. Develop about 7 minutes at 68° F. (20° C.).

TANK DEVELOPMENT: Take 1 part of A, 1 part of B, 1 part of C, and 13 parts of water. Develop about 10 minutes at 68° F. (20° C.).

This developer can be used for two or three weeks if the volume is maintained by adding fresh developer in the proportion of 1 part each of A, B, and C to 4 parts of water. It is usually necessary to increase the development time as the developer ages.

PHOTOGRAPHIC FORMULAE (Continued)

Glycin (Parahydroxyphenyl glycin)

Stock Solution

Water	10 oz. fl.	1000 ml
Sodium sulfite, anh	300 gr.	68.5 g
Glycin	120 gr.	27.5 g
Sodium carbonate, anh	240 gr.	54.8 g

TRAY DEVELOPMENT: Dilute with 4 parts of water to 1 of stock solution. Develop 6 to 10 minutes.

TANK DEVELOPMENT: Use 15 parts of water to 1 of stock solution; develop 20 to 30 minutes.

Glycin developer keeps well. The image is fine-grained and free from fog or stain.

Glycin

Stock Solution

Hot water (200° F.)	60 oz.	1700 c.c.
Sodium carbonate, anh	2 oz.	57 g
Glycin	0.5 oz.	14 g
Sodium sulfite, anh	0.5 oz.	14 g

Dissolve in order. For use take stock solution, 6 parts; water, 58 parts.

At 60° F. develop 30 min.; at 65° F. 25 min.; at 70° F. 20 min.

Glycin (Kodak D-78)

Water	2.5 qt.	750 c.c.
Sodium sulfite, anh	175 gr.	3 g
Glycin	175 gr.	3 g
Sodium carbonate, anh	350 gr.	6 g
Water to make	1 gal.	1000 c.c.

Time of development: 15 to 25 minutes at 65° F. (18° C.)

Glycin Developer (Agfa 72)

This formula is recommended for use with commercial films in reproduction work and is also suitable for development of roll, pack and cut film.

Stock Solution

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Sodium sulfite, anh	4¼ oz.	1 lb. 1 oz.	125 g
Potassium carbonate	8½ oz.	2 lb. 2 oz.	250 g
Glycin	1⅓ oz. 80 gr. (736 gr.)	6¾ oz.	50 g
Water to make	32 oz.	1 gal.	1000 c.c.

TANK DEVELOPMENT: Take one part stock solution, fifteen parts water and develop 20 to 25 minutes at 65° F. (18° C.).

TRAY DEVELOPMENT: Take one part stock solution, four parts water and develop 5 to 10 minutes at 65° F. (18° C.).

Hydroquinone

Water	10 oz. fl.	1000 ml
Sodium sulfite, anh	220 gr.	50 g
Hydroquinone	50 gr.	11.5 g
Sodium carbonate, anh	162 gr.	37 g

For use take 1 part of water to 1 part of stock solution. This is a slow acting developer. The temperature should not be allowed to fall below 60° F. (15° C.) as the developer becomes inert.

Metaborate Metol-Hydroquinone (Agfa 48M)

This formula is recommended for photofinishing, professional, and amateur developing and is suitable for deep tank use over a long period of time.

Hot water (125° F. or 52° C.)	3 qt.	$2\frac{1}{2}$ gal.	750 c.c.
Metol	119 gr.	418 gr.	2 g
Sodium sulfite, anh.	$5\frac{1}{4}$ oz.	1 lb. $2\frac{1}{4}$ oz. ($18\frac{1}{4}$ oz.)	40 g
Hydroquinone	88 gr.	309 gr.	1.5 g
Sodium metaborate	$1\frac{1}{4}$ oz. 30 gr. (577 gr.)	$4\frac{1}{2}$ oz.	10 g
Potassium bromide	30 gr.	$\frac{1}{4}$ oz.	.5 g
Water to make	1 gal.	$3\frac{1}{2}$ gal.	1000 c.c.

Do not dilute for use.

TANK DEVELOPMENT: Normal developing time 5 to 7 minutes at 65° F. (18° C.).

TRAY DEVELOPMENT: Normal developing time 4 to 6 minutes at 65° F. (18° C.).

Replenisher (Agfa 48M)

Add whenever necessary to keep tank up to full volume.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	90 gr.	358 gr.	6.3 g
Sodium sulfite, anh.	1 oz.	4 oz.	30 g
Hydroquinone	144 gr.	$1\frac{1}{4}$ oz.	10 g
Sodium metaborate	$1\frac{1}{4}$ oz.	5 oz.	40 g
Water to make	1 qt.	1 gal.	1000 c.c.

Metol

Water, warm	20 oz.	1000 c.c.
Metol	150 gr.	17 g
Sodium sulfite, anh.	1.25 oz.	63 g
Sodium carbonate, anh	1.75 oz.	88 g
Potassium bromide	16 gr.	1.8 g

Always dissolve metol first.

For use dilute with equal part of water for portraiture; for landscape use two parts of water to one of stock solution. Gives detail without density except by prolonged development.

Metol-Hydroquinone

Note: Elon may be used with hydroquinone in place of metol, in equal quantity.

Solution A

Water	64 oz.	1820 c.c.
Metol	120 gr.	7.8 g
Hydroquinone	120 gr.	7.8 g
Sodium sulfite, anh	2 oz.	57 g

Solution B

Water	16 oz.	455 c.c.
Sodium carbonate, anh	2 oz.	57 g

For use take A, 4 oz.; B, 1 oz.; water, 4 oz.

Metol-Hydroquinone Tray Developer (Agfa 40)

This is a brilliant tray developer for roll, pack and sheet film.

Stock Solution

Hot water (125° F. or 52° C.)	29 oz.	3½ qt.	900 c.c.
Metol	66 gr.	264 gr.	4.5 g
Sodium sulfite, anh.	1¾ oz. 25 gr. (791 gr.)	7¼ oz.	54 g
Hydroquinone	¼ oz.	1 oz.	7.5 g
Sodium carbonate, monohydrated	1¾ oz. 25 gr. (791 gr.)	7¼ oz.	54 g
Potassium bromide	45 gr.	189 gr.	3 g
Water to make	32 oz.	1 gal.	1000 c.c.

For use dilute 1 part stock solution with 2 parts water. Development time 4 to 5 minutes at 65° F. (18° C.).

Metol-Hydroquinone Tray Developer (Agfa 61)

This developer is recommended for use with commercial film to produce negatives of normal contrast. It may also be used satisfactorily for roll, pack and sheet film for negatives of average brilliance.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	15 gr.	60 gr.	1 g
Sodium sulfite, anh.	½ oz.	2 oz.	15 g
Hydroquinone	30 gr.	119 gr.	2 g
Sodium carbonate, monohydrated	½ oz.	2 oz.	15 g
Potassium bromide	15 gr.	60 gr.	1 g
Water to make	32 oz.	1 gal.	1000 c.c.

Do not dilute for use. Normal development time, 4 to 6 minutes at 65° F. (18° C.).

Metol-Hydroquinone Developer (Agfa 47)

This is a long-life, clean-working formula which will give excellent results as a standard film developer for either tray or tank development.

Hot water (125° F. or 52° C.)	3 qt.	2½ gal.	750 c.c.
Metol	88 gr.	309 gr.	1.5 g
Sodium sulfite, anh	6 oz.	1 lb. 5 oz. (21 oz.)	45 g
Sodium bisulfite	60 gr.	½ oz.	1 g
Hydroquinone	179 gr.	1¼ oz. 80 gr. (627 gr.)	3 g
Sodium carbonate, monohydrated	348 gr.	2½ oz.	6 g
Potassium bromide	47 gr.	269 gr.	.8 g
Water to make	1 gal.	3½ gal.	1000 c.c.

TANK DEVELOPMENT: Used without dilution. Normal development time 6 to 8 minutes at 65° F. (18° C.) with occasional agitation. For longer developing times, dilute one part developing solution with one part water and develop 12 to 16 minutes at 65° F. (18° C.).

TRAY DEVELOPMENT: Normal development time 5 to 7 minutes at 65° F. (18° C.).

Replenisher (Agfa 47A)

Add whenever necessary to keep tank up to full volume.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	45 gr.	179 gr.	3 g
Sodium sulfite, anh.	1½ oz.	6 oz.	45 g
Sodium bisulfite	30 gr.	119 gr.	2 g
Hydroquinone	88 gr.	348 gr.	6 g
Sodium carbonate, monohydrated.	174 gr.	1½ oz. 50 gr. (706 gr.)	12 g
Water to make	32 oz.	1 gal.	1000 c.c.

Metol-Hydroquinone Tank Developer (Agfa 42)

This is a soft-working tank formula recommended for pack, roll and portrait films.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	12 gr.	47 gr.	.8 g
Sodium sulfite, anh.	1½ oz.	6 oz.	45 g
Hydroquinone	18 gr.	70 gr.	1.2 g
Sodium carbonate, monohydrated.	119 gr.	1 oz. 40 gr. (478 gr.)	8 g
Potassium metabisulfite	59 gr.	239 gr.	4 g
Potassium bromide	22 gr.	88 gr.	1.5 g
Water to make	32 oz.	1 gal.	1000 c.c.

Do not dilute for use.
Develop 15 to 20 minutes at 65° F. (18° C.).

Ortol

Solution A

Ortol	140 gr.	16 g
Potassium metabisulfite	70 gr.	8 g
Cold water	20 oz.	1000 c.c.

Solution B

Sodium carbonate, anh.	1.25 oz.	63 g
Sodium sulfite, anh.	1.75 oz.	88 g
Potassium bromide	10–20 gr.	1.1–2.3 g
Water	20 oz.	1000 c.c.

For rapid developer take A, 1 part; B, 1 part. For slower, softer development take A, 1 part; B, 1 part; water, 1 part.

Paraformaldehyde Developer (Agfa 79B)

(Two Solution)

This developer has better keeping quality than when made in one solution.

Solution 1

Water (not over 90° F. or 32° C.)	24 oz.	3 qt.	750 c.c.
Sodium sulfite, anh.	15 gr.	60 gr.	1 g
Paraformaldehyde	1 oz.	4 oz.	30 g
Potassium metabisulfite	154 gr.	1¼ oz. 60 gr. (607 gr.)	10.5 g
Water to make	32 oz.	1 gal.	1000 c.c.

Solution 2

Hot water (125° F. or 52° C.)	24 oz.	3	qt.	750	c.c.
Sodium sulfite, anh.	4 oz.	1	lb.	120	g
Boric acid	1 oz.	4	oz.	30	g
Hydroquinone	3 oz.	12	oz.	90	g
Potassium bromide	88 gr.	348	gr.	6	g
Water to make	96 oz.	3	gal.	3000	c.c.

For use mix one part Solution 1 with three parts Solution 2.

Normal development time 2 to 3 minutes at 65° to 70° F. (18° to 21° C.).

Paraminophenol

Water, boiling	20 oz.	1000 c.c.
Potassium metabisulfite	6 oz.	300 g
Paraminophenol	2 oz.	100 g

Add sodium or potassium hydroxide in small quantities to dissolve the precipitate first formed.

For use take 1 part stock solution with 20 parts water.

Pyro Developer (Agfa 45)

This formula is recommended to those who prefer Pyro development. Stock solutions should be kept in stoppered bottles.

Solution 1

Sodium bisulfite	144	gr.	1¼	oz. 25 gr. (572 gr.)	9.8	g
Pyro	2	oz.	8	oz.	60	g
Potassium bromide	16	gr.	64	gr.	1.1	g
Water to make	32	oz.	1	gal.	1000	c.c.

Solution 2

Sodium sulfite, anh.	3½	oz.	14	oz.	105	g
Water to make	32	oz.	1	gal.	1000	c.c.

Solution 3

Sodium carbonate, monohydrated	2¾	oz.	11	oz.	85	g
Water to make	32	oz.	1	gal.	1000	c.c.

TANK DEVELOPMENT: Take one part each Solutions 1, 2, 3 and add 11 parts water. Normal development time, from 9 to 12 minutes at 65° F. (18° C.).

TRAY DEVELOPMENT: Take 1 part each Solutions 1, 2, 3 and add 7 parts water. Normal development time, from 6 to 8 minutes at 65° F. (18° C.). Solutions will keep well when stored separately but final developer should be used immediately after mixing.

Pyro Developer (Kodak D-1)

Stock Solution A

Sodium bisulfite	140	gr.	9.8	g
Pyro	2	oz.	60	g
Potassium bromide	16	gr.	1.1	g
Water to make	32	oz.	1000	c.c.

Stock Solution B

Water	32	oz.	1000	c.c.
Sodium sulfite, anh.	3½	oz.	105	g

Stock Solution C

Water	32 oz.	1000 c.c.
Sodium carbonate, anh	2½ oz.	75 g

For tray development take 1 part of A, 1 part of B, 1 part of C, and 7 parts of water. Develop about 5 to 7 minutes at 65° F. (18° C.).

For tank development take 1 part of A, 1 part of B, 1 part of C, and 11 parts of water. Develop about 12 minutes at 65° F. (18° C.).

Pyro Developer (Kodak D-90)

Stock Solution A

Sodium sulfite, anh	2 oz. 145 gr.	70 g
Sodium bisulfite	245 gr.	17 g
Pyro	290 gr.	20 g
Water to make	32 oz.	1000 c.c.

Stock Solution B

Sodium carbonate, anh	2½ oz.	75 g
Potassium bromide	15 gr.	1 g
Water to make	32 oz.	1000 c.c.

For average use take 1 part of stock solution A, 1 part of stock solution B, and 2 parts of water. Develop 4 to 6 minutes at 65°F. (18° C.). For greater contrast, use 1 part of A, 1 part of B, and 1 part of water; for less contrast, use 1 part of A, 1 part of B, and 4 parts of water.

Pyro Tank Developer

Water	48 oz.	1360 c.c.
Sodium sulfite, anh	115 gr.	7.5 g
Sodium carbonate, anh	90 gr.	5.8 g
Pyro	45 gr.	2.9 g

Dissolve immediately before use. Use full strength.
Develop 15 minutes at 65° F. (18° C.).

Pyro Tank Developer

(Three Solutions)

Solution A

Water	16 oz.	455 c.c.
Oxalic acid	10 gr.	0.65 g
Pyro	1 oz.	28 g

Solution B

Water	16 oz.	455 c.c.
Sodium sulfite, anh	3 oz.	85 g

Solution C

Water	16 oz.	455 c.c.
Sodium carbonate, anh	1 oz.	28 g

For use take A, 1 part; B, 1 part; C, 1 part; water, 61 parts. Develop 30 minutes at 65° F. (18° C.) for best results.

For temperature 60° F. develop 35 minutes.
For temperature 65° F. develop 30 minutes.
For temperature 70° F. develop 25 minutes.

CONTRAST NEGATIVE DEVELOPERS

Elon-Hydroquinone

Contrast Developer for Photomicrography

Water (52° C.)	16 oz.	500 c.c.
Elon	14 gr.	1 g
Sodium sulfite	2½ oz.	75 g
Hydroquinone	130 gr.	9 g
Sodium carbonate	360 gr.	25 g
Potassium bromide	70 gr.	5 g
Water to make	32 oz.	1000 c.c.

Elon-Hydroquinone (Kodak D-11)

Process tank or tray developer for high contrast on films and plates.

Water, about 125° F. (52° C.)	16 oz.	500 c.c.
Elon	15 gr.	1 g
Sodium sulfite, desiccated	2½ oz.	75 g
Hydroquinone	130 gr.	9 g
Sodium carbonate, desiccated	365 gr.	25 g
Potassium bromide	73 gr.	5 g
Cold water to make	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

For process photography use without dilution. For development of copies of continuous-tone subjects, dilute with an equal volume of water. Develop about 5 minutes in a tank or 4 minutes in a tray at 68° F. (20° C.).

Hydroquinine Developer for Line Work

Also for lantern slides, or wherever increased contrast is desired.

A

Distilled water	32 oz.
Hydroquinone	1½ oz.
Sodium sulfite, anh	1 oz.
Sulfuric acid (conc.)	60 min.

B

Distilled water	32 oz.
Sodium carbonate, anh	1 oz.
Potassium carbonate, anh	3 oz.
Potassium bromide	130 gr.
Sodium sulfite, anh	3 oz.

For tray or tank development, use equal parts of A and B without further dilution. Develop at 65° F. for 5 to 10 minutes according to exposure or density desired.

Hydroquinone-Caustic Soda (Kodak D-9)

Process Tray Developer

Stock Solution A

Water (about 125° F.) (52° C.)	16 oz.	500 c.c.
Sodium bisulfite	¾ oz.	22.5 g
Hydroquinone	¾ oz.	22.5 g
Potassium bromide	¾ oz.	22.5 g
Cold water to make	32 oz.	1000 c.c.

Stock Solution B

Cold water	32 oz.	1000 c.c.
Sodium hydroxide (caustic soda)	1¾ oz.	52.5 g

Use equal parts of A and B and develop not more than two minutes at 65° F. (18° C.). Wash thoroughly after development and before fixing, otherwise stains and dichroic fog will result. Development slows up greatly below 55° F. (13° C.).

Cold water should always be used when dissolving sodium hydroxide (caustic soda) because considerable heat is evolved. If hot water is used, the solution will boil with explosive violence and may cause serious burns if the hot alkali spatters on the hands or face. Solution A should be stirred thoroughly when the caustic alkali is added to it; otherwise the heavy caustic solution will sink to the bottom.

Hydroquinone Caustic Soda (Kodak D-8)

Developer for very high contrast on films and plates.

Stock Solution

Water, about 90° F. (32° C.)	24 oz.	750 c.c.
Sodium sulfite, desiccated	3 oz.	90 g
Hydroquinone	1½ oz.	45 g
Sodium hydroxide (caustic soda)	1¼ oz.	37.5 g
Potassium bromide	1 oz.	30 g
Water to make	32 oz.	1000 c.c.

Dissolve chemicals in the order given. Stir the solution thoroughly before use.

For use, take 2 parts of stock solution and 1 part of water. Develop about 2 minutes in a tray at 65° F. (18° C.).

For general use, a developer which is slightly less alkaline and gives almost as much density can be obtained by using 410 gr. of sodium hydroxide per 32 oz. of stock solution (28 g per 1000 c.c.) instead of the quantity given in this formula.

Hydroquinone Caustic Soda (Agfa 70)

This developer is recommended for Process film used in reproduction work.

Solution 1

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Hydroquinone	368 gr.	3¼ oz. 40 gr. (1462 gr.)	25 g
Potassium metabisulfite	368 gr.	3¼ oz. 40 gr. (1462 gr.)	25 g
Potassium bromide	368 gr.	3¼ oz. 40 gr. (1462 gr.)	25 g
Cold water	32 oz.	1 gal.	1000 c.c.

Solution 2

Cold water	32 oz.	1 gal.	1000 c.c.
*Sodium hydroxide (Caustic soda flakes).	1 oz. 90 gr. (528 gr.)	4¾ oz. 30 gr. (2108 gr.)	36 g
*May be substituted by:			
Potassium hydroxide	1½ oz. 80 gr. (736 gr.)	6¾ oz.	50 g

Mix equal parts of Solutions 1 and 2 immediately before use. Develop films within 3 minutes at 65° F. (18° C.).

Metol-Hydroquinone (Agfa 90)

This developer has been particularly designed for use with commercial and process films to produce negatives of brilliant contrast.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	75 gr.	294 gr.	5 g
Sodium sulfite, anh	1¼ oz. 40 gr. (587 gr.)	5¼ oz.	40 g
Hydroquinone	88 gr.	348 gr.	6 g
Sodium carbonate, monohydrated.	1¼ oz. 40 gr. (587 gr.)	5¼ oz.	40 g
Potassium bromide	45 gr.	179 gr.	3 g
Water to make	32 oz.	1 gal.	1000 c.c.

Do not dilute for use.

Normal development time, 4 to 6 minutes at 65° F. (18° C.).

For results of higher contrast, this developer may be modified by the addition of 3 g of potassium bromide per 1000 c.c. of developer (45 gr. per 32 oz.), with developing time of 2 to 3 minutes at 65° F. (18° C.).

Metol-Hydroquinone (Agfa 22)

This formula is recommended for tray or tank development of cine title film and positive film to obtain results of high contrast.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c c.
Metol	12 gr.	52 gr.	.8 g
Sodium sulfite, anh	1¼ oz.	5 oz.	40 g
Hydroquinone	119 gr.	1 oz. 40 gr. (478 gr.)	8 g
Sodium carbonate, monohydrated	1¾	7 oz.	50 g
Potassium bromide	75 gr.	299 gr.	5 g
Water to make	32 oz.	1 gal.	1000 c.c.

Do not dilute for use. Normal developing time 5 to 8 minutes at 65° F. (18° C.).

Fine Grain Developers

Elon-Hydroquinone-Borax (Kodak D-76)

For low contrast and greatest shadow detail on panchromatic films and plates.

Water (about 125° F.) (52° C.)	96 oz.	3000 c.c.
Elon	116 gr.	8 g
Sodium sulfite, anh	13¼ oz.	400 g
Hydroquinone	290 gr.	20 g
*Borax	116 gr.	8 g
Water to make	1 gal.	4000 c.c.

*Such as 20-Mule Team Borax.

Use without dilution. For tank use, develop 15 to 25 minutes at 65° F. (18° C.) in the fresh developer according to the contrast desired; for tray use, decrease the time about 20 %. A faster working developer can be obtained by increasing the quantity of borax.

Still finer grained results may be secured by adding potassium bromide to the developer. The maximum quantity which may be added without too great a loss of speed is 300 grains per gallon (20 grams per 4000 c.c.). As bromide is added, it will be necessary

to increase both the time of development and the exposure for best results.

Replenisher Solution

Water (about 125° F.) (52° C.)	96	oz.	3000	c.c.
Elon	175	gr.	12	g
Sodium sulfite, anh	13¼	oz.	400	g
Hydroquinone	1	oz.	30	g
*Borax	2 oz. 290	gr.	80	g
Water to make	1	gal.	4000	c.c.

*Such as 20-Mule Team Borax.

Use the replenisher without dilution and add to the tank to maintain the level of the solution.

Fine Grain Developer for Films and Plates (Kodak DK-20)

Water, about 125° F. (52° C)	96	oz.	750	c.c.
Elon	290	gr.	5	g
Sodium sulfite, desiccated	13¼	oz.	100	g
Kodalk (sodium metaborate, $4H_2O$)	116	gr.	2	g
Sodium thiocyanate (sulfocyanate)	58	gr.	1	g
Potassium bromide	29	gr.	.5	g
Cold water to make	1	gal.	1000	c.c.

Dissolve chemicals in the order given.

Average development time about 15 minutes in a tank at 68° F. (20° C.). See individual recommendations listed for each material.

The useful life of this developer can be increased 5 to 10 times by use of the following replenisher.

Replenisher (Kodak DK-20R)

Water, about 125° F. (52° C.)	96	oz.	750	c.c.
Elon	1	oz.	7.5	g
Sodium sulfite, desiccated	13¼	oz.	100	g
Kodalk (sodium metaborate $4H_2O$)	2	oz. 290 gr. (1165 gr.)	20	g
Sodium thiocyanate (sulfocyanate)	290	gr.	5	g
Potassium bromide	58	gr.	1	g
Cold water to make	1	gal.	1000	c.c.

Dissolve chemicals in the order given. The replenisher should be added at a rate which will maintain constant development activity.

Metol-Hydroquinone, Automatic System

Two Solutions

A

Water	1 qt.
Metol	95 gr.
Sulfite of soda, anh	750 gr.
Hydroquinone	95 gr.

B

Saturated solution of borax

To mix solution A take one-half of the water, add the metol and, when dissolved, add one-half of the sulfite. To the other half of the water, hot, add the rest of the sulfite and, when dissolved, add the hydroquinone. Cool and add this second solution to the first, making solution A.

To use pour enough of solution A into a tray to well cover the film or plate, add drops of saturated solution of potassium bromide, enough for the kind of material in use. Some do not require any, others do. Use only enough to keep the whites clear. Soak the film or plate in the A solution for at least two minutes, drain but do not rinse, and then soak in solution B for at least two minutes. Rinse, fix and wash as usual. If a tank is used, the time in each solution must be at least two minutes after the tank is filled. It is necessary to give a full exposure as the high lights cannot be over developed and the shadows will go as far as the exposure will permit. This system gives a gamma of about 0.7 and will be found to produce a very fine negative for enlarging. It is especially good for work in photomicrography.

These solutions are very concentrated and must not be allowed to go below 60° F. They can be used repeatedly and keep well. Results are best at about 70° F., but it makes very little difference between 65° and 80° F.

Metol-Hydroquinone (Agfa 17M)

Fine-Grain Metaborate Tank Developer

This developer is recommended for those who desire a formula similar to Agfa 17, but permitting greater variation in developing time.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	22 gr.	88 gr.	1.5 g
Sodium sulfite, anh.	2½ oz. 80 gr. (1174 gr.)	10¾ oz.	80 g
Hydroquinone	45 gr.	179 gr.	3 g
Sodium metaborate	30 gr.	119 gr.	2 g
Potassium bromide	7½ gr	30 gr.	.5 g
Water to make	32 oz.	1 gal.	1000 c.c.

Do not dilute for use.

Development time at 65° F. (18° C.), 10 to 15 minutes for fine-grain films.

Larger amounts of sodium metaborate may be used with corresponding reduction of developing time (up to 10 g of sodium metaborate per 1000 c.c. with a developing time of 5 minutes at 65°) although slightly coarser grain size will then be experienced.

Replenisher (Agfa 17M)

Add whenever necessary to keep tank up to full volume.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	32 gr.	129 gr.	2.2 g
Sodium sulfite, anh.	2½ oz. 80 gr. (1174 gr.)	10¾ oz.	80 g
Hydroquinone	65 gr.	269 gr.	4.5 g
Sodium metaborate	119 gr.	478 gr.	8 g
Water to make	1 qt.	1 gal.	1000 c.c.

Metol-Hydroquinone (Agfa 17)

Fine Grain Borax Tank Developer

In addition to its usefulness as a fine-grain developer, this formula is satisfactory for obtaining soft gradation. It is also recommended for motion picture negative development.

PHOTOGRAPHIC FORMULAE (Continued)

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	22 gr.	88 gr.	1.5 g
Sodium sulfite, anh.	2½ oz. 80 gr. (1174 gr.)	10¾ oz.	80 g
Hydroquinone	45 gr.	179 gr.	3 g
Borax	45 gr.	179 gr.	3 g
Potassium bromide	7½ gr.	30 gr.	.5 g
Water to make	32 oz.	1 gal.	1000 c.c.

Do not dilute for use.

Development time at 65° F. (18° C.), 10 to 15 minutes for fine-grain films, 12 to 20 minutes for direct copy, direct duplicating, and portrait cut films.

Replenisher (Agfa 17A)

Add whenever necessary to keep tank up to full volume.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	32 gr.	129 gr.	2.2 g
Sodium sulfite, anh.	2½ oz. 80 gr. (1174 gr.)	10¾ oz.	80 g
Hydroquinone	65 gr.	269 gr.	4.5 g
Borax	263 gr.	2¼ oz. 75 gr. (1059 gr.)	18 g
Water to make	32 oz.	1 gal.	1000 c.c.

Paraphenylene Diamine

Paraphenylene diamine	10 g
Sodium sulfite, anh.	60 g
Tribasic sodium phosphate (10 %)	20 c.c.
Potassium bromide (10 %)	10 c.c.
Water	1000 c.c.

Develop one hour at 65° F.

Paraphenylene-diamine Glycin

	No. 1	No. 2	No. 3	No. 4
Water	32 oz.	32 oz.	32 oz.	32 oz.
Sodium sulfite, dry	3 oz.	3 oz.	3 oz.	3 oz.
Paraphenylene-diamine	146 gr.	146 gr.	146 gr.	146 gr.
Glycin		15 gr.	88 gr.	175 gr.

No. 1 gives the finest grain, and requires three to four times normal exposure. The other formulas require about twice normal exposure, develop a film in a shorter time, and give more graininess as the glycin content increases. Formula No. 3 is standard.

Lantern Slide Developers

Elon-Hydroquinone (Kodak D-34)

Developer for blue black tones on lantern slide plates.

Stock Solution A

Water (about 125° F.) (52° C.)	16 oz.	500 c.c.
Elon	60 gr.	4.2 g
Sodium sulfite, anh.	½ oz.	15 g
Hydroquinone	½ oz.	15 g
Cold water to make	32 oz.	1000 c.c.

Stock Solution B

Water	32	oz.	1000	c.c.
Sodium carbonate, anh	½	oz.	15	g
Potassium bromide	30	gr.	2.1	g

For use, take equal parts of A and B.
For softer tones, dilute with an equal volume of water.
Develop 1½ to 3 minutes at 70° F. (21° C.).

Hydroquinone (Kodak D-32)

Developer for warm tones on lantern slide plates.

Stock Solution A

Water, about 125° F. (52° C.)	16	oz.	500	c.c.
Sodium sulfite, desiccated	90	gr.	6.3	g
Hydroquinone	100	gr.	7	g
Potassium bromide	50	gr.	3.5	g
Citric acid	10	gr.	0.7	g
Cold water to make	32	oz.	1000	c.c.

Stock Solution B

Cold water	32	oz.	1000	c.c.
Sodium carbonate, desiccated	1	oz.	30	g
Sodium hydroxide (caustic soda)	60	gr.	4.2	g

Dissolve chemicals in the order given.

For use, take 1 part of A and 1 part of B. For still warmer tones, 1 part of A and 2 parts of B. Stir thoroughly before use. Develop about 5 minutes in a tray at 68° F. (20° C.).

Maximum Energy Developer (Kodak D-82)

For high speed films or plates.

Water (about 125° F.) (52° C.)	24	oz.	750	c.c.
Wood alcohol	1½	oz.	48	c.c.
Elon	200	gr.	14	g
Sodium sulfite, anh	1¾	oz.	52.5	g
Hydroquinone	200	gr.	14	g
Sodium hydroxide (caustic soda)	125	gr.	8.8	g
Potassium bromide	125	gr.	8.8	g
Cold water to make	32	oz.	1000	c.c.

Develop about four to five minutes at 65° F. (18° C.).

The prepared developer does not keep more than a few days. If wood alcohol is not added and the developer is diluted, the solution is not so active as in the concentrated form. This developer gives the greatest possible density with negatives having a minimum exposure.

Motion Picture Film Developer (Kodak D-79)

Pyro

For negative motion picture film.

Water	2.5	qt.	750	c.c.
Sodium sulfite, anh	3.3	oz.	25	g
Pyro	145.8	gr.	2.5	g
Sodium carbonate, anh	291.6	gr.	5	g
Potassium bromide	29.2	gr.	0.5	g
Water to make	1	gal.	1000	c.c.

Time of development: 9 to 12 minutes at 65° F. (18° C.).

PORTRAIT DEVELOPER

Elon-Hydroquinone (Kodak DK-50)

Developer for professional films and plates.

Stock Solution

Water, about 125° F. (52° C.)	64 oz.	500 c.c.
Elon	145 gr.	2.5 g
Sodium sulfite, desiccated	4 oz.	30 g
Hydroquinone	145 gr.	2.5 g
Kodalk (sodium metaborate ($4H_2O$)	1 oz. 145 gr. (583 gr.)	10 g
Potassium bromide	29 gr.	.5 g
Water to make	1 gal.	1000 c.c.

Dissolve chemicals in the order given.

For tank development of portrait negatives, dilute with an equal volume of water; develop about 9 minutes at 68° F. (20° C.). For tray development, use without dilution; develop about 5 minutes at 68° F. (20° C.).

For commercial work, use without dilution. Develop about 8 minutes in a tank or 6 minutes in a tray at 68° F. (20° C.).

Replenisher (Kodak DK-50R)

Water, about 125° F. (52° C.)	96 oz.	750 c.c.
Elon	290 gr.	5 g
Sodium sulfite, desiccated	4 oz.	30 g
Hydroquinone	1 oz. 145 gr. (583 gr.)	10 g
Kodalk (sodium metaborate $4H_2O$)	5¼ oz.	40 g
Water to make	1 gal.	1000 c.c.

Dissolve chemicals in the order given.

Add to the developer to maintain the activity constant, as described in the instructions for Replenisher DK-20R.

If the developer is diluted 1 to 1 for use, the replenisher should be diluted in the same proportion.

Elon-Hydroquinone (Kodak D-61a)

Developer for professional films and plates.

Stock Solution

Water, about 125° F. (52° C.)	16 oz.	500 c.c.
Elon	45 gr	3.1 g
Sodium sulfite, desiccated	3 oz.	90 g
Sodium bisulfite	30 gr.	2.1 g
Hydroquinone	85 gr.	5.9 g
Sodium carbonate, desiccated	165 gr.	11.5 g
Potassium bromide	24 gr.	1.7 g
Cold water to make	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

TRAY DEVELOPMENT: Take 1 part of stock solution to 1 part of water. Develop about 6 minutes at 68° F. (20° C.).

TANK DEVELOPMENT: Take 1 part of stock solution and 3 parts of water. Develop about 12 minutes at 68° F. (20° C.). Add stock solution (diluted 1:3) at intervals to maintain the volume, or the replenisher, Kodak D-61R, to maintain the strength of the solution.

Replenisher (Kodak D-61R)
Stock Solution A

Water, about 125° F. (52° C.)	96	oz.	3000	c.c.
Elon	85	gr.	5.9	g
Sodium sulfite, desiccated	6	oz.	180	g
Sodium bisulfite	55	gr.	3.8	g
Hydroquinone	170	gr.	11.9	g
Potassium bromide	45	gr.	3.1	g
Cold water to make	1½	gal.	6000	c.c.

Stock Solution B

Sodium carbonate, desiccated	8	oz.	240	g
Water to make	64	oz.	2000	c.c.

Dissolve chemicals in the order given.

For use take 3 parts of A and 1 part of B and add to the tank of developer as needed. Do not mix solutions A and B until ready to use.

Elon-Pyro (Kodak D-7)

For professional films and plates.

Stock Solution A

Water, about 125° F. (52° C.)	16	oz.	500	c.c.
Elon	¼	oz.	7.5	g
Sodium bisulfite	¼	oz.	7.5	g
Pyro	1	oz.	30	g
Potassium bromide	60	gr.	4.2	g
Water to make	32	oz.	1000	c.c.

Stock Solution B

Water	32	oz.	1000	c.c.
Sodium sulfite, desiccated	5	oz.	150	g

Stock Solution C

Water	32	oz.	1000	c.c.
Sodium carbonate, desiccated	2½	oz.	75	g

Dissolve chemicals in the order given.

TRAY DEVELOPMENT: Take 1 part of A, 1 part of B, 1 part of C and 8 parts of water. Develop about 7 minutes at 68° F. (20° C.).

TANK DEVELOPMENT: Take 1 part of A, 1 part of B, 1 part of C and 13 parts of water. Develop about 10 minutes at 68° F. (20° C.).

This developer can be used for two or three weeks if the volume is maintained by adding fresh developer in the proportion of 1 part each of A, B, and C to 4 parts of water. It is usually necessary to increase the development time as the developer ages.

PHOTOGRAPHIC FORMULAE (Continued)

Positive Film Developer

Metol-Hydroquinone (Agfa 20)

This clean-working developer is recommended for normal contrast with tray or tank development of positive film.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	30 gr.	119 gr.	2 g
Sodium sulfite, anh	368 gr.	3¼ oz. 40 gr. (1462 gr.)	25 g
Hydroquinone	60 gr.	239 gr.	4 g
Sodium carbonate, monohydrated	269 gr.	2¼ oz.	18.5 g
Potassium bromide	30 gr.	119 gr.	2 g
Water to make	32 oz.	1 gal.	1000 c.c.

Do not dilute for use. Normal developing time 3 to 4 minutes at 65° F. (18° C.).

Speed Processing

Metol-Hydroquinone

Water (cool, 60° F. to 70° F.)	90 oz.
Metol	1¾ oz. 30 gr. (796 gr.)
Sodium sulfite, anh	10 oz.
Hydroquinone	3½ oz. 60 gr. (1591 gr.)
Sodium hydroxide	3½ oz. 60 gr. (1591 gr.)
Water to concentration	(about 112 oz.)

Dissolve chemicals in the order given, using full strength. Develop 10 seconds in tray at 80° F. Rinse for the same time.

Standard Developers for Sensitometry

Pyro

Hürter and Driffield standard developer for plate testing:

Pyro	8 parts
Sodium sulfite, crystal	40 parts
Sodium carbonate, crystal	40 parts
Water to make	1000 parts

Paraminophenol

Adopted at Eighth International Congress of Photography

p-Aminophenol hydrochloride	7.25 g
Sodium sulfite, anh	50.00 g
Sodium carbonate, anh	50.00 g
Water to make	1000.00 c.c.

Tropical Developers

Metol for Tropical Development of Films and Plates (Kodak DK-15)

Water, about 125° F. (52° C.)	24 oz.	750 c.c.
Elon	82 gr.	5.7 g
Sodium sulfite, desiccated	3 oz.	90 g
Kodalk (sodium metaborate $4H_2O$)	¾ oz.	22.5 g
Potassium bromide	27 gr.	1.9 g
*Sodium sulfate, desiccated	1½ oz.	45 g
Cold water to make	32 oz.	1000 c.c.

*If it is desired to use crystalline sodium sulfate instead of the desiccated sulfate, then 3½ oz. per 32 oz. (105 g per 1000 c.c.) should be used.

Dissolve chemicals in the order given.

Average time for tank development is about 10 minutes at 68° F. (20° C.) and 2 to 3 minutes at 90° F. (32° C.) in the fresh developer according to the contrast desired. When working *below* 75° F. (24° C.) the sulfate may be omitted if a more rapid formula is required. Development time *without* the sulfate is about 6 minutes at 68° F. (20° C.). Develop about 20 percent less for tray use.

When development is completed, rinse the film or plate in water for 1 or 2 seconds only and immerse in the Tropical Hardener or Hardening Bath SB-4 for 3 minutes (omit water rinse if film tends to soften); then fix for at least 10 minutes in an acid hardening fixing bath, and wash for 10 to 15 minutes in water (not over 95° F.) (35° C.).

Kodalk developers make it impossible to produce gas blisters, because Kodalk does not evolve a gas when treated with an acid. This is a distinct advantage, especially for summer work, when temperature control of solutions is often difficult.

Developer for Low Contrast Tropical Development of Films and Plates (Kodak DK-15a)

A developer which gives less contrast than Kodak DK-15 can be obtained by reducing the quantity of Kodalk to 73 gr. per 32 oz. of developer (5 g per 1000 c.c.).

Development times and processing instructions are the same as for the above developer.

Paraminophenol for Tropical Development

Water (at 125° F.)	96 oz.
Paraminophenol hydrochloride	400 gr.
Sodium sulfite, desiccated	6 oz. 290 gr. (2915 gr.)
Sodium carbonate, desiccated	6 oz. 290 gr. (2915 gr.)
Water to make	1 gal.

Dissolve chemicals in the order given, using full strength. Average time of development 7 to 9 minutes in tray at 65° F., and 3 to 4 minutes at 80° F. If the temperature of the developer is 80° F. or above, add 6 oz. sodium sulfate, desiccated, to 1 gal. of solution.

Metol-Hydroquinone, Rapid (Tropical) Developer (Agfa 64)

This is a clean-working developer of particular value for rapid development or development at high temperatures.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	36 gr.	144 gr.	2.5 g
Sodium sulfite, anh.	368 gr.	3¼ oz. 40 gr. (1462 gr.)	25 g
Hydroquinone	95 gr.	383 gr.	6.5 g
Sodium carbonate, monohydrated	234 gr.	2 oz. 60 gr. (935 gr.)	16 g
Potassium bromide	15 gr.	60 gr.	1 g
Water to make	32 oz.	1 gal.	1000 c.c

Do not dilute for use.

Normal development time—3 to 4 minutes at 65° F. (18° C.).
2 to 3 minutes at 85° F. (29° C.).

Underexposures

Elon-Hydroquinone Developer for Extreme Underexposure
(Kodak D-82)

Water, about 125° F. (52° C.)	24	oz.	750	c.c.
Wood alcohol	1½	oz. fl.	48	g
Elon	200	gr.	14	g
Sodium sulfite, desiccated	1¾	oz.	52.5	g
Hydroquinone	200	gr.	14	g
Sodium hydroxide (caustic soda)	125	gr.	8.8	g
Potassium bromide	125	gr.	8.8	g
Cold water to make	32	gr.	1000	c.c.

Dissolve chemicals in the order given.

Develop about 5 minutes in a tray at 68° F. (20° C.).

The prepared developer does not keep more than a few days in a full bottle or about 2 hours in an open tray. If wood alcohol is omitted and the developer is diluted, the solution is not so active as in the concentrated form.

Universal Developers

Amidol for Films, Plates or Papers

The following developer will give excellent results for plates, films, lantern slides, bromide paper or gaslight paper. It should be dissolved immediately before using, since it keeps only a few hours in solution.

Amidol	25	gr.	1.6	g
Sodium sulfite	120	gr.	7.8	g
Water	10	oz.	300	c.c.

For lantern slides, bromide paper or gaslight papers add to the above,

Potassium bromide	7	gr.	0.5	g

The concentration given is satisfactory for any of the purposes mentioned. Develop three to five minutes at a temperature of 65° F. or 18° C.

Elon-Hydroquinone (Kodak D-72)
Stock Solution

Water, about 125° F. (52° C.)	16	oz.	500	c.c.
Elon	45	gr.	3.1	g
Sodium sulfite, desiccated	1½	oz.	45	g
Hydroquinone	175	gr.	12	g
Sodium carbonate, desiccated	2¼	oz.	67.5	g
Potassium bromide	27	gr.	1.9	g
Water to make	32	oz.	1000	c.c.

Dissolve chemicals in the order given.

For fast chloride papers such as Velox: stock solution 1 part, water 1 part. Develop 45 seconds at 70° F. (21° C.).

For chloride papers such as Azo: stock solution 1 part, water 2 parts. Develop 45 seconds at 70° F. (21° C.).

For bromide papers: stock solution 1 part, water 4 parts. Develop not less than 1½ minutes at 70° F. (21° C.).

For films and plates: stock solution 1 part, water 1 part and develop about 4 minutes in a tray or 5 minutes in a tank.

Kodelon (Kodak DK-93)

Developer for films, plates, and papers.

Water, about 125° F. (52° C.)	16 oz.	500 c.c.
Kodelon (paraminophenol oxalate)	73 gr.	5 g
Sodium sulfite, desiccated	1 oz.	30 g
Hydroquinone	37 gr.	2.5 g
Kodalk (sodium metaborate $4H_2O$)	290 gr.	20 g
Potassium bromide	7 gr.	.5 g
Cold water to make	32 oz.	1000 c.c.

Dissolve the chemicals in the order given.

Use without dilution. Develop roll films about 9 minutes in a tank of fresh developer at 68° F. (20° C.). Develop professional films and plates about 6 minutes at 68° F. (20° C.). Greater or less contrast may be obtained by developing longer or shorter times than those specified.

For warm tones on papers, use without dilution and develop for 2 minutes at 68° F. (20° C.). For colder tones, double the quantity of Kodalk; use without dilution and develop 1 to 2 minutes at 68° F. (20° C.). In either case, the tones given with this developer are slightly warmer than the normal tones given with Kodak Developers D-52 and D-72.

The use of Kodak DK-93 is especially recommended for those persons subject to trouble from skin irritation.

Metol-Hydroquinone (Agfa 103)

Universal film and paper developer. This formula may be used both as a developer for film and as a developer for Convira, Speedex and Brovira papers when cold, blue-black tones are desired.

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	50 gr.	204 gr.	3.5 g
Sodium sulfite, anh.	1½ oz.	6 oz.	45 g
Hydroquinone	164 gr.	1½ oz.	11.5 g
Sodium carbonate, monohydrated	2½ oz. 35 gr. (1129 gr.)	10½ oz.	78 g
Potassium bromide	18 gr.	72 gr.	1.2 g
Water to make	32 oz.	1 gal.	1000 c.c.

FILM DEVELOPMENT: Dilute one part stock solution with two parts water. Normal development time 5 minutes at 65° F. (18° C.).

PAPER DEVELOPMENT: Dilute 1 part stock solution with 2 parts water. For Brovira and similar bromide papers, develop 1 to 1½ minutes at 70° F. (21° C.). For Speedex and Convira (new type) normal development time is 45 seconds. Other contact papers may require 1 to 1½ minutes.

For slower, softer development of Brovira dilute 1 to 4. Develop 1½ to 3 minutes, at 70° F. (21° C.).

X-RAY DEVELOPERS

Elon-Hydroquinone (Kodak D-19b)

Water (about 125° F.) (52° C.)	16 oz.	500	c.c.
Elon	32 gr.	2.2	g
Sodium sulfite, anh.	2 oz. 175 gr.	72	g
Hydroquinone	128 gr.	8.8	g
Sodium carbonate, anh.	1 oz. 265 gr.	48	g
Potassium bromide	60 gr.	4	g
Cold water to make	32 oz.	1000	c.c.

Use without dilution. Develop for 5 minutes at 65° F. (18° C.).

Metol-Hydroquinone (Agfa-30)

This developer is recommended when results of maximum brilliance are desired. It is clean-working, has long life and gives high contrast.

Hot water (125° F. or 52° C.)	24	oz.	3	qt.	750	c.c.
Metol	50	gr.	204	gr.	3.5	g
Sodium sulfite, anh.	2	oz.	8	oz.	60	g
Hydroquinone	129	gr.	1	oz. 80 gr. (517 gr.)	9	g
Sodium carbonate, monohydrated	1¼	oz. 40 gr. (587 gr.)	5¼	oz.	40	g
Potassium bromide	30	gr.	119	gr.	2	g
Water to make	32	oz.	1	gal.	1000	c.c.

Do not dilute for use.

Normal development time at 65° F. (18° C.), for x-ray film, 6 minutes, for non-screen x-ray film, 8 minutes, for direct copy film and direct duplicating film, 4 to 5 minutes, for S. S. Pan-Aero film 10–15 minutes depending upon the type of developing machine.

DESENSITIZERS

Pinakryptol Yellow Desensitizer

Pinakryptol yellow	15 gr.	1 g
Water to make	32 oz.	1000 c.c.

Use without dilution at a temperature of 65° F. (18° C.). Immerse films in total darkness for two minutes. Orthochromatic film may then be handled in bright red light, panchromatic film in bright green light. Pinakryptol yellow desensitizer should be used as a separate bath and not mixed with the developer.

Use of a 50-50 water alcohol mixture for solution will improve the keeping qualities of the desensitizer.

Pinakryptol Green Desensitizer

This solution is not recommended for high speed panchromatic films.

Stock Solution

Pinakryptol green	15 gr.	1 g
Water to make	16 oz.	500 c.c.

For use dilute one part stock desensitizing solution with ten parts water. Immerse films in total darkness for two minutes at 65° F. (18° C.). Development may then be carried out in bright red light.

PHOTOGRAPHIC FORMULAE (Continued)

The same stock solution may be used, if preferred, directly in the developer in the proportion: desensitizer: one part, developer: thirty parts. After two minutes' development in total darkness, bright red light may be used as above.

Use of a 50-50 water-alcohol mixture for solution will improve the keeping qualities of the desensitizer.

Developers for Papers

Amidol (Kodak D-51)

Developer for bromide papers.

Stock Solution

Water (about 125° F.) (52° C.)	24	oz.	750	c.c.
Sodium sulfite, anh.	4	oz.	120	g
Di-aminophenol hydrochloride (amidol)	1¼	oz.	37.5	g
Cold water to make	32	oz.	1000	c.c.

For use, take 6 ounces (180 c.c.) stock solution, ¾ dram (3 c.c.) 10 % potassium bromide solution, and 24 ounces (750 c.c.) of water. This developer oxidizes rapidly when exposed to the air so that only a quantity sufficient for immediate use should be mixed.

Amidol Paper Developer (Agfa 113)

This formula is intended for tray development only and must be mixed fresh each time. It is recommended only for small lots of prints.

Amidol	96 gr.	6.6	g
Sodium sulfite, anh.	1¼ oz. 90 gr. (637 gr.)	44	g
Potassium bromide	8 gr.	.55	g
Water to make	32 oz.	1000	c.c.

Do not dilute for use. If hot water is used for dissolving chemicals, the sodium sulfite and potassium bromide should be dissolved first and the amidol added only after the solution has cooled.

For development of Cykora and similar papers use twice the amount of potassium bromide specified above.

Develop 1 to 2 minutes at 70° F. (21° C.).

Elon-Hydroquinone (Kodak D-52)

Developer for warm tone papers.

Stock Solution

Water, about 125° F. (52° C.)	16	oz.	500	c.c.
Elon	22	gr.	1.5	g
Sodium sulfite, desiccated	¾	oz.	22.5	g
Hydroquinone	90	gr.	6.3	g
Sodium carbonate, desiccated	½	oz.	15	g
Potassium bromide	22	gr.	1.5	g
Cold water to make	32	oz.	1000	c.c.

Dissolve chemicals in the order given.

For use, take 1 part of stock solution to 1 part of water. Develop about 2 minutes at 68° F. (20° C.).

More bromide may be added if warmer tones are desired.

Glycin-Hydroquinone Developer (Agfa 115)

This is a warm-tone developer suitable for Cykron, Cykora, Indiatone, Brovira, and similar papers.

Stock Solution

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750	c.c.
Sodium sulfite, anh.........	3 oz.	12 oz.	90	g
Sodium carbonate, monohydrated.............	5 oz.	1 lb. 4 oz.	150	g
Glycin	1 oz.	4 oz.	30	g
Hydroquinone.........	139 gr.	1¼ oz. 10 gr. (557 gr.)	9.5	g
Potassium bromide.......	60 gr.	239 gr.	4	g
Water to make.............	32 oz.	1 gal.	1000	c.c.

For warm tones, dilute 1 part stock solution with 3 parts water and develop prints 2½ to 3 minutes at 70° F. (21° C.).

For very warm tones and more open shadows, especially with Cykora, dilute 1 part stock solution with 6 parts water, giving prints 3 to 4 times normal exposure and 2½ to 5 minutes development. Because of dilution of the developer, solution will exhaust more rapidly and will require more frequent replacement.

Hydroquinone (Agfa 110)

Direct brown-black paper developer. Beautiful warm tones may be obtained with this developer on both contact and projection papers.

Stock Solution

Hot water (125° F. or 52° C.)....	24 oz.	3 qt.	750	c.c.
Hydroquinone.. ..	¾ oz.	3 oz.	22.5	g
Sodium sulfite, anh. ..	1¾ oz. 50 gr. (816 gr.)	7½ oz.	57	g
Sodium carbonate, monohydrated....	2½ oz.	10 oz.	75	g
Potassium bromide..... .	40 gr.	159 gr.	2.75	g
Water to make...........	32 oz.	1 gal.	1000	c.c.

For use dilute 1 part stock solution with 5 parts water.

Give prints 3 to 4 times normal exposure and develop 5 to 7 minutes at 70° F. (21° C.).

Metol (Agfa 120)

This is a soft-working developer, primarily intended for portrait work where soft gradation is required.

Stock Solution

Hot water (125° F. or 52° C.)............	24 oz.	3 qt.	750	c.c.
Metol..	179 gr.	1½ oz. 60 gr. (716 gr.)	12.3	g
Sodium sulfite, anh.....	1 oz. 88 gr. (526 gr.)	4¾ oz.	36	g
Sodium carbonate, monohydrated....	1 oz. 88 gr. (526 gr.)	4¾ oz.	36	g
Potassium bromide.. .	27 gr.	¼ oz.	1.8	g
Water to make.... .	32 oz.	1 gal.	1000	c.c.

For use, dilute 1 part stock solution with 2 parts water.
Normal developing time, 1½ to 3 minutes at 70° F. (21° C.).

Metol-Hydroquinone (Agfa 135)

This developer is recommended for rich, warm-black tones with Cykon, Convira, Cykora, Brovira, Indiatone and similar papers.

Stock Solution

Hot water (125° F. or 52° C.)	24	oz.	3	qt.	750	c.c.
Metol	24	gr.	96	gr.	1.6	g
Sodium sulfite, anh.	348	gr.	3¼	oz.	24	g
Hydroquinone	96	gr.	388	gr.	6.6	g
Sodium carbonate, monohydrated	348	gr.	3¼	oz.	24	g
Potassium bromide	40	gr.	159	gr.	2.8	g
Water to make	32	oz.	1	gal.	1000	c.c.

For use, dilute 1 part stock solution with 1 part water. A properly exposed print will be fully developed at 70° F. (21° C.) in about 1½ to 2 minutes. Complete development may be expected to take slightly longer with rough-surfaced papers than with semi-glossy or luster-surfaced papers. For greater softness, dilute the bath with water up to equal quantities of developer and water. To increase the warmth, add bromide up to double the amount in the formula. The quantity of bromide specified in the formula, however, assures rich, warm, well-balanced tones.

Metol-Hydroquinone (Agfa 130)

This formula is a universal developer for all projection and contact papers. It gives rich black tones with excellent brilliance and detail. It provides unusual latitude in development and is clean-working even with long developing times.

Stock Solution

Hot water (125° F. or 52° C.)	24	oz.	3	qt.	750	c.c.
Metol	32	gr.	129	gr.	2.2	g
Sodium sulfite, anh	1¾	oz.	6¾	oz.	50	g
Hydroquinone	159	gr.	1½	oz.	11	g
Sodium carbonate, monohydrated	2½	oz.	10½	oz.	78	g
Potassium bromide	80	gr.	¾	oz.	5.5	g
Glycin	159	gr.	1½	oz.	11	g
Water to make	32	oz.	1	gal.	1000	c.c.

The prepared stock solution is clear but slightly colored. The coloration in this case does not indicate the developer has deteriorated or is unfit for use.

For use dilute 1 part stock solution with 1 part water.

Normal developing time at 70° F. (21° C.) for Brovira, 2 to 6 minutes, for Convira and Indiatone, 1½ to 3 minutes.

Greater contrast can be obtained by using the developer stock solution full strength. Softer results can be obtained by diluting 1 part stock solution with 2 parts water.

Metol-Hydroquinone (Agfa 125)

This formula is recommended for development of Cykon, Cykora, Brovira and similar papers. It can also be used as recommended below for the rapid development of press films.

PHOTOGRAPHIC FORMULAE (Continued)

Stock Solution

Hot water (125° F. or 52° C.)	24 oz.	3 qt.	750 c.c.
Metol	45 gr.	179 gr.	3 g
Sodium sulfite, anh.	1½ oz.	6 oz.	44 g
Hydroquinone	169 gr.	1½ oz. 20 gr. (676 gr.)	12 g
Sodium carbonate, monohydrated	2¼ oz.	9 oz.	65 g
Potassium bromide	30 gr.	119 gr.	2 g
Water to make	32 oz.	1 gal.	1000 c.c.

PAPER DEVELOPMENT: Dilute 1 part stock solution with 2 parts water. Develop 1 to 2 minutes at 70° F. (21° C.). For softer and slower development dilute 1 to 4, and develop 1½ to 3 minutes at 70° F. (21° C.). For greater brilliance, shorten the exposure slightly and lengthen the development time. For greater softness, lengthen the exposure slightly and shorten the development time.

Rinsing, Hardening and Fixing Baths

Rinsing Bath or Short Stop

After development rinse prints (or negatives) for five seconds before fixing.

Water	32 oz.	1000 c.c.
Acetic acid (glacial)	0.5 oz.	6 c.c.

Stop Bath (Kodak SB-1)

For papers.

Water	32 oz.	1000 c.c.
Acetic acid, 28 %	1½ oz.	48 c.c.

To make approximately 28 % acetic acid from glacial acetic acid, dilute three parts of glacial acetic acid with eight parts of water.

Rinse prints for at least 5 seconds. Capacity: about 20 8 × 10-inch prints per quart (1000 c.c.).

Stop Bath (Kodak SB-1a)

For films, plates, and papers for graphic arts.

Water	32 oz.	1000 c.c.
Acetic acid, 28 %	4 oz.	125 c.c.

To make approximately 28 % acetic acid from glacial acetic acid, dilute three parts of glacial acetic acid with eight parts of water.

The action of this bath checks development instantly, provided the acid has not been neutralized. It also tends to prevent uneven spots and streaks when the prints or negatives are immersed in the fixing bath.

Hardening Bath (Kodak SB-3)

For use at 65° to 75° F. with films and plates.

Water	32 oz.	1000 c.c.
Potassium chrome alum	1 oz.	30 g

This bath is intended for use in hot weather after development and before fixation in conjunction with Kodak Fixing Bath F-5.

Agitate the negatives for a few seconds when first immersed in hardener. Leave them in the bath for 3 to 5 minutes to secure maximum hardening. This bath should be renewed frequently.

Hardening Bath (Kodak SB-4)

For use at 75° to 90° F. with films and plates.

This solution is recommended for use in conjunction with the High Temperature Developer (Kodak DK-15), when working above 75° F. (24° C.).

Water	32 oz.	1000 c.c.
Potassium chrome alum	1 oz.	30 g
*Sodium sulfate, desiccated	2 oz.	60 g

*If crystalline sodium sulfate is preferred instead of the desiccated, use 4½ oz. (140 g) in the above formula.

Agitate the negatives for 30 to 45 seconds when they are first immersed in the hardener, or streakiness will result. Leave them in the bath for at least 3 minutes between development and fixation. If the temperature is below 85° F. (29° C.), rinse for 1 to 2 seconds in water before immersing in the hardener bath.

The hardening bath is a violet blue color by tungsten light when freshly mixed, but it ultimately turns a yellow-green with use; it then ceases to harden and should be replaced with a fresh bath. The hardening bath should never be overworked. An unused bath will keep indefinitely, but the hardening power of a partially used bath decreases rapidly on standing for a few days.

Formaldehyde Hardener (Kodak SH-1)

For after treatment of films and plates.

Water	16 oz.	500 c.c.
Formaldehyde (about 37 % solution by weight)	2½ dr.	10 c.c.
Sodium carbonate, desiccated	73 gr.	5 g
Water to make	32 oz.	1000 c.c.

This formula is recommended for the treatment of negatives which normally would be softened by a chemical treatment as for the removal of stains or for intensification or reduction.

After hardening for three minutes, negatives should be rinsed and immersed for five minutes in a fresh acid fixing bath and then washed thoroughly before they are given any further chemical treatment.

Plain Non-hardening Fixing Bath

Water	32 oz.	852 c.c.
Hypo (sodium thiosulfate)	8 oz.	227 g

Do not use the bath when it is discolored; it must be made fresh each day.

Non-Hardening Metabisulfite Fixer (Agfa 203)

This fixing bath is recommended for use when hardening is not desired. It is highly desirable for accuracy of registration in color work with Reprolith Film.

Stock Solution

Hypo	4 lb.	1900 g
Potassium metabisulfite	9 oz.	270 g
Water to make	1 gal.	4000 c.c.

The metabisulfite should be added only when the hypo solution is cool.

For use dilute one part stock solution with one part water. Normal fixing time 5 to 10 minutes at 65° F. (18° C.).

Fixing Bath Non-Hardening; For Special Processes (Kodak F-24)

Water, about 125° F. (52° C.)	16 oz.	500 c.c.
Sodium thiosulfate (hypo)	8 oz.	240 g
Sodium sulfite, desiccated	145 gr.	10 g
Sodium bisulfite	365 gr.	25 g
Cold water to make	32 oz.	1000 c.c.

Dissolve chemicals in the order given.

This bath may be used for films, plates or paper when no hardening is desired.

For satisfactory use, the temperature of the developer, rinse bath, and wash water should not be higher than 68° F. (20° C.).

Acid Hardening Fixer (Agfa 201)

This hardening fixing bath for use with either film or paper may be stored indefinitely and used repeatedly until exhausted. If the fixing bath froths, turns cloudy, or takes longer than 10 minutes to fix out completely, it must be replaced by a fresh solution.

Solution 1			
Hot water (125° F. or 52° C.)	16 oz.	½ gal.	500 c.c.
Hypo	8 oz.	2 lb.	240 g
Solution 2			
Hot water (125° F. or 52° C.)	5 oz.	20 oz.	150 c.c.
Sodium sulfite, anh	½ oz.	2 oz.	15 g
Acetic acid (28 %)	1½ oz.	6 oz.	45 c.c.
Potassium alum	½ oz.	2 oz.	15 g
Add solution 2 to 1 and add water to make	32 oz.	1 gal.	1000 c.c.

Dissolve chemicals thoroughly in order given and stir rapidly while adding solution 2 to solution 1. Glacial acetic acid may be diluted to 28 % concentration by adding 3 parts of acid to 8 parts of water. Do not dilute for use. Normal fixing time 5 to 10 minutes at 65° to 70° F. (18° to 21° C.).

Acid Hardening Fixing Bath (Kodak F-5)

For films, plates, and papers.

Water, about 125° F. (52° C.)	20 oz.	600 c.c.
Sodium thiosulfate (hypo)	8 oz.	240 g
Sodium sulfite, desiccated	½ oz.	15 g
*Acetic acid, 28 %	1½ oz. fl.	48 c.c.
Boric acid, crystals	¼ oz.	7.5 g
Potassium alum	½ oz.	15 g
Cold water to make	32 oz.	1000 c.c.

*To make approximately 28 % acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with 8 parts of water.

Films or plates should be fixed properly in 10 to 20 minutes in a freshly prepared bath. The bath need not be discarded until the fixing time exceeds 20 minutes.

This bath has the advantage over the older type of fixing baths, which do not contain boric acid, that it gives much better hardening and has less tendency to precipitate a sludge of aluminum sulfite.

Acid Fixing Bath for Papers

(May also be used for plates or films)

Water	64	oz.
Hypo	16	oz.

Dissolve, then add the following acid hardener:

Water	5	oz.
Sodium sulfite, anh.	$\frac{1}{2}$	oz.
Acetic acid, 25 %	3	oz.
Alum, anh	$\frac{1}{2}$	oz.

This fixing bath is also excellent for dry plates and films, and will keep indefinitely before using; therefore it can be made up some time in advance. One pint of the bath should fix at least fifty 4 × 5 prints. The acid fixing bath can be used repeatedly. It keeps with but little care. It will by degrees become alkaline by the gradual addition of developer adhering to the prints. It should be discarded entirely when it becomes frothy, and a fresh bath prepared.

Rapid Fixing Bath for General Photographic Use (Kodak F-7)

Water, about 125° F. (52° C.)	80	oz.	600	c.c.
Sodium thiosulfate (hypo)	3	lb.	360	g
Ammonium chloride	$6\frac{3}{4}$	oz.	50	g
Sodium sulfite, desiccated	2	oz.	15	g
*Acetic acid, 28 %	6	oz. fl.	48	c.c.
Boric acid, crystals	1	oz.	7.5	g
Potassium alum	2	oz.	15	g
Cold water to make	1	gal.	1000	c.c.

* To make approximately 28 % acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with 8 parts of water.

Dissolve chemicals in the order given.

Chrome Alum Fixing Bath for Films and Plates (Kodak F-16)

Solution A

Sodium thiosulfate (hypo)	2	lb.	960	g
Sodium sulfite, desiccated	2	oz.	60	g
Water to make	96	oz.	3000	c.c.

Solution B

Water	32	oz.	1000	c.c.
Potassium chrome alum	2	oz.	60	g
Sulfuric acid	$\frac{1}{4}$	oz. fl.	8	c.c.

Caution: Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid: otherwise the solution may boil and spatter the acid on the hands or face, causing serious burns.

Pour solution B into solution A slowly while stirring A rapidly. This bath, when freshly mixed, is recommended for use in hot weather, but it rapidly loses its hardening properties with or without use, when it should be replaced by a fresh bath. With an old bath there is a tendency for scum to form on the surface of the film. Any such scum should be removed by swabbing with cotton before the film is dried. It is not advisable to use this bath in metal tanks.

Hypo Eliminator

Water	16 oz.
Hydrogen peroxide (3 percent)	4 oz. fl.
Ammonia (3 percent)	3¼ oz. fl.
Water to make ...	32 oz.

Directions for use: Wash prints for 30 minutes at 65° F. Immerse each print for 6 minutes in hypo eliminator solution, then wash for 10 minutes and dry. Capacity of bath is about fifty 8 × 10 prints or the equivalent per gallon.

Hypo Test Solution

Water (cool, 60° F. to 70° F., preferably distilled).........	8 oz.
Potassium permanganate..	4 gr.
Sodium hydroxide.......	8 gr.

Use ¼ dr. (15 drops) of above solution to 8 oz. of water, preferably distilled. Pour ½ oz. of this solution in small graduate. Take equivalent of six 4 × 6 inch prints from water, drain hurriedly, and allow drippings to drip into the ½ oz. of solution for 30 seconds. The least trace of hypo in the water draining from the prints will cause this violet solution to turn to an orange color. If more hypo is present in the drippings, the solution will change to a greenish-yellow color As certain impurities in water will cause similar discoloration of the solution, a number of drops of tap water, equivalent to number of drops to be dropped from prints, should be dropped into the ½ oz. of violet-colored solution. If no change in color takes place, any change in color that will take place from the water drained from prints will be due to the presence of hypo which will prove that the prints have not been sufficiently washed.

STAIN REMOVERS

Hand Stain Remover (Kodak S-5)

Solution A

Potassium permanganate	¼ oz.	7.5 g
Water	32 oz.	1000 c.c.

Solution B

Sodium bisulfite	16 oz.	480 g
Water..	32 oz.	1000 c.c.

Rub the hands with a small amount of solution A, rinse in water; then pour a small quantity of solution B into the palm of one hand, rub it quickly over the hands, and, when free of stain, wash them thoroughly with water. If the original stain is not entirely removed, repeat the treatment with solutions A and B.

If it is desired to immerse the hands in solution B, 1 part of the solution should be diluted with 4 parts of water.

Stain Remover for Removal of Developer Stain on Negatives (Kodak S-6)

Developer or oxidation stain may be removed by first hardening the film for 2 or 3 minutes in the formalin hardener then washing for 5 minutes and bleaching in:

Stock Solution A

Potassium permanganate.......	75 gr.	5.2 g
Water to make..	32 oz.	1000 c.c.

Stock Solution B

Cold water	16 oz.	500 c.c.
Sodium chloride	2¼ oz.	75 g
Sulfuric acid	½ oz.	16 c.c.
Water to make	32 oz.	1000 c.c.

Caution: Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid; otherwise the solution may boil and spatter the acid on the hands or face, causing serious burns.

Use equal parts of A and B. The solutions should not be mixed until ready for immediate use since they do not keep long after mixing. All particles of permanganate should be dissolved completely when preparing solution A, since undissolved particles are likely to produce spots on the negative. Bleaching should be complete in 3 or 4 minutes at 68° F. (20° C.). The brown stain of manganese dioxide formed in the bleach bath is best removed by immersing the negative in 1% sodium bisulfite solution. Then rinse well and develop in strong light, preferably sunlight, with any general purpose developer. Then wash thoroughly.

Iron Clearing Solution

To remove yellow stain caused by pyro or hydroquinone developer, wash well to free from hypo and place in

Water	20 oz.	568 c.c.
Ferrous sulfate, pure	3 oz.	85 g
Sulfuric acid, C. P	1 oz.	28 g
Powdered alum	1 oz.	28 g

until stain is gone, then wash well.

INTENSIFIERS

Mercury Intensifier for Films and Plates (Kodak In-1)

BLEACH the negative in the following solution until it is white, *then wash thoroughly.*

Potassium bromide	¾ oz.	22.5 g
Mercuric chloride	¾ oz.	22.5 g
Water to make	32 oz.	1000 c.c.

The negative can be blackened with 10% sulfite solution, a developing solution, or 10% ammonia (1 part concentrated ammonia (28%) to 9 parts water), these giving progressively greater density in the order given.

Chromium Intensifier for Films and Plates (Kodak In-4)

Stock Solution

Potassium bichromate	3 oz.	90 g
Hydrochloric acid	2 oz. fl.	64 c.c.
Water to make	32 oz.	1000 c.c.

For use, take 1 part of stock solution to 10 parts of water.

Harden the negative first in a formaldehyde hardening solution. Bleach thoroughly at 65° to 70° F. (18° to 21° C.), then wash five minutes and redevelop fully in artificial light or daylight (not sunlight) in any quick-acting, non-staining developer which does not contain an excess of sulfite; for example, about 10 minutes at 68° F. (20° C.) in any general purpose developer. Developers containing a high proportion of sodium sulfite should be avoided.

Then rinse, fix for five minutes, and wash thoroughly. Greater intensification can be secured by repeating the process. Negatives intensified with chromium are more permanent than those intensified with mercury.

Silver Intensifier for Films and Plates (Kodak In-5)

The following formula is the only intensifier known that will not change the color of the image on positive film on projection. It gives proportional intensification and is easily controlled by varying the time of treatment. The formula is equally suitable for positive and negative film.

Stock Solution No. 1 (Store in brown bottle)		
Silver nitrate, crystals	2 oz.	60 g
Distilled water to make	32 oz.	1000 c.c.
Stock Solution No. 2		
Sodium sulfite, desiccated	2 oz.	60 g
Water to make	32 oz.	1000 c.c.
Stock Solution No. 3		
Sodium thiosulfate (hypo)	3½ oz.	105 g
Water to make	32 oz.	1000 c.c.
Stock Solution No. 4		
Sodium sulfite, desiccated	½ oz.	15 g
Elon	350 gr.	24 g
Water to make	96 oz.	3000 c.c.

Prepare the intensifier solution for use as follows: Slowly add 1 part of solution No. 2 to 1 part of solution No. 1, shaking or stirring to obtain thorough mixing. The white precipitate which appears is then dissolved by the addition of 1 part of solution No. 3. Allow the resulting solution to stand a few minutes until clear. Then add, with stirring, 3 parts of solution No. 4. The intensifier is then ready for use and the film should be treated immediately. The mixed intensifier solution is stable for approximately 30 minutes at 68° F. (20° C.).

The degree of intensification obtained depends upon the time of treatment which should not exceed 25 minutes. After intensification, immerse the film for 2 minutes with agitation in a plain 30 % hypo solution. Then wash thoroughly.

The stability of the mixed intensifier solution and the rate of intensification are very sensitive to changes in the thiosulfate concentration. A more active but less stable working solution may be obtained by using a stock solution No. 3 prepared with 3 oz. of hypo per 32 oz. (90 g per 1000 c.c.) instead of the quantity in the formula. The directions for preparing the working solution are the same as before but the mixed intensifier will not keep over 20 minutes at 68° F. (20° C.).

For best results, the intensifier should be used in artificial light; the solution tends to form a precipitate of silver quite rapidly when exposed directly to sunlight.

REDUCERS

Farmer's Reducer, Proportional, for Lowering Contrast (Kodak R-4b)

Farmer's Reducer also may be used as a two-bath formula by treating the negative in the ferricyanide solution first and sub-

sequently in the hypo solution. This method gives almost proportional reduction and corrects for overdevelopment. The single solution Farmer's Reducer gives only cutting reduction and corrects for overexposure.

Solution A

Potassium ferricyanide	¼ oz.	7.5 g
Water to make	32 oz.	1000 c.c.

Solution B

Sodium thiosulfate (hypo)	6¾ oz.	200 g
Water to make	32 oz.	1000 c.c.

Treat the negatives in solution A with uniform agitation for 1 to 4 minutes at 65–70° F. (18–20° C.) depending on the degree of reduction desired. Then immerse them in solution B for 5 minutes and wash thoroughly. The process may be repeated if more reduction is desired. For the reduction of general fog, one part of solution A should be diluted with one part of water.

Farmer's Reducer (Agfa 310)

This is a cutting reducer for lessening the density of heavy negatives and at the same time increasing their contrast. It is especially valuable for reproduction films to clear the whites.

Solution 1

Hypo	8 oz.	240 g
Water to make	32 oz.	1000 c.c.

Solution 2

Potassium ferricyanide	274 gr.	19 g
Water to make	8 oz.	250 c.c.

For use mix one part solution 2 and four parts solution 1 in 32 parts water. Solutions 1 and 2 should be stored separately and mixed immediately before use.

Flattening Reducer (Agfa 311)

This reducer is useful for lessening the density and contrast of heavy negatives.

Solution 1

Potassium ferricyanide	1 oz. 75 gr. (513 gr.)	35 g
Potassium bromide	149 gr.	10 g
Water to make	32 oz.	1000 c.c.

Bleach in solution 1 and after thorough washing, redevelop to desired density and contrast in any except fine-grain developers. Then fix and wash in usual manner. Conduct operation in subdued light.

Farmer's Reducer for Amateur Use for Clearing Shadow Areas (Kodak R-4)

Solution A

Water	1 oz.	32 c.c.
Potassium ferricyanide	15 gr.	1 g

Solution B

Water	32 oz.	1000 c.c.
Sodium thiosulfate (hypo)	1 oz.	30 g

Add A to B and immediately pour over the negative to be reduced. The reducer solution decomposes rapidly after mixing together the A and B solutions and therefore should be used at once. When the negative has been reduced sufficiently, wash thoroughly before drying. Local areas may be reduced by applying the solution with a cotton pad.

Reducer for Clearing Shadow Areas (Kodak R-2)

Stock Solution A

Water	32	oz.	1000	c.c.
Potassium permanganate	1¾	oz.	52.5	g

Stock Solution B

Water	32	oz.	1000	c.c.
Sulfuric acid	1	oz. fl.	32	c.c.

Caution: Always add the sulfuric acid to the water slowly stirring constantly, and never the water to the acid; otherwise the solution may boil and spatter the acid on the hands or face causing serious burns.

The best method of dissolving the permanganate crystals in solution A is to use a small volume of hot water (about 180° F.) (82° C.) and shake or stir the solution vigorously until completely dissolved; then dilute to volume with cold water.

The negative must be thoroughly washed to remove all traces of hypo before it is reduced. For use, take 1 part A, 2 parts B and 64 parts of water. When the negative has been reduced sufficiently, place it in a fresh acid fixing bath for a few minutes, to remove yellow stains, then wash thoroughly.

If reduction is too rapid, use a larger volume of water when diluting the solution for use. This solution should *not be used* as a stain remover as it has a tendency to attack the image before it removes the stain.

The two solutions should not be combined until immediately before use. They will not keep long in combination.

Proportional Reducer for Lowering Contrast (Kodak R-5)

Stock Solution A

Water	32	oz.	1000	c.c.
Potassium permanganate	4	gr.	.3	g
Sulfuric acid (10 % solution)	½	oz. fl.	16	c.c.

Stock Solution B

Water	96	oz.	3000	c.c.
Ammonium persulfate	3	oz.	90	g

To make a 10 % solution of sulfuric acid, take 1 part of sulfuric acid and add it to 9 parts of water, slowly with stirring. *Never add the water to the acid* because the solution may boil and spatter the acid on the hands or face, causing serious burns.

For use, take one part of solution A to three parts of solution B. When sufficient reduction is secured, the negative should be cleared

in a 1 % solution of sodium bisulfite. Wash the negative thoroughly before drying.

Semi-Proportional Reducer for Lowering Contrast and Clearing Shadow Areas (Kodak R-8)

This is the only single solution which keeps well in a tank.

Water, about 125° F. (52° C.).....	24	oz.	750	c.c.
Ferric chloride....	365	gr.	25	g
Potassium citrate..	2½	oz.	75	g
Sodium sulfite, desiccated....	1	oz.	30	g
Citric acid..............	290	gr.	20	g
Sodium thiosulfate (hypo)....	6¾	oz.	200	g
Water to make..............	32	oz.	1000	c.c.

Dissolve chemicals in the order given.

Use full strength for maximum rate of reduction. Treat negatives 1 to 10 minutes at 65° to 70° F. (18° to 21° C.). Then wash thoroughly. If a slower action is desired, dilute one part of solution with one part of water. The reducer is especially recommended for the treatment of dense, contrasty negatives.

Super-Proportional Reducer for Great Reduction of Contrast (Kodak R-1)

Water......	32	oz.	1000	c.c.
Ammonium persulfate.......	2	oz.	60	g
Sulfuric acid	¾	dr.	3	c.c.

Caution: Always add the sulfuric acid to the solution slowly, stirring constantly, and never the solution to the acid; otherwise the solution may boil and spatter the acid on the hands or face causing serious burns.

For use, take 1 part stock solution and 2 parts water.

Treat the negative in a formaldehyde hardener solution and wash thoroughly before reduction. When reduction is complete, immerse in an acid fixing bath for a few minutes and wash thoroughly before drying. If reduction is too rapid, dilute the solution with a further volume of water.

Toning Formulae

Hypo Alum Toner (Agfa 222)

This toner is recommended for beautiful reddish-brown tones.

Solution 1

Water..	80	oz.	2350	c.c.
Hypo..	15	oz.	450	g

Solution 2

Water...............	1	oz.	30	c.c.
Silver nitrate...........	20	gr.	1.3	g

Solution 3

Water....................	1	oz.	30	c.c.
Potassium iodide...........	40	gr.	2.7	g

Add solution 2 to solution 1. Then add solution 3 to the mixture. Finally add 105 grams (3½ oz.) of potassium alum to this solution, and heat the entire bath to the boiling point or until sulfurization

takes place (indicated by a milky appearance of the solution). Tone prints 20 to 60 minutes in this bath at 110–125° F. (43–52° C.). Agitate prints occasionally until toning is complete. Care should be taken to see that the blacks are fully converted before removing the prints from the toning bath, otherwise double tones may result.

Hypo Alum Sepia Toner for Papers (Kodak T-1a)

Cold water	90 oz.	2800 c.c.
Sodium thiosulfate (hypo)	16 oz.	480 g

Dissolve thoroughly, and add the following solution:

Hot water, about 160° F. (70° C.)	20 oz.	640 c.c.
Potassium alum	4 oz.	120 g

Then add the following solution (including precipitate) *slowly to the hypo-alum solution while stirring the latter rapidly.*

Cold water	2 oz.	64 c.c.
Silver nitrate, crystals	60 gr.	4.2 g
Sodium chloride	60 gr.	4.2 g

After combining above solutions,

Add water to make	1 gal.	4000 c.c.

Note: The silver nitrate should be dissolved completely before adding the sodium chloride and immediately afterward, the solution containing the milky white precipitate should be added to the hypo-alum solution as directed above. The formation of a black precipitate in no way impairs the toning action of the bath if proper manipulation technique is used.

For use, pour into a tray supported in a water bath and heat to 120° F. (49° C.). At this temperature prints will tone in 12 to 15 minutes depending on the type of paper. Never use the solution at a temperature above 120° F. (49° C.). Blisters and stains may result. Toning should not be continued longer than 20 minutes at 120° F. (49° C.).

In order to produce good sepia tones, the prints should be exposed so that the print is slightly darker than normal when developed normally ($1\frac{1}{2}$ to 2 minutes).

The prints to be toned should be fixed thoroughly and washed for a few minutes before being placed in the toning bath. Dry prints should be soaked thoroughly in water. To insure even toning, the prints should be immersed completely, and separated occasionally, especially during the first few minutes.

After prints are toned, they should be wiped with a soft sponge and warm water to remove any sediment, and washed for one hour in running water.

Sulfide Sepia for Papers (Kodak T-7a)

Stock Bleaching Solution A

Potassium ferricyanide	$2\frac{1}{2}$ oz.	75 g
Potassium bromide	$2\frac{1}{2}$ oz.	75 g
Potassium oxalate	$6\frac{1}{2}$ oz.	195 g
Acetic acid, 28 %	$1\frac{1}{4}$ oz. fl.	40 c.c.
Water	64 oz.	2000 c.c.

PHOTOGRAPHIC FORMULAE (Continued)

To make approximately 28 % acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with 8 parts of water.

Stock Toning Solution B

Sodium sulfide (not sulfite)	1½	oz.	45 g
Water	16	oz.	500 c.c.

Prepare bleaching bath as follows:

Stock solution A	16	oz.	500 c.c.
Water	16	oz.	500 c.c.

Prepare toner as follows:

Stock solution B	4	oz.	125 c.c.
Water to make	32	oz.	1000 c.c.

Stock hardener solution (Kodak F-1a)

Water, about 125° F. (52° C.)	14	oz.	425 c.c.
Sodium sulfite, desiccated	2	oz.	60 g
Acetic acid, 28 %	6	oz. fl.	190 c.c.
Potassium alum	2	oz.	60 g
Cold water to make	32	oz.	1000 c.c.

To make approximately 28 % acetic acid from glacial acetic acid, dilute 3 parts of glacial acetic acid with eight parts of water.

Dissolve the chemicals in the order given. The sodium sulfite should be dissolved completely before the acetic acid is added. After the sulfite-acid solution has been mixed thoroughly, add the potassium alum with constant stirring.

The print to be toned should first be washed thoroughly. Place it in the bleaching bath, and allow it to remain until only faint traces of the halftones are left and the black of the shadows has disappeared. This operation will take about one minute.

Note: Particular care should be taken *not* to use trays with any *iron* exposed, otherwise blue spots may result.

Rinse *thoroughly* in clean cold water.

Place in toner solution until original detail returns. This will require about 30 seconds. Give the print an immediate and thorough water rinse; then immerse it for five minutes in a hardening bath composed of 1 part of the stock hardener Kodak F-1a and 16 parts of water. The color and gradation of the finished print will not be affected by the use of this hardening bath. Remove the print from the hardener bath and wash for one-half hour in running water.

Sepia Toner (Agfa 221)

This toner is recommended for warm-brown sepia tones.

Solution 1

Hot water (125° F. or 52° C.)	24	oz.	750 c.c.
Potassium ferricyanide	1½	oz. 80 gr. (736 gr.)	50 g
Potassium bromide	144	gr.	10 g
Sodium carbonate, monohydrated	289	gr.	20 g
Water to make	32	oz.	1000 c.c.

Solution 2

Sodium sulfide	1½	oz.	45 g
Water to make	16	oz.	500 c.c.

For use as described below, dilute one part solution 2 with eight parts water. IMPORTANT—Be sure to use sodium sulfide, not sodium sulfite, in compounding the re-developer. Also, use clean trays, free from exposed iron spots, especially with bleaching bath. Otherwise blue spots may form on prints.

Prints should be washed thoroughly and then bleached in solution 1 until the black image is converted to a very light brown color (about 1 minute). Prints should then be washed for 10 to 15 minutes and redeveloped in diluted solution 2.

Redevelopment should be complete in about 1 minute. After redevelopment the prints should be washed for about 30 minutes and then dried. If the toner should leave sediment which results in streaks or finger marks on the surface of the paper, the print should be immersed for a few seconds in a 3 % solution of acetic acid, after which a 10-minute washing is necessary.

Sulfide Toner for Warm Sepia Tones on Lantern Slides
(Kodak T-10)

Solution A

Potassium ferricyanide	1	oz	30	g
Potassium bromide	½	oz.	15	g
Water to make	32	oz.	1000	c.c.

Solution B

Sodium sulfide (not sulfite)	13	gr.	.9	g
Water to make	32	oz.	1000	c.c.

Use three times the quantity if crystalline sodium sulfide is used.

The well washed slide, or film, is thoroughly bleached in solution A, washed for 5 minutes, and immersed in solution B for about 2 minutes until thoroughly toned. The slide should then be washed thoroughly for 10 to 15 minutes before drying. The transparency of the tone is much improved by the addition of a little hypo to the B solution, say, 66 gr. per 32 oz. or 4.5 g per 1000 c.c.

Uranium Toning Bath for Papers (Kodak T-17)

Stock Solution

Uranium nitrate	116 gr.	8 g
Oxalic acid, crystals	58 gr.	4 g
Potassium ferricyanide	58 gr.	4 g
Water to make	32 oz.	1000 c.c.

Dissolve the uranium nitrate in a small volume of water, about 8 oz. (250 c.c.) (about 125° F.) (50° C.). Dissolve the oxalic acid separately in about 8 oz. (250 c.c.) of water and filter; then add the oxalic acid solution to the uranium nitrate solution. Dissolve the potassium ferricyanide separately in about 8 oz. (250 c.c.) of water; if the solution is clear, add it to the uranium nitrate and oxalic acid solution. If not clear, filter before mixing together.

For Use as a Toning Bath (Chocolate to Brick Red). Dilute 1 part of the stock solution with 2 parts of water. As the toning time is increased, the tone changes from chocolate to brown and finally to brick red. The print may be removed at any stage.

Wash until the highlights are clean; this usually requires from 10 to 15 minutes. Prolonged washing should be avoided.

Uranium Toner for Brown to Red Tones on Slides or Films
(Kodak T-9)

Uranium nitrate	35 gr.	2.5 g
Potassium oxalate	35 gr.	2.5 g
Potassium ferricyanide	15 gr.	1 g
Ammonium alum	85 gr.	6 g
Hydrochloric acid, 10 % solution	1¼ dr.	5 c.c.
Water to make	32 oz.	1000 c.c.

To make a 10 % solution, add 1 part of hydrochloric acid to 9 parts of water, slowly with stirring.

Dissolve chemicals in the order given.

The solution should be perfectly clear and pale yellow in color. *It is light sensitive, however, and should be stored in the dark.*

The maximum toning effect is produced in about 10 minutes, the tone passing from brown to red during this time.

After toning, wash for about 10 minutes; the washing should not be prolonged, especially if the water is slightly alkaline, since the toned image is soluble in alkali.

Gold Toner (Agfa 231)

This formula gives a range of red tones to sepia-toned prints, the brilliance of the tone depending on the paper used. Brilliant chalk-red tones are produced on Cykon, while with Indiatone and Cykora darker shades are formed. If desired, deep blue tones may also be obtained with this formula by using black-and-white prints instead of prints that have first been sepia-toned. Unusual effects of mixed tones of blue-black shadows and soft reddish highlights can be produced by using prints which have been partially toned in a hypo alum sepia-toner.

Hot water (125° F. or 52° C.)	24 oz.	750 c.c.
*Ammonium sulfocyanate	3½ oz.	105 g
Gold chloride, 1 % solution	2 oz. fl.	60 c.c.
Water to make	32 oz.	1000 c.c

*May be substituted by:

Sodium sulfocyanate	3¾ oz.	110 g
or		
Potassium sulfocyanate	4½ oz.	135 g

For Red Tones: Prints must first be bleached and toned by sulfide redevelopment method. After washing, place prints in above solution until toning is complete (requires 15-45 minutes). For redder tones one-half the specified amount of sulfocyanate may be used.

For Deep Blue Tones: Omit sepia toning operation and place well-washed black-and-white prints directly in above toning solution.

For Mixed Tones: Prints should be incompletely toned in a hypo alum toner and washed before treatment in above solution.

Iron Toner for Blue Tones on Papers (Kodak T-12)

Ferric ammonium citrate (green scales)	58 gr.	4 g
Oxalic acid, crystals	58 gr.	4 g
Potassium ferricyanide	58 gr.	4 g
Water to make	32 oz.	1000 c.c.

Dissolve each chemical separately in a small volume of water, about 8 oz. (250 c.c.) and filter before mixing together. This solution does not keep well except in brown bottles.

Immerse the well-washed print in the toning bath for 10 to 15 minutes until the desired tone is obtained. Then wash until the highlights are clear.

Iron Blue Toner (Agfa 241)

Producing brilliant blue tones, this formula is suitable for use with Cykora, Brovira and Indiatone papers.

Hot water (125° F. or 52° C.)	16 oz.	500 c.c.
Ferric ammonium citrate	¼ oz.	8 g
Potassium ferricyanide	¼ oz.	8 g
Acetic acid, 28 %	9 oz.	265 c.c.
Water to make	32 oz.	1000 c.c.

Solution should be prepared with distilled water if possible. If enameled iron trays are used, no chips or cracks in the enamel should be present or spots and streaks may appear in the print.

Prints for blue toning should be fixed in plain, non-hardening hypo bath (which should be kept at a temperature of 68° or under to avoid undue swelling). When prints have been fully toned in the above solution, they will be greenish in appearance, but will be easily washed out to a clear blue color when placed in running water.

The depth of the blue toning will vary somewhat with the quality of prints toned in it, light-toned prints generally toning to lighter blues. Some intensification of the print usually occurs in toning; consequently, prints should be slightly lighter than the density desired in the final toned print.

Wash water should be acidified slightly with acetic acid since the blue tone is quite soluble in alkaline solutions and is considerably weakened when wash water is alkaline. Pleasing variations in the tone can be obtained by bathing the washed prints in a ½ % solution (5 g per 1000 c.c.) of borax which produces softer, blue-gray tones, the extent depending on the length of treatment.

Iron Toner for Blue Tones on Slides or Films (Kodak T-11)

Ammonium persulfate	7 gr.	.5 g
Iron and ammonium sulfate (ferric alum)	20 gr.	1.4 g
Oxalic acid	45 gr.	3 g
Potassium ferricyanide	15 gr.	1 g
Ammonium alum	73 gr.	5 g
Hydrochloric acid, 10 % solution	¼ dr.	1 c.c.
Water to make	32 oz.	1000 c.c.

To make a 10 % solution, add 1 part of hydrochloric acid to 9 parts of water, slowly with stirring.

Dissolve chemicals in the order given.

The method of compounding this bath is important. Each of the solid chemicals should be dissolved separately in a small volume of water; the solutions then should be mixed strictly in the order given, and the whole diluted to the required volume. If these instructions are followed, the bath will be pale yellow in color and perfectly clear.

Immerse the slides or films from 2 to 10 minutes at 68° F. (20° C.) until the desired tone is obtained. Wash for 10 to 15 minutes until

the highlights are clear. A slight permanent yellow coloration of the clear gelatin will usually occur, but should be too slight to be detectable on projection. If the highlights are stained blue, then either the slide (film) was fogged during development, or the toning bath was stable or not mixed correctly.

Since the toned image is soluble in alkali, washing should not be carried out for too long a period, especially if the water is slightly alkaline.

BLUE PRINT PAPER, FORMULAE FOR SENSITIZING

1

Solution A

Water	8.5 oz.	50 c.c.
Iron and ammonium citrate	1.7 oz.	10 g

Solution B

Water	8.5 oz.	50 c.c.
Potassium ferricyanide	1.4 oz.	8 g

Filter separately. The solutions, which may be preserved separately for some time, are best kept in the dark. For use, mix, in a dark room or by an artificial light of low intensity, equal quantities of the two solutions.

Any non-absorbent paper may be sensitized by brushing the solution over it rapidly with a soft, wide, flat brush, going over the surface twice, the second coat being applied in a direction at right angles to the first. An alternative method is to lower the paper, beginning at one edge, on to the surface of the solution in a tray and allow it to float for a few seconds. Care must be taken to exclude air bubbles. After sensitizing by either method, the paper should be hung by one edge in a dark room to dry.

2

Blue printing depends to a large extent upon surface of paper. The following formula is recommended as producing clear whites:

Solution 1

Potassium ferricyanide, $K_3Fe(CN)_6$	10 g
Distilled water	100 c.c.

Solution 2

Iron and ammonium citrate (ferric)	30 g
Water	100 c.c.
Gum arabic (gum acacia)	5 g

Equal parts of the above solutions are mixed just before use. The paper to be sensitized may be floated on the surface or the liquid may be applied with a tuft of absorbent cotton using cross strokes to insure an even coating. The sensitized paper must be dried in the dark and should be used within 36 hours.

ULTRAVIOLET SENSITIZATION

Photographic plates can be made sensitive to short-wave ultraviolet light by immersion in a dilute solution of citric acid in 95 % ethyl alcohol (1 % citric acid). (Sodium salicylate may be substituted for the citric acid.) The plate is immersed in the citric acid solution and immediately withdrawn and dried in less than one minute by waving in the air before putting in the holder. After

exposure the plate can be developed without previous washing and without special precautions. The coating of citric acid adheres to the plate so that a number of plates may be treated and stored away for future use. Citric acid has no detrimental action on the emulsion or the developer. The sharpness of the image is not diminished.

FACTORIAL DEVELOPMENT

If the image first appears after immersion in the developer for a certain time, then this period of time multiplied by the "factor" for the particular developer used will give the total time required for full, normal development. The factor for the degree of development desired may well be determined by experiment; the following are suggested:

Amidol, 2 gr. per oz.	18
Glycin	8–12
Hydroquinone	4½–5
Metol	30
Metol-hydroquinone	14
Ortol	10

Pyro, without bromide:

1 gr. per oz.	18
2 gr. per oz.	12
3 gr. per oz.	10
4 gr. per oz.	8
5 gr. per oz.	6

With 1 part bromide to 4 parts pyro:

1 gr. pyro per oz.	9
2 gr. pyro per oz	5
3 gr. pyro per oz	4½
4 gr. pyro per oz.	4

DIAPHRAGM OR STOP NUMBERS

F System	f/2	f/3	f/3.5	f/4	f/4.5	f/5.6	f/6.3
Rel. Exp.	1/16	1/7	1/5		1/3		5/8
U. S. No.				1		2	

F System	f/8	f/11.3	f/16	f/22.6	f/32	f/45	f/64
Rel. Exp.	1	2	4	8	16	32	
U. S. No.	4	8	16	32	64	128	256

PLATE AND FILM SPEEDS

Compiled with the collaboration of
Chas. H. Shipman

It is pertinent to state that there is at present no exact way to indicate plate and film speeds. Also since different manufacturers do not use identical methods in their speed determinations the stated speeds vary among the different makes.

In 1900 two English amateurs, Messrs. Hurter and Driffield, proposed a system of plate speeds based on the assumption that, if a plate is given a series of graded exposures, and developed in a pyro developer free from bromide, a density-log exposure curve may be plotted from which a speed value may be determined which is supposed to be inversely proportional to the exposure required to produce average density. The Scheiner system is based upon the assumption that speeds are inversely proportional to the exposure necessary to produce a just visible image. It will be evident that these two systems cannot be compared exactly. Nor is either system correct since the assumptions upon which they are based are not exactly true. Nevertheless the results obtained by these methods are well within the latitude of the emulsions and will serve well as a starting point for all ordinary work. The exposures may be easily altered after a trial to produce the type of result desired.

Kodak Film Speeds are determined by a system of testing in which the exposure on which the speed number is based is taken as the value of exposure for which the slope at the lower part of the characteristic curve is three-tenths the average slope over an exposure range of 30:1 which is found to be the maximum contrast for the average scene.

There can be no simple relationship between speeds obtained in fundamentally different ways and the conversion table given below can be considered only a rough guide.

Comparison of Speed Systems

H & D American	Din	American Scheiner	Weston Numbers	Kodak Speeds	Relative Exposure
35	1/10	8	0 75	4	32
45	2/10	9	1	5	27
56	3/10	10	1 3	6	21
72	4/10	11	1 5	8	16
91	5/10	12	2	10	13
117	6/10	13	2.5	12	11
150	7/10	14	3	16	8
190	8/10	15	4	20	7
240	9/10	16	5	25	5
308	10/10	17	6	32	4
390	11/10	18	8	40	3 3
500	12/10	19	10	50	2 7
636	13/10	20	12	64	2 0
800	14/10	21	16	80	1 7
1050	15/10	22	20	100	1 3
1300	16/10	23	24	125	1 0
1700	17/10	24	32	160	80
2100	18/10	25	40	200	67
2700	19/10	26	50	250	50
3500	20/10	27	64	320	40
4400	21/10	28	80	400	33
5600	22/10	29	100	500	25
7200	23/10	30	125	640	.20
9100	24/10	31	160	800	17
11600	25/10	32	200	1000	.125
15400	26/10	33	250	1250	.10
20500	27/10	34	320	1600	08
27300	28/10	35	400	2000	0625
31400	29/10	36	500	2500	.05
41700	30/10	37	650	3200	04
54700	31/10	38	800	4000	.03125

PLATE AND FILM SPEEDS (Continued)

Shutter Speeds of Moving Picture Cameras

Ciné Ansco Model B	1/30 sec.
DeVry	1/30
Eastman (all models)	1/30
Filmo all 70's Reg. and 121	1/30
Filmo Golf 70, 71's, 75 and 141	1/40
Filmo 8 mm. (all)	1/30
Keystone Late Models A-3 and A-7	1/40
Keystone Model K-8 No. 872650 and above	1/40
Keystone 16B	1/50
Keystone (other models)	1/50 sec.
Model B Agfa	1/30
Paillard Bolex	1/30
Paragon	1/30
Revere	1/30
Simplex	1/40
Stewart Warner 8	1/50
Stewart Warner Hollywood and 532A	1/40
Sept	1/90
Univex	1/30
Victor (all models)	1/30
Zeiss Kinamo S-10-16	1/30
Zeiss Movikon	1/30*

* When shutter is at 180°.

PLATE AND FILM SPEEDS

The following table presents the most recent figures available at the time of compilation for speed numbers in American Scheiner values and as given for two widely used exposure meters. Values are given for daylight and for tungsten or photoflood illumination.

Speed values given can be considered only as a general guide. Values given by different authorities differ somewhat according to the characteristics of the negatives considered satisfactory. In general the speeds given are for full exposure. The Weston and G. E. figures may be increased by about 50 per cent or the Scheiner values by about two units if a thinner negative is desired.

Many types of material no longer available are included in the table for purposes of comparison.

PLATE AND FILM SPEEDS (Continued)

Maker and kind	American Scheiner		Weston		General Electric	
	Daylight	Tungsten or Photoflood	Daylight	Tungsten or Photoflood	Daylight	Tungsten or Photoflood
CINÉ FILM 8 mm						
Ansco						
Hypan Reversible.. ...	23	21	24	16	32	24
Triple S. Pan..........	29	27	100	64	125	100
Eastman						
Ciné Kodak Pan. Reversible........	18	17	8	6	12	8
Super X Pan. Reversible	24	23	32	24	48	32
CINÉ FILM 16 mm						
Ansco						
F. G. Plenachromatic Reversible.	20	...	12	.....	16	.....
Finopan Negative....	23	21	24	16	32	24
Hypan Reversible....	24	23	32	24	48	32
Panchromatic Reversible	21	20	16	12	24	16
Superpan Supreme Negative	27	25	64	40	100	64
Triple S Pan Reversible..	29	27	100	64	125	100
Dupont						
Regular Pan. Reversible.	20	18	12	8	16	12
Superior Pan. Neg. . .	24	22	32	20	48	24
Eastman						
Ciné Kodak Safety... ..	20	18	12	8	16	12
Super X Pan Safety... .	24	23	32	24	48	32
Super XX Pan Safety ..	29	28	100	80	125	100
Gevaert						
F. G. Pan. Reversible	20	18	12	8	16	12
Ortho	21	17	16	6	24	8
Pan. Super Reversible...	23	21	24	16	32	24
MINIATURE AND 35 mm						
Ansco						
F. G. Plenachrome ...	23	21	24	16	32	12
F. G. Reversible Superpan...	23	21	24	16	32	24
Finopan.	23T	21T	24T	16T	32	24
Minipan...	15*	16*	4*	5*	6*	7*
Superpan.	26	24	50	32	64	48
Ultra Speed Pan.. .. .	29	27	100	64	125	100
Dupont						
Superior Pan. 2.........	26	24	50	32	64	48
Microcopy.. . .	..	15*	....	2 5*	... .	4*
Eastman						
Direct Positive. .	26	24	50	32	64	48
Microfile.	15*	13*	4*	2.5*	6*	4*
Panatomic X . .	23	21	24	16	32	24
Plus X ..	26	24	50	32	64	48
Super XX........ .	29	27	100	64	125	100
Gevaert						
Express Superchrome...	23	21	24	16	32	24
Panchromosa....... .	20	18	12	8	16	12
Panchromosa Micrograin	20	18	12	8	16	12
ROLL FILM AND FILM PACK						
Ansco						
Finopan......... .	23	21	24	16	32	24
Plenachrome. . . .	26	24	50	32	64	48
Standard........... .	23	18	24	8	32	12
Super Plenachrome. .	26	24	50	32	64	32
Superpan Press... .	29	27	100	64	125	100
Superpan Supreme	26	24	50	32	64	48

PLATE AND FILM SPEEDS (Continued)

Maker and kind	American Scheiner		Weston		General Electric	
	Daylight	Tungsten or Photoflood	Daylight	Tungsten or Photoflood	Daylight	Tungsten or Photoflood
ROLL FILM AND FILM PACK (Continued)						
Eastman						
Panatomic X...... .	23	21	24	16	32	24
Plus X . .	26	24	50	32	64	48
Super Ortho Press .	29	24	100	32	125	48
Super XX	29	27	100	64	125	100
Verichrome....... . .	26	24	50	32	64	48
Gevaert						
Superchrome.......	23	18	24	8	32	12
Panchromosa....... .	23	21	24	16	32	24
CUT FILM						
Ansco						
Commercial........ .	20	15	12	4	16	6
Commercial Ortho.	20	18	12	8	16	12
Commercial Pan.. .	20	18	12	8	16	12
Isopan	26	24	50	32	64	48
Portrait ..	20	18	12	8	16	12
Process .	20	15	12	4	16	8
S. S. Plena . . .	26	21	50	16	64	24
Super Plenachrome Press	29	24	100	32	125	48
Superpan Portrait .	26	24	50	32	64	48
Superpan Press .	29	27	100	64	125	100
Triple S. Pan....	32	30	200	125	250	200
Triple S. Ortho.	29	27	100	64	125	100
Defender						
Arrow Pan	29	27	100	64	125	100
Commercial	20	15	12	4	16	6
F. G. Pan	23	21	24	16	32	12
Ortho 7 . .	29	27	100	64	125	100
Pentagon .	23	21	24	16	32	16
Portrait. ...	23	18	24	8	32	12
Portrait H. G. S	26	21	50	16	48	24
Process .	20	15	12	4	16	6
Process Pan .	20	18	12	8	24	12
X. F. Ortho. .	26	21	50	16	64	24
X. F. Ortho Press.	26	21	50	16	64	24
X. F. Pan..... .	26	24	50	32	64	48
X. F. Pan Press	26	24	50	32	64	48
Eastman						
Commercial....	23	15	24	4	32	6
Commercial Matte	23	15	24	4	32	6
Commercial Ortho	23	18	24	8	48	12
Commercial Pan.	23	20	24†	12†	40†	20†
Contrast process Ortho	.	18	...	8	. .	12
Ortho X ..	29	27	100	64	125	64
Panatomic X	23	21	24	16	32	24
Pan Press.....	25	24	40†	32†	64†	50†
Par Speed Portrait	24	19	32†	10†	50†	16†
Portrait Pan......	26	24	50	32	64	48
Process Pan. .. .	21	19	16†	10†	24†	16†
S. S. Ortho Portrait	26	21	50	16	64	32
S. S. Pan . .	26	24	50	32	64	48
Super Ortho Press ..	29	24	100	32	100	48
Super Pan Press, Type B	29	27	100	64	125	100
Super Panchro Press, Sports type	32	31	200	160	250	225
Super XX .	29	27	100	64	125	100
Tri-X Panchromatic .	32	30	200	125	250	200

Maker and kind	American Scheiner		Weston		General Electric	
	Daylight	Tungsten or Photoflood	Daylight	Tungsten or Photoflood	Daylight	Tungsten or Photoflood
CUT FILM (Continued)						
Gevaert						
Commercial.........	20	15	12	4	16	6
Commercial Ortho...	20	18	12	8	16	12
Studio High Speed..	23	21	24	16	32	24
Studio Ultra Panchro.	20	18	12	8	16	12
Superchrome.....	23	18	24	8	32	12
Hammer						
Commercial Pan......	20	18	12	8	16	12
Medium Commercial...	20	15	12	4	16	6
Medium Commercial Ortho	20	18	12	8	16	12
Portrait Ortho....	26	24	50	32	64	48
Safety......	17	12	6	2	8	3
Slow	14	9	3	1	4	1.5
Slow Ortho........	14	9	3	1	4	1.5
Special Super Process	17	12	6	2	8	3
Super Ortho Press..	32	15	24	4	32	6
True Tone Pan....	32	18	24	8	32	12
PLATES						
Defender						
Seed L. NH.......	20	18	12	8	16	12
Seed L. Ortho...	20	18	12	8	16	12
Seed 23.	17	12	6	2	8	3
Seed 26 X.........	20	18	12	8	16	12
Seed 27	23	18	24	8	32	12
Standard Orthonon	20	18	12	8	16	12
Stanley Ex. Imp...	20	18	12	8	16	12
Stanley Reg..........	20	18	12	8	16	12
Eastman						
Commercial.........	20	18	12	8	16	12
D. C. Ortho Plate.	22	17	20†	6†	32	10
Panatomic X.....	23	21	24	16	32	24
Polychrome..... .	23	18	24	8	40†	12
Postcard.....	22	19	12	4	32†	10†
Process.	17	9	6	1	8	1.5
S. C. Ortho Plate...	23	18	24	8	40†	12
Super Ortho Press. .	29	27	100	64	125	100
Super Panchro Press..	29	27	100	64	125	100
Tri-X Pan Type B.....	29	27	100	64	125	100
Tri-X Pan Type B, Matte	29	27	100	64	125	100
Universal...	23	17†	24	6†	40†	10†
Wratten and Wainwright M............... .	...	23	....	24	....	32
W & W Metallographic..	...	20	....	12	....	16
Wratten and Wainwright Pan...............	20	18	12	8	20	12
Wratten Process Pan....	...	23	....	24	...	32
W & W Tri Color.....	25	23	40†	24†	64†	40†
"33"............... .	20	15	12	4	24	6
"33" Matte.......... .	20	15	12	4	16	6
"40"....	23	18	24	8	32	12
"50".........	23	18	24	8	32	12
Gevaert						
Sensima Ortho.......	20	15	12	4	16	6
Super Chromosa...	17	15	6	4	8	6
Ultra Panchro	32	21	24	16	32	24

PLATE AND FILM SPEEDS (Continued)

Maker and kind	American Scheiner		Weston		General Electric	
	Daylight	Tungsten or Photoflood	Daylight	Tungsten or Photoflood	Daylight	Tungsten or Photoflood
PLATES (Continued)						
Hammer						
Commercial Pan ..	17	15	6	4	8	6
Contrast Pan. ...	17	15	6	4	8	6
Extra Fast.	20	18	24	8	16	12
Medium Commercial...	20	12	12	2	16	3
Medium Commercial Ortho .	20	15	12	4	16	6
Portrait Ortho....			24	16	32	24
Process . . .	17	12	6	2	8	3
Process Pan .. .	17	12	6	2	8	3
Slow	14	9	3	1	4	1 5
Slow Ortho.........	14	9	3	1	4	1.5
Soft Gradation Pan			12	4	16	6
Special Process. . .	17	12	6	2	8	3
Specials.	23	18	24	8	32	12
COLOR PLATES AND FILMS						
Ansco						
Reversible 16 mm. .	18	20	8	12	12	18
Reversible 35 mm	18	19	8	10	12	15
Reversible sheet film	18	18	8	8	12	12
Defender						
Dupac......	17	20	6	12	8[1]	16
Tripac......	11	14	1 5	3	2[1]	5
Dufay Color, Roll Film	18	14[1]	8	3[1]	12	4[1]
Dufay Color, Cut Film						
Daylight type[1]	19	14	10	3	14	4
Photoflood type[1] .	15	15	4	4	5	[illegible]
Eastman						
Kodachrome, Roll film, Regular (daylight)	18	14[1]	8	3[1]	12	5[1]
Kodachrome, Roll film Type A..... ..	18[1]	20	8[1]	12	12[1]	20
Kodachrome Professional Cut film, daylight	19	...	10	.....	15	
Kodachrome, professional Cut Film Type B..	15[1]	17	4[1]	6	6[1]	10
Kodacolor........ .	22		20	..	32	

* Read meter on white surface placed over copy work.
† Value given by manufacturer
T-Tentative value subject to further test.
[1] Use filter recommended by the manufacturer. (Haze filter requires no change in film value.)

WIRE TABLES

COMPARISON OF WIRE GAUGES

Diameter of Wire in Inches

Gauge No.	Brown & Sharpe	Birmingham or Stubs'.	Washburn & Moen	Imperial or Brit. Std.	Stubs' Steel	U. S. Std. plate
00000000	. .			. . . . .	.	
0000000				.500	.	. . . .
000000				464		46875
00000	.			432		4375
0000	4600	454	3938	400		40625
000	4096	425	3625	372		375
00	3648	380	3310	.348		34375
0	3249	340	3065	.324	.	3125
1	2893	300	2830	.300	.227	28125
2	2576	284	2625	.276	219	265625
3	2294	.259	2437	252	.212	25
4	2043	238	2253	232	207	234375
5	1819	220	2070	.212	204	21875
6	.1620	203	.1920	192	201	203125
7	.1443	.180	1770	.176	199	1875
8	.1285	165	.1620	.160	.197	171875
9	.1144	.148	1483	.144	.194	15625
10	.1019	.134	.1350	.128	.191	140625
11	.09074	.120	1205	.116	188	125
12	.08081	.109	.1055	.104	185	109375
13	.07196	.095	.0915	.092	.182	09375
14	.06408	.083	.0800	.080	.180	.078125
15	.05707	.072	.0720	.072	.178	0703125
16	.05082	.065	.0625	.064	.175	0625
17	.04526	.058	.0540	056	.172	.05625
18	.04030	.049	0475	.048	.168	.05
19	.03589	.042	.0410	.040	.164	.04375
20	.03196	.035	.0348	.036	.161	0375
21	.02846	.032	.0318	.032	.157	.034375
22	.02535	.028	.0286	.028	.155	.03125
23	.02257	.025	.0258	.024	.153	.028125
24	.02010	.022	.0230	.022	151	025

COMPARISON OF WIRE GAUGES (Continued)

Diameter of Wire in Inches

Gauge No.	Brown & Sharpe	Birmingham or Stubs'.	Washburn & Moen	Imperial or Brit. Std.	Stubs' steel	U. S. Std. plate
25	0 01790	0.020	0 0204	0.020	0 148	0 021875
26	0 01594	0.018	0 0181	0 018	0 146	0.01875
27	0 01419	0.016	0.0173	0 0164	0 143	0 0171875
28	0 01264	0.014	0.0162	0 0149	0 139	0.015625
29	0 01126	0.013	0.0150	0 0136	0 134	0 0140625
30	0 01003	0 012	0.0140	0 0124	0 127	0 0125
31	0 008928	0.010	0 0132	0 0116	0.120	0 0109375
32	0 007950	0 009	0.0128	0.0108	0 115	0 01015625
33	0 007080	0 008	0 0118	0 0100	0.112	0 009375
34	0 006304	0.007	0.0104	0 0092	0.110	0 00859375
35	0 005614	0.005	0.0095	0.0084	0.108	0.0078125
36	0 005000	0 004	0.0090	0 0076	0 106	0 00703125
37	0 004453	. .	0.0085	0.0068	0 103	0 006640625
38	0 003965	.	0 0080	0 0060	0.101	0.00625
39	0 003531	. .	0.0075	0 0052	0 099	.
40	0 003145		0.0070	0 0048	0.097	
41	. .	.	0.0066	0 0044	0.095	
42		.	0.0062	0.0040	0 092	.
43			0.0060	0.0036	0 088	. .
44	.	.	0.0058	0 0032	0 085	
45	.	.	0.0055	0 0028	0.081	
46			0 0052	0 0024	0.079	.
47	. .		0 0050	0 0020	0 077	
48		.	0.0048	0.0016	0.075	
49		.	0.0046	0 0012	0.072	
50	. .		0.0044	0.0010	0.069	

COMPARISON OF WIRE GAUGES (Continued)

Diameter of Wire in Centimeters

Gauge No.	Brown & Sharpe	Birmingham or Stubs.	Washburn & Moen	Imperial or Brit. Std.	Stubs' steel	U. S. Std. plate
00000000	. . .		. . .	. . .	. . . . . .	. . .
0000000	.	.	1.245	1.27	.	1.27
000000		.	1.172	1.18	. .	1.191
00000		. . . . .	1.093	1.10	. .	1.111
0000	1.168	1.15	1.000	1.02	. . .	1.032
000	1.040	1.08	0.9208	0.945		0.9525
00	0.9266	0.965	0.8407	0.884	. . .	0.8731
0	0.8252	0.864	0.7785	0.823	. . . . . .	0.7938
1	0.7348	0.762	0.7188	0.762	0.577	0.7144
2	0.6543	0.721	0.6668	0.701	0.556	0.6747
3	0.5827	0.658	0.6190	0.640	0.538	0.6350
4	0.5189	0.605	0.5723	0.589	0.526	0.5953
5	0.4620	0.559	0.5258	0.538	0.518	0.5556
6	0.4115	0.516	0.4877	0.488	0.511	0.5159
7	0.3665	0.457	0.4496	0.447	0.505	0.4763
8	0.3264	0.419	0.4115	0.406	0.500	0.4366
9	0.2906	0.376	0.3767	0.366	0.493	0.3969
10	0.2588	0.340	0.3429	0.325	0.485	0.3572
11	0.2305	0.305	0.3061	0.295	0.478	0.3175
12	0.2053	0.277	0.2680	0.264	0.470	0.2778
13	0.1828	0.241	0.232	0.234	0.462	0.2381
14	0.1628	0.211	0.203	0.203	0.457	0.1984
15	0.1450	0.183	0.183	0.183	0.452	0.1786
16	0.1291	0.165	0.159	0.163	0.445	0.1588
17	0.1150	0.147	0.137	0.142	0.437	0.1429
18	0.1024	0.124	0.121	0.122	0.427	0.1270
19	0.09116	0.107	0.104	0.102	0.417	0.1111
20	0.08118	0.089	0.0884	0.0914	0.409	0.09525
21	0.07229	0.081	0.0808	0.0813	0.399	0.08731
22	0.06439	0.071	0.0726	0.0711	0.394	0.07938
23	0.05733	0.064	0.0655	0.0610	0.389	0.07144
24	0.05105	0.056	0.0584	0.0559	0.384	0.06350

COMPARISON OF WIRE GAUGES (Continued)

DIAMETER OF WIRE IN CENTIMETERS

Gauge No.	Brown & Sharpe	Birmingham or Stubs'.	Washburn & Moen	Imperial or Brit. Std.	Stubs' steel	U. S. Std. plate
25	0.04547	0.051	0.0518	0 0508	0.376	0 05556
26	0.04049	0.046	0 0460	0 0457	0.371	0 04763
27	0.03604	0.041	0.0439	0 0417	0.363	0 04366
28	0.03211	0.036	0.0411	0.0378	0.353	0.03969
29	0.02860	0.033	0.0381	0.0345	0.340	0.03572
30	0.02548	0.030	0.0356	0.0315	0.323	0.03175
31	0.02268	0 025	0 0335	0 0295	0.305	0 02778
32	0 02019	0.023	0.0325	0.0274	0.292	0 02580
33	0.01798	0 020	0.0300	0.0254	0.284	0 02381
34	0.01601	0.018	0.0264	0.0234	0.279	0.02183
35	0.01426	0.013	0.024	0 0213	0.274	0.01984
36	0 01270	0 010	0.023	0.0193	0.269	0 01786
37	0 01131	...	0.022	0.0173	0.262	0 01687
38	0.01007		0 020	0.0152	0 257	0 01588
39	0.008969	.	0.019	0.0132	0.251	.
40	0 007988		0.018	0.0122	0 246	
41	.		0 017	0.0112	0.241	
42	...		0 016	0.0102	0.234	
43	. .	.	0.015	0 0091	0 224	
44	....	. .	0.015	0.0081	0.216	
45	....	..	0 014	0.0071	0 206	
46	. .		0.013	0 0061	0.201	
47	. . .		0 013	0.0051	0 196	.
48	. .		0.012	0.0041	0.191	
49	.....		0.012	0.0030	0.183	.
50	....	. .	0.011	0 0025	0.175	

TWIST DRILL AND STEEL WIRE GAUGE

Inches

No.	Size	No.	Size	No.	Size	No.	Size	No.	Size
1	0 2280	17	0.1730	33	0.1130	49	0.0730	65	0.0350
2	0.2210	18	0.1695	34	0.1110	50	0.0700	66	0.0330
3	0.2130	19	0.1660	35	0.1100	51	0.0670	67	0.0320
4	0 2090	20	0.1610	36	0.1065	52	0.0635	68	0.0310
5	0 2055	21	0 1590	37	0.1040	53	0.0595	69	0.02925
6	0 2040	22	0.1570	38	0.1015	54	0.0550	70	0 0280
7	0.2010	23	0.1540	39	0.0995	55	0.0520	71	0.0260
8	0 1990	24	0.1520	40	0.0980	56	0.0465	72	0.0250
9	0.1960	25	0.1495	41	0.0960	57	0.0430	73	0.0240
10	0.1935	26	0.1470	42	0.0935	58	0.0420	74	0.0225
11	0 1910	27	0.1440	43	0.0890	59	0.0410	75	0.0210
12	0.1890	28	0.1405	44	0.0860	60	0.0400	76	0.0200
13	0.1850	29	0.1360	45	0.0820	61	0.0390	77	0.0180
14	0.1820	30	0.1285	46	0.0810	62	0.0380	78	0.0160
15	0.1800	31	0 1200	47	0.0785	63	0.0370	79	0.0145
16	0.1770	32	0 1160	48	0.0760	64	0.0360	80	0.0135

Centimeters

No.	Size	No.	Size	No.	Size	No.	Size	No.	Size
1	0.5791	17	0 4394	33	0.2870	49	0.1854	65	0.0889
2	0.5613	18	0.4305	34	0.2819	50	0.1778	66	0 0838
3	0.5410	19	0.4216	35	0.2794	51	0.1702	67	0.0813
4	0 5309	20	0.4089	36	0.2705	52	0.1613	68	0.0787
5	0.5220	21	0.4039	37	0.2642	53	0.1511	69	0.0743
6	0.5182	22	0.3988	38	0.2578	54	0.1397	70	0 0711
7	0.5105	23	0.3912	39	0.2527	55	0.1321	71	0.0660
8	0.5055	24	0.3861	40	0.2489	56	0.1181	72	0.0635
9	0 4978	25	0.3797	41	0.2438	57	0.1092	73	0.0610
10	0.4915	26	0.3734	42	0.2375	58	0.1067	74	0.0572
11	0.4851	27	0.3658	43	0.2261	59	0.1041	75	0.0533
12	0.4801	28	0.3569	44	0.2184	60	0.1016	76	0.0508
13	0 4699	29	0.3454	45	0.2083	61	0.0991	77	0 0457
14	0.4623	30	0.3264	46	0.2057	62	0.0965	78	0.0406
15	0.4572	31	0.3048	47	0.1994	63	0.0940	79	0.0368
16	0.4496	32	0.2946	48	0.1930	64	0.0914	80	0.0343

DIMENSIONS OF WIRE

Stubs' Gauge

Giving the diameter and cross-section in English and metric system for the Birmingham or Stubs' gauge

Gauge No	Diameter in in	Section in sq in	Diameter in cm	Section in sq cm
0000	0 454	0 16188	1 1532	1 0444
000	425	14186	1 0795	0 9152
00	380	11341	0 9652	7317
0	0 340	0 09079	0 8636	0 5858
1	300	07069	7620	4560
2	284	06335	7214	4087
3	259	05269	6579	3399
4	238	04449	6045	2870
5	0 220	0 03801	0 5588	0 2452
6	203	03237	5156	20881
7	180	02545	4572	16147
8	.165	02138	4191	13795
9	148	01720	3759	11099
10	0 134	0 01410	0 3404	0 09098
11	120	011310	3048	07297
12	109	009331	2769	06160
13	095	007088	2413	04573
14	083	005411	2108	03491
15	0 072	0 004072	0 1829	0 02627
16	065	0033183	16510	021409
17	058	0026421	14732	017046
18	049	0018857	12446	012166
19	042	0013854	10668	008938
20	0 035	0 0009621	0 08890	0 006207
21	032	0008042	08128	005189
22	028	0006158	07112	003973
23	025	0004909	06350	003167
24	022	0003801	05588	002452
25	0 020	0 0003142	0 05080	0 002027
26	018	0002545	04572	0016417
27	016	0002011	04064	0012972
28	014	0001539	03556	0009932
29	013	0001327	03302	0008563
30	0 012	0 0001181	0 03048	0 0007297
31	010	00007854	02540	0005067
32	009	00006362	02286	0004104
33	008	00005027	02032	0003243
34	007	00003848	01778	0002483
35	0 005	0 00001963	0 01270	0 0001267
36	004	00001257	01016	0000811

DIMENSIONS OF WIRE (Continued)

British Standard Gauge

Giving the diameter and cross-section in English and metric system for the British Standard Gauge

Gauge No.	Diameter in in.	Section in sq in	Diameter in cm	Section in sq. cm
0000000	0 500	0 1963	1 2700	1 267
000000	.464	.1691	1 1786	1.091
00000	0 432	0 1466	1 0973	0 9456
0000	400	1257	1 0160	.8107
000	372	.1087	0 9449	.7012
00	.348	0951	8839	6136
0	0 324	0 0825	0 8230	0 5319
1	300	07069	7620	4560
2	.276	05983	.7010	3858
3	.252	.04988	6401	.3218
4	.232	04227	.5893	.2727
5	0 212	0 03530	0 5385	0 2277
6	192	02895	4877	18679
7	176	02433	4470	15696
8	.160	02010	4064	12973
9	144	01629	3658	10507
10	0 128	0 01287	0 3251	0.08302
11	116	010568	2946	06818
12	.104	008495	2642	05480
13	092	006648	2337	04289
14	080	005027	2032	03243
15	0 072	0 004071	0.1829	0 02627
16	064	003217	16256	020755
17	.056	002463	14224	015890
18	048	001810	12192	011675
19	040	.001257	10160	008107
20	0 036	0 001018	0 09144	0 006567
21	.032	0008042	08128	005189
22	028	0006158	07112	003973
23	024	0004524	06096	002922
24	022	0003801	05588	002452
25	0 020	0 0003142	0 05080	0 002027
26	0180	0002545	04572	0016417
27	0164	0002112	04166	0013628
28	0148	0001728	03759	0011099
29	.0136	0001453	03454	0009363
30	0 0124	0 0001208	0 03150	0 0007791
31	.0116	00010568	02946	0006818
32	.0108	00009161	02743	.0005910
33	.0100	00007854	02540	0005067
34	.0092	00006648	02337	0004289
35	0 0084	0 00005542	0 02134	0 0003575
36	0076	00004536	01930	0002927
37	0068	00003632	01727	.0002343
38	0060	00002827	01524	0001824
39	0052	00002124	01321	0001370
40	0 0048	0 00001810	0 01219	0 0001167
41	0044	00001521	.01118	.0000982
42	0040	00001257	01016	.0000811
43	.0036	00001018	.00914	.0000656
44	0032	00000804	.00813	.0000519
45	0 0028	0 00000616	0 00711	0.0000397
46	.0024	.00000452	00610	.0000212
47	0020	.00000314	.00508	.0000203
48	0016	.00000201	00406	.0000129
49	.0012	.00000113	.00305	.0000073
50	0 0010	0.00000079	0.00254	0 0000051

PLATINUM WIRE

Mass in Grams per Foot

B. &. S. Gauge	Diameter, inches	Mass, g per ft	B & S Gauge	Diameter, inches	Mass, g per ft
10	.1019	37 5	23	02257	1 8
11	09074	28 0	24	02010	1 4
12	.08081	22 0	25	01790	1 1
13	.07196	17 5	26	01594	0 9
14	06408	14 0	27	01420	0 7
15	05707	11 0	28	01264	0 6
16	05082	9 0	29	01126	0.45
17	04526	7 0	30	01003	0 35
18	04030	5 7	31	008928	0 28
19	03589	4 4	32	007950	0 22
20	03196	3 4	33	007080	0.17
21	02846	2 9	34	006305	0 15
22	02535	2 3	35	005615	0 11

ALLOWABLE CARRYING CAPACITIES OF COPPER WIRE

(Regulations of the National Board of Fire Underwriters)

Size, B. & S Gauge	Diameter, mils	Cross section, circular mils	Amperes	
			Rubber insulation	Other insulation
0000	460 0	211600	225	325
000	409 6	167800	175	275
00	364 8	133100	150	225
0	324 9	105500	125	200
1	289 3	83690	100	150
2	257 6	66370	90	125
4	204 3	41740	70	90
6	162 0	26250	50	70
8	128 5	16510	35	50
10	101 9	10380	25	30
12	80 81	6530	20	25
14	64 08	4107	15	20
16	50 82	2583	6	10
18	40 30	1624	3	5

WIRE TABLE, STANDARD ANNEALED COPPER
American Wire Gauge (B. & S.) English Units

Gauge No.	Diameter in mils at 20°C	Cross section at 20°C		Ohms per 1000 feet*			
		Circular mils	Sq. inches	0°C (32°F)	20°C (68°F)	50°C (122°F)	75°C (167°F)
0000	460 0	211600	0 1662	0.04516	0 04901	0 05479	0 05961
000	409 6	167800	.1318	.05695	.06180	06909	07516
00	364 8	133100	1045	.07181	.07793	08712	09478
0	324 9	105500	08289	.09055	.09827	.1099	1195
1	289 3	83690	06573	.1142	1239	.1385	1507
2	257 6	66370	05213	.1440	.1563	.1747	.1900
3	229 4	52640	04134	1816	1970	2203	.2396
4	204 3	41740	03278	2289	2485	.2778	.3022
5	181 9	33100	02600	2887	3133	.3502	3810
6	162 0	26250	02062	3640	.3951	.4416	.4805
7	144 3	20820	01635	4590	4982	.5569	6059
8	128 5	16510	01297	5788	6282	7023	.7640
9	114 4	13090	01028	.7299	.7921	8855	.9633
10	101 9	10380	008155	9203	9989	1.117	1 215
11	90 74	8234	006467	1 161	1 260	1 408	1.532
12	80 81	6530	005129	1 463	1 588	1.775	1 931
13	71 96	5178	004067	1 845	2 003	2 239	2 436
14	64 08	4107	003225	2 327	2 525	2 823	3 071
15	57 07	3257	002558	2 934	3 184	3 560	3 873
16	50 82	2583	002028	3 700	4 016	4 489	4 884
17	45 26	2048	001609	4 666	5 064	5 660	6.158
18	40 30	1624	001276	5 883	6 385	7 138	7 765
19	35 89	1288	001012	7 418	8 051	9 001	9 792
20	31 96	1022	0008023	9 355	10 15	11 35	12.35
21	28 45	810 1	0006363	11 80	12 80	14 31	15 57
22	25 35	642 4	0005046	14 87	16 14	18.05	19.63
23	22 57	509 5	0004002	18 76	20 36	22 76	24 76
24	20 10	404 0	0003173	23.65	25 67	28 70	31 22
25	17 90	320 4	0002517	29 82	32 37	36 18	39 36
26	15 94	254 1	0001996	37 61	40 81	45 63	49.64
27	14 20	201 5	0001583	47 42	51 47	57 53	62 59
28	12 64	159 8	0001255	59 80	64 90	72 55	78 93
29	11 26	126 7	00009953	75.40	81.83	91.48	99 52
30	10 03	100 5	00007894	95 08	103 2	115 4	125 5
31	8 928	79 70	00006260	119 9	130.1	145 5	158 2
32	7 950	63 21	00004964	151 2	164 1	183 4	199 5
33	7 080	50 13	00003937	190 6	206 9	231 3	251 6
34	6.305	39 75	.00003122	240 4	260.9	291 7	317 3
35	5 615	31 52	00002476	303 1	329 0	367 8	400 1
36	5 000	25 00	00001964	382 2	414 8	463 7	504.5
37	4 453	19 83	00001557	482 0	523 1	584 8	636.2
38	3 965	15 72	00001235	607.8	659 6	737 4	802 2
39	3 531	12 47	000009793	766.4	831 8	929.8	1012
40	3 145	9 888	000007766	966 5	1049	1173	1276

* Resistance at the stated temperatures of a wire whose length is 1000 feet at 20°C.

WIRE TABLE, STANDARD ANNEALED COPPER
(Continued)

American Wire Gauge (B. & S.) English Units (Continued)

Gauge No.	Pounds per 1000 feet	Feet per pound	Feet per ohm*			
			0°C (32°F)	20°C (68°F)	50°C (122°F)	75°C (167°F)
0000	640 5	1 561	22140	20400	18250	16780
000	507 9	1 968	17560	16180	14470	13300
00	402 8	2 482	13930	12830	11480	10550
0	319 5	3 130	11040	10180	9103	8367
1	253 3	3 947	8758	8070	7219	6636
2	200 9	4 977	6946	6400	5725	5262
3	159 3	6 276	5508	5075	4540	4173
4	126 4	7 914	4368	4025	3600	3309
5	100 2	9 980	3464	3192	2855	2625
6	79 46	12 58	2747	2531	2264	2081
7	63 02	15 87	2179	2007	1796	1651
8	49 98	20 01	1728	1592	1424	1309
9	39 63	25 23	1370	1262	1129	1038
10	31 43	31 82	1087	1001	895 6	823 2
11	24 92	40 12	861 7	794 0	710 2	652 8
12	19 77	50 59	683 3	629 6	563 2	517 7
13	15 68	63 80	541 9	499 3	446 7	410 6
14	12 43	80 44	429 8	396 0	354 2	325 6
15	9 858	101 4	340 8	314 0	280 9	258 2
16	7 818	127 9	270 3	249 0	222 8	204 8
17	6 200	161 3	214 3	197 5	176 7	162 4
18	4 917	203 4	170 0	156 6	140 1	128 8
19	3 899	256 5	134 8	124 2	111 1	102 1
20	3 092	323 4	106 9	98 50	88 11	80 99
21	2 452	407 8	84 78	78 11	69 87	64 23
22	1 945	514 2	67 23	61 95	55 41	50 94
23	1 542	648 4	53 32	49 13	43 94	40 39
24	1 223	817 7	42 28	38 96	34 85	32 03
25	0 9699	1031	33 53	30 90	27 64	25 40
26	7692	1300	26 59	24 50	21 92	20 15
27	6100	1639	21 09	19 43	17 38	15 98
28	4837	2067	16 72	15 41	13 78	12 67
29	3836	2607	13 26	12 22	10 93	10 05
30	3042	3287	10 52	9 691	8 669	7 968
31	2413	4145	8 341	7 685	6 875	6 319
32	1913	5227	6 614	6 095	5 452	5 011
33	1517	6591	5 245	4 833	4 323	3 974
34	1203	8310	4 160	3 833	3 429	3 152
35	09542	10480	3 299	3 040	2 719	2 499
36	07568	13210	2 616	2 411	2 156	1 982
37	06001	16660	2 075	1 912	1 710	1 572
38	04759	21010	1 645	1 516	1 356	1 247
39	03774	26500	1 305	1 202	1 075	0 9886
40	.02993	33410	1 035	0 9534	0 8529	7840

* Length at 20°C of a wire whose resistance is 1 ohm at the stated temperatures.

WIRE TABLE, STANDARD ANNEALED COPPER (Continued)

American Wire Gauge (B. & S.) English Units (Continued)

Gauge No.	Diameter in mils at 20°C	Ohms per pound			Lbs per ohm
		0°C (32°F)	20°C (68°F)	50°C (122°F)	20°C (68°F)
0000	460 0	0 00007051	0 00007652	0 00008554	13070
000	409 6	0001121	0001217	0001360	8219
00	364 8	0001783	0001935	0002163	5169
0	324 9	0002835	0003076	0003439	3251
1	289 3	0004507	0004891	0005468	2044
2	257 6	0007166	0007778	0008695	1286
3	229 4	001140	.001237	.001383	808 6
4	204 3	.001812	001966	002198	508 5
5	181 9	002881	003127	003495	319 8
6	162 0	004581	004972	005558	201 1
7	144 3	007284	007905	008838	126 5
8	128 5	01158	.01257	01405	79 55
9	114 4	01842	01999	02234	50 03
10	101 9	02928	03178	03553	31 47
11	90 74	04656	.05053	.05649	19 79
12	80 81	07404	08035	08983	12 45
13	71 96	1177	.1278	1428	7 827
14	64 08	1872	2032	2271	4 922
15	57 07	2976	.3230	3611	3 096
16	50 82	4733	.5136	5742	1 947
17	45 26	.7525	.8167	9130	1 224
18	40 30	1 197	1.299	1 452	0 7700
19	35 89	1 903	2 065	2 308	4843
20	31 96	3 025	3 283	3 670	3046
21	28 46	4 810	5 221	5 836	1915
22	25 35	7 649	8 301	9 280	1205
23	22 57	12 16	13 20	14 76	07576
24	20 10	19 34	20 99	23 46	04765
25	17 90	30 75	33 37	37 31	02997
26	15 94	48 89	53 06	59 32	01885
27	14 20	77 74	84 37	94 32	01185
28	12 64	123 6	134 2	150 0	007454
29	11 26	196 6	213 3	238 5	004688
30	10 03	312 5	339 2	379 2	002948
31	8 928	497 0	539 3	602 9	001854
32	7 950	790 2	857 6	958 7	.001166
33	7 080	1256	1364	1524	0007333
34	6 305	1998	2168	2424	.0004612
35	5 615	3177	3448	3854	0002901
36	5 000	5051	5482	6128	.0001824
37	4 453	8032	8717	9744	0001147
38	3 965	12770	13860	15490	00007215
39	3 531	20310	22040	24640	00004538
40	3 145	32290	35040	39170	00002854

WIRE TABLE, STANDARD ANNEALED COPPER (Continued)

American Wire Gauge (B. & S.) Metric Units (Continued)

Gauge No.	Diameter in mm at 20°C	Cross section in mm² at 20°C	Ohms per kilometer* 0°C	20°C	50°C	75°C
0000	11 68	107 2	0 1482	0 1608	0.1798	0 1956
000	10 40	85 03	1868	2028	2267	2466
00	9 266	67 43	2356	2557	.2858	.3110
0	8 252	53 48	2971	3224	.3604	3921
1	7 348	42 41	3746	4066	.4545	4944
2	6 544	33 63	4724	5127	5731	.6235
3	5 827	26 67	5956	6465	7227	7862
4	5 189	21 15	7511	8152	9113	9914
5	4 621	16 77	9471	1 028	1 149	1 250
6	4 115	13 30	1 194	1 296	1 449	1 576
7	3 665	10 55	1 506	1 634	1 827	1 988
8	3 264	8 366	1 899	2 061	2 304	2 506
9	2 906	6 634	2 395	2 599	2 905	3 161
10	2 588	5 261	3 020	3 277	3 663	3 985
11	2 305	4 172	3 807	4 132	4 619	5 025
12	2 053	3 309	4 801	5 211	5 825	6 337
13	1 828	2 624	6 054	6 571	7 345	7 991
14	1 628	2 081	7 634	8 285	9 262	10 08
15	1 450	1 650	9 627	10 45	11 68	12 71
16	1 291	1 309	12 14	13 17	14 73	16 02
17	1 150	1 038	15 31	16 61	18 57	20 20
18	1 024	0 8231	19 30	20 95	23 42	25 48
19	0 9116	6527	24 34	26 42	29 53	32.12
20	8118	5176	30 69	33 31	37 24	40 51
21	7230	4105	38 70	42 00	46 95	51 08
22	6438	3255	48 80	52 96	59 21	64 41
23	5733	2582	61 54	66 79	74 66	81 22
24	5106	2047	77 60	84 21	94 14	102 4
25	4547	1624	97 85	106 2	118 7	129 1
26	4049	1288	123 4	133 9	149 7	162 9
27	3606	.1021	155 6	168 9	188 8	205 4
28	3211	08098	196 2	212 9	238 0	258 9
29	2859	.06422	247 4	268 5	300 1	326 5
30	2546	05093	311 9	338 6	378 5	411 7
31	2268	.04039	393 4	426 9	477 2	519 2
32	2019	03203	496 0	538 3	601 8	654 7
33	1798	02540	625 5	678 8	758 8	825 5
34	.1601	02014	788 7	856 0	956 9	1041
35	1426	01597	994 5	1079	1207	1313
36	1270	01267	1254	1361	1522	1655
37	1131	01005	1581	1716	1919	2087
38	.1007	007967	1994	2164	2419	2632
39	08969	006318	2514	2729	3051	3319
40	.07987	.005010	3171	3441	3847	4185

* Resistance at the stated temperatures of a wire whose length is 1 kilometer at 20°C.

WIRE TABLE, STANDARD ANNEALED COPPER
(Continued)
American Wire Gauge (B. & S.) Metric Units (Continued)

Gauge No.	Diameter in mm at 20°C	Kilograms per kilometer	Meters per gram	Meters per ohm*			
				0°C	20°C	50°C	75°C
0000	11 68	953 2	0 001049	6749	6219	5563	5113
000	10 40	755 9	.001323	5352	4932	4412	4055
00	9 266	599 5	001668	4245	3911	3499	3216
0	8 252	475 4	002103	3366	3102	2774	2550
1	7.348	377 0	002652	2669	2460	2200	2022
2	6 544	299 0	003345	2117	1951	1745	1604
3	5 827	237 1	004217	1679	1547	1384	1272
4	5 189	188 0	005318	1331	1227	1097	1009
5	4 621	149 1	006706	1056	972 9	870 2	799 9
6	4 115	118 2	008457	837 3	771 5	690 1	634 4
7	3 665	93 78	01066	664 0	611 8	547 3	503 1
8	3 264	74 37	01345	526 6	485 2	434 0	399 0
9	2 906	58 98	01696	417 6	384 8	344 2	316 4
10	2 588	46 77	02138	331 2	305 1	273 0	250 9
11	2 305	37 09	02696	262 6	242 0	216 5	199 0
12	2 053	29 42	03400	208 3	191 9	171 7	157 8
13	1 828	23 33	04287	165 2	152 2	136 1	125 1
14	1 628	18 50	05406	131 0	120 7	108 0	99 24
15	1 450	14 67	06816	103 9	95 71	85 62	78.70
16	1 291	11 63	.08595	82 38	75 90	67 90	62 41
17	1 150	9 226	1084	65 33	60 20	53 85	49 50
18	1 024	7 317	1367	51 81	47 74	42 70	39 25
19	0 9116	5 803	1723	41 09	37 86	33 86	31 13
20	8118	4 602	2173	32 58	30 02	26 86	24 69
21	7230	3 649	2740	25 84	23 81	21 30	19 58
22	6438	2 894	3455	20 49	18 88	16 89	15 53
23	5733	2 295	4357	16 25	14 97	13 39	12 31
24	5106	1 820	5494	12 89	11 87	10 62	9 764
25	4547	1 443	6928	10 22	9 417	8 424	7 743
26	4049	1 145	8736	8 105	7 468	6 680	6 141
27	3606	0 9078	1 102	6 428	5 922	5 298	4 870
28	3211	7199	1 389	5 097	4 697	4 201	3 862
29	2859	5709	1 752	4 042	3 725	3 332	3 063
30	2546	4527	2 209	3 206	2 954	2 642	2 429
31	2268	3590	2 785	2 542	2 342	2 095	1 926
32	2019	2847	3 512	2 016	1 858	1 662	1 527
33	1798	2258	4 429	1 599	1 473	1 318	1 211
34	1601	1791	5 584	1 268	1 168	1.045	0 9606
35	1426	1420	7 042	1 006	0 9265	0 8288	.7618
36	1270	1126	8 879	0 7974	7347	6572	.6041
37	1131	08931	11 20	6324	5827	5212	.4791
38	1007	07083	14 12	5015	4621	4133	3799
39	08969	.05617	17 80	3977	3664	3278	.3013
40	07987	.04454	22 45	3154	2906	2600	.2390

* Length at 20°C of a wire whose resistance is 1 ohm at the stated temperatures.

WIRE TABLE, STANDARD ANNEALED COPPER
(Continued)
American Wire Gauge (B. & S.) Metric Units (Continued)

Gauge No.	Ohms per kilogram			Grams per ohm
	0°C	20°C	50°C	20°C
0000	0 0001554	0 0001687	0 0001886	5928000
000	0002472	0002682	0002999	3728000
00	0003930	.0004265	0004768	2344000
0	0006249	0006782	.0007582	1474000
1	0009936	001078	.001206	927300
2	001580	001715	001917	583200
3	002512	002726	003048	366800
4	003995	004335	004846	230700
5	006352	006893	007706	145100
6	01010	01096	01225	91230
7	01606	01743	01948	57380
8	02553	02771	03098	36080
9	04060	04406	04926	22690
10	06456	07007	07833	14270
11	1026	1114	1245	8976
12	1632	1771	1980	5645
13	2595	2817	3149	3550.
14	4127	4479	5007	2233
15	6562	7122	7961	1404
16	1 043	1 132	1 266	883 1
17	1 659	1 801	2 013	555 4
18	2 638	2 863	3 201	349 3
19	4 194	4 552	5 089	219 7
20	6 670	7 238	8 092	138 2
21	10 60	11 51	12 87	86 88
22	16 86	18 30	20 46	54 64
23	26 81	29 10	32 53	34 36
24	42 63	46 27	51 73	21 61
25	67 79	73 57	82 25	13 59
26	107 8	117 0	130 8	8 548
27	171 4	186 0	207 9	5 376
28	272 5	295 8	330 6	3 381
29	433 3	470 3	525 7	2 126
30	689 0	747 8	836 0	1 337
31	1096	1189	1329	0 8410
32	1742	1891	2114	5289
33	2770	3006	3361	3326
34	4404	4780	5344	2092
35	7003	7601	8497	1316
36	11140	12090	13510	08274
37	17710	19220	21480	05204
38	28150	30560	34160	03273
39	44770	48590	54310	02058
40	71180	77260	86360	01294

ALUMINUM WIRE TABLE

Hard-Drawn Aluminum Wire at 20°C (or, 68°F)

American Wire Gauge (B. & S.) English Units

Gauge No.	Diameter in mils	Cross section		Ohms per 1000 ft.	Pounds per 1000 ft.	Pounds per ohm	Feet per ohm
		Circular mils	Square inches				
0000	460	212000	0 166	0 0804	195	2420	12400
000	410	168000	132	.101	154	1520	9860
00	365	133000	105	.128	122	957	7820
0	325	106000	0829	.161	97 0	602	6200
1	289	83700	0657	203	76 9	379	4920
2	258	66400	0521	256	61 0	238	3900
3	229	52600	0413	323	48 4	150	3090
4	204	41700	0328	408	38 4	94 2	2450
5	182	33100	0260	514	30 4	59 2	1950
6	162	26300	0206	648	24 1	37 2	1540
7	144	20800	0164	817	19 1	23 4	1220
8	128	16500	0130	1 03	15 2	14 7	970
9	114	13100	0103	1 30	12 0	9 26	770
10	102	10400	00815	1 64	9 55	5 83	610
11	91	8230	00647	2 07	7 57	3 66	484
12	81	6530	00513	2 61	6 00	2 30	384
13	72	5180	00407	3 29	4 76	1 45	304
14	64	4110	00323	4 14	3 78	0 911	241
15	57	3260	00256	5 22	2 99	.573	191
16	51	2580	00203	6 59	2 37	360	152
17	45	2050	00161	8 31	1 88	.227	120
18	40	1620	00128	10 5	1 49	143	95 5
19	36	1290	00101	13 2	1 18	.0897	75 7
20	32	1020	000802	16 7	0 939	0564	60 0
21	28 5	810	000636	21 0	745	0355	47 6
22	25 3	642	000505	26 5	591	0223	37 8
23	22 6	509	000400	33 4	468	0140	29 9
24	20.1	404	000317	42 1	371	00882	23 7
25	17 9	320	000252	53 1	295	00555	18 8
26	15 9	254	000200	67 0	234	00349	14 9
27	14 2	202	000158	84 4	185	00219	11 8
28	12 6	160	000126	106.	147	00138	9 39
29	11 3	127	0000995	134.	117	000868	7 45
30	10 0	101	0000789	169.	0924	000546	5 91
31	8 9	79 7	0000626	213.	0733	000343	4 68
32	8 0	63 2	0000496	269.	0581	000216	3 72
33	7 1	50 1	0000394	339.	0461	000136	2 95
34	6 3	39 8	0000312	428	.0365	0000854	2 34
35	5 6	31 5	0000248	540.	0290	0000537	1 85
36	5 0	25 0	0000196	681	0230	0000338	1 47
37	4 5	19 8	0000156	858.	0182	0000212	1 17
38	4 0	15 7	0000123	1080.	0145	0000134	0 924
39	3.5	12 5	00000979	1360.	.0115	.00000840	733
40	3 1	9 9	00000777	1720.	0091	00000528	.581

ALUMINUM WIRE TABLE (Continued)
Hard-Drawn Aluminum Wire at 20°C (or, 68°F)
American Wire Gauge (B. & S.) Metric Units

Gauge No.	Diameter in mm	Cross section in mm²	Ohms per kilometer	Kilograms per kilometer	Grams per ohm	Meters per ohm
0000	11.7	107	0.264	289	1100000	3790
000	10.4	85.0	333	230	690000	3010
00	9.3	67.4	.419	182	434000	2380
0	8.3	53.5	.529	144	273000	1890
1	7.3	42.4	.667	114.	172000	1500
2	6.5	33.6	.841	90.8	108000	1190
3	5.8	26.7	1.06	72.0	67900	943
4	5.2	21.2	1.34	57.1	42700	748
5	4.6	16.8	1.69	45.3	26900	593
6	4.1	13.3	2.13	35.9	16900	470
7	3.7	10.5	2.68	28.5	10600	373
8	3.3	8.37	3.38	22.6	6680	296
9	2.91	6.63	4.26	17.9	4200	235
10	2.59	5.26	5.38	14.2	2640	186
11	2.30	4.17	6.78	11.3	1660	148
12	2.05	3.31	8.55	8.93	1050	117
13	1.83	2.62	10.8	7.08	657	92.8
14	1.63	2.08	13.6	5.62	413	73.6
15	1.45	1.65	17.1	4.46	260	58.4
16	1.29	1.31	21.6	3.53	164	46.3
17	1.15	1.04	27.3	2.80	103	36.7
18	1.02	0.823	34.4	2.22	64.7	29.1
19	0.91	653	43.3	1.76	40.7	23.1
20	81	518	54.6	1.40	25.6	18.3
21	72	411	68.9	1.11	16.1	14.5
22	64	326	86.9	0.879	10.1	11.5
23	57	258	110	697	6.36	9.13
24	51	205	138	553	4.00	7.24
25	45	162	174	438	2.52	5.74
26	40	.129	220	348	1.58	4.55
27	.36	102	277	276	0.995	3.61
28	32	0810	349	219	.626	2.86
29	.29	0642	440	.173	394	2.27
30	25	.0509	555	138	.248	1.80
31	227	.0404	700	109	.156	1.43
32	202	.0320	883	0865	.0979	1.13
33	180	.0254	1110	0686	.0616	0.899
34	.160	.0201	1400	.0544	.0387	.712
35	.143	0160	1770	0431	0244	.565
36	.127	.0127	2230	.0342	.0153	.448
37	.113	.0100	2820	.0271	.00963	355
38	.101	.0080	3550	.0215	.00606	.282
39	.090	.0063	4480	.0171	.00381	.223
40	.080	.0050	5640	.0135	.00240	.177

CROSS-SECTION AND MASS OF WIRES

U. S. Measure

Diameters are given in mils (1 mil = .001 in.), and area in square mils (1 sq. mil = .000001 sq. in.). For sections and masses foı one-tenth the diameters given, divide by 100 and for sections and masses for ten times the diameter multiply by 100.

Diam. in mils	Cross-sec. in sq. mils	Pounds per foot			
		Copper, density 8.90	Iron, density 7.80	Brass, density 8.56	Aluminum, density 2.67
10	78.54	0.000303	0.0002656	0.0002915	0.0000909
11	95 03	0367	03214	03527	01100
12	113 10	0436	03825	04197	01309
13	132 73	0512	04488	04926	01536
14	153.94	0594	05206	05713	01782
15	176 71	0 000682	0.0005976	0 0006558	0 0002045
16	201.06	0776	06799	07461	02327
17	226 98	0876	07675	08423	02627
18	254 47	0982	08605	09443	02946
19	283 53	1094	09588	10522	03282
20	314 16	0.001212	0 001062	0.001166	0.0003636
21	346 36	1336	1171	1285	04009
22	380 13	1467	1286	1411	04400
23	415 48	1603	1405	1542	04809
24	452 39	1746	1530	1679	05237
25	490.87	0 001894	0 001660	0 001822	0 0005682
26	530 93	2046	1795	1970	06147
27	572 56	2209	1936	2125	06628
28	615 75	2376	2082	2285	07127
29	660.52	2549	2234	2451	07646
30	706 86	0 002727	0 002390	0 002623	0 0008182
31	754.77	2912	2552	2801	08737
32	804 25	3103	2720	2985	09309
33	855 30	3300	2892	3174	09900
34	907 92	3503	3070	3369	10509
35	962 11	0.003712	0 003253	0 003570	0.001114
36	1017 88	3927	3442	3777	1178
37	1075 21	4149	3636	3990	1245
38	1134 11	4376	3844	4218	1316
39	1194 59	4609	4040	4433	1383
40	1256 64	0.004849	0.004249	0 004664	0.001455
41	1320 25	5094	4465	4900	1528
42	1385.44	5346	4685	5141	1604
43	1452 20	5603	4911	5389	1681
44	1520 53	5867	5142	5643	1760
45	1590.43	0 006137	0 005378	0 005902	0.001841
46	1661 90	6412	5620	6167	1924
47	1734.94	6694	5867	6438	2008
48	1809 56	6982	6119	6715	2095
49	1885.74	7276	6377	6998	2183
50	1963.50	0.007576	0.006640	0.007287	0.002273
51	2042.82	7882	6908	7581	2365
52	2123.72	8194	7181	7881	2458
53	2206 18	8512	7460	8187	2554
54	2290 22	8837	7744	8499	2651

CROSS-SECTION AND MASS OF WIRES (Continued)

U. S. Measure (Continued)

Diameters are given in mils (1 mil = .001 in.), and area in square mils (1 sq. mil = .000001 sq. in.). For sections and masses for one-tenth the diameters given, divide by 100 and for sections and masses for ten times the diameter multiply by 100.

Diam. in mils	Cross-sec. in sq. mils	Pounds per foot			
		Copper, density 8.90	Iron, density 7.80	Brass, density 8.56	Aluminum, density 2.67
55	2375.83	0.009167	0.008034	0.008817	0.002750
56	2463.01	09504	08329	09140	2851
57	2551.76	09846	08629	09470	2954
58	2642.08	10195	08934	09805	3058
59	2733.97	10549	09245	10146	3165
60	2827.43	0.01091	0.00956	0.01049	0.003273
61	2922.47	1128	0988	1085	3383
62	3019.07	1165	1021	1120	3495
63	3117.25	1203	1054	1157	3608
64	3216.99	1241	1088	1194	3724
65	3318.31	0.01280	0.01122	0.01231	0.003841
66	3421.19	1320	1157	1270	3960
67	3525.65	1360	1192	1308	4081
68	3631.68	1401	1228	1348	4204
69	3739.28	1443	1264	1388	4328
70	3848.45	0.01485	0.01302	0.01429	0.004456
71	3959.19	1528	1339	1469	4583
72	4071.50	1571	1377	1511	4713
73	4185.39	1615	1415	1553	4845
74	4300.84	1660	1454	1596	4978
75	4417.86	0.01705	0.01494	0.01639	0.005114
76	4536.46	1751	1534	1684	5251
77	4656.63	1797	1575	1728	5390
78	4778.36	1844	1616	1773	5531
79	4901.67	1892	1658	1819	5674
80	5026.55	0.01939	0.01700	0.01865	0.005818
81	5153.00	1988	1743	1912	5965
82	5281.02	2038	1786	1960	6113
83	5410.61	2088	1830	2008	6263
84	5541.77	2138	1874	2057	6415
85	5674.50	0.02189	0.01919	0.02106	0.006568
86	5808.80	2241	1964	2156	6724
87	5944.68	2294	2010	2206	6881
88	6082.12	2347	2057	2257	7040
89	6221.14	2400	2104	2309	7201
90	6361.73	0.02455	0.02151	0.02360	0.007364
91	6503.88	2509	2199	2414	7528
92	6647.61	2565	2248	2467	7695
93	6792.91	2621	2297	2521	7863
94	6939.78	2678	2347	2575	8033
95	7088.22	0.02735	0.02397	0.02630	0.008205
96	7238.23	2793	2448	2686	8378
97	7389.81	2851	2499	2742	8554
98	7542.96	2910	2551	2799	8731
99	7697.69	2970	2603	2857	8910
100	7853.98	0.03030	0.02656	0.02915	0.009091

CROSS-SECTION AND MASS OF WIRES (Continued)

Metric Measure

Diameters are given in thousandths of a centimeter and area of section in square thousandths of a centimeter. 1 $(cm/1000)^2$ = .000001 sq. cm For sections and masses for diameters 1/10 or 10 times those of the table, divide or multiply by 100.

Diam. in thousandths of a cm	Cross-section in square thousandths of a cm	Grams per meter			
		Copper, density 8.90	Iron, density 7.80	Brass, density 8.56	Aluminum, density 2.67
10	78 54	0 06990	0 06126	0.06723	0.02097
11	95 03	08458	07412	08135	02537
12	113 10	.10065	08822	09681	.03020
13	132 73	11813	10353	11362	.03544
14	153 94	13701	.12008	.13177	.04110
15	176 71	0 1573	0 1378	0 1513	0 04718
16	201 06	1789	1568	.1721	.05368
17	226 98	.2020	1770	.1943	.06060
18	254.47	2265	1985	.2178	06794
19	283 53	2523	2212	2427	.07570
20	314 16	0 2796	0 2450	0 2689	0 08388
21	346 36	3083	2702	.2965	09248
22	380 13	3383	2965	3254	10149
23	415 48	3698	3241	3557	11093
24	452 39	4026	3529	3872	12079
25	490 87	0 4369	0.3829	0 4202	0 1311
26	530 93	4725	.4141	.4545	1418
27	572 56	5096	4466	.4901	1529
28	615 75	5480	.4803	.5271	.1644
29	660.52	.5879	5152	.5654	1764
30	706.86	0 6291	0.5514	0 6051	0 1887
31	754 77	6717	.5887	.6461	.2015
32	804.25	.7158	.6273	.6884	.2147
33	855 30	.7612	.6671	.7321	2284
34	907 92	.8081	7082	7772	.2424
35	962.11	0 856	0 7504	0 8236	0 2569
36	1017 88	906	.7939	.8713	.2718
37	1075 21	957	8387	.9204	2871
38	1134 11	1.012	8866	.9730	.3035
39	1194 59	063	9318	1 0230	.3190
40	1256.64	1 118	0 980	1 076	0 3355
41	1320 25	.175	1 030	.130	3525
42	1385.44	233	.081	.186	.3699
43	1452 20	.292	133	.243	.3877
44	1520 53	353	186	.302	.4060
45	1590 43	1 415	1.241	1 361	0.4246
46	1661 90	479	296	423	.4437
47	1734 94	.544	353	.485	.4632
48	1809.56	.611	.411	.549	.4832
49	1885 74	.678	471	614	.5035
50	1963 50	1 748	1 532	1 681	.5243
51	2042.82	.818	.593	753	.5454
52	2123.72	.890	.657	.818	5670
53	2206.18	964	.721	.888	.5891
54	2290 22	2 038	.786	.960	.6115

CROSS-SECTION AND MASS OF WIRES (Continued)

Metric Measure (Continued)

Diameters are given in thousandths of a centimeter and area of section in square thousandths of a centimeter. 1 $(cm/1000)^2$ = .000001 sq. cm. For sections and masses for diameters 1/10 or 10 times those of the table, divide or multiply by 100.

Diam. in thousandths of a cm	Cross-section in square thousandths of a cm	Grams per meter			
		Copper, density 8.90	Iron, density 7.80	Brass, density 8.56	Aluminum, density 2.67
55	2375 83	2.114	1.853	2.034	0.6343
56	2463 01	.192	.921	.108	.6576
57	2551.76	.271	.990	.184	.6813
58	2642 08	.351	2.061	.262	.7054
59	2733.97	.433	.132	.340	.7300
60	2827.43	2.516	2.205	2.420	0.7549
61	2922.47	.601	.280	.502	.7803
62	3019.07	.687	.355	.584	.8061
63	3117 25	.774	.431	.668	.8323
64	3216.99	.863	.509	.760	.8589
65	3318.31	2.953	2.588	2 840	0 8860
66	3421.19	3.045	.669	929	.9135
67	3525.65	.138	.750	3.018	.9413
68	3631.68	.232	.833	.109	.9697
69	3739.28	.328.	.917	.201	.9984
70	3848.45	3 426	3.003	3 295	1.028
71	3959.19	.524	.088	.389	057
72	4071.50	624	176	.485	.087
73	4185 39	725	.265	.583	117
74	4300.84	.828	.355	682	.148
75	4417 86	3 932	3 446	3 782	1 180
76	4536.46	4 037	.538	883	211
77	4656 63	.144	.632	986	.243
78	4778 36	.253	.727	4 090	.276
79	4901 67	.362	.823	.177	.309
80	5026 55	4 474	3 921	4 303	1 342
81	5153 00	.586	4 019	411	376
82	5281 02	.700	119	.521	.410
83	5410 61	.815	.220	.631	445
84	5541 77	.932	.323	744	480
85	5674 50	5.050	4 426	4 857	1 515
86	5808 80	.170	.531	.972	551
87	5944 68	.291	.637	5.089	.587
88	6082 12	.413	.744	.206	.624
89	6221 14	.537	.852	.325	.661
90	6361.73	5 662	4 962	5 446	1.699
91	6503.88	.788	5 073	567	.737
92	6647 61	.916	.185	.690	775
93	6792.91	6.046	.298	.815	.814
94	6939.78	.176	.413	.940	.853
95	7088.22	6.309	5.529	6.068	1 893
96	7238.23	.442	.646	.196	.933
97	7389 81	.577	.764	.326	.973
98	7542 96	.713	.884	.457	2.014
99	7697.69	.851	6.004	.589	.055
100	7853 98	6 990	6 126	6 723	2 097

RESISTANCE OF WIRES

The following table gives the approximate resistance of various metallic conductors. The values have been computed from the resistivities at 20°C, except as otherwise stated, and for the dimensions of wire indicated. Owing to differences in purity in the case of elements and of composition in alloys, the values can be considered only as approximations.

The following dimensions have been adopted in the computations.

B. & S. gauge	Diameter mm	Diameter mils 1 mil = .001 in.	B. & S. gauge	Diameter mm	Diameter mils 1 mil = .001 in.
10	2 588	101.9	26	0 4049	15 94
12	2 053	80.81	27	0.3606	14.20
14	1.628	64.08	28	0.3211	12.64
16	1.291	50.82	30	0.2546	10.03
18	1.024	40.30	32	0 2019	7.950
20	0 8118	31.96	34	0.1601	6.305
22	0 6438	25 35	36	0 1270	5.000
24	0.5106	20.10	40	0.07987	3.145

B. & S. No.	Ohms per cm	Ohms per ft.	B. & S. No.	Ohms per cm	Ohms per ft.
Advance (0°C) $\rho = 48. \times 10^{-6}$ ohm cm			Aluminum $\rho = 2.828 \times 10^{-6}$ ohm cm		
10	.000912	0278	10	0000538	.00164
12	00145	.0442	12	0000855	.00260
14	.00231	.0703	14	.000136	.00414
16	.00367	.112	16	.000216	.00658
18	.00583	.178	18	.000344	0105
20	.00927	.283	20	.000546	.0167
22	0147	.449	22	.000869	0265
24	.0234	.715	24	.00138	.0421
26	0373	1.14	26	.00220	.0669
27	.0470	1.43	27	.00277	0844
28	.0593	1.81	28	.00349	.106
30	.0942	2.87	30	.00555	.169
32	.150	4.57	32	.00883	.269
34	.238	7.26	34	.0140	.428
36	.379	11.5	36	.0223	.680
40	.958	29 2	40	.0564	1.72

RESISTANCE OF WIRES (Continued)

B. & S. No.	Ohms per cm	Ohms per ft.	B. & S. No.	Ohms per cm	Ohms per ft.
Brass $\rho = 7.00 \times 10^{-6}$ ohm cm			Climax $\rho = 87. \times 10^{-6}$ ohm cm		
10	000133	.00406	10	.00165	0504
12	.000212	.00645	12	.00263	0801
14	.000336	.0103	14	.00418	127
16	.000535	0163	16	.00665	.203
18	.000850	0259	18	.0106	.322
20	.00135	.0412	20	.0168	.512
22	.00215	.0655	22	0267	.815
24	00342	.104	24	0425	1.30
26	.00543	.166	26	0675	2.06
27	00686	.209	27	0852	2 60
28	00864	263	28	107	3.27
30	0137	419	30	171	5 21
32	0219	666	32	272	8.28
34	0348	1 06	34	.432	13 2
36	0552	1 68	36	687	20.9
40	140	4 26	40	1.74	52.9
Constantan (0°C) $\rho = 44\ 1 \times 10^{-6}$ ohm cm			Copper, annealed $\rho = 1\ 724 \times 10^{-6}$ ohm cm		
10	.000838	0255	10	0000328	.000999
12	.00133	0406	12	.0000521	00159
14	.00212	.0646	14	0000828	00253
16	00337	103	16	000132	00401
18	00536	163	18	000209	00638
20	00852	260	20	.000333	0102
22	.0135	.413	22	.000530	0161
24	.0215	.657	24	.000842	.0257
26	.0342	1 04	26	.00134	0408
27	.0432	1 32	27	.00169	0515
28	.0545	1 66	28	.00213	0649
30	.0866	2.64	30	.00339	.103
32	.138	4 20	32	.00538	.164
34	.219	6 67	34	.00856	.261
36	.348	10 6	36	0136	415
40	.880	26 8	40	0344	1 05
Eureka (0°C) $\rho = 47. \times 10^{-6}$ ohm cm			Excello $\rho = 92 \times 10^{-6}$ ohm cm		
10	.000893	0272	10	00175	.0533
12	.00142	.0433	12	.00278	.0847
14	.00226	0688	14	00442	.135
16	.00359	.109	16	.00703	.214
18	.00571	174	18	.0112	341
20	.00908	.277	20	.0178	542
22	0144	.440	22	0283	.861
24	0230	.700	24	.0449	1.37
26	0365	1.11	26	0714	2 18
27	0460	1.40	27	.0901	2.75
28	0580	1 77	28	.114	3.46
30	0923	2 81	30	.181	5.51
32	147	4 47	32	.287	8.75
34	233	7 11	34	.457	13.9
36	371	11 3	36	.726	22 1
40	938	28.6	40	1 84	56.0

RESISTANCE OF WIRES (Continued)

B. & S. No	Ohms per cm	Ohms per ft.	B. & S. No.	Ohms per cm	Ohms per ft.
German silver $\rho = 33. \times 10^{-6}$ ohm cm			Gold $\rho = 2.44 \times 10^{-6}$ ohm cm		
10	.000627	0191	10	.0000464	.00141
12	000997	.0304	12	.0000737	.00225
14	00159	0483	14	.000117	.00357
16	00252	0768	16	.000186	00568
18	00401	.122	18	.000296	.00904
20	00638	194	20	.000471	.0144
22	0101	309	22	000750	.0228
24	.0161	.491	24	00119	.0363
26	.0256	.781	26	.00189	.0577
27	0323	985	27	00239	0728
28	0408	1 24	28	.00301	.0918
30	0648	1 97	30	00479	.146
32	103	3 14	32	00762	.232
34	.164	4 99	34	0121	.369
36	.260	7.94	36	0193	.587
40	.659	20 1	40	.0487	1.48
Iron $\rho = 10. \times 10^{-6}$ ohm cm			Lead $\rho = 22. \times 10^{-6}$ ohm cm		
10	000190	00579	10	000418	.0127
12	.000302	00921	12	.000665	.0203
14	000481	0146	14	00106	.0322
16	000764	0233	16	.00168	.0512
18	00121	0370	18	.00267	0815
20	00193	0589	20	.00425	.130
22	00307	.0936	22	00676	206
24	.00489	.149	24	.0107	.328
26	00776	.237	26	.0171	.521
27	.00979	.299	27	.0215	657
28	.0123	.376	28	0272	.828
30	.0196	598	30	0432	1.32
32	.0312	.952	32	0687	2.09
34	0497	1.51	34	109	3.33
36	.0789	2.41	36	.174	5.29
40	.200	6 08	40	.439	13.4
Magnesium $\rho = 4.6 \times 10^{-6}$ ohm cm			Manganin $\rho = 44. \times 10^{-6}$ ohm cm		
10	0000874	00267	10	.000836	0255
12	.000139	.00424	12	00133	0405
14	.000221	.00674	14	.00211	.0644
16	.000351	.0107	16	.00336	.102
18	000559	.0170	18	00535	.163
20	.000889	.0271	20	00850	259
22	00141	.0431	22	.0135	.412
24	.00225	.0685	24	.0215	.655
26	.00357	.109	26	.0342	1.04
27	.00451	.137	27	.0431	1.31
28	.00568	.173	28	.0543	1 66
30	.00903	.275	30	.0864	2 63
32	.0144	438	32	.137	4.19
34	.0228	696	34	.218	6.66
36	.0363	1 11	36	.347	10.6
40	.0918	2 80	40	.878	26.8

RESISTANCE OF WIRES (Continued)

B. & S. No.	Ohms per cm	Ohms per ft.	B & S. No.	Ohms per cm	Ohms per ft.
Molybdenum ρ = 5 7 $\times$ 10^{-6} ohm cm			Monel Metal ρ = 42 $\times$ 10^{-6} ohm cm		
10	000108	00330	10	.000798	.0243
12	000172	.00525	12	00127	0387
14	000274	.00835	14	00202	0615
16	000435	0133	16	00321	0978
18	000693	0211	18	.00510	156
20	00110	.0336	20	00811	247
22	.00175	0534	22	0129	393
24	00278	0849	24	0205	625
26	.00443	.135	26	.0326	994
27	00558	170	27	.0411	1 25
28	.00704	215	28	0519	1 58
30	0112	.341	30	0825	2 51
32	0178	542	32	131	4 00
34	0283	863	34	209	6 36
36	0450	1 37	36	331	10 1
40	114	3 47	40	838	25 6
Nichrome ρ = 100 $\times$ 10^{-6} ohm cm			Nickel ρ = 7 8 $\times$ 10^{-6} ohm cm		
10	00190	0579	10	000148	00452
12	00302	0921	12	000236	00718
14	00481	.146	14	000375	0114
16	00764	233	16	000596	0182
18	0121	370	18	000948	0289
20	0193	589	20	00151	0459
22	0307	936	22	00240	0730
24	.0489	1 49	24	00381	116
26	0776	2 37	26	00606	.185
27	0979	2 99	27	00764	233
28	123	3 76	28	00963	294
30	.196	5 98	30	0153	467
32	312	9 52	32	0244	742
34	497	15 1	34	0387	1 18
36	789	24 1	36	0616	1 88
40	2 00	60 8	40	156	4 75
Platinum ρ = 10 $\times$ 10^{-6} ohm cm			Silver (18°C) ρ = 1 629 $\times$ 10^{-6} ohm cm		
10	000190	00579	10	.0000310	000944
12	000302	00921	12	.0000492	00150
14	000481	0146	14	0000783	00239
16	000764	0233	16	000124	00379
18	00121	0370	18	.000198	00603
20	00193	0589	20	.000315	00959
22	.00307	0936	22	000500	0153
24	00489	.149	24	000796	0243
26	00776	237	26	00126	0386
27	00979	299	27	00160	0486
28	0123	376	28	00201	0613
30	0196	598	30	00320	0975
32	0312	952	32	00509	155
34	0497	1 51	34	00809	247
36	0789	2 41	36	0129	392
40	200	6 08	40	.0325	991

RESISTANCE OF WIRES (Continued)

Steel, piano wire (0°C)
$\rho = 11.8 \times 10^{-6}$ ohm cm

B. & S. No.	Ohms per cm	Ohms per ft.
10	000224	.00684
12	.000357	.0109
14	000567	.0173
16	.000901	0275
18	.00143	.0437
20	.00228	.0695
22	.00363	.110
24	.00576	.176
26	.00916	.279
27	.0116	.352
28	.0146	.444
30	.0232	.706
32	.0368	1 12
34	0586	1 79
36	.0931	2 84
40	236	7.18

Steel, invar (35 % Ni)
$\rho = 81. \times 10^{-6}$ ohm cm

B. & S. No.	Ohms per cm	Ohms per ft.
10	.00154	.0469
12	.00245	.0746
14	.00389	.119
16	.00619	.189
18	.00984	.300
20	.0156	.477
22	.0249	.758
24	.0396	1.21
26	.0629	1.92
27	.0793	2.42
28	.100	3.05
30	.159	4.85
32	253	7.71
34	.402	12.3
36	.639	19 5
40	1.62	49.3

Tantalum $\rho = 15\ 5 \times 10^{-6}$ ohm cm

B. & S. No.	Ohms per cm	Ohms per ft.
10	000295	00898
12	.000468	.0143
14	.000745	.0227
16	.00118	.0361
18	00188	.0574
20	00299	.0913
22	00476	.145
24	00757	.231
26	.0120	.367
27	0152	.463
28	0191	.583
30	0304	928
32	0484	1 47
34	0770	2 35
36	122	3.73
40	.309	9.43

Tin $\rho = 11\ 5 \times 10^{-6}$ ohm cm

B. & S. No.	Ohms per cm	Ohms per ft.
10	000219	.00666
12	000348	.0106
14	.000553	.0168
16	.000879	.0268
18	00140	.0426
20	00222	.0677
22	00353	.108
24	.00562	.171
26	00893	.272
27	.0113	.343
28	.0142	.433
30	0226	.688
32	0359	1.09
34	0571	1 74
36	.0908	2.77
40	230	7 00

Tungsten $\rho = 5.51 \times 10^{-6}$ ohm cm

B. & S. No.	Ohms per cm	Ohms per ft.
10	000105	.00319
12	000167	.00508
14	000265	.00807
16	.000421	.0128
18	.000669	.0204
20	.00106	.0324
22	.00169	.0516
24	.00269	.0820
26	00428	.130
27	00540	.164
28	00680	.207
30	0108	.330
32	0172	.524
34	.0274	.834
36	.0435	1.33
40	.110	3.35

Zinc (0°C) $\rho = 5\ 75 \times 10^{-6}$ ohm cm

B. & S. No.	Ohms per cm	Ohms per ft.
10	.000109	.00333
12	.000174	.00530
14	.000276	.00842
16	.000439	.0134
18	.000699	.0213
20	.00111	.0339
22	.00177	.0538
24	.00281	.0856
26	.00446	.136
27	.00563	.172
28	.00710	.216
30	.0113	.344
32	.0180	.547
34	.0286	.870
36	.0454	1.38
40	.115	3.50

FUSING CURRENTS FOR WIRES

Owing to the influence of various factors which control the rate of loss of heat energy the following values can be considered only as approximations.

Gauge No A W G.	Diameter inches	Fusing current in amp.			
		Cu	Al	Fe	Fuse wire
43	0 0021	1			
41	.0026		1		
39	0035	2			
38	.0040		2		
37	.0045	3		1	
35	0056	4	3		
34	0063	5	4		
33	0071			2	
32	0080		5		
30	0100	10		3	1 7
28	0126	15	10		
27	0142			5	
26	0159	20	15		
25	0179	25			
24	0201	30	20	10	4 9
23	0226	35	25		
22	.0253	40	30		
21	0285	45	35	15	
20	032	60	40		9 0
19	036	70	50	20	11.3
18	040	80	60	25	13 3
17	045	100	70	30	
16	051	120	90	35	19 8
15	057	140	100	45	
14	064	160	120	50	25 4
13	.072	200	160	60	32
12	081	225	180	70	39 1
11	091	275	200	90	
10	102		225	100	54 1
9	114		275	120	63.1
8	128			140	81 1
7	144			160	90 6
6	.162			200	110 7
5	182			225	132 1
4	204			275	154 7

FUNDAMENTAL DATA RELATING TO SIEVES OF THE STANDARD SCREEN SCALE

From "Report of Committee on Standards," A.C.S. Year Book, 1921–1922

Sieve No.	Sieve opening, millimeters	Sieve opening, inches	Wire diameter, millimeters	Wire diameter, inches	Tolerance in average opening, per cent	Tolerance in wire diameter, per cent	Tolerance in maximum opening, per cent	Mesh per cm.	Mesh per inch
2½	8.00	0.315	1.85	0.073	1	5	10	1	2.6
3	6.72	0.265	1.65	0.065	1	5	10	1.2	3.0
3½	5.66	0.223	1.45	0.057	1	5	10	1.4	3.6
4	4.76	0.187	1.27	0.050	1	5	10	1.7	4.2
5	4.00	0.157	1.12	0.044	1	5	10	2	5.0
6	3.36	0.132	1.02	0.040	1	5	10	2.3	5.8
7	2.83	0.111	0.92	0.036	1	5	10	2.7	6.8
8	2.38	0.094	0.84	0.033	2	5	10	3	7.9
10	2.00	0.079	0.76	0.030	2	5	10	3.5	9.2
12	1.68	0.066	0.69	0.027	2	5	10	4	10.8
14	1.41	0.0557	0.61	0.024	2	5	10	5	12.5
16	1.19	0.0468	0.54	0.021	2	5	10	6	14.7
18	1.00	0.0394	0.48	0.0187	2	5	10	7	17.2
20	0.84	0.0331	0.42	0.0165	3	5	25	8	20.2
25	0.71	0.0278	0.37	0.0146	3	5	25	9	23.6
30	0.59	0.0234	0.33	0.0129	3	5	25	11	27.5
35	0.50	0.0197	0.29	0.0113	3	5	25	13	32.3
40	0.42	0.0166	0.25	0.0098	3	5	25	15	37.9
45	0.35	0.0139	0.22	0.0085	3	5	25	18	44.7
50	0.30	0.0117	0.188	0.0074	4	10	40	20	52.4
60	0.25	0.0098	0.162	0.0064	4	10	40	24	61.7
70	0.21	0.0083	0.140	0.0055	4	10	40	29	72.5
80	0.177	0.0070	0.119	0.0047	4	10	40	34	85.5
100	0.149	0.0059	0.102	0.0040	4	10	40	40	101
120	0.125	0.0049	0.086	0.0034	4	10	40	47	120
140	0.105	0.0041	0.074	0.0029	5	15	60	56	143
170	0.088	0.0035	0.063	0.0025	5	15	60	66	167
200	0.074	0.0029	0.053	0.0021	5	15	60	79	200
230	0.062	0.0025	0.046	0.0018	5	15	60	93	233
270	0.053	0.0021	0.041	0.0016	5	15	60	106	270
325	0.044	0.0017	0.036	0.0014	5	15	60	125	323

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION

Station		Latitude °	Latitude ′	Longitude °	Longitude ′	Elevation, meters	g cm/sec²
UNITED STATES							
Alaska	Fort Egbert, Eagle City	64	47 4	141	12 4	269	982 183
	Percy Islands, S. E. Alaska	54	55 8	131	35 3	4	981 524
	Point Young, S. E. Alaska	58	11 5	134	33 4	7	981 757
	Quiet Harbor, S. E. Alaska	56	14 1	132	39 6	4	981 624
	St. Michael	63	28 5	162	2 4	1	982 192
	St. Paul Island	57	7 3	170	16 6	10	981 726
Arizona	Yavapai	36	3 9	112	7 1	2179	979 192
Arkansas	Little Rock	34	45 0	92	16 4	89	979 721
California	Mount Hamilton	37	20 4	121	38 6	1282	979 660
	San Francisco	37	47 5	122	25 7	114	979 965
Colorado	Colorado Springs	38	50 7	104	49 0	1841	979 490
	Denver	39	40 6	104	56 9	1638	979 609
Connecticut	Hartford	41	44 8	72	41 8	37	980 336
Delaware	Dover	39	9 7	75	32 0	12	980 099
District of Columbia	Washington { B.S.	38	56 3	77	4 0	103	980 095
	Washington { U.S.C. and G.S.	38	53 2	77	0 5	14	980 112
Florida	Apalachicola	29	43 5	84	58 8	4	979 322
	Key West	24	33 6	81	48 4	1	978 970
Georgia	Atlanta	33	45 0	84	23 3	324	979 524
Idaho	Boise	43	37 2	116	12 3	821	980 212
	Sandpoint	48	16 4	116	33 3	637	980 680
Illinois	Chicago	41	47 4	87	36 1	182	980 278
	Springfield	39	47 7	89	39 5	183	980 089
Indiana	Indianapolis	39	45 9	86	8 8	217	980 090
	Terre Haute	39	28 7	87	23 8	151	980 072
Louisiana	New Orleans	29	57 0	90	4 2	2	979 324
Maine	Calais	45	11 2	67	16 9	38	980 631
Maryland	Baltimore	39	17 8	76	37 3	30	980 097
Massachusetts	Cambridge	42	22 8	71	7 8	14	980 398
	Worcester	42	16 5	71	48 5	170	980 324
Minnesota	Minneapolis	44	58 7	93	13 9	256	980 597
Missouri	Kansas City	39	5 8	94	35 4	278	979 990
	St. Louis	38	38 0	90	12 2	154	980 001

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION (Cont.)

Station		Latitude °	Latitude ′	Longitude °	Longitude ′	Elevation, meters	g cm/sec²
UNITED STATES (Continued)							
Montana	Hinsdale	48	23 8	107	5.3	661	980 739
Nevada	Goldfield	37	42 2	117	14 5	1716	979.456
New Hampshire	Lancaster	44	29 5	71	34 3	261	980.486
New Jersey	Hoboken	40	44	74	2	11	980 269
	Princeton	40	21 0	74	39 5	64	980 178
New Mexico	Las Vegas	35	35 8	105	12.1	1960	979.204
New York	Albany	42	39 1	73	46 1	61	980.344
	Ithaca	42	27 1	76	29.0	247	980.300
	New York	40	48 5	73	57 7	38	980.267
	Potsdam	44	40 1	74	58 8	130	980 571
North Carolina	Asheville	35	35 9	82	33 3	670	979.603
	Wilmington	34	14 2	77	56 6	9	979 663
North Dakota	Bismarck	46	48 5	100	47 0	516	980 625
	Pembina	48	58 1	97	14 9	243	980 917
Ohio	Cincinnati	39	8 3	84	25 3	245	980.004
	Cleveland	41	30 4	81	36 6	210	980.241
Oregon	Portland	45	31 4	122	40.7	8	980 646
Pennsylvania	Philadelphia	39	57 1	75	11 7	16	980.196
	Pittsburgh	40	27 4	80	0 6	235	980 118
	State College	40	47 9	77	51 8	358	980.124
South Carolina	Charleston	32	47 2	79	56 0	6	979 546
South Dakota	Pierre	44	21 9	100	20 8	454	980 427
Texas	Austin	30	17 2	97	44 2	189	979 283
	El Paso	31	46 3	106	29 0	1146	979.124
	Galveston	29	18 2	94	47 5	3	979 272
	Georgetown	30	38 0	97	40 1	231	979.298
	Point Isabel	26	4 7	97	12 4	8	979.076
Utah	Salt Lake City	40	46 1	111	53 8	1322	979.803
Virginia	Charlottesville	38	2 0	78	30.3	166	979 938
	Richmond	37	32 2	77	26.1	30	979.960
Washington	Seattle	47	39 6	122	18 3	58	980.733
West Virginia	Charleston	38	20.9	81	37.7	184	979.936
Wisconsin	Madison	43	4.6	89	24.0	270	980.365
Wyoming	Norris Geyser Basin	44	44 2	110	42 0	2276	979 950

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION (Cont.)

Station		Latitude °	Latitude ′	Longitude °	Longitude ′	Elevation, meters	g cm/sec²
CANADA							
Alberta	Banff	51	10.9	115	34.5	1376	980.753
	Calgary	51	2.7	114	3.8	1044	980.823
	Chipewyan	58	42.7	111	8.8	229	981.723
	Peace River	56	14.1	117	17.2	324	981.482
British Columbia	Liard River	59	58.7	123	47.5	160	981.790
	Revelstoke	50	59.8	118	11.8	453	980.903
	Vancouver	49	16.8	123	6.8	6	980.949
Manitoba	Winnipeg	49	54.4	97	8.0	231	980.990
New Brunswick	St. John	45	16.0	66	5.0	33	980.663
	Woodstock	46	9.0	67	34.5	56	980.699
Northwest Territory	Arctic Red River	67	26.6	133	44.2	41	982.434
	Good Hope	66	15.3	128	38.2	59	982.340
	Norman	64	54.0	125	34.2	87	982.214
	Providence	61	21.2	117	39.2	156	981.955
	Resolution	61	10.1	113	40.5	152	981.942
	Simpson	61	51.6	121	20.8	132	982.004
Nova Scotia	Halifax	44	40.8	63	33.8	9	980.574
	Sydney	46	8.4	60	11.8	12	980.731
Ontario	Kenora	49	46.0	94	30.0	330	980.974
	Kingston	44	14.6	76	28.8	79	980.530
	Ottawa	45	23.6	75	43.0	83	980.618
	Port Arthur	48	26.0	89	13.0	189	980.820
	Sault Ste. Marie	46	30.4	84	19.2	186	980.680
	Woodstock	43	8.6	80	47.0	299	980.352
Prince Edward Island	Charlottetown	46	13.9	63	7.5	8	980.733
Quebec	St. Jérôme	45	46.6	74	0.0	107	980.681
Saskatchewan	Moose Jaw	50	23.4	105	31.9	541	980.943

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION (Cont.)

Station		Latitude °	Latitude ′	Longitude °	Longitude ′	Elevation, meters	g cm sec²
CENTRAL AND SOUTH AMERICA							
Argentina	Bahía Blanca	38	47 1S.	62	15 9	2	980.061
	Buenos Aires	34	36 5S.	58	22 2	2	979 669
Brazil	Bahia	12	58.5S.	38	31.0	4	978 331
Canal Zone	Panama	8	54.9	79	31 9	6	978 243
Chile	Valdivia	39	53 4S.	73	28 3	10	979 920
	Valparaiso	33	1 8S.	71	38 5	60	979.609
Peru	Callao	12	4 1S.	77	15 8	1	978 375
Salvador	Acajutla	13	34 7	89	50.4	12	978.303
Uruguay	Montevideo	34	54 5S.	56	12.9	4	979.772
EUROPE							
Austria	Vienna	48	12 7	16	21 5E.	183	980.860
Belgium	Brussels	50	51 0	4	22 E.	102	981.112
Denmark	Copenhagen	55	41 2	12	34 7E.	14	981.559
England	Greenwich	51	28 6	0	0 0	48	981.188
Finland	Helsinki	60	9 7	24	57 3E.	29	981 912
France	Paris	48	50 2	2	20 3E.	61	980 943
Germany	Königsberg	54	42 8	20	29 8E.	22	981.477
	Leipzig	51	20 1	12	23 5E.	115	981 180
	Munich	48	8 7	11	36 6E.	525	980.733
Hungary	Budapest	47	29 5	19	3 6E.	108	980 852
Italy	Milan	45	28 0	9	11 5E.	141	980.569
	Rome	41	53 5	12	29 7E.	49	980 367
Netherlands	Amsterdam	52	21 9	4	54 7E.	0	981 288
Norway	Bergen	60	23 9	5	18 3E.	38	981.922
Portugal	Lisbon	38	42 5	9	11 3	75	980 088
Roumania	Bucharest	44	24 6	26	6 8E.	83	980.553
Russia and Siberia	Archangel	64	34	40	31.0E.	5	982 278
	Leningrad	59	56 5	30	17.7E.	3	981.929
	Odessa	46	26 4	30	46 4E.	43	980 769
Scotland	Glasgow	55	51 5	4	14 0	61	981.605
Spain	Barcelona	41	25 0	2	7 0E.	407	980.240

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION (Cont.)

Station		Latitude °	′	Longitude °	′	Elevation, meters	g cm/sec²
EUROPE (Continued)							
Sweden	Stockholm	59	20 6	18	3 5E.	45	981.843
Switzerland	Geneva	46	12 0	6	9 2E.	402	980.592
ASIA							
China	Hongkong	22	18 2	114	10 5E.	33	978.771
India	Madras	13	4 1	80	14 9E.	6	978 281
Japan	Tokyo	35	42 6	139	46 0E.	18	979 801
Siam	Bankok	13	43.9	100	29.4E.	7	978.278
AFRICA							
Algeria	Algiers	36	44 8	3	3 E.	213	979 905
Egypt and Anglo-Egyptian Sudan	Khartum	15	36 6	32	32 9E.	383	978 308
Liberia	Monrovia	6	19 0	10	48 8	41	978 165
Red Sea	Suez	29	56 0	32	33 4E.	3	979 307
Union of South Africa	Cape Town	33	56 1S.	18	28 7E.	11	979 657
AUSTRALIA							
	Melbourne	37	49.9S.	144	58 5E.	26	979.987
OCEANIC							
Atlantic Ocean and Mediterranean Sea							
Azores	Ponta Delgada	37	43.8	25	40.8	4	980.143
Bermuda	St. George	32	21	64	40	2	979.806
Canary Islands	Las Palmas	28	7 0	15	26 0	8	979.385
Greenland	Karajak Glacier	70	26 9	50	19 8	20	982.534
Iceland	Reykjavik	64	8 5	22	0 3	39	982 273
Jamaica	Kingston	17	57 7	76	47 3	2	978.591
Pacific and Indian Oceans							
Java	Batavia	6	11 0S.	106	49 8E.	7	978.178
New Zealand	Auckland	36	50.9S.	174	46 2E.	3	979.962
Philippines	Manila	14	34 7	120	38 6E.	3	978 360
Territory of Hawaii	Honolulu	21	18 1	157	51 8	6	978 946

ACCELERATION DUE TO GRAVITY AND LENGTH OF THE SECONDS PENDULUM

For Sea Level at Various Latitudes

Based on the formula of the U. S. Coast and Geodetic Survey. The length of the simple pendulum whose period is two seconds, that is which beats seconds, is computed in each case from the corresponding value of the acceleration.

Latitude	Acceleration due to gravity		Length of seconds pendulum	
°	cm/sec.²	ft./sec.²	cm	in.
0	978 039	32 0878	99 0961	39 0141
5	978 078	32 0891	99 1000	39 0157
10	978 195	32 0929	99 1119	39 0204
15	978 384	32 0991	99 1310	39 0279
20	978 641	32.1076	99.1571	39 0382
25	978 960	32 1180	99 1894	39 0509
30	979 329	32.1302	99 2268	39 0656
31	979 407	32 1327		
32	979 487	32 1353		
33	979 569	32.1380		
34	979 652	32 1407		
35	979 737	32 1435	99 2681	39 0819
36	979 822	32 1463		
37	979 908	32 1491		
38	979.995	32.1520		
39	980 083	32 1549		
40	980 171	32 1578	99 3121	39.0992
41	980 261	32 1607		
42	980 350	32 1636		
43	980 440	32 1666		
44	980 531	32 1696		
45	980 621	32 1725	99.3577	39.1171
46	980 711	32.1755		
47	980 802	32 1785		
48	980 892	32.1814		
49	980 981	32.1844		
50	981 071	32 1873	99 4033	39 1351
51	981 159	32 1902		
52	981 247	32.1931		
53	981 336	32 1960		
54	981 422	32.1988		
55	981 507	32 2016	99 4475	39.1525
56	981 592	32 2044		
57	981 675	32.2071		
58	981.757	32.2098		
59	981.839	32.2125		
60	981.918	32 2151	99 4891	39.1689
65	982 288	32 2272	99 5266	39 1836
70	982 608	32 2377	99 5590	39 1964
75	982 868	32.2463	99.5854	39.2068
80	983 059	32.2525	99.6047	39 2144
85	983 178	32.2564	99.6168	39 2191
90	983 217	32.2577	99.6207	39.2207

ACCELERATION DUE TO GRAVITY

Free Air Correction for Altitude

−0.0003086 cm/sec.^{2}/m for altitude in meters.
−0.000003086 ft./sec.^{2}/ft. for altitude in feet.

Altitude meters	Correction cm/sec.^{2}	Altitude feet	Correction ft./sec.^{2}
200	−0.0617	200	−0.000617
300	.0926	300	.000926
400	.1234	400	.001234
500	.1543	500	.001543
600	.1852	600	.001852
700	.2160	700	.002160
800	.2469	800	.002469
900	.2777	900	.002777

DATA IN REGARD TO THE EARTH

Equatorial radius, 6,378,388 meters, 3,963.34 miles.
Polar radius, 6,356,911.946 meters, 3,949.99 miles.
Radius of sphere having same volume, 6,371,221.3 meters, 3,958.89 miles.
Quadrant of the equator, 10,019,148.4 meters, 6,225.60 miles.
Quadrant of the meridian, 10,002,288.3 meters, 6,215.12 miles.
1° latitude at the equator = 68.70 miles.
1° latitude at the pole = 69.41 miles.
Mean density of the earth, 5.522 g/cm^3, 344.7 lb./ft.^{3}
Mass of the earth, 5.983 × 10^{24} kg, 6.595 × 10^{21} tons.
Mean surface density of the continents, 2.67 g/cm^3, 166.7 lb./ft.^{3}
Mean linear velocity of the earth in its orbit, 29.77 km/sec., 18.50 mi./sec.
Mean linear velocity of rotation of the surface at the equator, 0.465 km/sec., 0.289 mi./sec.
Land area, 148.847 × 10^6 km^2, 57.470 × 10^6 sq. mi.
Ocean area, 361.254 × 10^6 km^2, 139.480 × 10^6 sq. mi.
Highest mountain, Everest, 8840 meters, 29,003 ft.
Greatest sea depth, 10,430 meters, 34,219 ft.
Thermal gradient of the earth, higher at increasing depths, 30° C per km, 48° C per mi. (uncertain).
Mean distance to the sun, 149,500,000 km or 92,900,000 mi.
Mean distance to the moon, 384,393 km or 238,854 mi.

Chemical Composition of the Earth, Including the Atmosphere

Arranged in order of abundance

Element	%	Element	%
O	46.43	P	0.130
Si	27.77	H	.127
Al	8.14	Mn	.096
Fe	5.12	F	.077
Ca	3.63	Cl	.055
Na	2.85	S	.052
K	2.60	Ba	.048
Mg	2.09	C	.027
Ti	0.629	Sr	.018
		Total of all others	.111

Velocity of Seismic Waves

Depth km	Longitudinal or condensational km/sec.	Transverse or distortional km/sec.
0–20	5 4 –5 6	3 2
20–45	6.25- 6 75	3 5
1300	12 5	6 9
2400	13.5	7 5

DATA CONCERNING THE SOLAR SYSTEM

Body	Mass Earth = 1	Distance from Sun		Sidereal period, days	Mean specific gravity
		km	miles		
Sun	329390			. .	1 42
Mercury	0 0549	58 × 10⁶	36 0 × 10⁶	87 97	5 61
Venus	0 8073	108 × 10⁶	67 1 × 10⁶	244 70	5 16
Earth	1 000	149 × 10⁶	92.9 × 10⁶	365 26	5 52
Mars	0 1065	228 × 10⁶	141 7 × 10⁶	686 98	3 95
Jupiter	314 5	778 × 10⁶	483 4 × 10⁶	4332 59	1 34
Saturn	94 07	1426 × 10⁶	886 1 × 10⁶	10759 20	0 69
Uranus	14 40	2869 × 10⁶	1782.7 × 10⁶	30685.93	1 36
Neptune	16.72	4495 × 10⁶	2793 1 × 10⁶	60187 64	1.30
Pluto	. . . .	5900 × 10⁶	3666 1 × 10⁶	90885.	. . .
Moon	0.01228	*38 × 10⁴	*23.6 × 10⁴	27 32	3 36

Body	Diameter		Acceleration due to gravity at surface		Albedo visual
	km	miles	cm/sec.²	ft./sec.²	
Sun	. .	.	27440	900 3	
Mercury	5140	3194	392	12 9	0 069
Venus	12620	7842	882	28 9	.59
Earth	12756	7926	980	32 2	. . . . .
Mars	6860	4263	392	12 9	.154
Jupiter	143600	89229	2646	86 8	.56
Saturn	120600	74937	1176	38 6	63
Uranus	53400	33181	980	32 2	63
Neptune	49700	30882	980	32 2	73
Moon	.	. . . .	167	5 47	073

ATMOSPHERIC AND METEOROLOGICAL DATA

Total mass of the atmosphere, estimated by Ekholm, 5.2×10^{21} g, $11\ 4 \times 10^{18}$ pounds, 5.70×10^{15} tons.

Evidence of extent: twilight, 63 km, 39 mi.; meteors, 200 km, 124 mi.; aurora 44–360 km, 27-224 mi

Height if homogeneous at normal atmospheric pressure, 7991 m, 4.965 mi.

Composition of the atmosphere, mean percentage by volume, at sea level, of the dry air components.

N_2	78 03	H_2	0.01
O_2	20 99	Ne	0.0012
A	0 94	He	0.0004
CO_2	0 03		

* Distance to Earth.

Variation of Composition of the Atmosphere with Elevation. Percentage Distribution by Volume.

(Humphreys)

Km	Mi.	A	N	H_2O	O	CO_2	H	He
100	62	....	2.95	0.05	0.11	....	95.58	1.31
50	31	0.12	86.78	0.10	10.17	..	2.76	0.07
20	12	0.59	81.24	0.02	18.10	0.01	0.04	
11	6.8	0.94	78.02	0.01	20.99	0.03	0.01	

Variation of Temperature, Pressure and Density of the Atmosphere with Altitude

Compiled by Humphreys

Elevation		Summer			Winter		
Km	Mi.	Temp. °C	Pressure mm of Hg.	Density, dry air g/cm^3	Temp. °C	Pressure mm of Hg.	Density, dry air g/cm^3
20.0	12.4	−51.0	44.1	0.000092	−57.0	39.5	0.000085
19.0	11.8	−51.0	51.5	.000108	−57.0	46.3	.000100
18.0	11.2	−51.0	60.0	.000126	−57.0	54.2	.000117
17.0	10.6	−51.0	70.0	.000146	−57.0	63.5	.000137
16.0	9.9	−51.0	81.7	.000171	−57.0	74.0	.000160
15.0	9.3	−51.0	95.3	.000199	−57.0	87.1	.000187
14.0	8.7	−51.0	111.1	.000232	−57.0	102.1	.000220
13.0	8.1	−51.0	129.6	.000270	−57.0	119.5	.000257
12.0	7.5	−51.0	151.2	.000316	−57.0	140.0	.000301
11.0	6.8	−49.5	176.2	.000366	−57.0	164.0	.000353
10.0	6.2	−45.5	205.1	.000419	−54.5	192.0	.000408
9.0	5.6	−37.8	237.8	.000470	−49.5	224.1	.000466
8.0	5.0	−29.7	274.3	.000524	−43.0	260.6	.000526
7.0	4.3	−22.1	314.9	.000583	−35.4	301.6	.000590
6.0	3.7	−15.1	360.2	.000649	−28.1	347.5	.000659
5.0	3.1	−8.9	410.6	.000722	−21.2	398.7	.000735
4.0	2.5	−3.0	466.6	.000803	−15.0	455.9	.000821
3.0	1.9	+2.4	528.9	.000892	−9.3	519.7	.000915
2.5	1.6	+5.0	562.5	.000942	−6.7	554.3	.000967
2.0	1.2	+7.5	598.0	.000990	−4.7	590.8	.001023
1.5	0.9	+10.0	635.4	.001043	−3.0	629.6	.001083
1.0	0.6	+12.0	674.8	.001100	−1.3	670.6	.001146
0.5	0.3	+14.5	716.3	.001157	0.0	714.0	.001215
0.0	0.0	+15.7	760.0	.001223	+0.7	760.0	.001290

Atmospheric Electricity

Normal potential gradient:
- Over land, 67 to 317 volts/m.
- Over sea, 128 volts/m.

Potential gradient at Earth's surface beneath thunder cloud, 1×10^4 volts/m
Quantity discharged by lightning flash, 10–50 coulombs.
Energy of flash, 1×10^{17} ergs.
Potential difference between discharge points, 1×10^9 volts.

Angular Radius of Halos and Rainbows

Coronae due to small water drops . .	1° to 10°
Small halo, due to 60° angles of ice crystals	22°
Large halo, due to 90° angles of ice crystals	46°
Rainbow, primary	41° 20′
Rainbow, secondary.	52° 15′

Solar Constant

The energy falling on one sq. cm area at normal incidence equals 1.92 small calories per minute.

MOLECULAR CONSTANTS

The following gives the arithmetical average velocity, the mean free path, molecular diameter and collision frequency for the temperatures indicated and at standard pressure, 760 mm Hg. except as otherwise stated.

Gas	Average velocity in cm/sec.		Mean free path in cm at 75 cm Hg.		
			Boltzmann		Meyer
	0° C	20° C	0° C	20° C	20° C
Air	447×10^2	463×10^2	...	...	...
Ammonia	583	604	5.92×10^{-6}	6.60×10^{-6}	5.83×10^{-6}
Argon	381	395	8.98	9.88	8.73
Carbon monoxide	454	471	8.46	9.23	8.16
Carbon dioxide	362	376	5.56	6.15	5.44
Helium	1208	1252	25.25	27.45	33.10
Hydrogen	1696	1755	16.00	17.44	15.40
Krypton	263	272	9.5		...
Mercury	170	176	.	(14.70)	(13.0)
Neon	538	557	.	.	
Nitrogen	454	471	8.50	9.29	8.21
Oxygen	425	440	9.05	9.93	8.78
Water vapor	566	587		.	
Xenon	210	218	5.6		

Gas	Collision frequency 20° C	Molecular diameter, cm		
		From viscosity	From van der Waal's equation	From heat conductivity
Ammonia	9150×10^6	2.97×10^{-8}	3.08×10^{-8}	.
Argon	4000	2.88	2.94	2.86×10^{-8}
Carbon monoxide	5100	3.19	3.12	
Carbon dioxide	6120	3.34	3.23	3.40
Helium	4540	1.90	2.65	2.30
Hydrogen	10060	2.40	2.34	2.32
Krypton		...	(3.69)	3.14
Mercury			3.01	...
Nitrogen	5070	3.15	3.15	3.53
Oxygen	4430	2.98	2.92	...
Xenon			4.02	3.42

NUMBER OF MOLECULES IN A GRAM-MOLECULE

Perrin, 1909–11 .... $6.2\ \times10^{23}$
Perrin (Brownian movement) 6.85
Millikan, 1910 .... 6.2
Millikan, 1917 .... 6.06

MASS OF THE HYDROGEN ATOM

1.6617×10^{-24} g

EFFECTIVE RADII OF ATOMS

Values given have been computed by Goldschmidt on the basis of empirical assumptions or by Pauling on the basis of wave-mechanics. The latter values are in bold-faced type. Values considered non-typical are in parenthesis.

Condensed from a compilation by Wherry, American Mineralog **14**, 54, 1929.

Element	Charge	Radius Angstrom
A	0	(1.54)
Ag	0	1.44
	+1	1.13
		1.26
Al	0	1.43
	+3	**0.50**
		0.57
As	0	1.16
	+3	0.69
	+5	**0.47**
	−3	**2.22**
Au	0	1.40
		1.44
	+1	**1.37**
B	+3	**0.20**
Ba	0	2.10
	+2	1.35
		1.43
Be	0	1.05
	+2	**0.31**
		0.34
Bi	0	1.46
	+5	**0.74**
Br	0	1.19
	+7	**0.39**
	−1	**1.95**
		1.96
C	0	0.77
	+4	**0.15**
	−4	**2.60**
Ca	0	1.97
	+2	0.99
		1.06
Cb	0	1.43
	+4	**0.67**
		0.69
	+5	0.69
		0.70

Element	Charge	Radius Angstrom
Cd	0	1.49
	+2	**0.97**
		1.03
Ce	0	1.82
		1.83
	+3	1.18
	+4	**1.01**
		1.02
Cl	0	1.05
		1.07
	+7	**0.26**
	−1	**1.81**
Co	0	1.26
	+2	**0.72**
		0.82
	+3	0.29
		0.47
Cr	0	1.25
	+6	**0.52**
		0.65
Cs	0	2.55
	+1	1.65
		1.69
Cu	0	1.27
	+1	**0.96**
	+2	0.70
Dy	+3	1.07
Er	+3	1.04
Eu	+3	1.13
F	0	0.67
	+7	**0.07**
	−1	1.33
		1.36
Fe	0	1.26
	+2	**0.75**
		0.83
	+3	0.67

EFFECTIVE RADII OF ATOMS (Continued)

Element	Charge	Radius Angstrom
Ga	0	1.33
	+3	**0.62**
Gd	+3	1.11
Ge	0	1.22
	+4	0.44
		0.53
	−4	**2.72**
H	−1	**2.08**
He	0	(0.93)
Hf	0	1.66
Hg	0	1.46
		1.49
	+2	**1.10**
		1.12
Ho	+3	1.05
I	0	1.36
		1.40
	+5	0.94
	+7	**0.50**
	−1	**2.16**
		2.20
In	0	1.45
		1.62
	+3	**0.81**
		0.92
Ir	0	1.35
	+4	**0.64**
		0.66
K	0	2.23
	+1	1.33
Kr	0	(1.69)
La	+3	**1.15**
		1.22
Li	0	1.56
	+1	**0.60**
		0.78
Mg	0	1.62
	+2	**0.65**
		0.78

Element	Charge	Radius Angstrom
Mn	0	1.29
	+2	**0.80**
		0.91
	+4	**0.50**
		0.52
	+7	**0.46**
Mo	0	1.36
	+4	**0.66**
	+6	**0.62**
N	0	0.71
	+5	**0.11**
	−3	1.71
Na	0	1.86
	+1	**0.95**
		0.98
Nd	+3	1.15
Ne	0	(1.12)
Ni	0	1.24
	+2	**0.69**
		0.78
	+3	0.35
O	0	0.60
	+6	**0.09**
	−2	1.32
		1.40
Os	0	1.30
		1.34
	+4	**0.65**
		0.67
P	0	0.93
	+5	**0.34**
	−3	**2.12**
Pb	0	1.74
	+2	**1.21**
		1.32
	+4	**0.84**
	−4	**2.15**
Pd	0	1.37
Pr	+3	1.16
	+4	**0.92**
		1.00

EFFECTIVE RADII OF ATOMS (Continued)

Element	Charge	Radius Angstrom
Pt	0	1.38
Rb	0	2.36
	+1	**1.48**
		1.49
Rh	0	1.34
		1.35
	+3	0.69
Ru	0	1.27
		1.34
	+4	**0.63**
		0.65
S	0	1.02
		1.04
	+6	**0.29**
		0.34
	−2	1.74
		1.84
Sa, Sm	+3	1.13
Sb	0	1.34
	+3	0.90
	+5	**0.62**
	−3	**2.45**
Sc	0	1.51
	+3	**0.81**
		0.83
Se	0	1.13
		1.17
	+6	**0.42**
	−2	1.91
		1.98
Si	0	1.18
	+4	0.39
		0.41
	−4	**2.71**
Sn	0	1.40
	+4	**0.71**
	−4	**2.94**
Sr	0	1.95
	+2	**1.13**
		1.27
Ta	0	1.42
		1.44
Tb	+3	1.09
Te	0	1.33
		1.43
	+4	**0.81**
		0.89
	+6	**0.56**
	−2	2.03
		2.21
Th	0	1.80
		1.82
	+4	**1.02**
		1.10
Ti	0	1.49
	+4	0.64
		0.68
Tl	0	1.99
	+1	1.44
		1.51
	+3	**0.95**
		1.05
Tm	+3	1.04
U	+4	**0.97**
		1.05
V	0	1.32
	+4	**0.59**
		0.61
	+5	**0.59**
W	0	1.37
	+4	**0.66**
		0.68
	+6	0.88
Xe	0	(1.90)
Y	+3	**0.93**
		1.06
Yb	+3	1.00
Zn	0	1.31
		1.34
	+2	**0.74**
		0.83
Zr	0	1.60
		1.62
	+4	**0.80**
		0.89
NH_4	+1	**1.42**
		1.59

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS

Raymond T. Birge, Reviews of Modern Physics **13**, 233, 1941

Table A. Principal Constants and Ratios*

Section		
A	Velocity of light	$c = (2.99776 \pm 0.00004) \times 10^{10}$ cm · sec^{-1}
B	Gravitation constant	$G = (6.670 \pm 0.005) \times 10^{-8}$ dyne · cm^2 · g^{-2}
C	Liter (= 1000 ml)	$l = 1000.028 \pm 0.002$ cm^3
D	Volume of ideal gas (0°C, A_0)	$V_0 = (22.4146 \pm 0.0006) \times 10^3$ cm^3 · atmos · mole^{-1}
		$V_0' = 22.4140 \pm 0.0006$ liter · atmos · mole^{-1}
D	Volume of ideal gas (0°C, A_{45})	$V_{45} = (22.4157 \pm 0.0006) \times 10^3$ cm^3 · atmos · mole^{-1}
		$V_{45}' = 22.4151 \pm 0.0006$ liter · atmos · mole^{-1}
E	International ohm (= p abs-ohm)	$p = 1.00048 \pm 0.00002$
E	International ampere (= q abs-amp)	$q = 0.99986 \pm 0.00002$
F	Atomic weights (see Table A′)	
G	Standard atmosphere	$A_0 = (1.013246 \pm 0.000004) \times 10^6$ dyne · cm^{-2} · atmos^{-1}
G	45° atmosphere	$A_{45} = (1.013195 \pm 0.000004) \times 10^6$ dyne · cm^{-2} · atmos^{-1}
H	Ice-point (absolute scale)	$T_0 = 273.16 \pm 0.01$°K
I	Joule equivalent	$J_{15} = 4.1855 \pm 0.0004$ abs-joule · cal$_{15}^{-1}$
I	Joule equivalent (electrical)	$J_{15}' = 4.1847 \pm 0.0003$ int-joule · cal$_{15}^{-1}$
J	Faraday constant	

(1) Chemical scale

$F = 96501._2 \pm 10$ int-coul · g-equiv^{-1}
$= 96487._7 \pm 10$ abs-coul · g-equiv^{-1}
$= 9648.7_7 \pm 1.0$ abs. e.m.u. · g-equiv^{-1}
$F' = Fc = (2.89247 \pm 0.00030) \times 10^{14}$ abs. e.s.u. · g-equiv^{-1}

(2) Physical scale

$F = 96514._0 \pm 10$ abs-coul · g-equiv^{-1}
$= 9651.4_0 \pm 1.0$ abs. e.m.u. · g-equiv^{-1}
$F' = Fc = (2.89326 \pm 0.00030) \times 10^{14}$ abs. e.s.u. · g-equiv^{-1}

K	Avogadro number (chemical scale)	$N_0 = (6.0228_3 \pm 0.0011) \times 10^{23}$ mole^{-1}
K	Electronic charge	$e = F/N_0 = (1.60203_3 \pm 0.00034) \times 10^{-20}$ abs. e.m.u.
		$e' = ec = (4.8025_1 \pm 0.0010) \times 10^{-10}$ abs. e.s.u.
L	Specific electronic charge	$e/m = (1.7592 \pm 0.0005) \times 10^7$ abs. e.m.u. · g^{-1}
		$e'/m = ec/m = (5.2736_6 \pm 0.0015) \times 10^{17}$ abs. e.s.u. · g^{-1}
M	Planck constant	h (see Table C).

* Unless otherwise specified, all quantities in these tables that involve the mole or the gram equivalent are on the chemical scale of atomic weights.

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS (Continued)

Table A′. Atomic Weights

(1) Physical scale ($O^{16} = 16.0000$)

$H^1 = 1.00813 \pm 0.00001_7$ $\qquad H^2 = 2.01473 \pm 0.00001_9$

$H = 1.00827_6 \pm 0.00001_7$ (from H^1/H^2 abundance $= 6900 \pm 100$)

$He^4 = 4.00389 \pm 0.00007$

$C^{12} = 12.00386 \pm 0.00004$ $\qquad C^{13} = 13.00761 \pm 0.00015$

$C = 12.01465 \pm 0.00023$ (from C^{12}/C^{13} abundance $= 92 \pm 2$)

$N^{14} = 14.00753 \pm 0.00005$ $\qquad N^{15} = 15.0049 \pm 0.0002$

$N = 14.01121 \pm 0.00009_5$ (from N^{14}/N^{15} abundance $= 270 \pm 6$)

$O^{16} = 16.0000$ $\qquad O^{17} = 17.0045$ $\qquad O^{18} = 18.0049$

$O = 16.00435_7 \pm 0.00008_6$ (from abundance $O^{16}:O^{18}:O^{17} = (506 \pm 10):1:(0.204 \pm 0.008)$)

(2) Chemical scale ($O = 16.0000$)

Ratio physical to chemical scale

$$r = (16.004357 \pm 0.000086)/16 = 1.000272 \pm 0.000005$$

$H^1 = 1.00785_6 \pm 0.00001_8$ (from physical scale)

$H^2 = 2.01418_2 \pm 0.00002_1$ (from physical scale)

$H = 1.00800_2 \pm 0.00001_8$ (from physical scale)

$He^4 = 4.00280 \pm 0.00007$ (from physical scale)

$C = 12.01139 \pm 0.00024$ (from physical scale)

$N = 14.00740 \pm 0.00012$ (from physical scale)

$N = 14.0086 \pm 0.0007$ (direct observation)

$Na = 22.994 \pm 0.003$ $\qquad Cl = 35.457 \pm 0.001$

$Ca = 40.080 \pm 0.005$ $\qquad Ag = 107.880 \pm 0.002$ $\qquad I = 126.915 \pm 0.004$

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS (Continued)

Table B. Additional Quantities Evaluated or Used in Connection with Table A

Section			
A	Ratio of e.s.u. to e.m.u. (direct)	c'	$= (2.9971_2 \pm 0.0001) \times 10^{10}\ \mathrm{cm}^{1/2} \cdot \mathrm{sec}^{-1/2} \cdot \mathrm{int\text{-}ohm}^{1/2}$
			$= (2.9978_4 \pm 0.0001_0) \times 10^{10}\ \mathrm{cm} \cdot \mathrm{sec}^{-1}$
A	Ratio of e.s.u. to e.m.u. (indirect)	$c' = c$	$= (2.99776 \pm 0.00004) \times 10^{10}\ \mathrm{cm} \cdot \mathrm{sec}^{-1}$
B	Average density of earth	δ	$= 5.517 \pm 0.004\ \mathrm{g} \cdot \mathrm{cm}^{-3}$
C	Maximum density of water	$\delta\ m(H_2O)$	$= 0.999972 \pm 0.000002\ \mathrm{g} \cdot \mathrm{cm}^{-3}$
D	Acceleration of gravity (standard)	g_0	$= 980.665\ \mathrm{cm} \cdot \mathrm{sec}^{-2}$
D	Acceleration of gravity (45°)	g_{45}	$= 980.616\ \mathrm{cm} \cdot \mathrm{sec}^{-2}$
D	Density of oxygen gas (0°C, A_{45})	L_1	$= 1.42897 \pm 0.00003\ \mathrm{g} \cdot \mathrm{liter}^{-1}$
D	Limiting density of oxygen gas (0°C, A_{45})	$L_{\lim}$	$= 1.427609 \pm 0.000037\ \mathrm{g} \cdot \mathrm{liter}^{-1}$
D	Factor converting oxygen (0°C, A_{45}) to ideal gas	$1 - \alpha$	$= 1.000953_5 \pm 0.000009_4$
E	International coulomb (= q abs-coul)	q	$= 0.99986 \pm 0.00002$
E	International gauss (= q abs-gauss)		
E	International henry (= p abs-henry)	p	$= 1.00048 \pm 0.00002$
E	International volt (= pq abs-volt)	pq	$= 1.00034 \pm 0.00003$
E	International joule (= pq^2 abs-joule)	pq^2	$= 1.00020 \pm 0.00004_5$
G	Specific gravity of Hg (0°C, A_0) referred to air-free water at maximum density	ρ_0	$= 13.59542 \pm 0.00005$
G	Density of Hg (0°C, A_0)	D_0	$= 13.59504_0 \pm 0.00005_7\ \mathrm{g} \cdot \mathrm{cm}^{-3}$
J	Electrochemical equivalents (chemical scale)		
	silver (apparent)	E_{Ag}	$= 1.11800 \times 10^{-3}\ \mathrm{g} \cdot \mathrm{int\text{-}coul}^{-1}$
	(corrected)	E_{Ag}	$= (1.11807 \pm 0.00012) \times 10^{-3}\ \mathrm{g} \cdot \mathrm{abs\text{-}coul}^{-1}$
	iodine (apparent)	E_I	$= (1.315026 \pm 0.000025) \times 10^{-3}\ \mathrm{g} \cdot \mathrm{int\text{-}coul}^{-1}$
	(corrected)	E_I	$= (1.31535 \pm 0.00014) \times 10^{-3}\ \mathrm{g} \cdot \mathrm{abs\text{-}coul}^{-1}$
K	Effective calcite grating space (18°C), Siegbahn system	d_{18}''	$= 3.02904 \times 10^{-8}\ \mathrm{cm}$
K	True calcite grating space (20°C), Siegbahn system	d_{20}'	$= 3.02951_2 \times 10^{-8}\ \mathrm{cm}$
K	True calcite grating space (20°C), c.g.s. system	d_{20}	$= (3.03567_4 \pm 0.00018) \times 10^{-8}\ \mathrm{cm}$
K	Ratio of grating and Siegbahn scales of wave-lengths	λ_g/λ_s	$= 1.002034 \pm 0.000060$
K	Density of calcite (20°C)	ρ	$= 2.71029 \pm 0.00003\ \mathrm{g} \cdot \mathrm{cm}^{-3}$
K	Structural constant of calcite (20°C)	ϕ	$= 1.09594 \pm 0.00001$
K	Molecular weight of calcite (chemical scale)	M	$= 100.091_4 \pm 0.005$
L	Rydberg constant for hydrogen (H^1)	R_H	$= 109677.581_2 \pm 0.007_5\ \mathrm{cm}^{-1}$ (I.A. scale)
L	Rydberg constant for deuterium (H^2)	R_D	$= 109707.419_3 \pm 0.007_5\ \mathrm{cm}^{-1}$ (I.A. scale)
L	Rydberg constant for helium	R_{He}	$= 109722.263 \pm 0.012\ \mathrm{cm}^{-1}$ (I.A. scale)
L	Rydberg constant for infinite mass	R_∞	$= 109737.303 \pm 0.017\ \mathrm{cm}^{-1}$ (I.A. scale)
			or $\pm 0.05\ \mathrm{cm}^{-1}$ (c.g.s. system)

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS (Continued)

Table C. Partial List of Derived Quantities*

Planck constant

$$h = \left\{ \frac{2\pi^2 c^3 F^5}{R_\infty N_0^5 (e/m)} \right\}^{1/3} = (6.624_2 \pm 0.002_4) \times 10^{-27} \text{ erg} \cdot \text{sec}$$

$$h/c = \left\{ \frac{2\pi^2 c^3 F^2}{R_\infty N_0^2 (e/m)} \right\}^{1/3} = (4.1349_0 \pm 0.0007_1) \times 10^{-7} \text{ erg} \cdot \text{sec} \cdot \text{e.m.u.}^{-1}$$

$$h/\epsilon' = h/ec = \left\{ \frac{2\pi^2 F^2}{R_\infty N_0^2 (e/m)} \right\}^{1/3} = (1.3793_3 \pm 0.0002_3) \times 10^{-17} \text{ erg} \cdot \text{sec} \cdot \text{e.s.u.}^{-1}$$

Atomic weight of electron

$$E = F/(e/m)$$

$$\text{(physical scale)} = (5.4862_4 \pm 0.0017) \times 10^{-4}$$

$$\text{(chemical scale)} = (5.4847_5 \pm 0.0017) \times 10^{-4}$$

Band spectra constant connecting wave number and moment of inertia

$$h/8\pi^2 c = \left\{ \frac{F^5}{256\pi^4 R_\infty N_0^5 (e/m)} \right\}^{1/3} = (27.98_{60} \pm 0.01_0) \times 10^{-40} \text{ g} \cdot \text{cm}$$

Boltzmann constant

$$k = R_0/N_0 = V_0 A_0/T_0 N_0 = (1.38047_4 \pm 0.00026) \times 10^{-16} \text{ erg} \cdot \text{deg}^{-1}$$

Charge in electrolysis of one gram of H

$$F/H = 9572.1_{77} \pm 1.0 \text{ abs. e.m.u.} \cdot \text{g}^{-1}$$

Charge in electrolysis of one gram of H^1

$$e/M_{H^1} = F/H^1 = 9573.5_{60} \pm 1.0 \text{ abs e.m.u. g}^{-1}$$

Compton shift at 90°

$$h/mc = \left\{ \frac{2\pi^2 F^2 (e/m)^2}{R_\infty N_0^2} \right\}^{1/3} = (0.024265_{14} \pm 0.000005_7) \times 10^{-8} \text{ cm}$$

Energy in ergs of one abs-volt-electron

$$E_0 = 10^8 e = 10^8 F/N_0 = (1.60203_3 \pm 0.00034) \times 10^{-12} \text{ erg}$$

Energy in calories per mole for one abs-volt-electron per molecule

$$\frac{F \text{ (abs. coul. per gram equiv)}}{J_{15} \text{ (abs. joules per cal)}} = 23052._{86} \pm 3._2 \text{ cal}_{15} \cdot \text{mole}^{-1}$$

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS (Continued)

Fine structure constant . . $\alpha = 2\pi(e')^2/hc = \left\{\frac{4\pi R_\infty F(e/m)}{N_0}\right\}^{1/3} = (7.2976_6 \pm 0.0008_6) \times 10^{-3}$

$1/\alpha = 137.030_2 \pm 0.016$

$\alpha^2 = (5.3256 \pm 0.0013) \times 10^{-5}$

Gas constant per mole . . . . . . $R_0 = V_0A_0/T_0 = (8.31436 \pm 0.00038) \times 10^7$ erg · deg^{-1} · mole^{-1}

$R_0' = R_0 \cdot 10^{-7}/J_{15} = 1.98646_7 \pm 0.00021$ cal$_{15}$ · deg^{-1} · mole^{-1}

$R_0'' = V_0'/T_0 = (8.20544_7 \pm 0.00037) \times 10^{-2}$ liter · atmos · deg^{-1} · mole^{-1}

$R_0''' = R_0/A_0 = V_0/T_0 = 82.0566_7 + 0.0037$ cm^3 · atmos · deg^{-1} · mole^{-1}

also $R_0T_0 = V_0A_0 = (2.27115_0 \pm 0.00006) \times 10^{10}$ erg · mole^{-1}

Loschmidt number (0°C, A_0) $n_0 = N_0/V_0 = (2.68701_2 \pm 0.00050) \times 10^{19}$ atmos^{-1} · cm^{-3}

Magnetic moment of one Bohr magneton $\mu_1 = (h/4\pi)(e/m) = \frac{1}{4\pi}\left\{\frac{2\pi^2 c^3 F^5(e/m)^2}{R_\infty N_0^5}\right\}^{1/3}$

$= (0.92731_0 \pm 0.0003_4) \times 10^{-20}$ erg · gauss^{-1}

Magnetic moment per mole for one Bohr magneton per molecule

$\mu_1 N_0 = \frac{1}{4\pi}\left\{\frac{2\pi^2 c^3 F^5(e/m)^2}{R_\infty N_0^2}\right\}^{1/3} = 5585.2_4 \pm 1.6$ erg · gauss^{-1} · mole^{-1}

Mass of α-particle . . . . $M_\alpha = (\mathrm{He} - 2E)/N_0 = (6.6442_2 \pm 0.0012) \times 10^{-24}$ g

Mass of atom of unit atomic weight . . . $M_0 = 1/N_0 = (1.66035 \pm 0.00031) \times 10^{-24}$ g

Mass of electron . . . . . . $m = e/(e/m) = (F/N_0)/(e/m) = (9.1066_0 \pm 0.0032) \times 10^{-28}$ g

Mass of H^1 atom . . . $M_{H^1} = H^1/N_0 = (1.67339_3 \pm 0.00031) \times 10^{-24}$ g

Mass of proton . . . . $M_p = (H^1 - E)/N_0 = (1.67248_1 \pm 0.00031) \times 10^{-24}$ g

Radiation density constant . $a = 8\pi^5k^4/15c^3h^3 = \left(\frac{V_0A_0}{T_0}\right)^4 \frac{4\pi^3 N_0 R_\infty(e/m)}{15c^6F^5}$

$= (7.569_{12} \pm 0.0049) \times 10^{-15}$ erg · cm^{-3} · deg^{-4}

Ratio mass H^1 atom to mass electron . . . . $M_{H^1}/m = (e/m)(H^1/F) = 1837.5_{61} \pm 0.5_6$

Ratio mass proton to mass electron . . . . $M_p/m = (e/m)\left(\frac{H^1 - E}{F}\right) = 1836.5_{61} \pm 0.5_6$

Second radiation constant $c_2 = hc/k = \frac{c^2T_0}{V_0A_0}\left\{\frac{2\pi^2F^5}{R_\infty N_0^2(e/m)}\right\}^{1/3} = 1.4384_8 \pm 0.0003_4$ cm · deg

NEW TABLE OF VALUES OF THE GENERAL PHYSICAL CONSTANTS (Continued)

Specific charge of α-particle . . $2e/M_\alpha = \dfrac{2F}{\text{He} - 2\bar{E}} = 4822.3_3 \pm 0.5_1$ abs. e.m.u. g^{-1}

Specific charge of proton . . . . . $e/M_p = \dfrac{F}{H^1 - \bar{E}} = 9578.7_7 \pm 1.0$ abs. e.m.u. g^{-1}

Stefan-Boltzmann constant . $\sigma = ac/4 = 2\pi^5k^4/15c^2h^3 = \left(\dfrac{V_0A_0}{T_0}\right)^4 \dfrac{\pi^3 N_0 R_\infty (e/m)}{15(Fc)^5}$

$= (5.672_{83} \pm 0.003_7) \times 10^{-5}$ erg · cm^{-2} · deg^{-4} · sec^{-1}

Wave-length associated with one abs-volt†

$$\lambda_0 = 10^{-8}c^2(h/e') = \frac{c^2}{10^8}\left\{\frac{2\pi^2F^2}{R_\infty N_0^2(e/m)}\right\}^{1/3} = (12395._4 \pm 2._1) \times 10^{-8}\ \text{cm} \cdot \text{abs-volt}$$

Wave number associated with one abs-volt

$$\nu_0 = 1/\lambda_0 = \frac{10^8}{c^2}\left\{\frac{R_\infty N_0^2(e/m)}{2\pi^2F^2}\right\}^{1/3} = 8067.4_0 \pm 1.4\ \text{cm}^{-1} \cdot \text{abs-volt}^{-1}$$

Wien's displacement law constant‡ $A = c_2/4.965114 = 0.28971_8 \pm 0.00007$ cm · deg

Zeeman displacement per gauss . $(e/m)/4\pi c = (4.6699_1 \pm 0.0013) \times 10^{-5}$ cm^{-1} · gauss^{-1}

* In order to be able to calculate, by propagation of errors, the probable error in a derived quantity, it is necessary to express the quantity explicitly in terms of the various fundamental quantities of Table A, or of Table B, and that has been done in each case. Since in this paper e and h are treated as derived quantities, they do not therefore appear in such explicit expressions. But in calculating *numerical* values of derived quantities, the work can often be greatly simplified by using the values of other previously calculated derived quantities—in particular e and h. In order to show how certain derived quantities depend on quantities like e and h, such alternative expressions are given in many cases.

† The factor 10^{-8} was accidentally omitted, in G.C. 1929, in the equation for λ_0.

‡ The factor 4.965114 is the root of $e^{-\beta} + (\beta/5) - 1 = 0$

ABBREVIATIONS AND SYMBOLS

Abbreviations

The following list of abbreviations is intended to cover those in common use in chemistry and physics. Symbols are presented in a separate list following the abbreviations.

A.	Acre
Å	Ångström unit
a	Are
a.	Acid
abs.	Absolute
abt.	About
a.c.	Alternating current
acet.	Acetone
acet. a.	Acetic acid
al.	Alcohol
alk.	Alkali
alt.	Altitude
amal.	Amalgam; amalgamated
amor. *or* amorph.	Amorphous
amp.	Ampere
anh.	Anhydrous
antilog	Antilogarithm
ap.	Apothecaries'
appr.	Approximately
aq.	Aqua; aqueous; water
aq. reg.	Aqua regia
asym.	Asymmetrical
atm. *or* atmos.	Atmosphere (atmospheric)
At. No.	Atomic number
At. Wt.	Atomic weight
aux.	Auxiliary
Av.	Average
av. *or* avoir.	Avoirdupois
bar	Barometer
bbl.	Barrel
bd	Board
Bé	Beaumé (degrees)
B.G.	Birmingham gauge (hoop and sheet)
b.h.p.	Brake horse power
bl.	Blue
blk.	Black
B.M.	Board measure
b.p.	Boiling point
br.	Brown
BTU	British thermal unit
bu.	Bushel
B.W.G.	Birmingham wire gauge
bz.	Benzene
C	Centigrade
c	Carat; centi-
c.	Cold
ca	Candle
ca.	*Circa*, about; approximately
cal.	Calorie (gram)
cc. *or* c.c.	Cubic centimeter
cd.	Cord
c. cm	Cubic centimeter
Cent.	Centigrade
centi-	Prefix meaning 1/100
cf.	*Confer*, compare
c.f.m.	Cubic foot per minute
cgs	Centimeter-gram-second system of units
cgse	Cgs electrostatic system
cgsm	Cgs electromagnetic system
ch.	Chain
chl	Chloroform
cir.	Circular
circum.	Circumference
cl	Centiliter
cm	Centimeter
cm^2	Square centimeter
cm^3	Cubic centimeter
c.m.	Circular mil
coef.	Coefficient
colog	Cologarithm
colorl.	Colorless
comm'l	Commercial
conc.	Concentrated
cond.	Condensing
const.	Constant
cos	Cosine
cos^{-1}	Arc or angle whose cosine is . ; anti-cosine of; inverse cosine of
cosec	Cosecant
cosh	Hyperbolic cosine
$cosh^{-1}$	Inverse hyperbolic cosine
cot	Cotangent
cot^{-1}	Arc or angle whose cotangent is . . .
coth	Hyperbolic cotangent
$coth^{-1}$	Inverse hyperbolic cotangent
covers	Coversed sine
c.p.	Candle power; circular pitch; center of pressure
cry. *or* cryst.	Crystalline; crystals
csc	Cosecant
csc^{-1}	Arc or angle whose cosecant is
csch	Hyperbolic cosecant
$csch^{-1}$	Inverse hyperbolic cosecant
CTU	Centigrade thermal unit
cu.	Cubic
cu. cm	Cubic centimeter
cu. ft.	Cubic foot
cu. in.	Cubic inch
cu. m	Cubic meter
cu. yd.	Cubic yard
cwt.	Hundredweight
cyl.	Cylinder
d	Derivative; deci-
d.	Decomposes; day
d.	Dextrorotary
d.c.	Direct current
dec.	Decomposes
deci-	Prefix meaning 1/10
def.	Definition (s)
deg	Thermometric degree; absolute C unless contrary is indicated
deka-	Prefix meaning 10
deliq.	Deliquescent
den. *or* dens.	Density
dg	Decigram
diam.	Diameter
dil.	Dilute
dissd	Dissolved
dk	Deka-
dk.	Dark
dkg.	Dekagram
dkl	Dekaliter
dkm	Dekameter
dkm^2	Square dekameter
dkm^3	Cubic dekameter
dks	Dekastere
dl	Deciliter

Abbreviations (Continued)

dm	Decimeter
dm^2	Square decimeter
dm^3	Cubic decimeter
d.p.	Diametral pitch; double pole
dr.	Dram
dr. ap. *or* ℨ ap.	Dram, apothecaries'
dr. av. *or* ℨ av.	Dram, avoirdupois
dr. fl. *or* ℨ fl.	Dram, fluid
dr. t. *or* ℨt.	Dram, troy
ds	Decistere
dwt.	Pennyweight
efflor.	Efflorescent
e.g.	*Exempli gratia*, for example
e.h.p.	Effective horse power
E.L.	Elastic limit
em	Cgsm unit of quantity of electricity
emf *or* e.m.f.	Electromotive force
es	Electrostatic or cgse unit of quantity of electricity
etc	*Et cetera*, and so forth
eth.	Ether
eth acet.	Ethyl acetate
et. seq.	*Et sequentes*, and the following
evap.	Evaporation
ex.	Excess
exp	Exponential function
exp.	Explodes
exsec	Exterior secant
F	Fahrenheit
f	From
fahr.	Fahrenheit
fath.	Fathom
feath.	Feathery
f.h.p.	Friction horse power
fir.	Firkin
fl.	Fluid
fl. dr.	Dram, fluid
fl. oz.	Ounce, fluid
fluores.	Fluorescent
fps	Foot-pound-second system of units
fpse	Foot-pound-second electrostatic system
fpsm	Foot-pound-second electromagnetic system
F.S.	Factor of safety
ft.	Foot
$ft.^2$	Square foot
$ft.^3$	Cubic foot
ft.-lb.	Foot-pound
fur.	Furlong
G	Gravitation constant
g	Gram
g-cal. *or* g.-cal.	Gram calorie
gal.	Gallon
gel.	Gelatinous
gi.	Gill
glac.	Glacial
glit.	Glittering
glyc.	Glycerine
gm.	Gram
gr.	Gray; grain
grn.	Green
gyr.	Gyration
h	Hecto-
h.	Hot; hour
ha	Hectare
hecto-	Prefix meaning 100
hex.	Hexagonal
hg	Hectogram
hhd.	Hogshead
hl	Hectoliter
hm	Hectometer
hm^2	Square hectometer
hm^3	Cubic hectometer
hor. *or* horiz.	Horizontal
h.-p.	High-Pressure
HP *or* h.p.	Horse power
h.p.-hr.	Horse power-hour
hr.	Hour
hyg.	Hygroscopic
i.	Insoluble
ibid.	*Ibidem*, in the same place
i.e.	*Id est*, that is
ign.	Ignites
i.h.p.	Indicated horse power
in.	Indigo, inch
$in.^2$	Square inch
$in.^3$	Cubic inch
inc.	Inclusive
in.-lb.	Inch-pound
insol.	Insoluble
Int.	International
iso.	Isotropic
isom.	Isometric
isoth.	Isothermal
k	Kilo-
kg	Kilogram
kg-cal.	Kilogram-calorie
kg-m	Kilogram-meter
kilo-	Prefix meaning 1,000
kl	Kiloliter
km	Kilometer
km^2	Square kilometer
km^3	Cubic kilometer
kva.	Kilovolt-ampere
kw.	Kilowatt
kw.-hr.	Kilowatt-hour
l	Liter
l.	Long
l	Laevorotary
lat.	Latitude
lb.	Pound
lb. ap.	Pound, apothecaries'
lb. av.	Pound, avoirdupois
lb. t.	Pound, troy
leaf.	Leaflets
lgr.	Ligroin
li.	Link
lin.	Linear
liq.	Liquid
lim.	Limit
ln	Natural hyperbolic or Napierian logarithm
log *or* log.	Logarithm
$\log_e$	Logarithm to the base *e*, natural, hyperbolic or Napierian logarithm
$\log_{10}$	Common logarithm, logarithm to the base 10
long.	Longitude
lng.	Long
l.-p.	Low-pressure
lt.	Light
lust.	Lustrous
♏	Minim or drop
m	Meter; milli-
m^2	Square meter
m^3	Cubic meter
m.	Minute
m.	Meta-
max.	Maximum
med.	Medium
meth.	Methyl
meth. al.	Methyl alcohol
m.e.p.	Mean effective pressure
met.	Metallic
mg	Milligram

ABBREVIATIONS AND SYMBOLS (Continued)

Abbreviations (Continued)

m.h.c.p.	Mean horizontal candle power
mi.	Mile
mic.	Microscopic
micro-	Prefix meaning 1/1,000,000 or 10^{-6}
micro-micro	Prefix meaning 10^{-12}
milli-	Prefix meaning 1/1,000
milli-micro-	Prefix meaning 10^{-9}
min *or* min.	Minute
min	Minim; minimum; mineral
ml	Milliliter
m.l.h.c.p.	Mean lower hemispherical candle power
mm	Millimeter
mm²	Square millimeter
mm³	Cubic millimeter
mmf *or* m.m.f.	Magnetomotive force
mol.	Molecule
Mol. Wt.	Molecular weight
monocl.	Monoclinic
m.p.	Melting point
m.s.c.p.	Mean spherical candle power
myria-	Prefix meaning 10,000 or 10^4
$m\mu$	Millimicron; millimicro-
N	Numeric; number (in mathematical tables)
n	Normal
n	Refractive index
need.	Needles
o	Ortho-
Obs	Observer
octahdr.	Octahedral
oil turp	Oil of turpentine
or.	Orange
oz.	Ounce
oz. ap *or* ℥ ap.	Ounce apothecaries'
oz. av. *or* ℥ av.	Ounce, avoirdupois
oz. fl. *or* ℥ fl.	Ounce, fluid
oz. t. *or* ℥ t.	Ounce, troy
p	Para-
pa.	Pale
p. ct.	Per cent
perp.	Perpendicular
p.f.	Power factor
pk.	Peck
pl.	Plates
powd.	Powder
pr.	Prisms
precip. *or* p'p't'd	Precipitated
p. sol.	Partly soluble
pt.	Point; pint
purp.	Purple
pyr.	Pyridine
Q	Quantity
q	Quintal
qt.	Quart
q.v.	*Quod vide*, which see
R	Réaumur; radioactive mineral
rac	Racemic
rad	Radian, measure of angle
rad.	Radius
rd.	Rod
reg.	Regular
rev.	Revolution
rhbdr.	Rhombohedral
rhomb.	Rhombic or orthorhombic
R.M.S.	Square root of mean square
r.p.m.	Revolutions per minute
s	Stere
s.	Scruple; soluble; second
s. ap. *or* ℈	Scruple, apothecaries'
sat. *or* sat'd	Saturated
sc.	Scales
S.E.	Siemens unit
sec *or* sec.	Second (mean solar unless contrary is stated)
sec	Secant
sec^{-1}	Arc or angle whose secant is . . .
sech	Hyperbolic secant
$sech^{-1}$	Inverse hyperbolic secant
segm.	Segment
sh.	Short
sin	Sine
sin^{-1}	Arc or angle whose sine is . . .
sinh	Hyperbolic sine
$sinh^{-1}$	Inverse hyperbolic sine
sl.	Slightly
sm.	Small
sol.	Solution; soluble
soln.	Solution
sp.	Specific
specif.	Specification
sp. gr.	Specific gravity
sq.	Square
sq. ch.	Square chain
sq. ft.	Square foot
sq. in.	Square inch
sq. mi.	Square mile
sq. rd.	Square rod
sq. yd.	Square yard
std.	Standard
subl.	Sublimes
sym.	Symmetrical
t	Metric ton
t.	Troy
tab. *or* tabl.	Tablets
tan	Tangent
tan^{-1}	Arc or angle whose tangent is . . .
tanh	Hyperbolic tangent
$tanh^{-1}$	Inverse hyperbolic tangent
temp.	Temperature
tetr. *or* tetrag.	Tetragonal
tn.	Ton
tr.	Transition
tricl.	Triclinic
trig.	Trigonal
trim.	Trimetric
T.S.	Tensile strength
turp.	Turpentine
Tw°	Degrees Twaddell, hydrometer scale
ult.	Ultimate
uns.	Unsymmetrical
U.S.	United States of America; universal system of lens apertures
v.	Very
v.	*Vide*, see
vel. *or* veloc.	Velocity
vers	Versed sine
vert	Vertical
visc.	Viscous
vol.	Volume
volt.	Volatilizes
w.	Water
wh.	White
wt.	Weight
yd.	Yard
yel.	Yellow
yr.	Year
μ	Micron; micro-
$\mu\mu$	Micromicron; micromicro-

ABBREVIATIONS AND SYMBOLS (Continued)

Symbols

The following list of symbols is rearranged from a report of the Committee on Letter Symbols and Abbreviations of the American Association of Physics Teachers, H. K. Hughes chairman, published in the American Journal of Physics **8**, 300–315, 1940.

Symbols or definitions in parentheses are those whose use is discouraged by the committee. Symbols or meanings indicated by an asterisk (*) are not recommended by the committee but have been added to the list for the sake of completeness.

English Letter Symbols

$\mathbf{A}$	Magnetic vector potential.
$\mathbf{A}_n$	Normal atmosphere*.
$\mathbf{A}_{45}$	Atmosphere, 45° latitude*.
A	Helmholtz function or maximum isothermal work function or Helmholtz free energy [$= U - TS$]; refracting angle of prism; area; amplitude; strength of simple acoustic source; atomic weight.
A, A_p	Power gain of amplifier; power amplification of amplifier.
A, A_v	Voltage gain of amplifier; voltage amplification of amplifier.
A, b	Richardson equation factors [$I_s = AT^2 \exp(-b/T)$].
$\mathbf{a}$	Linear acceleration.
a	Width of slit, transparent portion; semimajor axis of ellipse; radius of tube, disk or membrane, acous.; coefficient of accommodation; mean absorption coefficient for a room, acous.; absorption coefficient [$I_x = I_0 \exp(-ax)$]; chemical activity; aperture, optics.
a_0	Bohr radius [$= h^2/4\pi^2me^2$].
$_a$ (subscript)	Adsorbed.
$_{av}$ (subscript or bar over symbol)	Average value (e.g., $\bar{T}$, I_{av}).
a, b	Van der Waals constants.
$\mathbf{B}$	Magnetic flux density or induction; magnetic induction density.
B	Density of electric charge of magnetic flux [$d\Phi/dA$]; brightness or luminance [$= dI/dA \cos\theta$].
B, b	Susceptance or reciprocal of reactance.
$\mathfrak{B}$	Steradiancy or steradiance [$= dW/d\omega$].
b	Semiminor axis of ellipse; closest possible distance of approach (in Rutherford scattering formula); first Wien displacement constant [$= \lambda_m T$]; breadth or width.
b_1	Second Wien displacement constant [$= J_m/AT^5$]
$(\mathbf{C})$	Root-mean square velocity.
C	Molar thermal capacity; normality; (rms speed); capacitance or permittance; compliance.
C_p, C_v	Molecular heat at constant pressure, at constant volume*.
$(\bar{\mathbf{c}}_0)$	Most probable velocity.
c	Velocity of light in vacuum; specific heat or thermal capacity; coefficient of induction, or partial capacitance; distance from neutral axis to extreme fiber (beams); velocity of sound or other waves; acoustic conductivity of an opening; concentration of solutions.
c (with suitable subscripts)	Partial capacitance.
$(\bar{c}_0)$	Most probable speed.
c_p	Specific heat or thermal capacity for constant pressure.
c_V	Specific heat or thermal capacity for constant volume.
c_1, c_2	Planck radiation law constants [$J_\lambda = Ac_1\lambda^{-5}/(\exp c_2/\lambda T - 1)$].
$_c$ (subscript)	Cathode; critical properties.

ABBREVIATIONS AND SYMBOLS (Continued)
English Letter Symbols (Continued)

$\mathbf{D}$	Displacement; displacement flux density; electric flux density [$= \int \mathbf{D} \cdot d\mathbf{A}$]; electric induction density.
$\dot{\mathbf{D}}$, $\dot{\mathbf{D}}/4\pi$	Displacement current.
D	Derivative operator.
D	Minimum deviation angle; coefficient of diffusion, fluid; diameter; optical density [$= \log_{10} I_0/I$]; power of lens system or refracting power [$= n/f$ diopters]; relative density; density of electric flux [$= d\Psi/dA$]; optical attenuation; angular dispersion [$= d\theta/d\lambda$]; (density [$= m/V$]).
d	Differential operator.
d	Distance between corresponding points of grating; distance between lens units in an optical system; interplanar distance (Bragg law); spacing of Bragg planes in a crystal.
$d_{t_1}^{t_2}$	Specific gravity at temperature t_2, with reference to water at temperature t_1*.
($\mathbf{E}$)	Electric potential gradient; electric field strength or intensity.
E	Illumination or illuminance [$= dF/dA$]; total energy, other than work; electromotive force or electromotance or emf; Young's modulus of elasticity; (internal or intrinsic energy, thermodyn).
E_k	Kinetic energy.
E_p	Potential energy.
E_v	Total energy of vibration.
$\mathcal{E}$	Irradiancy or irradiance [$= d\Phi/dA$ or dP/dA, w cm^{-2}].
$\mathfrak{E}$	Electric potential gradient; electric field strength or intensity.
e	Eccentricity of ellipse; probable error; base of natural logarithms [$= 2.718 \ldots$]; modulus of electronic charge; coefficient of restitution or resilience.
$\mathbf{F}$	Force.
F	Force in a string or membrane; luminous flux [$= dQ/dt$], hyperfine quantum number [$= I + J$]; Faraday constant or equivalent; formality; (weight); (Helmholtz function or maximum isothermal work function or Helmholtz free energy [$= U - TS$]).
F, F_g	Gravitational force.
$\mathfrak{F}$	Magnetomotive force or magnetic scalar potential.
f	Relative humidity; fugacity; frequency (electric circuits, mechanics, sound); focal length of object space; coefficient of friction, if μ designates the Poisson ratio; degrees of freedom, kinetic theory and Gibbs phase rule.
(f_0)	Photoelectric threshold frequency.
f_r	Natural or resonant frequency.
f'	Focal length of image space.
f, F	Function; distribution function.
f (subscript)	Filament.
G	Newtonian gravitational constant; Gibbs free energy, Gibbs function or free enthalpy [$= H - TS$].
g	Landé factor; statistical weight or degeneracy; gyromagnetic ratio; gravitational acceleration.
g_g	Grid or input conductance.
g_{gp}, (g_m)	Grid-plate transconductance, real part of grid-plate transadmittance.
g_L	Gravitational acceleration, local value.
g_p	Plate or output conductance.
g_s	Gravitational acceleration, standard value [$= 980.665$ cm sec^{-2}].
g_{45}	Gravitational acceleration 45° value [$= 980.616$ cm sec^{-2}].

English Letter Symbols (Continued)

G, g	Reciprocal resistance or conductance; electric conductance.
$_g$ (subscript)	Reference to gas or vapor.
H	Magnetic field strength or intensity.
H	Hamiltonian function or operator.
H	Irradiancy or irradiance [$= d\Phi/dA$ or dP/dA, w cm^{-2}]; Hessian function; with suitable subscript, Hermitian function; heat content or enthalpy; Henry law constant; Boltzmann function $\left[= \sum_i n_i \ln n_i\right]$.
$\mathcal{H}$	Perturbing Hamiltonian function or operator.
h	Head, hydrodyn; radius of lens zone; Planck constant; degree of hydrolysis, electrolytes; depth or height.
$\hbar$	Dirac $\hbar [= h/2\pi]$.
h, k, l	Miller indices.
$h_1[= nh]$, $h_2[= nk]$, $h_3[= nl]$	Bragg reflection indices.
$_h$ (subscript)	Heater.
I	Rectangular areal moment of inertia [$= \int y^2 dA$]; integration constant of Gibbs function equation; luminous intensity or candlepower [$= dF/d\omega$, lu/steradian], nuclear spin; strength of magnetic shell; acoustic intensity, e.g., erg cm^{-2} sec^{-1}; activity at time t, radioactivity; conduction current; steady direct current; rms or effective current; convection current.
I_0	Initial luminous intensity; initial activity, radioactivity
I_q	Quiescent current.
I_s	Saturation current, total electron emission or saturation.
I_{xy}, etc.	Product of inertia.
I, I_{xx}, etc.	Moment of inertia.
I, I_{av}	Average current.
$\hat{I}$, (I_{pk})	Peak current.
I_m, (I_{max})	Maximum current.
i	Unit vector in X-direction.
i	Mole factor or van't Hoff coefficient; inertia of photographic plate; vapor pressure constant.
i, (I)	Instantaneous current.
J, (J')	Electric Joule equivalent.
J	Jacobian determinant; mechanical equivalent of heat or Joule equivalent; polar areal moment of inertia [$= \int r^2 dA$]; number of equivalents; total inner quantum number; radiant intensity [$= d\Phi/d\omega = dP/d\omega$]; total emissive power; variable action; (moment of inertia).
J_λ	Spectral radiant intensity [$= dJ/d\lambda$].
J_λ, J_ν	Monochromatic emissive power.
j	Unit vector in Y-direction.
j	Inner quantum number, inverse Jacobian determinant [$jJ = 1$].
K	Karat*; Kelvin, or absolute C scale of temperature*.
K_λ	Visibility factor or luminosity or monochromatic luminous efficiency [$= F_\lambda/P_\lambda = F_\lambda/\Phi_\lambda$ lu w^{-1}].
K	Extinction coefficient or index [$= (1/x) \log_{10} I_0/I$]; Kerr constant; luminous efficiency [$= F/P = F/\Phi$]; equilibrium constant, products/reactants; curvature.
K_h	Hydrolysis constant.
k	Unit vector in Z-direction.
k	Volume modulus of elasticity; molecular gas constant or Boltzmann constant; torque per unit twist or torsion constant; magnetic volume susceptibility [$\mathbf{M} = k\mathbf{H}$]; wave-length constant [$= 2\pi/\lambda$]; load per unit

	displacement; magnetic susceptibility; radius of gyration; restoring force per unit displacement; spring constant [$= -F/s$]; force constant [$= -F/s$]; specific reaction velocity, specific reaction rate or reaction velocity constant; velocity coefficient of chemical reaction*; thermal conductivity; coefficient or factor of compressibility; coupling coefficient.
k_g	Grid conductance at zero frequency and constant plate potential [$= (\partial i_g/\partial v_g)_{v_p}$].
k_p	Plate conductance at zero frequency and constant grid potential [$= (\partial i_p/\partial v_p)_{v_g}$].
L	Torque*.
L	Lagrange function or Lagrangian or kinetic potential [$= E_k - E_p$]; total azimuthal or orbital quantum number; relative heat content; total heat of fusion or vaporization; inductance; with suitable subscript, Laguerre function; Lorentz unit [$= Be/4\pi mc^2$]; (standard density, referred to g_s = 980.665 cm sec^{-2} at 0°C, 1 A_s).
L_{12}	Mutual inductance.
$\bar{L}$	Heat of fusion or vaporization, per mole.
L, l	Length of heat flow path.
l	Free path; azimuthal or orbital quantum number; heat of fusion or vaporization per unit mass; length of vibrating string, rod or tube; length.
l_0	Length rest.
l_T	Tait free path.
$\bar{l}$	Heat of fusion or vaporization per molecule; mean free path.
l (subscript)	Reference to liquid.
M	Intensity of magnetization, magnetization or magnetic polarization.
M	Mutual inductance; total mass; mass per mole; total magnetic quantum number.
$M, \bar{M}$	Molecular weight.
$M_i, \bar{M}_i$	Ionic molecular weight, if necessary to distinguish between ions and neutrals.
$M[\alpha]$	Molecular rotatory power*.
$M[\omega]$	Molecular magnetic rotatory power*.
m	Moment of atom, dipole or molecule; magnetic moment, total.
m	Order of spectrum; number of phases, elec. circuits; magnetic quantum number; magnification; mass of molecule; modulation factor; mass of electron; mass*; (strength of magnetic pole).
m_e	Electronic mass, when m is magnetic quantum number.
m_H	Mass of a hydrogen atom*.
m_l	Longitudinal mass [$= m_0/(1-\beta^2)^{3/2}$].
m_0	Rest mass.
m_t	Transverse mass [$= m_0/(1-\beta^2)^{1/2}$]
m or max (subscripts)	Maximum.
min (subscript)	Minimum.
$\mathbf{N}_0$	Avogadro's number*.
N	Safety factor; number of turns or of conductors; number of molecules; total number of lines of a grating; number of atoms or nuclei at time t, radioactivity; normalization factor, probability.
N_0	Initial number of atoms or nuclei, radioactivity.
$N_{1,2\ldots}$	Number of atoms or nuclei, if more than one type is considered.
$N^0_{1,2\ldots}$	Initial number of atoms or nuclei, if more than one type is considered, radioactivity.

English Letter Symbols (Continued)

N, N_0	Number of molecules per gram-molecule, 0°C, 1A, or Avogadro number.
n	Number; number of components, Gibbs phase rule; number of molecules per unit volume or molecular concentration; number of moles; number of revolutions or rotations per unit time; principal quantum number; rotational frequency [rev/time]; rigidity or shear modulus of elasticity; refractive index; (order of spectrum); molecular concentration or molecular density [= no./cm³]; (angular frequency without damping).
n_g	Group refractive index.
n_0	Number of molecules per cubic centimeter 0°C, 1A, or Loschmidt number.
(n')	Angular frequency of free vibration with damping.
n_a n_k	Transport number for anion, kation*.
O	Atomic weight of oxygen*.
O	Opacity, reciprocal of absorptance.
P	Electric polarization.
P$_s$	Surface polarization or strength of double layer, electric.
P	Probability; active power, elec.; power, used with same system of subscripts as for potential difference except that P unmodified signifies average power; radiant power or flux [= dU/dt]; amplitude of simple harmonic pressure, acous.
P_i	Input power.
$P_{l,m}$	Legendre polynomial.
P_0	Static pressure, acous.; output power.
P_p	Plate power.
p	Generalized momentum; electric moment of atom, molecule or dipole; total electric moment.
p	Heaviside time operator [= d/dt].
p	Vapor pressure; partial potential coefficient; varying pressure, acous.; partial pressure; impact parameter, Rutherford scattering formula; number of pairs of magnetic poles, elec. mach.; distance between a principal plane of a lens system and the appropriate principal plane of a unit; generalized momentum; strength of magnetic pole; pressure; osmotic pressure; potential coefficient; (angular frequency of impressed force).
p_c	Critical pressure.
$_p$ (subscript)	Plate.
Q	Figure of merit of reactance [= X/R]; electric quadrupole moment; thermoelectric power; luminous energy [= $\int F dt$]; quantity of heat; quantity of light or luminous energy; Q-factor, or quality factor, of reactor [= X/R]; moment of area [= $\int y dA$].
q	Generalized coordinate; heat entering system.
q, Q	Electric charge; quantity of electric charge.
R	Gas constant [= pV/nT]; thermal resistance; Rydberg constant; radiation resistance; range, radioactivity; rotational quantum number; acoustic resistance; (radius of tube, disk or membrane, acous.).
R_∞	Rydberg constant at infinite mass.
$\mathcal{R}$	Reluctance; radiancy or radiant emittance or radiance or radiant flux density [= $d\Phi/dA$ = dP/dA, w/area].
r	Radius vector; position vector.
r	Residual of an observation; radial distance; nuclear radius; radius, relative humidity; specific acoustic resistance [= R/A]; spherical coordinates θ[= colatitude], λ[= latitude], φ[= longitude].
r_p	Plate resistance
$R, (r)$	Electric resistance.
r, θ	Polar coordinates.
$r, \theta, z, (y)$	Cylindrical coordinates.

English Letter Symbols (Continued)

$_r$ (subscript) — Reduced properties.

S — Area; total spin; static sensitivity of photoelectric tube; reciprocal capacitance or elastance; total spin quantum number, strictly speaking, spin is not a quantum number; entropy; action; effective molecular cross section; area of cross section, walls, acous.

$\mathbf{s}$ — Linear displacement.

s — Length of arc or path; linear distance; spin quantum number, strictly speaking, spin is not a quantum number; dynamic sensitivity of photoelectric tube; slip; spin; displacement in general; distance between object and corresponding principal plane; object distance, optics; acoustic condensation.

s_p — Transconductance at zero frequency and constant plate potential [$= (\partial i_p/\partial v_g)_{vp}$].

s' — Image distance; distance between image and corresponding principal plane.

S_{2870}, s_{2870} — 2870 tungsten sensitivity of photoelectric tube.

$_s$ (subscript) — Reference to solid.

$\mathbf{T}$ — Torque*.

T — Kelvin temperature; reverberation time; half-life, radioactivity; period of a periodic motion; oscillation period; (kinetic energy; force in a string or membrane).

T_0 — Absolute temperature of ice-point; absolute ice-point.

t — Time; length of prism base; transmission coefficient [$t^x = I_x/I_0 = \exp(-ax)$]; ordinary temperature.

t_0 — Ordinary ice-point.

t_c, T_c — Critical temperature.

$_t$ (subscript) — Transition between polymorphic forms.

U — Radiant energy; potential energy; total energy, other than work; internal or intrinsic energy, thermodyn.

$\mathbf{u}$ — Velocity; linear or particle velocity; with suitable subscript, ionic velocity; (component of linear or particle velocity).

$\mathbf{u}_0$ — Initial velocity.

$\mathbf{u}_{x,y,z}$ — Component of linear or particle velocity; rectangular component of velocity.

$\hat{\mathbf{u}}$ — Most probable velocity.

$\bar{\bar{\mathbf{u}}}$ — Root-mean-square velocity.

u — Linear or particle speed; speed; density of radiant energy [$= dU/dV$]; reaction velocity [$= -dc/dt$]; time-independent wave function.

u_0 — Initial speed.

$\hat{u}$ — Most probable speed.

$\bar{\bar{u}}$ — Rms speed.

$\mathbf{u}$, $\mathbf{u}_g$ — Group velocity.

$\mathbf{u}$, $\mathbf{u}_t$ — Velocity at time t.

$\mathbf{u}_\omega$, $\mathbf{u}_\varphi$ — Phase or wave velocity.

$\bar{\mathbf{u}}$, $\mathbf{u}_{av}$ — Average velocity.

u, u_t — Speed at time t.

$\bar{u}$, u_{av} — Average speed.

V — Volume; volume of a cavity or room; rms or effective potential difference; steady d.c. potential difference; molecular volume; shearing force in beam section; electric potential; specific magnetic rotation or Verdet constant; configuration-space volume; atomic volume; (time-dependent variable in Hamilton-Jacobi equation; electromotive force or electromotance or emf; potential energy).

V_c — Critical volume.

V_e — Excitation potential; excitation potential difference.

V_i — Ionization potential.

V_n — Volume of perfect gas, 0°C, A_n.

V_Q — Quiescent potential difference.

V_s	Seebeck potential difference.
V_t	Thomson potential difference.
V_v	Contact or Volta potential difference.
V_π	Peltier potential difference.
$\hat{V}_m$	Maximum peak potential difference.
$\mathbf{v}$	Velocity; linear or particle velocity; (component of linear or particle velocity).
$\mathbf{v}_0$	Initial velocity.
$\mathbf{v}_{x,y,z}$	Component of linear or particle velocity; rectangular component of velocity.
$\hat{\mathbf{v}}$	Most probable velocity.
$\mathbf{v}$	Root-mean-square velocity.
v	Specific volume [V/m]; linear or particle speed; speed; velocity of sound or other waves; vibrational quantum number; instantaneous potential difference.
v_0	Initial speed.
v_0	Volume per gram mole of ideal gas at 0°C and A_0*.
$\hat{v}$	Most probable speed.
v	Rms speed.
V, V_i	Inner potential, metals.
V_m (V_{max})	Maximum potential difference.
$\bar{V}$, V_a	Average potential difference.
$\hat{V}$, (V_{pk})	Peak potential difference.
$\mathbf{v}$, $\mathbf{v}_g$	Group velocity.
$\mathbf{v}$, $\mathbf{v}_t$	Velocity at time t.
$\bar{\mathbf{v}}$, $\mathbf{v}_{av}$	Average velocity.
v, v_t	Speed at time t.
v_c, v_r	Critical volume, reduced volume*.
$\bar{v}$, v_{av}	Average speed.
W	Radiant emittance or radiant flux density or radiancy or radiance [$= d\Phi/dA = dP/dA$, w/area]; time-dependent variable in Hamilton-Jacobi equation; (weight).
($\mathbf{w}$)	Phase or wave velocity; component of linear or particle velocity.
w	Weight; mixing ratio or water-vapor content; net work function.
w_g	Gross work function.
W, (w)	Work
X	Volume displacement, acous.; acoustic reactance.
X_C	Capacitive reactance.
X_L	Inductive reactance.
x	Distance between object and principal focus of object space; specific acoustic reactance [$= X/A$].
x'	Distance between image and principal focus of image space.
x, y, z	Rectangular coordinates; variable.
Y	Young's modulus of elasticity; admittance or reciprocal impedance.
$Y_{l,m}$	Associated Legendre polynomial or spherical function [$= P_{l,m}(\theta)$ exp $im\,\varphi$].
y	Super-compressibility factor; length of object, optics; variable; (depth or height).
y_g	Grid or input admittance or reciprocal impedance with plate-load [$= g_g - \mathbf{j}b_g$].
y_{gp}	Grid-plate transadmittance [$= g_{gp} - \mathbf{j}b_{gp}$].
y_p	Plate or output, admittance or reciprocal impedance [$= g_p - \mathbf{j}b_p$].
y'	Length of image; image size.
Z	Gram-equivalent weight; radius of image of a point; modulus of section [$= I/c$, where c is distance of neutral axis from extreme fiber]; number of molecular collisions per unit time or collision frequency; coefficient of relative viscosity, referred to water; atomic

English Letter Symbols (Continued)

number; acoustic impedance; radius of circle of least confusion.

z — Variable; electrochemical equivalent; valence; specific acoustic impedance [$= Z/A$].

Greek Letter Symbols

α — Angular acceleration.

α — Half-angle subtended by point object at objective of microscope; thermal coefficient of resistance; end correction for a tube, acous.; fine-structure or Sommerfeld constant [$= ch/2\pi e^2$]; specific rotatory power [$= \theta/lc$]; degree of dissociation or ionization, electrolytes; linear expansivity or linear coefficient of expansion; absorption or absorption factor [$= F_a/F_i$]; absorption coefficient of absorbing material, acous.; angular resolving power of telescope; attenuation constant [$\gamma = \alpha + j\beta$]; temperature coefficient of resistance; coefficient of recombination; (plane angle).

α' — Coefficient of thermal expansion or expansivity of a gas.

α, α_l — Linear coefficient of thermal expansion or linear expansivity.

$\alpha, \alpha', \alpha_V$ — Volume expansivity or coefficient of expansion.

β — Phase constant [$\gamma = \alpha + j\beta$]; u/c; pressure coefficient; $1/kT$; ratio of speed to speed of light [$= v/c$]; relativity ratio [$= v/c$]; specific heat constant*; (plane angle).

Γ — Reciprocal inductance [$= 1/L$].

γ — Coefficient of surface tension; propagation constant [$= \alpha + j\beta$]; weightivity or specific weight [w/V]; ratio of specific heat or thermal capacity [$= c_p/c_V$]; adiabatic exponent [pV^γ = const.]; angular magnification [$= \tan u'/\tan u$], contrast of photographic emulsion, electric conductivity [$I = \gamma E$].

Δ — Optical length of microscope tube; quadratic discriminant [$= b^2 - 4ac$]; difference in optical path; distance between adjacent principal foci of two lens units; small finite change operator; cubic discriminant [$= (b^2/4) + (a^3/27)$].

δ — Piezoelectric strain constant or modulus; deflection or total elongation; total thermal expansion; frequency deviation [$= \Delta f/f_r$]; galvanometer deflection; variation operator; angle of deviation; beam deflection or sag.

δ_m — Minimum deviation angle.

ϵ — Piezoelectric stress constant; molecular kinetic energy, average [$= \frac{1}{2}m\bar{v}^2$]; base of natural logarithms [$= 2.718 \ldots$]; self-energy [$= mc^2$]; dielectric coefficient or permittivity or capacitivity; epoch angle.

ϵ_h, ϵ_c — Electrode potential above that of normal hydrogen, of normal calomel, electrode*.

ϵ, ϵ_r — Relative dielectric coefficient or specific inductive capacity.

η — Coefficient of viscosity; efficiency; electric susceptibility [$P = \eta\mathfrak{S}$]

η_I — Current efficiency, electrolysis [$= I_{\mathrm{useful}}/I_{\mathrm{total}}$].

η_V — Voltage efficiency [$= V_{\mathrm{theor}}/V_{\mathrm{actual}}$], electrolysis.

$\eta(\xi, \eta, \zeta)$ — Transverse displacement, acous.

θ — Angular displacement.

θ — Angle of contact; polar coordinate angle; polar angle, colatitude; angle of optical rotation; angular distance; plane angle; angle of diffraction; glancing angle; (Kelvin temperature, ordinary temperature).

κ — Electric conductivity [$I = \kappa E$]; volume modulus of elasticity; coefficient or factor of compressibility; susceptibility, magnetic*; absorption index [$= (\lambda/4\pi x) \ln I_0/I$].

Λ — Nuclear dissociation energy; permeance [$= L/N^2$]; equivalent conductivity, mho/mole; spherical Laplace operator

$$\left[\frac{1}{\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial}{\partial\theta}\right) + \frac{1}{\sin^2\theta}\frac{\partial^2}{\partial\varphi^2}\right].$$

λ — Linear density [$= m/l$]; mass per unit length; free path; wavelength; latitude, colatitude $= \phi$; disintegration constant [$N = N_0 \exp(-\lambda t)$]; linear charge, density; (linear expansivity or linear coefficient of expansion).

Greek Letter Symbols (Continued)

λ_m	Wave-length of maximum monochromatic radiance of black-body at stated temperature*.
λ_T	Tait free path.
$\bar{\lambda}$	Mean free path.
μ	Partial molal, or chemical potential Gibbs function [= $\partial G/\partial n$]; Joule-Thomson coefficient [= $\partial T/\partial p_{\|H}$]; inductivity or absolute permeability; reduced mass [$1/\mu = (1/m_1) + (1/m_2)$]; molecular conductivity; gas amplification factor, photoelectric tube; amplification factor [= $-(\partial v_p/\partial v_g)i_p$]; chemical potential [$\partial G/\partial n$]; coefficient of friction; grid control ratio, thyratrons; (refractive index; coefficient of diffusion, fluid).
(μ_g)	Group refractive index.
μ_I	Nuclear magneton [= $\mu_0/1838$].
μ_0	Bohr magneton [= $eh/4\pi mc$].
μ_r	Coefficient of rolling friction.
μ_s	Coefficient of starting or static friction.
μ, (μ_k)	Coefficient of sliding or kinetic friction.
μ, μ_r	Relative magnetic permeability.
ν	Frequency, quantum theory of light; reluctivity [= $1/\mu$]; reciprocal of dispersive power; kinematic viscosity coefficient [= η/ρ].
ν_0	Photoelectric threshold frequency.
ν_∞	Rydberg's fundamental frequency*.
Ξ	Propagation flux density.
ξ	Longitudinal displacement, acous.
ξ, η, ζ	Displacement components of sound-bearing particle; generalized curvilinear coordinates; moving Cartesian axes coordinates.
Π	Osmotic pressure; Peltier coefficient; Poynting vector; continued product operator; Hertzian vector; reciprocal inductance.
ϖ	Pressure, used for total pressure when p represents vapor pressure; (osmotic pressure).
ρ	Volume density of electric charge; reflectance or reflectivity or reflection factor [= F_r/F_i]; vapor density; resistivity or specific resistance; density [= m/V]; absolute humidity; radius of curvature; (mass per unit length; linear density [= m/l]; surface density [m/A]).
ρ'	Convection current.
ρ_s	Standard density, referred to g_s = 980.665 cm sec^{-2} at 0°C, 1A_s.
Σ	Exposure [= Et].
σ	Specific magnetization [= M/ρ]; coefficient of surface tension; surface density [m/A]; effective molecular cross section; area; molecular diameter, collision; Poisson ratio; dispersion [= $dn/d\lambda$]; wave number; magnetic leakage coefficient; Stefan-Boltzmann constant [= J/T^4]; Thomson coefficient; electric conductivity [$I = \sigma E$]; surface charge density.
τ	Unit vector tangent to path.
τ	Coupling coefficient; optical transmittance or transmission factor [= F_t/F_i]; mean-life, radioactivity; modulus of decay [$s = A \cos(\omega t + \varphi) \exp(-t/\tau)$]; time constant; dew-point temperature; (volume; time, used when t is used for temperature).
$\mathbf{\Phi}$	Dyadic in general.
Φ	Magnetic flux of induction [$\int \mathbf{B} \cdot d\mathbf{A}$]; magnetic flux [= $\int \mathbf{B} \cdot d\mathbf{A}$]; radiant power or flux [= dU/dt].
φ	Function; net work function per unit charge or electron affinity [$d\varphi = dw/dq$ volts]; electromagnetic scalar potential; longitude; velocity potential, hydrodyn; fluidity, reciprocal of viscosity; angle between ray and normal in first medium; phase angle; (epoch angle).
φ_g	Gross work function per unit charge or gross electron affinity [$d\varphi_g = dw_g/dq$ volts].
φ_c	Critical angle.
φ'	Angle between ray and normal in second medium.
$\bar{\varphi}$	Polarizing angle or principal angle of incidence in dielectrics.
χ	Specific magnetic susceptibility [= k/ρ].

ABBREVIATIONS AND SYMBOLS (Continued)
Greek Letter Symbols (Continued)

Ψ	Planck function [$= -A/T$]; electric flux of induction [$= \int \mathbf{D} \cdot d\mathbf{A}$]; total flux of electric displacement [$= \int \mathbf{D} \cdot d\mathbf{A}$]; total electric flux [$= \int \mathbf{D} \cdot d\mathbf{A}$].
ψ	Time-dependent wave function; azimuth angle, optics.
$\bar{\psi}$	Principal azimuth angle.
Ω	Volume of phase space; ohm*.
$[\Omega]$	Relative molecular magnetic rotary power with reference to water*.
$\boldsymbol{\omega}$	Angular velocity.
ω	Pulsatance or periodicity; specific magnetic rotation or Verdet constant; dispersive power [$= (n_F - n_C)/(n_D - 1)$]; angular frequency of impressed force; angular frequency without damping; angular frequency, or periodicity or angular speed [$= 2\pi f$]; solid angle.
ω_r	Resonant periodicity.
ω'	Angular frequency of free vibration with damping.

Miscellaneous Symbols

· (Superscripts)	Time derivatives, dots used over symbol.
$1/k$	Thermal resistivity.
$1/R$	Thermal conductance.

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